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Draft**

**Environmental Impact Statement for the Combined Licenses (COLs) for Comanche Peak Nuclear
Power Plant Units 3 and 4**

August 2010



NUREG-1943, Vol. 1

**Environmental Impact Statement
for Combined Licenses (COLs) for
Comanche Peak Nuclear Power Plant
Units 3 and 4**

Draft Report for Comment

**U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001**

**U.S. Army Corps of Engineers
U.S. Army Engineer District, Fort Worth
Fort Worth, TX 76102-6199**



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Abstract

1 This environmental impact statement (EIS) has been prepared to satisfy the requirements of the
2 National Environmental Policy Act of 1969, as amended (NEPA). This EIS has been prepared
3 in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by
4 Luminant Generation Company LLC (Luminant), acting for itself and as agent for Nuclear
5 Project Company LLC (subsequently renamed Comanche Peak Nuclear Power Company LLC),
6 for combined construction permits and operating licenses (combined licenses or COLs). The
7 proposed actions related to the Luminant application are (1) NRC issuance of COLs for two new
8 nuclear power reactor units (Units 3 and 4) at the Comanche Peak Nuclear Power Plant
9 (CPNPP) site in Hood and Somervell Counties, Texas, and (2) U.S. Army Corps of Engineers
10 (Corps) issuance of a permit to perform certain construction activities on the site. The Corps is
11 participating with the NRC in preparing this EIS as a cooperating agency and participates
12 collaboratively on the review team.

13 This EIS includes the analysis by the NRC and Corps staff that considers and weighs the
14 environmental impacts of building and operating two new nuclear units at the CPNPP site and at
15 alternative sites, and mitigation measures available for reducing or avoiding adverse impacts.

16 The EIS includes the evaluation of the proposed action's impacts to waters of the United States
17 pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act) and
18 Section 10 of the Rivers and Harbors Appropriation Act of 1899. The Corps will conduct a
19 public interest review in accordance with the guidelines promulgated by the U.S. Environmental
20 Protection Agency under authority of Section 404(b) of the Clean Water Act. The public interest
21 review, which will be addressed in the Corps' permit decision document, will include an
22 alternatives analysis to determine the Least Environmentally Damaging Practicable Alternative.

23 After considering the environmental aspects of the proposed action, the NRC staffs' preliminary
24 recommendation to the Commission is that the COLs be issued as requested. This
25 recommendation is based on (1) the application, including the Environmental Report (ER)
26 submitted by Luminant and Luminant's responses to the NRC and Corps staffs' requests for
27 additional information (RAIs); (2) consultation with Federal, State, Tribal, and local agencies; (3)
28 the NRC and Corps staffs' independent review; (4) the NRC and Corps staffs' consideration of
29 comments related to the environmental review that were received during the public scoping
30 process; and (5) the assessments summarized in this EIS, including the potential mitigation
31 measures identified in the ER and this EIS. The Corps permit decision will be made following
32 issuance of the final EIS, and the Corps will issue its Record of Decision based, in part, on this
33 EIS.

Contents

	Page
Abstract	iii
Executive Summary	xxix
Abbreviations/Acronyms	xxxii
1.0 Introduction.....	1-1
1.1 Background.....	1-1
1.1.1 Application and Review	1-2
1.1.1.1 NRC COL Application Review	1-2
1.1.1.2 Corps Permit Application Review	1-3
1.1.2 Preconstruction Activities	1-4
1.1.3 Cooperating Agencies	1-4
1.1.4 Concurrent NRC Reviews	1-5
1.2 The Proposed Federal Actions.....	1-6
1.3 The Purpose and Need for the Proposed Actions.....	1-6
1.4 Alternatives to the Proposed Actions	1-6
1.5 Compliance and Consultations	1-7
1.6 Report Contents	1-7
1.7 References.....	1-8
2.0 Affected Environment	2-1
2.1 Site Location	2-1
2.2 Land Use.....	2-7
2.2.1 The Site and Vicinity.....	2-7
2.2.2 Transmission Lines and Offsite Areas.....	2-8
2.2.2.1 Transmission Lines	2-8
2.2.2.2 Pipelines.....	2-12
2.2.3 The Region.....	2-12
2.3 Water.....	2-12
2.3.1 Hydrology	2-12
2.3.1.1 Surface-Water Hydrology	2-12
2.3.1.2 Groundwater Hydrology	2-19
2.3.2 Water Use	2-20
2.3.2.1 Surface-Water Use.....	2-21
2.3.2.2 Groundwater Use	2-24
2.3.3 Water Quality.....	2-25
2.3.3.1 Surface-Water Quality	2-25
2.3.3.2 Groundwater Quality	2-29
2.3.4 Water Monitoring	2-30
2.3.4.1 Surface-Water Monitoring	2-30

2.3.4.2	Groundwater Monitoring.....	2-30
2.4	Ecology	2-31
2.4.1	Terrestrial Ecology	2-33
2.4.1.1	Terrestrial Resources—Site and Vicinity	2-33
2.4.1.2	Terrestrial Resources—Transmission Lines and Cooling Water Pipelines.....	2-40
2.4.1.3	Important Terrestrial Species and Habitats	2-43
2.4.1.4	Terrestrial Monitoring	2-50
2.4.2	Aquatic Ecology.....	2-51
2.4.2.1	Aquatic Resources—Site and Vicinity	2-51
2.4.2.2	Aquatic Resources—Transmission Lines and Cooling-Water Pipelines	2-63
2.4.2.3	Aquatic Resources—Wetlands.....	2-64
2.4.2.4	Important Aquatic Species and Habitats	2-66
2.4.2.5	Aquatic Monitoring.....	2-75
2.5	Socioeconomics.....	2-76
2.5.1	Demographics	2-77
2.5.1.1	Resident Population	2-77
2.5.1.2	Transient Population	2-77
2.5.1.3	Migrant Labor	2-78
2.5.2	Community Characteristics	2-80
2.5.2.1	Economy	2-81
2.5.2.2	Taxes.....	2-82
2.5.2.3	Transportation	2-83
2.5.2.4	Aesthetics and Recreation	2-91
2.5.2.5	Housing	2-91
2.5.2.6	Public Services.....	2-93
2.5.2.7	Education	2-95
2.6	Environmental Justice	2-96
2.6.1	Methodology.....	2-96
2.6.2	Scoping and Outreach.....	2-101
2.6.3	Subsistence and Communities with Unique Characteristics	2-101
2.6.4	Migrant Populations.....	2-102
2.6.5	Environmental Justice Summary.....	2-102
2.7	Historic and Cultural Resources.....	2-102
2.7.1	Cultural Background.....	2-103
2.7.1.1	Prehistoric Overview	2-103
2.7.1.2	Historic Overview	2-104
2.7.2	Historic and Cultural Resources at the Site.....	2-104
2.7.3	Consultation	2-105
2.8	Geology.....	2-105

2.9	Meteorology and Air Quality	2-106
2.9.1	Climate	2-110
2.9.1.1	Wind	2-112
2.9.1.2	Temperature.....	2-112
2.9.1.3	Atmospheric Moisture.....	2-113
2.9.1.4	Severe Weather	2-113
2.9.1.5	Atmospheric Stability.....	2-114
2.9.2	Air Quality.....	2-114
2.9.3	Atmospheric Dispersion	2-116
2.9.3.1	Short-Term Atmospheric Dispersion Estimates For Accident Releases.....	2-116
2.9.3.2	Long-Term Atmospheric Dispersion and Deposition Estimates for Routine Releases.....	2-117
2.9.4	Meteorological Monitoring	2-118
2.10	Nonradiological Health	2-119
2.10.1	Public and Occupational Health	2-119
2.10.1.1	Air Quality.....	2-119
2.10.1.2	Occupational Injuries.....	2-119
2.10.1.3	Etiological Agents.....	2-120
2.10.1.4	Noise	2-121
2.10.2	Transportation	2-121
2.10.3	Electromagnetic Fields	2-121
2.11	Radiological Environment or Monitoring	2-122
2.12	Related Federal Projects and Consultations.....	2-123
2.13	References.....	2-123
3.0	Site Layout and Plant Description	3-1
3.1	External Appearance and Plant Layout.....	3-1
3.2	Proposed Plant Structures, Systems, and Components	3-3
3.2.1	Reactor Power Conversion System	3-3
3.2.1.1	Plant Description	3-4
3.2.2	Structures with a Major Environmental Interface.....	3-6
3.2.2.1	Cooling Water System.....	3-6
3.2.2.2	Other Permanent Plant-Environment Interfacing Structures, Systems, or Components	3-12
3.2.2.3	Power Transmission System.....	3-14
3.3	Construction and Preconstruction Activities.....	3-16
3.3.1	Site Preparation.....	3-17
3.3.1.1	Power Block Earthwork (Excavation)	3-19
3.3.1.2	Power Block Earthwork (Backfill)	3-20
3.3.1.3	Reactor Building Base Mat Foundation.....	3-20
3.3.1.4	Blowdown Treatment Facility and Ponds	3-21
3.3.1.5	Road and Rail Construction	3-21

3.3.1.6	Security Construction	3-21
3.3.1.7	Temporary Utilities	3-21
3.3.1.8	Temporary Construction Facilities	3-22
3.3.1.9	Laydown, Fabrication, Shop Area Preparation.....	3-22
3.3.1.10	Clearing, Grubbing, and Grading	3-22
3.3.1.11	Underground Installations	3-23
3.3.1.12	Unloading Facilities Installation	3-23
3.3.1.13	Intake/Discharge Cofferdams and Piling Installation	3-23
3.3.2	Power Block Construction	3-24
3.3.3	Transmission Lines	3-25
3.3.3.1	Construction of Transmission Line Corridors	3-25
3.3.3.2	Clearing of Corridors	3-28
3.3.3.3	Construction and Erection of Towers and Lines.....	3-29
3.3.4	Construction Workforce.....	3-29
3.3.5	Summary of Resource Commitments during Construction and Preconstruction	3-29
3.4	Operational Activities	3-29
3.4.1	Description of Operational Modes	3-30
3.4.2	Plant-Environment Interfaces During Operation.....	3-31
3.4.2.1	Plant Water Use and Treatment.....	3-33
3.4.2.2	The Cooling System's Operational Modes	3-34
3.4.2.3	Transmission Line Operation and Corridor Maintenance.....	3-35
3.4.3	Radioactive Waste Management System	3-36
3.4.3.1	Liquid Radioactive Waste-Management System.....	3-36
3.4.3.2	Gaseous Radioactive Waste-Management System.....	3-38
3.4.3.3	Solid Radioactive Waste-Management System	3-38
3.4.4	Nonradioactive Waste Systems	3-39
3.4.4.1	Effluents Containing Chemicals or Biocides.....	3-39
3.4.4.2	Sanitary System Effluents	3-40
3.4.4.3	Other Nonradioactive Waste Effluents	3-40
3.4.5	Summary of Resource Parameters during Operation	3-42
3.5	References.....	3-43
4.0	Construction Impacts at the Proposed Site	4-1
4.1	Land-Use Impacts	4-3
4.1.1	The Site and Vicinity.....	4-3
4.1.2	Transmission Line and Pipeline Right(s)-of-Way and Offsite Areas.....	4-4
4.2	Water-Related Impacts	4-6
4.2.1	Hydrological Alterations.....	4-7
4.2.2	Water Use Impacts.....	4-9
4.2.2.1	Surface Water Use Impacts	4-9
4.2.2.2	Groundwater Use Impacts.....	4-9

4.2.3	Water Quality Impacts	4-10
4.2.3.1	Surface Water Quality Impacts.....	4-10
4.2.3.2	Groundwater Quality Impacts.....	4-11
4.2.4	Hydrological Monitoring.....	4-11
4.3	Ecological Impacts	4-11
4.3.1	Terrestrial Impacts.....	4-11
4.3.1.1	Terrestrial Resources – Site and Vicinity	4-13
4.3.1.2	Terrestrial Resources – Transmission Lines and Cooling Water Pipelines.....	4-18
4.3.1.3	Important Terrestrial Species and Habitats	4-20
4.3.1.4	Terrestrial Monitoring during Construction and Preconstruction	4-24
4.3.1.5	Potential Mitigation Measures for Construction- and Preconstruction- Related Terrestrial Impacts.....	4-24
4.3.1.6	Summary of Impacts to Terrestrial Resources during Construction and Preconstruction Activities.....	4-24
4.3.2	Aquatic Ecology and Wetlands Impacts Related to Construction and Preconstruction	4-25
4.3.2.1	Aquatic Resources and Wetlands – Site and Vicinity.....	4-25
4.3.2.2	Aquatic Resources and Wetlands – Transmission Lines and Cooling Water Pipelines.....	4-28
4.3.2.3	Important Aquatic and Wetlands Species and Habitats	4-30
4.3.2.4	Monitoring of Aquatic Ecosystems and Wetlands during Development.....	4-34
4.3.2.5	Potential Mitigation Measures for Development- Related Aquatic Ecology and Wetlands Impacts	4-35
4.3.2.6	Summary of Impacts to Aquatic and Wetlands Resources during Construction and Preconstruction.....	4-35
4.4	Socioeconomic Impacts	4-35
4.4.1	Physical Impacts	4-35
4.4.1.1	Workers and the Local Public.....	4-36
4.4.1.2	Buildings.....	4-36
4.4.1.3	Roads	4-37
4.4.1.4	Aesthetics.....	4-37
4.4.1.5	Noise	4-38
4.4.1.6	Air Quality.....	4-38
4.4.1.7	Summary of Physical Impacts	4-39
4.4.2	Demography.....	4-39
4.4.3	Economic Impacts to the Community.....	4-43
4.4.3.1	Economy	4-43
4.4.3.2	Taxes.....	4-45
4.4.4	Infrastructure and Community Service Impacts	4-46
4.4.4.1	Transportation	4-46
4.4.4.2	Recreation	4-51

4.4.4.3	Housing	4-52
4.4.4.4	Public Services	4-53
4.4.4.5	Education	4-59
4.4.4.6	Summary of Infrastructure and Community Service Impacts	4-60
4.4.5	Potential Mitigation Measures for Socioeconomic Impacts	4-60
4.4.6	Summary of Socioeconomic Impacts	4-60
4.5	Environmental Justice Impacts	4-61
4.5.1	Health and Environmental Impacts	4-61
4.5.1.1	Soil Pathway	4-62
4.5.1.2	Water Pathway	4-62
4.5.1.3	Air Pathway	4-62
4.5.1.4	Noise	4-63
4.5.2	Socioeconomic Impacts	4-63
4.5.3	Subsistence and Special Conditions	4-63
4.5.4	Summary of Environmental Justice Impacts	4-64
4.6	Historic and Cultural Resources	4-64
4.7	Meteorological and Air Quality Impacts	4-65
4.7.1	Construction and Preconstruction Activities	4-66
4.7.2	Transportation	4-67
4.7.3	Summary	4-67
4.8	Nonradiological Health Impacts	4-67
4.8.1	Public and Occupational Health	4-68
4.8.1.1	Public Health	4-68
4.8.1.2	Construction Worker Health	4-68
4.8.1.3	Summary of Public and Construction Worker Health Impacts	4-70
4.8.2	Noise Impacts	4-70
4.8.3	Transporting Construction Materials and Personnel to the CPNPP Site	4-71
4.8.4	Summary of Nonradiological Health Impacts	4-72
4.9	Radiological Exposure to Construction Workers	4-72
4.9.1	Direct Radiation Exposures	4-73
4.9.2	Radiation Exposures from Gaseous Effluents	4-73
4.9.3	Radiation Exposures from Liquid Effluents	4-73
4.9.4	Total Dose to Construction Workers	4-74
4.9.5	Summary of Radiological Health Impacts	4-74
4.10	Nonradioactive Waste Impacts	4-74
4.10.1	Impacts to Land	4-74

4.10.2	Impacts to Water	4-75
4.10.3	Impacts to Air	4-75
4.10.4	Summary of Impacts	4-75
4.11	Measures and Controls to Limit Adverse Impacts during Construction and Preconstruction Activities.....	4-76
4.12	Summary of Construction Impacts	4-80
4.13	References.....	4-83
5.0	Operational Impacts at the Proposed Site.....	5-1
5.1	Land-Use Impacts	5-1
5.1.1	The Site and Vicinity.....	5-1
5.1.2	Transmission Line and Pipeline Corridors.....	5-6
5.2	Water-Related Impacts	5-6
5.2.1	Hydrological Alterations.....	5-7
5.2.2	Water-Use Impacts.....	5-7
5.2.2.1	Surface Water Use Impacts	5-8
5.2.2.2	Groundwater Use Impacts.....	5-9
5.2.3	Water-Quality Impacts.....	5-10
5.2.3.1	Surface Water Quality Impacts.....	5-10
5.2.3.2	Groundwater Quality Impacts.....	5-13
5.2.4	Water Monitoring	5-14
5.2.5	Potential Mitigation Measures for Operation-Related Water Impacts	5-14
5.3	Ecological Impacts	5-15
5.3.1	Terrestrial Impacts Related to Operations.....	5-15
5.3.1.1	Terrestrial Resources – Site and Vicinity	5-16
5.3.1.2	Terrestrial Resources-Transmission Lines and Cooling Water Pipelines.....	5-19
5.3.1.3	Important Terrestrial Species and Habitats	5-21
5.3.1.4	Terrestrial Monitoring during Operation.....	5-23
5.3.1.5	Potential Mitigation Measures for Operation-Related Terrestrial Impacts	5-23
5.3.1.6	Summary of Impacts to Terrestrial Resources during Operation	5-24
5.3.2	Aquatic and Wetlands Impacts	5-24
5.3.2.1	Impacts on the Lake Granbury Ecosystem	5-24
5.3.2.2	Impacts on the Squaw Creek Reservoir Ecosystem	5-34
5.3.2.3	Impacts on the Brazos River Ecosystem.....	5-35
5.3.2.4	Impacts on Possum Kingdom Lake.....	5-36
5.3.2.5	Impacts on Wheeler Branch Reservoir and the Paluxy River ...	5-37
5.3.2.6	Impacts on Wetland Ecosystems	5-37

5.3.2.7	Impacts on Aquatic and Wetland Resources from Transmission Lines and Cooling Water Pipelines.....	5-37
5.3.2.8	Impacts on Important Aquatic Species and Habitats.....	5-38
5.3.2.9	Aquatic Monitoring during Operation.....	5-42
5.3.2.10	Potential Mitigation Measures for Operation-related Aquatic and Wetland Impacts	5-42
5.3.2.11	Summary of Operational Impacts on Aquatic and Wetland Resources	5-42
5.4	Socioeconomic Impacts	5-44
5.4.1	Physical Impacts	5-44
5.4.1.1	Workers and the Local Public.....	5-44
5.4.1.2	Buildings.....	5-45
5.4.1.3	Roads	5-45
5.4.1.4	Aesthetics.....	5-45
5.4.1.5	Noise	5-46
5.4.1.6	Air Quality.....	5-46
5.4.1.7	Summary of Physical Impacts	5-47
5.4.2	Demography.....	5-47
5.4.3	Economic Impacts to the Community.....	5-48
5.4.3.1	Economy	5-49
5.4.3.2	Taxes.....	5-50
5.4.3.3	Summary of Economic Impacts to the Community	5-51
5.4.4	Infrastructure and Community Services	5-51
5.4.4.1	Transportation	5-52
5.4.4.2	Recreation	5-52
5.4.4.3	Housing	5-53
5.4.4.4	Public Services.....	5-54
5.4.4.5	Education	5-57
5.4.4.6	Summary of Impacts to Public Services.....	5-58
5.4.5	Potential Mitigation Measures for Operation-Related Socioeconomic Impacts	5-58
5.4.6	Summary of Socioeconomic Impacts	5-58
5.5	Environmental Justice Impacts	5-58
5.5.1	Health and Environmental Impacts	5-59
5.5.1.1	Soil Pathway.....	5-59
5.5.1.2	Water Pathway	5-59
5.5.1.3	Air Pathway	5-60
5.5.1.4	Noise	5-60
5.5.2	Socioeconomic Impacts	5-60
5.5.3	Subsistence and Special Conditions	5-60
5.5.4	Summary of Environmental Justice Impacts	5-61
5.6	Historic and Cultural Resource Impacts from Operation.....	5-61

5.7	Meteorological and Air Quality Impacts.....	5-61
5.7.1	Air Quality Impacts	5-62
5.7.2	Cooling System Impacts.....	5-63
5.7.3	Summary	5-64
5.8	Nonradiological Health Impacts	5-64
5.8.1	Etiologic Agents.....	5-64
5.8.2	Noise	5-66
5.8.3	Acute Effects of Electromagnetic Fields.....	5-67
5.8.4	Chronic Effects of Electromagnetic Fields.....	5-69
5.8.5	Occupational Health	5-69
5.8.6	Impacts of Transporting Operations Personnel and Waste Salt	5-70
5.8.7	Summary of Nonradiological Health Impacts	5-71
5.9	Radiological Impacts of Normal Operations.....	5-73
5.9.1	Exposure Pathways.....	5-73
5.9.2	Radiation Doses to Members of the Public	5-76
5.9.2.1	Liquid Effluent Pathway.....	5-76
5.9.2.2	Gaseous Effluent Pathway	5-77
5.9.3	Impacts to Members of the Public	5-79
5.9.3.1	Maximally Exposed Individual	5-79
5.9.3.2	Population Dose	5-79
5.9.3.3	Summary of Radiological Impacts to Members of the Public	5-80
5.9.4	Occupational Doses to Workers.....	5-81
5.9.5	Dose to Biota Other Than Humans	5-81
5.9.5.1	Liquid Effluent Pathway.....	5-81
5.9.5.2	Gaseous Effluent Pathway	5-81
5.9.5.3	Impact of Estimated Non-Human Biota Doses.....	5-82
5.9.6	Radiological Monitoring	5-83
5.10	Nonradioactive Waste Impacts	5-84
5.10.1	Impacts to Land.....	5-84
5.10.2	Impacts to Water	5-85
5.10.3	Impacts to Air	5-85
5.10.4	Mixed Waste Impacts	5-86
5.10.5	Summary of Waste Impacts	5-86
5.11	Environmental Impacts of Postulated Accidents.....	5-86
5.11.1	Design Basis Accidents.....	5-88
5.11.2	Severe Accidents	5-90
5.11.2.1	Air Pathway	5-91
5.11.2.2	Surface-Water Pathways.....	5-98

5.11.2.3	Groundwater Pathway	5-98
5.11.2.4	Summary of Severe Accident Impacts	5-99
5.11.3	Severe Accident Mitigation Alternatives	5-99
5.11.4	Summary of Postulated Accident Impacts.....	5-100
5.12	Measures and Controls to Limit Adverse Impacts During Operation	5-101
5.13	Summary of Operational Impacts.....	5-101
5.14	References.....	5-115
6.0	Fuel Cycle, Transportation, and Decommissioning	6-1
6.1	Fuel Cycle Impacts and Solid Waste Management	6-1
6.1.1	Land Use	6-8
6.1.2	Water Use	6-8
6.1.3	Fossil Fuel Impacts	6-9
6.1.4	Chemical Effluents	6-9
6.1.5	Radiological Effluents.....	6-10
6.1.6	Radiological Wastes.....	6-12
6.1.7	Occupational Dose	6-14
6.1.8	Transportation	6-14
6.1.9	Conclusions.....	6-15
6.2	Transportation Impacts	6-15
6.2.1	Transportation of Unirradiated Fuel.....	6-16
6.2.1.1	Normal Conditions.....	6-17
6.2.1.2	Radiological Impacts of Transportation Accidents	6-22
6.2.1.3	Nonradiological Impacts of Transportation Accidents	6-22
6.2.2	Transportation of Spent Fuel.....	6-23
6.2.2.1	Normal Conditions.....	6-24
6.2.2.2	Radiological Impacts of Accidents.....	6-29
6.2.2.3	Nonradiological Impact of Spent Fuel Shipments	6-32
6.2.3	Transportation of Radioactive Waste	6-33
6.2.4	Conclusions.....	6-34
6.3	Decommissioning Impacts	6-35
6.4	References.....	6-37
7.0	Cumulative Impacts.....	7-1
7.1	Land Use.....	7-2
7.2	Water Use and Quality	7-8
7.2.1	Water-Use Impacts.....	7-8
7.2.1.1	Surface-Water-Use Impacts	7-8
7.2.1.2	Groundwater-Use Impacts	7-9
7.2.2	Water-Quality Impacts.....	7-9
7.2.2.1	Surface-Water Quality Impacts	7-10

7.2.2.2	Groundwater-Quality Impacts.....	7-12
7.3	Ecology	7-12
7.3.1	Terrestrial Ecology	7-13
7.3.1.1	Wildlife and Plant Communities.....	7-13
7.3.1.2	Important Species	7-15
7.3.2	Aquatic Ecosystem and Wetlands Impacts	7-17
7.4	Socioeconomics and Environmental Justice.....	7-21
7.4.1	Socioeconomics	7-21
7.4.2	Environmental Justice	7-22
7.5	Historic and Cultural Resources.....	7-23
7.6	Air Quality.....	7-24
7.6.1	Criteria Pollutants	7-24
7.6.2	Greenhouse Gas Emissions.....	7-25
7.6.3	Summary	7-26
7.7	Nonradiological Health	7-27
7.8	Radiological Impacts of Normal Operation.....	7-28
7.9	Postulated Accidents.....	7-29
7.10	Fuel Cycle, Transportation, and Decommissioning.....	7-30
7.10.1	Fuel Cycle	7-30
7.10.2	Transportation	7-31
7.10.3	Decommissioning	7-32
7.11	Conclusions and Recommendations.....	7-32
7.12	References.....	7-35
8.0	Need for Power.....	8-1
8.1	Description of Power System	8-3
8.1.1	The Applicant	8-3
8.1.2	The Restructured Texas Utility Industry	8-3
8.1.3	The Role of Market Forces in the Restructured System	8-5
8.1.4	ERCOT Load Forecasting Process.....	8-5
8.1.4.1	Historical and Forecasted Peak Demand and Average Load	8-6
8.1.4.2	Development of Peak Demand and Energy Consumption Forecasts	8-8
8.1.4.3	Historical Trends and Long-Term Forecasts	8-10
8.1.4.4	Load Participation Programs	8-12
8.1.4.5	Conclusion: Adequacy of ERCOT Assessments as per NUREG-1555 Criteria	8-12
8.2	Power Demand: Comparison of Applicant Demand Estimates and NRC Staff Estimates Updated with 2009 ERCOT Data.....	8-14
8.3	Power Supply	8-15

8.3.1	Generating Capacity Analysis and Planning	8-15
8.3.2	ERCOT Future Generation.....	8-18
8.3.3	Reserve Margin	8-19
8.3.3.1	Calculating the Reserve Margin	8-19
8.3.4	Comparison of Applicant Reserve Margins and NRC Staff Estimates	8-20
8.4	Assessment of Need for Power.....	8-20
8.4.1	Analysis	8-21
8.4.2	Summary and Conclusions	8-22
8.5	NRC Staff Conclusions	8-22
8.6	References.....	8-23
9.0	Environmental Impacts of Alternatives	9-1
9.1	No-Action Alternative	9-2
9.2	Energy Alternatives	9-3
9.2.1	Alternatives Not Requiring New Generation Capacity.....	9-3
9.2.1.1	Purchased Power	9-3
9.2.1.2	Reactivating Retired Power Plants or Extending Operating Life	9-4
9.2.1.3	Demand Side Management.....	9-5
9.2.1.4	Conclusions.....	9-6
9.2.2	Alternatives Requiring New Generation Capacity	9-6
9.2.2.1	Coal-Fired Power Generation.....	9-8
9.2.2.2	Natural Gas-Fired Power Generation.....	9-14
9.2.3	Other Alternatives.....	9-19
9.2.3.1	Wind Power Generation	9-20
9.2.3.2	Oil-Fired Power Generation.....	9-24
9.2.3.3	Solar Power Generation	9-24
9.2.3.4	Hydropower Generation	9-25
9.2.3.5	Geothermal Power Generation.....	9-25
9.2.3.6	Power Generation from Wood Waste.....	9-26
9.2.3.7	Power Generation from Municipal Solid Waste.....	9-26
9.2.3.8	Power Generated from Other Biomass-Derived Fuels.....	9-27
9.2.3.9	Fuel Cells Power Generation	9-27
9.2.4	Combination of Alternatives	9-28
9.2.5	Summary Comparison of Alternatives	9-30
9.3	Alternative Sites	9-33
9.3.1	Site Selection Process	9-33
9.3.1.1	Selection of Region of Interest	9-33
9.3.1.2	Selection of Candidate Areas.....	9-34
9.3.1.3	Selection of Potential Sites.....	9-34
9.3.1.4	Selection of Primary Sites	9-34

9.3.1.5	Selection of Candidate Sites	9-35
9.3.1.6	Evaluation of the Applicant's Site Selection Process	9-36
9.3.2	The Coastal Site	9-38
9.3.2.1	Land Use	9-41
9.3.2.2	Water Use and Quality	9-43
9.3.2.3	Terrestrial Resources	9-45
9.3.2.4	Aquatic and Wetland Resources	9-49
9.3.2.5	Socioeconomics	9-56
9.3.2.6	Environmental Justice	9-57
9.3.2.7	Historic and Cultural Resources	9-59
9.3.2.8	Air Quality	9-61
9.3.2.9	Nonradiological Health Impacts.....	9-62
9.3.2.10	Radiological Health Impacts of Normal Operations.....	9-64
9.3.2.11	Postulated Accidents	9-65
9.3.3	The Pineland Site	9-66
9.3.3.1	Land Use	9-69
9.3.3.2	Water Use and Quality	9-71
9.3.3.3	Terrestrial Resources	9-74
9.3.3.4	Aquatic and Wetland Resources	9-78
9.3.3.5	Socioeconomics	9-85
9.3.3.6	Environmental Justice	9-85
9.3.3.7	Historic and Cultural Resources	9-87
9.3.3.8	Air Quality	9-89
9.3.3.9	Nonradiological Health Impacts.....	9-90
9.3.3.10	Radiological Health Impacts of Normal Operations.....	9-92
9.3.3.11	Postulated Accidents	9-93
9.3.4	The Tradinghouse Site	9-93
9.3.4.1	Land Use	9-95
9.3.4.2	Water Use and Quality	9-97
9.3.4.3	Terrestrial Resources	9-99
9.3.4.4	Aquatic and Wetland Resources	9-102
9.3.4.5	Socioeconomics	9-107
9.3.4.6	Environmental Justice	9-108
9.3.4.7	Historic and Cultural Resources	9-110
9.3.4.8	Air Quality	9-111
9.3.4.9	Nonradiological Health	9-112
9.3.4.10	Radiological Health Impacts of Normal Operations.....	9-114
9.3.4.11	Postulated Accidents	9-115
9.3.5	Comparison of the Impacts of the Proposed Action and Alternative Sites	9-115
9.3.5.1	Comparison of Cumulative Impacts at the Proposed and Alternative Sites.....	9-116
9.3.5.2	Environmentally Preferable Sites	9-117
9.3.5.3	Obviously Superior Sites	9-120
9.4	System Design Alternatives	9-120

9.4.1	Heat Dissipation Systems	9-120
9.4.1.1	Dry Cooling Towers.....	9-121
9.4.1.2	Combination Wet/Dry Cooling Tower System	9-123
9.4.1.3	Wet Natural Draft Cooling Towers.....	9-124
9.4.2	Circulating Water System.....	9-124
9.4.2.1	Intake Alternatives.....	9-124
9.4.2.2	Discharge Alternatives	9-125
9.4.2.3	Water Supplies.....	9-126
9.4.2.4	Water Treatment	9-127
9.4.3	Conclusion.....	9-128
9.5	References.....	9-128
10.0	Conclusions and Recommendations	10-1
10.1	Impacts of the Proposed Action	10-2
10.2	Unavoidable Adverse Environmental Impacts	10-3
10.2.1	Unavoidable Adverse Impacts during Construction and Preconstruction .	10-3
10.2.2	Unavoidable Adverse Impacts during Operation	10-7
10.3	Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment	10-12
10.4	Irreversible and Irretrievable Commitments of Resources	10-12
10.4.1	Irreversible Commitments of Resources	10-12
10.4.1.1	Land Use	10-13
10.4.1.2	Water Use	10-13
10.4.1.3	Ecology.....	10-13
10.4.1.4	Socioeconomic Resources.....	10-13
10.4.1.5	Historic and Cultural Resources.....	10-13
10.4.1.6	Air and Water	10-13
10.4.2	Irretrievable Commitments of Resources	10-14
10.5	Alternatives to the Proposed Action	10-14
10.6	Benefit-Cost Balance	10-15
10.6.1	Benefits	10-16
10.6.1.1	Monetary Benefits	10-16
10.6.1.2	Non-Monetary Benefits.....	10-21
10.6.2	Costs	10-22
10.6.2.1	Internal Costs	10-22
10.6.2.2	External Costs.....	10-25
10.6.3	Summary of Benefits and Costs.....	10-26
10.7	Staff Conclusions and Recommendations	10-26
10.8	References.....	10-27
	Appendix A - Contributors to the Environmental Impact Statement.....	A-1
	Appendix B - Organizations Contacted.....	B-1

Appendix C - Chronology of the Nuclear Regulatory Commission and the U.S. Army Corps of Engineers Staff Environmental Review Correspondence Related to Luminant Generation Company, LLC, Application for Combined Licenses at the Comanche Peak Nuclear Power Plant Site	C-1
Appendix D - Scoping Comments and Responses	D-1
Appendix E - Draft Environmental Impact Statement Comments and Responses (Reserved).....	E-1
Appendix F - Key Consultation Correspondence Regarding the Comanche Peak Nuclear Power Plant, Units 3 and 4, Combined Licenses Application	F-1
Appendix G - Supporting Information and Data: Population Projections and Health Physics	G-1
Appendix H - List of Authorizations, Permits, and Certifications.....	H-1
Appendix I - Severe Accident Mitigation Alternatives	I-1
Appendix J - Carbon Dioxide Footprint Estimates for a 1000 MW(e) Light Water Reactor (LWR)	J-1

Figures

Figure	Page
2-1. 50-mi regional location of the CPNPP site	2-2
2-2. Location of the CPNPP site within Hood and Somervell Counties, Texas	2-3
2-3. The site plan for CPNPP Units 3 and 4	2-4
2-4. Location of proposed CPNPP Units 3 and 4 in relation to existing Units 1 and 2 on the CPNPP site	2-5
2-5. Existing and proposed water pipelines from Lake Granbury to the CPNPP site	2-6
2-6. Land use on CPNPP site	2-9
2-7. Land use features in project vicinity	2-10
2-8. Vicinity land use	2-11
2-9. Federal lands and State parks in the region	2-14
2-10. Regional land use	2-15
2-11. Predominant surface-water hydrologic features of the CPNPP site area, including locations of gauging stations	2-16
2-12. Map of the middle Brazos River watershed, including locations of Possum Kingdom Lake (Reservoir), Lake Granbury, Lake Whitney, and several other Brazos River reservoirs	2-17
2-13. Existing and proposed transmission line rights-of-way and pipeline routes (Note: All routes are approximate, and the proposed routes have yet to be determined. The existing 185 and 345-kV transmission lines would not be modified)	2-32
2-14. Ecological cover type vegetation map	2-36
2-15. Vegetative cover of the CPNPP site	2-65
2-16. Squaw Creek Reservoir wetland delineation. Upper: Proposed cooling tower locations on the peninsula to the north of the proposed site of Units 3 and 4. Lower: Closeup of wetland in inlet south of the peninsula	2-67
2-17. Locations of the contributors to transient populations in the region	2-80
2-18. Road and highway system in Somervell and Hood Counties	2-89
2-19. Census Block Groups with Minority Populations within a 50-mi Radius of CPNPP Units 3 and 4	2-99
2-20. Census Block Groups with Low-Income Populations within a 50-mi Radius of CPNPP Units 3 and 4	2-100
2-21. Physiographic map of Texas (The CPNPP site is located in the Grand Prairie physiographic province)	2-107
2-22. Bedrock stratigraphic column for the CPNPP site area	2-108
2-23. Geologic map of the region within 25 miles of the CPNPP site	2-109
2-24. Active gas wells in the vicinity of the CPNPP site and production volumes	2-110

3-1. Photograph of existing CPNPP Units 1 and 2, with an artist's conception of the proposed Units 3 and 4 on the left-hand side of the photograph.....	3-2
3-2. Simplified flow diagram for the CPNPP reactor power conversion system	3-4
3-3. Simplified water use diagram for CPNPP Units 3 and 4.....	3-7
3-4. Mass balance for blowdown treatment facility (BDTF) when Lake Granbury total dissolved solids (TDS) and chloride concentrations are high (Flow rates are per unit)	3-13
3-5. Oncor transmission line towers with vacant circuit positions	3-15
3-6. Detailed site plan showing construction laydown areas	3-20
3-7. Proposed makeup water intake structure on Lake Granbury (cross section).....	3-26
3-8. Blowdown water system discharge diffuser as proposed for construction in Lake Granbury.....	3-27
4-1. Potentiometric map showing groundwater isopleths and flow directions beneath the CPNPP site.....	4-12
4-2. Ecological cover types within development footprint.....	4-15
5-1. Schematic Layout of the Proposed Blowdown Treatment Facility Showing Distances from the Misters to Nearby Locations	5-3
5-2. Exposure Pathways to Man.....	5-74
5-3. Exposure Pathways to Biota Other Than Man	5-75
6-1. The Uranium Fuel Cycle: No-Recycle Option.....	6-6
6-2. Illustration of Truck Stop Model	6-26
8-1. Electric Reliability Council of Texas region.....	8-2
8-2. ERCOT historical load versus system peak growth	8-7
8-3. ERCOT forecasted average load versus system peak growth.....	8-8
8-4. Weather zones	8-9
8-5. The forecasting process	8-10
8-6. Historical and base forecast hourly peak demand	8-11
8-7. Comparison of 2008 and 2009 long-term energy forecasts	8-12
9-1. Map showing the locations of Luminant's alternative sites.....	9-37

Tables

Table	Page
2-1. Water Withdrawals in the Vicinity of the CPNPP Site in 2006 (numerical values are in acre-feet)	2-22
2-2. Chemical analysis of surface water samples collected in Lake Granbury near DeCordova Dam, January 2001 through September 2006 [11860 - Lake Granbury DeCordova Dam (01/01-09/06)]	2-27
2-3. TPDES-permitted discharges to Lake Granbury and the Brazos River below Lake Granbury	2-28
2-4. Range of concentrations of chemical constituents in water samples collected in Lake Granbury and other monitoring stations in the Brazos and Paluxy Rivers. Data from BRA for the period between January 1, 1997 and September 29, 2009. Applicable Texas surface water quality criteria are shown in parentheses below the range values	2-29
2-5. Species characterizing the silver bluestem – Texas wintergrass grassland cover type	2-34
2-6. Species characterizing the oak-mesquite-juniper savanna and woodlands cover type	2-34
2-7. Distribution of cover types and acreage totals at CPNPP	2-37
2-8. Water-dependent bird species observed at CPNPP in 2007	2-39
2-9. Upland game birds, birds of prey, and woodpeckers observed at CPNPP in 2007	2-39
2-10. Ecological Oriented Public Recreation Areas within a 50-mi Radius of CPNPP	2-41
2-11. Acreages of vegetation types that would be crossed by expanded existing transmission lines on existing towers.	2-42
2-12. Pipeline corridor land use and cover types	2-43
2-13. Threatened, endangered, or rare terrestrial plant and animal species listed in Somervell, Hood, and Bosque Counties	2-46
2-14. Fish Numbers and Catch Rates from 2005–2006 and Previous TPWD Surveys of Lake Granbury	2-55
2-15. Fish Species Occurring in Lake Granbury	2-56
2-16. Fish Species Occurring in Squaw Creek Reservoir	2-59
2-17. Fish Species Potentially Occurring in the Brazos River between Lake Granbury and Lake Whitney	2-62
2-18. Federally and State-Listed Aquatic Species Occurring in the Vicinity of Proposed CPNPP Units 3 and 4 and Proposed New 345-kV Transmission Line ROWs	2-71
2-19. Counties entirely or partially located within the 50-mi CPNPP region	2-76

2-20. Population and percent population change in the EIA and the State of Texas (1970–2040)	2-79
2-21. Annual average labor force, employment, and unemployment in the EIA and the State of Texas (2008)	2-81
2-22. Total non-farm employment by industry type in the EIA (2007)	2-84
2-23. Place of residence for CPNPP Units 1 and 2 workers.....	2-86
2-24. Total personal and per capita income in the EIA and the State of Texas (2007)	2-87
2-25. Property tax rates and revenues in Somervell and Hood Counties (2007)	2-87
2-26. Ad valorem taxes paid by CPNPP Units 1 and 2 (2006)	2-88
2-27. Housing data for the EIA (2000 or 2007).....	2-88
2-28. Housing data for Glen Rose, Granbury, Pecan Plantation CDP, and Tolar (2000).....	2-92
2-29. Minority and low-income population as a percent of total population within 50-mi of CPNPP and for the State of Texas (2000)	2-101
2-30. Expected maximum tornado wind speeds and upper limits	2-114
2-31. Emissions and operations limits associated with CPNPP Units 1 and 2.....	2-115
2-32. CPNPP short-term atmospheric dispersion estimates for accident releases	2-117
3-1. Heat transfer to the environment for six operating modes (data values are in million Btu/hr)	3-8
3-2. Water withdrawn and discharged per unit for six operating modes.....	3-9
3-3. Chemicals that would be added to the essential service water system (ESWS) and circulating water system (CWS) of the CPNPP Units 3 and 4.....	3-10
3-4. Descriptions and examples of building activities for CPNPP Units 3 and 4	3-18
3-5. Schedule for construction of CPNPP Units 3 and 4	3-19
3-6. Total workforce by craft for construction of CPNPP Units 3 and 4	3-30
3-7. Expected numbers of onsite workers by year for construction of CPNPP Units 3 and 4.....	3-31
3-8. Summary of Resource Commitments Associated with Building Proposed Units 3 and 4	3-32
3-9. Average annual pollutant emissions from Unit 3 and 4 stationary fuel burning equipment (data values are in pounds per year)	3-41
3-10. Parameters Associated with Operation of Proposed CPNPP Units 3 and 4	3-42
4-1. Acres of habitat types before and after construction and preconstruction at the CPNPP site that would be affected by development of Units 3 and 4.....	4-14
4-2. Terrestrial habitat acreages on CPNPP site and vicinity (6- mi radius).....	4-16
4-3. Stream crossings within the 18-mi segment of new ROW for the Whitney transmission line	4-31
4-4. Stream crossings for the new pipelines to be installed in the existing ROW between CPNPP and Lake Granbury	4-32

4-5. Total number of Unit 3 and 4 construction and operations workers onsite each year during building	4-41
4-6. Potential population growth in the EIA due to peak building year (2014) employment at CPNPP Units 3 and 4.....	4-42
4-7. Potential total ad valorem taxes paid on CPNPP Units 3 and 4	4-46
4-8. Peak hour traffic impacts on FM 56 during the peak building year at CPNPP Units 3 and 4	4-49
4-9. Expected daily traffic distribution during the peak building period at CPNPP Units 3 and 4	4-50
4-10. Vacant permanent and temporary housing units and projected housing demand from in-migrating CPNPP workers ² (2014) in the EIA	4-53
4-11. Existing excess water and wastewater treatment capacity and projected water demand from in-migrating CPNPP workers (2014) in the EIA	4-55
4-12. Projected total nonfatal occupational illnesses and injuries to construction force using 2007 rates for various groups	4-69
4-13. Construction noise sources and attenuation with distance.....	4-71
4-14. Summary of measures and controls proposed by Luminant to limit adverse impacts when building proposed Units 3 and 4	4-77
4-15. Summary of Impacts from Building of Proposed CPNPP Units 3 and 4.....	4-80
5-1 Annual Hours of Fogging and Icing Affecting Residential Area Adjacent to CPNPP Boundary.....	5-2
5-2. Estimated Concentrations of Selected Water Quality Constituents at the Discharge of CPNPP Units 3 and 4 when Diluted in Lake Granbury. All concentrations expressed as mg/L.....	5-11
5-3. Egg and Spawning Characteristics of Lake Granbury Fish Species	5-27
5-4. Thermal Tolerances of Some Fish Species of Lake Granbury	5-30
5-5. Potential Population Growth in the EIA due to Peak Operations Employment at CPNPP Units 3 and 4	5-48
5-6. Average Annual Salary for Operations Workforce at CPNPP Units 3 and 4	5-50
5-7. Potential Total Annual ad Valorem Taxes Paid on CPNPP Units 3 and 4 During Operations	5-51
5-8. Vacant Housing Units and Projected Housing Demand from In-migrating CPNPP Operations Workers in the EIA.....	5-54
5-9. Air Emissions Associated with CPNPP Units 3 and 4 (lb/yr)	5-62
5-10. Predicted Noise Levels (DbA) Expected due to Plant Operations.....	5-68
5-11. Expected Annual Total Recordable Cases of Injuries and Illnesses	5-70
5-12. Annual Expected Impacts of Transporting Operations Personnel to the Comanche Peak Site.....	5-72

5-13. Annual Expected Impacts of Transporting Salt Waste from CPNPP Units 3 and 4	5-72
5-14. Annual Doses to the MEI for Liquid Effluent Releases from a New Unit	5-76
5-15. Annual Doses to MEI from Gaseous Effluent Releases from a New Unit	5-78
5-16. Comparison of Annual MEI Dose for Single Unit with 10 CFR 50, Appendix I Dose Design Objectives	5-78
5-17. Comparison of MEI Annual Doses (mrem/yr) with 40 CFR Part 190 Standards	5-80
5-18. Biota Annual Doses for Proposed Units 3 and 4	5-82
5-19. Comparison of Biota Doses from the Proposed Units 3 and 4 at the CPNPP Site to Relevant Guidelines for Biota Protection.....	5-82
5-20. Atmospheric Dispersion Factors for Comanche Peak Site DBA Calculations.....	5-88
5-21. DBA Doses for a US-APWR for Proposed CPNPP Units 3 and 4.....	5-89
5-22. Environmental Risks from a US APWR Severe Accident at the Comanche Peak Site (2006 Meteorological data)	5-92
5-23. Total Severe Accident Health Effects (based on 2006 Meteorological data)	5-93
5-24. Comparison of Environmental Risks for a US-APWR at the Comanche Peak Site using 2006 Meteorological Data with Risks for Current-generation Reactors at Five Sites Evaluated in NUREG-1150	5-94
5-25. Comparison of Environmental Risks from Severe Accidents for a US-APWR at the Comanche Peak Site with Risks for Current Plants from Operating License Renewal Reviews, Including CPNPP Units 1 and 2.....	5-96
5-26. The Mean CDF and LRF Estimated Contributions for US-APWR at CPNPP	5-97
5-27. Summary of Measures and Controls Proposed by Luminant to Limit Adverse Impacts During Operation.....	5-102
5-28. Characterization of Operational Impacts at the Proposed Unit 3 and 4 Comanche Peak Site.....	5-110
6-1. Uranium fuel cycle environmental data as provided in Table S-3 of 10 CFR 51.51(b)	6-2
6-2. Comparison of annual average dose received by an individual from all sources	6-12
6-3. Numbers of Truck Shipments of Unirradiated Fuel for the Reference LWR and the US-APWR.....	6-17
6-4. RADTRAN 5.6 input parameters for unirradiated fuel shipments.....	6-19
6-5. Radiological impacts under normal conditions of transporting unirradiated fuel to the CPNPP site and alternative sites.....	6-20
6-6. Nonradiological impacts of transporting unirradiated fuel to the CPNPP site and alternative sites, normalized to reference LWR	6-24

6-7. Transportation Route Information for Shipments from the CPNPP Site and Alternative Sites to the Proposed Geologic Repository at Yucca Mountain, Nevada (Johnson and Michelhaugh 2003) Spent Fuel Disposal Facility	6-25
6-8. RADTRAN 5.6 normal (incident-free) exposure parameters	6-27
6-9. Normal (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from the CPNPP Site and Alternative Sites to the Proposed High-Level Waste Repository at Yucca Mountain	6-28
6-10. Radionuclide inventories used in transportation accident risk calculations for the US-APWR	6-30
6-11. Annual spent fuel transportation accident impacts for an US-APWR reactor at the CPNPP Site and alternative sites normalized to reference 1100-MW(e) LWR Net electrical generation	6-32
6-12. Nonradiological impacts of transporting spent fuel from the CPNPP site and alternative sites to Yucca Mountain, normalized to reference LWR	6-33
6-13. Summary of radioactive waste shipments from the CPNPP site and alternative sites.....	6-34
6-14. Nonradiological impacts of radioactive waste shipments from the CPNPP site.....	6-35
7-1. Projects and Other Actions Considered in the Cumulative Analysis at the CPNPP Site.....	7-3
7-2. Comparison of Annual Carbon Dioxide Emission Rates	7-26
7-3. Cumulative Impacts on Environmental Resources, Including the Impacts of the Proposed CPNPP Units 3 and 4	7-33
8-1. Comparison of peak load forecasts, loads acting as reserves, and demand-side management energy saving for 2014, 2019, and 2024	8-15
8-2. 2009 report on the capacity, demand, and reserves in the ERCOT region.....	8-16
8-3. Generation interconnection information.....	8-18
8-4. Summary of generating capacity and simple reserve margins based on ERCOT and Luminant forecasts.....	8-20
8-5. Summary of need for power	8-21
9-1. Land areas of Luminant lignite coal plants	9-12
9-2. Summary of environmental impacts of coal-fired power generation.....	9-15
9-3. Summary of environmental impacts of natural gas-fired power generation	9-20
9-4. Summary of environmental impacts of a combination of power sources	9-31
9-5. Summary of environmental impacts (Impact Category Level) of construction and operation of new nuclear, coal-fired, and natural gas-fired generating units, and a combination of alternatives	9-32

9-6. Comparison of Carbon Dioxide Emissions for Energy Alternatives.....	9-33
9-7. Projects and Other Actions Considered in the Cumulative Analysis at the Coastal Site	9-39
9-8. Threatened or Endangered Terrestrial Species that May Occur within 10 mi of Coastal Site	9-46
9-9. State-listed Aquatic Species and State Species of Concern Potentially Occurring in the Vicinity of the Coastal Site.....	9-51
9-10. Population and Labor Force in Victoria County, Texas, and the Other Counties Surrounding the Coastal Site	9-57
9-11. Minority and Low-income Percentages in Victoria County, Texas, and the Other Counties Surrounding the Coastal Site	9-59
9-12. Nearby Nuclear Projects/Facilities Considered in the Cumulative Analysis at the Coastal Site	9-65
9-13. Projects and Other Actions Considered in the Cumulative Analysis at the Pineland Site	9-67
9-14. Threatened or endangered terrestrial species that may occur within 10 mi of the Pineland Site	9-75
9-15. State-listed Aquatic Species and State Species of Concern Potentially Occurring in the Vicinity of the Pineland Site.....	9-80
9-16. Population and Labor Force in San Augustine County, Texas, and the Other Counties and Parishes Surrounding the Pineland Site.....	9-86
9-17. Minority and Low-income Percentages in San Augustine County, Texas, and the Other Counties and Parishes Surrounding the Pineland Site.....	9-87
9-18. Projects and other actions considered in the cumulative analysis at the Tradinghouse Site	9-94
9-19. Threatened or endangered terrestrial species that may occur within 10 mi of Tradinghouse Site	9-100
9-20. Federally and State-listed Aquatic Species and State Species of Concern Potentially Occurring in the Vicinity of the Tradinghouse Site	9-104
9-21. Population and Labor Force in McLennan County, Texas, and the Other Counties Surrounding the Tradinghouse Site.....	9-108
9-22. Minority and Low-income Percentages in McLennan County, Texas, and the Other Counties Surrounding the Tradinghouse Site.....	9-109
9-23. Nearby Nuclear Projects/Facilities Considered in the Cumulative Analysis at the Tradinghouse Site	9-115
10-1. Unavoidable Adverse Environmental Impacts during Construction and Preconstruction.....	10-5

10-2. Unavoidable Adverse Environmental Impacts from Operations 10-9

10-3. Monetary and nonmonetary benefits from constructing and operating
CPNPP Units 3 and 4 10-17

10-4. Internal and external costs of constructing and operating CPNPP Units 3 and 4 10-19

Executive Summary

1 By letter dated September 19, 2008, the U.S. Nuclear Regulatory Commission (NRC) received
2 an application from Luminant Generation Company LLC (Luminant), acting for itself and as
3 agent for Nuclear Project Company LLC (subsequently renamed Comanche Peak Nuclear
4 Power Company LLC), for combined construction permits and operating licenses (combined
5 licenses or COLs) for two new nuclear reactor power units (the proposed Units 3 and 4) at the
6 Comanche Peak Nuclear Power Plant (CPNPP) site, which is located in Hood and Somervell
7 Counties, Texas. The NRC staff's evaluation is based on Luminant's November 2009 revision
8 to the application, responses to requests for additional information (RAIs), and supplemental
9 letters.

10 The proposed actions related to the CPNPP Unit 3 and 4 application are (1) NRC issuance of
11 COLs for two new nuclear power reactor units at the CPNPP site and (2) U.S. Army Corps of
12 Engineers (Corps) issuance of a permit pursuant to Section 404 of the Federal Water Pollution
13 Control Act (Clean Water Act) and Section 10 of the Rivers and Harbors Act to perform certain
14 construction activities on the site. The Corps is participating as a cooperating agency with the
15 NRC in preparing this environmental impact statement (EIS) and participates collaboratively on
16 the review team. The reactor specified in the application is a Mitsubishi Heavy Industries, Ltd.
17 (MHI), U.S. Advanced Pressurized-Water Reactor (US-APWR) design (hereafter referred to as
18 US-APWR in this EIS).

19 Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA)
20 (42 USC 4321 et seq.) directs that an EIS be prepared for major Federal actions that
21 significantly affect the quality of the human environment. The NRC has implemented Section
22 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. Further, in 10 CFR
23 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action
24 that requires an EIS.

25 The purpose of Luminant's requested NRC action is to obtain COLs to construct and operate
26 two new baseload nuclear power units. These licenses are necessary but not sufficient for
27 construction and operation of the units. A COL applicant must obtain and maintain the
28 necessary permits from other Federal, State, Tribal, and local agencies and permitting
29 authorities. Therefore, the purpose of the NRC's environmental review of Luminant's
30 application is to determine the impacts on the human environment if two new nuclear power
31 units of the proposed US-APWR design are constructed and operated at the CPNPP site. The
32 purpose of Luminant's requested Corps action is to obtain a permit to perform regulated
33 activities that would have an effect on waters of the United States.

34 Upon acceptance of the Luminant application, the NRC began the environmental review
35 process described in 10 CFR Part 51 by publishing in the *Federal Register* (FR) a Notice of
36 Intent (73 FR 9604) to prepare an EIS and to conduct scoping. On January 6, 2009, the NRC
37 held two scoping meetings in Glen Rose, Texas, to obtain public input on the scope of the
38 environmental review. The staff reviewed the comments received during the scoping process
39 and contacted Federal, State, Tribal, regional, and local agencies to solicit comments.

40 To gather information and to become familiar with the sites and their environs, the NRC, its
41 contractors [the Oak Ridge National Laboratory (ORNL) and Information Systems Laboratories,
42 Inc. (ISL)], and the Corps visited the CPNPP site in February 2009 to examine the ecological
43 resources of the site and to conduct an environmental site audit. The NRC and its contractors
44 also visited three alternative sites (the Coastal site, the Pineland site, and the Tradinghouse
45 site) in Texas in February 2009. During the site visits, the NRC staff and its contractors met
46 with Luminant staff, public officials, and the public.

1 Included in this EIS are (1) the results of the joint NRC/Corps review team's analyses, which
2 consider and weigh the environmental effects of the proposed actions; (2) potential mitigation
3 measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives
4 to the proposed action; and (4) the NRC staff's preliminary recommendation regarding the
5 proposed action.

6 To guide its assessment of the environmental impacts of a proposed action or alternative
7 actions, the NRC has established a standard of significance for impacts based on Council on
8 Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A,
9 Appendix B, provides the following definitions of the three significance levels – SMALL,
10 MODERATE, and LARGE:

11 SMALL – Environmental effects are not detectable or are so minor that they will neither
12 destabilize nor noticeably alter any important attribute of the resource.

13 MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize,
14 important attributes of the resource.

15 LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize
16 important attributes of the resource.

17 In preparing this EIS, the review team reviewed the application, including the Environmental
18 Report (ER) submitted by Luminant; consulted with Federal, State, Tribal, and local agencies;
19 and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plan*. In
20 addition, the NRC staff considered the public comments related to the environmental review
21 received during the scoping process. Comments within the scope of the environmental review
22 are included in Appendix D of this EIS.

23 The NRC staff's preliminary recommendation to the Commission related to the environmental
24 aspects of the proposed action is that the COLs be issued as requested. This recommendation
25 is based on (1) the application, including the ER submitted by Luminant and Luminant's
26 supplemental letters and responses to the review team's RAIs; (2) consultation with other
27 Federal, State, Tribal, and local agencies; (3) the review team's independent review; (4) the
28 review team's consideration of public scoping comments; and (5) the assessments summarized
29 in this EIS, including the potential mitigation measures identified in the ER and this EIS. The
30 Corps permit decision will be made following issuance of the final EIS, and the Corps will issue
31 its Record of Decision (ROD) based, in part, on this EIS.

32 A 75-day comment period will begin on the date of publication in the FR of the U.S.
33 Environmental Protection Agency Notice of Availability of the filing of the draft EIS to allow
34 members of the public and agencies to comment on the results of the environmental review.
35 During that period, the NRC and Corps staff will conduct a public meeting near the CPNPP site
36 to describe the results of the environmental review, respond to questions, and accept public
37 comments. After the comment period, the review team will consider all the comments received.
38 The final EIS will include these comments and the review team's responses.

39 The NRC staff's evaluation of the site safety and emergency preparedness aspects of the
40 proposed action will be addressed in the NRC's Safety Evaluation Report, currently anticipated
41 to be published in December 2011. The reactor specified in the application is the MHI US-
42 APWR design, which is currently undergoing a design certification review. The NRC staff's
43 evaluation of the design certification and final rulemaking is currently anticipated to be
44 completed in September 2011.

Abbreviations/Acronyms

1	µg	micrograms
2	µS	microsiemens
3	X/Q	dispersion values
4	°C	degree(s) Celsius
5	°F	degree(s) Fahrenheit
6	A/B	auxiliary building
7	AADT	Annual Average Daily Traffic
8	ABWR	Advanced Boiling Water Reactor
9	ac	acre(s)
10	AC	alternating current
11	ACHP	Advisory Council on Historic Preservation
12	AD	Attainment Demonstration
13	AEC	Atomic Energy Commission
14	AEP	Archaeology and Ethnography Program
15	ALARA	as low as reasonably achievable
16	AML	abandoned mine land
17	AMUD	Acton Municipal Utility District
18	AN	ammonia nitrogen
19	APE	Area of Potential Effect
20	APLIC	Avian Powerline Interaction Committee
21	ASLB	Atomic Safety and Licensing Board
22	AWEA	American Wind Energy Association
23	BA	Biological Assessment
24	BDTF	Blowdown Treatment Facility
25	BEA	Bureau of Economic Analysis
26	BEIR	Biological Effects of Ionizing Radiation
27	BLS	U.S. Bureau of Labor Statistics
28	BMP	best management practice
29	BOD	biochemical oxygen demand
30	Bq	Becquerel(s)
31	BRA	Brazos River Authority
32	BRM	Brazos River mile
33	Btu	British thermal unit(s)
34	BUL	balancing up load
35	BWR	boiling-water reactor
36	C/V	containment vessel
37	CAA	Clean Air Act
38	CBC	Christmas Bird Count
39	CBOD	carbonaceous biochemical oxygen demand
40	CCD	Census County Division
41	CCWS	component cooling water system

1	CDC	Center for Disease Control and Prevention
2	CDF	core damage frequency
3	CDP	census-designated place
4	CDR	Capacity, Demand, and Resources Report
5	CEQ	Council on Environmental Quality
6	CFR	Code of Federal Regulations
7	cfs	cubic feet per second (water flow)
8	cfu	colony forming units
9	Ci	Curie(s)
10	CLNGT	Calhoun Liquefied Natural Gas Terminal
11	cm	centimeters
12	cm ²	centimeter(s) squared
13	CMP	Coastal Management Program
14	CMZ	Coastal Management Zone
15	CO	carbon monoxide
16	CO ₂	carbon dioxide
17	COL	combined license
18	Corps	U.S. Army Corps of Engineers
19	CP	construction permit
20	CPCN	Certificate of Public Convenience and Necessity
21	CPNPP	Comanche Peak Nuclear Power Plant
22	CPS	Energy City Public Service Board of San Antonio, Texas
23	CPUE	catch per unit effort
24	CR	County Road (CR 360, CR 392)
25	CREZ	Competitive Renewable Energy Zones
26	CS	containment spray
27	CVCS	Chemical and Volume Control System
28	CVDT	containment vessel reactor coolant drain tank
29	CWA	Clean Water Act
30	CWIS	circulating water intake structure
31	CWS	circulating water system
32	d	day
33	D/Q	annual normalized total surface deposition rates
34	DA	Department of the Army
35	dBA	decibel(s) (acoustic)
36	DBA	Design Basis Accident
37	DBH	diameter at breast height
38	DC	direct current
39	DCD	Design Control Document
40	DDT	dichlorodiphenyltrichloroethane
41	DFPS	Department of Family Protective Services
42	DFW	Dallas–Fort Worth
43	DHV	design hourly volume
44	DNL	day-night average sound levels
45	DO	dissolved oxygen

1	DOE	U.S. Department of Energy
2	DOT	U.S. Department of Transportation
3	DSM	demand side management
4	DSWG	Demand Side Working Group
5	DWS	demineralized water system
6	EAB	Exclusion Area Boundary
7	ECP	essential cooling pond
8	EFH	Energy Future Holdings Corporation
9	EFH	essential fish habitat
10	EIA	Energy Information Administration
11	EIS	environmental impact statement
12	ELCC	effective load carrying capacity
13	ELF	extremely low frequency
14	EMF	electromagnetic field
15	EPA	U.S. Environmental Protection Agency
16	ER	Environmental Report
17	ERCOT	Electric Reliability Council of Texas
18	ESA	U.S. Endangered Species Act of 1973, as amended
19	ESP	early site permit
20	ESRP	Environmental Standard Review Plan
21	ESWS	essential service water system
22	FAA	Federal Aviation Administration
23	FAC	free available chlorine
24	FC	fecal coliform
25	FDA	final design approval
26	FERC	Federal Energy Regulatory Commission
27	FES	Final Environmental Statement
28	FM	Farm-to-Market Road
29	FPS	fire protection system
30	FR	Federal Register
31	FRA	Federal Railroad Administration
32	FSAR	Final Safety Analysis Report
33	ft	foot or feet
34	ft ²	square feet
35	ft ³	cubic feet
36	FWS	U.S. Fish and Wildlife Service
37	gal	gallon(s)
38	GAM	general area monitoring
39	GATF	Generation Adequacy Task Force
40	GBq	gigabecquerel
41	GBRA	Guadalupe-Blanco River Authority
42	GCC	global climate change
43	GCD	Groundwater Conservation District
44	GCRP	Global Change Research Program

1	GE	General Electric
2	GED	Global Energy Decisions, Inc.
3	GEIS	generic environmental impact statement
4	GEIS-DECOM	GEIS-Decommissioning of Nuclear Facilities (NUREG-0586)
5	GHG	greenhouse gas
6	GIT	Georgia Institute of Technology
7	GIWW	Gulf Intracoastal Waterway
8	gpd	gallon(s) per day
9	gpm	gallon(s) per minute
10	GPS	global positioning system
11	GTG	gas turbine generator
12	GWMS	Gaseous Waste Management System
13	ha	hectare(s)
14	HCLPF	high confidence of low probability of failures
15	HCP	Ham Creek Park
16	hr	hour(s)
17	HT	holdup tank
18	HUD	U.S. Department of Housing and Urban Development
19	HVAC	heating, ventilation, and air conditioning
20	Hz	hertz
21	IA	Interconnection Agreement
22	IAEA	International Atomic Energy Agency
23	ICRP	International Commission on Radiological Protection
24	IGCC	integrated gasification combined cycle
25	in.	inch(es)
26	INL	Idaho National Laboratory
27	IOU	investor owned utility
28	ISD	Independent School District
29	ISFSI	Independent Spent Fuel Storage Installation
30	ISL	Information Systems Laboratories, Inc.
31	ISO	independent system operator
32	JPPP	E.S. Joslin Power Plant Project
33	KC	Keystone Center
34	km	kilometer(s)
35	km ²	square kilometer(s)
36	kV	kilovolt(s)
37	kWh	kilowatt-hour(s)
38	L	liter(s)
39	LaaR	load acting as resource
40	lb	pound(s)
41	LC ₅₀	concentration lethal to 50% of the sample population
42	LCRA	Lower Colorado River Authority

1	LCRWPG	Lower Colorado Regional Water Planning Group
2	Ldn	day-night average sound level
3	LEDPA	least environmentally damaging practicable alternative
4	lin ft	linear foot (feet)
5	LLMW	low-level mixed waste
6	LLW	low-level radioactive waste
7	LOCA	loss of coolant accident
8	LOS	Level of Service
9	LPSD	low power shutdown
10	LPZ	low population zone
11	LRF	large release frequency
12	LST	local standard time
13	LTSF	Long-Term Storage Facility
14	LVW	low volume waste
15	LWA	Limited Work Authorization
16	LWMS	liquid waste management system
17	LWR	light-water reactor
18	m	meter(s)
19	m ²	square meter(s)
20	m ³	cubic meter(s)
21	mA	milliampere
22	MBq	megabecquerel
23	MCCI	molten corium-to-concrete interaction
24	mcf	million cubic feet
25	mCi	millicurie
26	MCR	main cooling reservoir
27	MDC	main drainage channel
28	MDCT	mechanical draft cooling tower
29	MEI	maximally exposed individual
30	mG	milligauss
31	mg	milligram(s)
32	MGD	million gallon(s) per day
33	MHI	Mitsubishi Heavy Industries, Ltd.
34	MHz	megahertz
35	mi	mile(s)
36	mi ²	square mile(s)
37	min	minute
38	MIT	Massachusetts Institute of Technology
39	mL	milliliter(s)
40	MMS	Minerals Management Service
41	MNES	Mitsubishi Nuclear Energy Systems
42	mo	month
43	MOU	Memorandum of Understanding
44	MOX	mixed oxide (fuel)
45	mph	mile(s) per hour

1	mpn	most probable number
2	mR	milliroentgen
3	mrad	millirad(s)
4	mrem	millirem(s)
5	MSA	Metropolitan Statistical Area
6	MSL	above mean sea level
7	mSv	millisievert(s)
8	MT	metric ton(s) (or tonne[s])
9	MTU	metric ton(s) of uranium
10	MW	megawatt(s)
11	MW(e)	megawatt(s) electrical
12	MW(t)	megawatt(s) thermal
13	MWd	megawatt-day(s)
14	MW-h	megawatt-hour(s)
15	MWS	makeup water system
16	N	nitrogen
17	NAAQS	National Ambient Air Quality Standard
18	NCA	Noise Control Act
19	NCI	National Cancer Institute
20	NCRP	National Council on Radiation Protection & Measurements
21	NEPA	National Environmental Policy Act of 1969, as amended
22	NERC	North American Electric Reliability Corporation
23	NESC	National Electric Safety Code
24	NESWS	nonessential service water system
25	NGO	nongovernmental organization
26	NHPA	National Historic Preservation Act of 1966, as amended through 2000
27	NIEHS	National Institute of Environmental Health Sciences
28	NMM	navigation mile marker
29	NO ₂	nitrite
30	NO ₃	nitrate
31	NOAA	National Oceanic and Atmospheric Administration
32	NO _x	nitrogen oxide(s)
33	NPDES	National Pollutant Discharge Elimination System
34	NRC	U.S. Nuclear Regulatory Commission
35	NRHP	National Register of Historic Places
36	NWPCC	Northwest Power and Conservation Council
37	O&M	operations and maintenance
38	ODCM	offsite dose calculation manual
39	OECD	Organization for Economic Cooperation and Development
40	OPO4	orthophosphate
41	ORNL	Oak Ridge National Laboratory
42	OSF	Onsite Staging Facility
43	OSHA	Occupational Safety and Health Administration

1	P	phosphorous
2	PAM	primary amoebic meningoencephalitis
3	PBS&J	Post, Buckley, Schuh & Jernigan, Inc.
4	pCi	picocuries
5	PGC	Power Generation Company
6	PGMA	Priority Groundwater Management Plan
7	PIR	Public Interest Review
8	PKL	Possum Kingdom Lake
9	PM	particulate matter
10	PM ₁₀	particulate matter with a diameter of 10 microns or less
11	PM _{2.5}	particulate matter with a diameter of 2.5 microns or less
12	PNNL	Pacific Northwest National Laboratory
13	ppm	parts per million
14	ppt	parts per thousand
15	PRA	probabilistic risk assessment
16	PSD	prevention of significant deterioration
17	PSWS	potable and sanitary water system
18	PUCT	Public Utility Commission of Texas
19	PURA	Public Utilities Regulatory Act
20	PWR	pressurized-water reactor(s)
21	Q	flow
22	QSE	qualified scheduling entity
23	R/B	reactor building
24	RAI	Request for Additional Information
25	RCDT	reactor coolant drain tank
26	RCRA	Resource Conservation and Recovery Act of 1976, as amended
27	RCW	Reactor Building Cooling Water
28	rem	Roentgen equivalent man (a special unit of radiation dose)
29	REMP	radiological environmental monitoring program
30	REP	retail electric provider
31	RFP	Reasonable Further Progress
32	RHR	residual heat removal
33	RIMS	Regional Input-Output Model System
34	RLE	review level earthquake
35	RMPF	Reservoir Makeup Pumping Facility
36	RMR	reliability must run
37	ROD	Record of Decision
38	ROI	region of interest
39	ROW	right(s)-of-way
40	rpm	revolutions per minute
41	RRY	reference reactor year
42	RSICC	Radiation Safety Information Computational Center
43	RSW	Reactor Service Water
44	RV	recreational vehicle

1	RWST	refueling water storage tank
2	Ryr	reactor-year
3	s	second(s)
4	SACTI	Seasonal and Annual Cooling Tower Impacts Prediction Code
5	SAMA	severe accident mitigation alternative
6	SAMDA	severe accident mitigation design alternative
7	SAWS	San Antonio Water System
8	SB	Senate Bill
9	SCR	Squaw Creek Reservoir
10	SCWD	Somervell County Water District
11	SER	Safety Evaluation Report
12	SES	Steam Electric Station
13	SFSI	Spent Fuel Storage Installation
14	SG	steam generator
15	SGBD	Steam Generator Blowdown
16	SGIA	signed generation permit agreement
17	SGTR	steam generator tube rupture
18	SH	state highway
19	SHPO	State Historic Preservation Office
20	SIP	State Implementation Plan
21	SMA	Seismic Margin Analysis
22	SNDC	summer net dependable capability
23	SO ₂	sulfur dioxide
24	SOP	System Operation Permit
25	SO _x	sulfur oxide
26	SPP	Southwest Power Pool
27	SSC	structure, system, or component
28	STP	South Texas Project Electric Generating Station
29	STPNOC	STP Nuclear Operating Company
30	SWATS	Surface Water and Treatment System
31	SWMS	Solid Waste Management System
32	SWPPP	Stormwater Pollution Prevention Plan
33	SWWTS	sanitary wastewater treatment system
34	T&D	transmission and distribution
35	TAC	Texas Administrative Code
36	TBEG	Texas Bureau of Economic Geology
37	TBq	terabecquerel(s)
38	TCC	Texas Central Company
39	TCEQ	Texas Commission on Environmental Quality
40	TCS	turbine component cooling water system
41	TCWP	Texas Coastal Watershed Program
42	TDS	total dissolved solids
43	TDSHS	Texas Department of State Health Services
44	TEDE	total effective dose equivalent

1	Temp	temperature
2	THC	Texas Historical Commission
3	THPO	Tribal Historic Preservation Office
4	TIS	Texas Interconnected System
5	TLD	thermoluminescent dosimeter
6	TMDL	total maximum daily load
7	TPDES	Texas Pollutant Discharge Elimination System
8	TPWD	Texas Parks and Wildlife Department
9	TPWP	Texas Prairie Wetlands Project
10	tpy	tons per year
11	TRC	total residual chlorine
12	TSDC	Texas State Data Center
13	TSS	total suspended solids
14	TSWQS	Texas Surface Water Quality Standard
15	TUGC	Texas Utilities Generating Company
16	TW	terawatt
17	TWC	Texas Water Code
18	TWDB	Texas Water Development Board
19	TW-h	terawatt-hour(s)
20	TX	Texas
21	TxDOT	Texas Department of Transportation
22	TXNDD	Texas Natural Diversity Database
23	UC	University of Chicago
24	U ₃ O ₈	triuranium octaoxide (“yellowcake”)
25	UF ₆	uranium hexafluoride
26	UFC	uranium fuel cycle
27	UHS	ultimate heat sink
28	UO ₂	uranium oxide
29	USACE	U.S. Army Corps of Engineers (Corps)
30	US-APWR	U.S. Advanced Pressurized Water Reactor
31	USCB	U.S. Census Bureau
32	USFWS	U.S. Fish and Wildlife Service
33	USGCRP	U.S. Global Change Research Program National Assessment
34	USGS	U.S. Geological Survey
35	VCNS	Victoria County Nuclear Station
36	VCT	volume control tank
37	VFD	Volunteer Fire Department
38	VOC	volatile organic compound
39	WBR	Wheeler Branch Reservoir
40	WDA	Workforce Development Area
41	WHO	World Health Organization
42	WMA	Wildlife Management Area
43	WWS	wastewater system

1	yd	yard(s)
2	yd ³	cubic yard(s)
3	yr	year(s)

1.0 Introduction

1 By letter dated September 19, 2008, the U.S. Nuclear Regulatory Commission (NRC or the
2 Commission) received an application from Luminant Generation Company LLC (Luminant),
3 acting for itself and as agent for Nuclear Project Company LLC (subsequently renamed
4 Comanche Peak Nuclear Power Company LLC), for combined construction permits and
5 operating licenses (combined licenses or COLs) for Comanche Peak Nuclear Power Plant
6 (CPNPP) Units 3 and 4, to be located in Hood and Somervell Counties, Texas (Luminant 2008).
7 The NRC staff and the U.S. Army Corps of Engineers (Corps or USACE) staff review is based
8 on Revision 1 of the application (Luminant 2009a, 2009b), responses to the NRC staff's
9 requests for additional information (RAIs), and supplemental information from Luminant.

10 The location of the proposed Units 3 and 4 is in Hood and Somervell Counties, Texas, adjacent
11 to the existing CPNPP Units 1 and 2, about 5 mi north of Glen Rose. The CPNPP site and
12 existing facilities are owned by Luminant, and Luminant is the licensee and operator of the
13 existing Units 1 and 2. In its application, Luminant specified the U.S. Advanced Pressurized-
14 Water Reactor (US-APWR) as the proposed reactor design for Units 3 and 4.

15 The proposed project will require issuance of a permit by the Corps pursuant to Section 404 of
16 the Federal Water Pollution Control Act (Clean Water Act) and Section 10 of the Rivers and
17 Harbors Appropriation Act to perform certain construction activities on the site, including building
18 a new water intake and discharge structure on the nearby Lake Granbury and possible
19 disturbance to a wetland area near the proposed cooling towers for Units 3 and 4. The Corps is
20 participating with the NRC in preparing this environmental impact statement (EIS) as a
21 cooperating agency and participates collaboratively on the review team.

22 The proposed actions related to the CPNPP Unit 3 and 4 application are (1) NRC issuance of
23 COLs for construction and operation of two new nuclear units at the CPNPP site, and (2) the
24 Corps issuance of a permit pursuant to Section 404 of the Clean Water Act and Section 10 of
25 the Rivers and Harbors Act.

26 1.1 Background

27 A COL is Commission approval for the construction and operation of a nuclear power facility.
28 NRC regulations related to COLs are found primarily in Title 10 of the Code of Federal
29 Regulations (CFR) Part 52, Subpart C.

30 Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA 1969)
31 (42 USC 4321 et seq.), requires preparation of an EIS for major Federal actions that
32 significantly affect the quality of the human environment. The NRC has implemented
33 Section 102 of NEPA in 10 CFR Part 51. Further, in 10 CFR 51.20, the NRC has determined
34 that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

35 According to 10 CFR 52.80(b), a COL application must contain an Environmental Report (ER).
36 The ER provides input that the staff evaluates in preparing the NRC's EIS. NRC regulations
37 related to ERs and EISs are found in 10 CFR Part 51. Part 3 of Luminant's application contains
38 the ER, which provides a description of the proposed actions related to the application and the
39 applicant's analysis of the potential environmental impacts of construction and operation of
40 proposed Units 3 and 4.

41 The Luminant application references Mitsubishi Heavy Industries, Ltd.'s (MHI's) US-APWR
42 Design Control Document (DCD) for the two proposed nuclear units (MHI 2009). Subpart B of
43 10 CFR Part 52 contains NRC regulations related to standard design certification. MHI

1 submitted the documentation for design certification of its US-APWR to the NRC in December
2 2007 (MHI 2007). An application for a standard design certification undergoes an extensive
3 review, usually taking several years, which may result in a rulemaking certifying the reactor
4 design. Where appropriate, this EIS incorporates the information provided in MHI's certification
5 submittal that is referenced in the COL application.

6 **1.1.1 Application and Review**

7 The purpose of Luminant's requested NRC action is to obtain COLs to construct and operate a
8 baseload nuclear power plant comprised of two new nuclear power reactors. These licenses
9 are necessary but not sufficient by themselves for construction and operation of the new nuclear
10 power reactors. In addition to the COLs, Luminant must obtain and maintain permits from other
11 Federal, State, and local agencies and permitting authorities. The purpose of Luminant's
12 requested Corps action is to obtain a permit to perform regulated activities that would impact
13 waters of the United States, including jurisdictional wetlands.

14 **1.1.1.1 NRC COL Application Review**

15 Luminant submitted an ER as part of its COL application (Luminant 2009a). The ER focuses on
16 the environmental effects of construction and operation of two US-APWR units. The NRC
17 regulations setting standards for review of a COL application are listed in 10 CFR 52.81.
18 Detailed procedures for conducting the environmental portion of the review are found in
19 guidance set forth in NUREG-1555, *Environmental Standard Review Plan* (NRC 2000) and
20 recent updates, hereafter referred to as the ESRP.

21 In this EIS, the NRC staff evaluates the environmental effects of two US-APWR reactors, each
22 with a thermal power rating of 4451 MW(t), at the CPNPP site. The new units would use
23 mechanical draft cooling towers (two such towers for each of the proposed new nuclear units).
24 In addition to considering the environmental effects of the proposed action, the NRC considers
25 alternatives to the proposed action, including the no-action alternative and the construction and
26 operation of new reactors at alternative sites. Also, the benefits of the proposed action (e.g.,
27 need for power) and measures and controls to limit adverse impacts are evaluated.

28 Upon acceptance of the Luminant application, the NRC began the environmental review
29 process by publishing in the *Federal Register* (FR) on December 18, 2008, a Notice of Intent to
30 prepare an EIS and to conduct scoping in compliance with requirements set forth in 10 CFR
31 Part 51 (73 FR 77076-8). On January 6, 2009, the NRC held two public scoping meetings in
32 Glen Rose, Texas, to obtain public input on the scope of the environmental review and
33 contacted Federal, State, Tribal, regional, and local agencies to solicit comments. A listing of
34 the agencies and organizations contacted is provided in Appendix B. The staff reviewed the
35 comments received during the scoping process, and responses were developed for each
36 comment. Comments within the scope of NRC's environmental review and the associated
37 responses are included in Appendix D. A complete listing of the scoping comments and
38 responses is documented in the *Comanche Peak Combined License Scoping Summary Report*
39 (NRC 2009).

40 To gather information and to become familiar with the proposed and alternative sites and their
41 environs, the NRC and its contractors, the Oak Ridge National Laboratory (ORNL) and
42 Information Systems Laboratories, Inc. (ISL), visited the CPNPP site and the three alternative
43 sites (the Coastal site, the Pineland site, and the Tradinghouse site) in February 2009. During
44 the site visits, the NRC staff and its contractors met with Luminant staff, public officials, and the
45 public. Documents related to the CPNPP site and alternative sites were reviewed and are
46 listed as references where appropriate.

1 To guide its assessment of the environmental impacts of a proposed action or alternative
2 actions, the NRC has established a standard of significance for impacts based on Council on
3 Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A,
4 Appendix B, provides the following definitions of the three significance levels established by the
5 NRC—SMALL, MODERATE, and LARGE:

6 SMALL—Environmental effects are not detectable or are so minor that they will neither
7 destabilize nor noticeably alter any important attribute of the resource.

8 MODERATE—Environmental effects are sufficient to alter noticeably, but not to
9 destabilize, important attributes of the resource.

10 LARGE—Environmental effects are clearly noticeable and are sufficient to destabilize
11 important attributes of the resource.

12 This EIS presents the staff's analysis, which considers and weighs the environmental impacts of
13 the proposed action at the CPNPP site, including the environmental impacts associated with
14 constructing and operating the two new power reactors at the site, the cumulative effects of the
15 proposed action and other actions, the impacts of constructing and operating reactors at
16 alternative sites, the environmental impacts of alternatives to granting the COLs, and the
17 mitigation measures available for reducing or avoiding adverse environmental effects. This EIS
18 also provides the NRC staff's preliminary recommendation to the Commission regarding the
19 issuance of COLs for proposed Units 3 and 4 at the CPNPP site.

20 A 75-day comment period will begin on the date of publication in the FR of the U.S.
21 Environmental Protection Agency (EPA) Notice of Availability of the filing of the draft EIS to
22 allow members of the public and agencies to comment on the results of the NRC and Corps
23 staffs' review. A public meeting will be held near the CPNPP site during the EIS public
24 comment period. During this public meeting, the NRC staff will describe the results of the
25 environmental review, provide members of the public with information to assist them in
26 formulating comments on the EIS, respond to questions, and accept comments on the EIS. The
27 review team will respond to all the comments received during the draft EIS comment period.
28 The comments and responses will be contained in Appendix E in the final EIS.

29 **1.1.1.2 Corps Permit Application Review**

30 The Corps is part of the review team that makes a determination based on the three
31 significance levels established by the NRC. The Corps' independent Record of Decision (ROD)
32 regarding the aforementioned permit application will reference the analyses in the EIS and
33 present any additional information required by the Corps to support its permit decision. The
34 Corps' role as a cooperating agency in the preparation of this EIS is to ensure that the
35 information presented is adequate to fulfill the requirements of Corps regulations applicable to
36 construction of the preferred alternative identified in the EIS. The Clean Water Act Section
37 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR
38 Part 230), which contains the substantive environmental criteria used by the Corps in evaluating
39 discharges of dredged or fill material into waters of the United States, and the Corps' Public
40 Interest Review (PIR) (33 CFR 320.4), direct the Corps to consider a number of factors as part
41 of a balanced process. A discussion of those factors is provided below. The Corps' PIR will be
42 part of its permit decision document and thus will not be addressed in the EIS.

43 This EIS includes the Corps' evaluation of construction and maintenance activities that impact
44 waters of the United States. The Corps' permit decision will reflect the national concern for both
45 protection and use of important resources. The benefit, which reasonably may be expected to
46 accrue from the proposal, must be balanced against its reasonably foreseeable detriments.
47 Public interest factors that may be relevant to the proposal will be considered. These factors

Introduction

1 include conservation, economics, aesthetics, general environmental concerns, wetlands, historic
2 and cultural resources, fish and wildlife values, flood hazards, floodplain values, land use,
3 navigation, shore erosion and accretion, recreation, water supply, water quality, energy needs,
4 safety, food and fiber production, mineral needs, considerations of property ownership, and
5 cumulative impacts thereof. Evaluation of the impact on the public interest will include
6 application of the guidelines promulgated by the Administrator, EPA, under authority of
7 Section 404(b) of the Clean Water Act. The Corps will address these issues in its permit
8 decision document.

9 As part of the Corps' permit evaluation process, the Corps will issue a public notice to solicit
10 comments from the public about Luminant's proposal to perform site preparation activities and
11 to construct supporting facilities at the CPNPP site.

12 **1.1.2 Preconstruction Activities**

13 In a final rule dated October 9, 2007, "Limited Work Authorizations (LWAs) for Nuclear Power
14 Plants" (72 FR 57416), the Commission defined "construction" (10 CFR 50.10 and 51.4) as
15 those activities within its regulatory authority. Many of the activities required to construct a
16 nuclear power plant are not part of the NRC action to license the plant. Activities associated
17 with building the plant that are not within the purview of the NRC action are grouped under the
18 term "preconstruction." Preconstruction activities include clearing and grading, excavating,
19 erection of support buildings and transmission lines, and other associated activities. These
20 preconstruction activities may take place before the application for a COL is submitted, during
21 the NRC staff's review of a COL application, or after a COL is granted. Although
22 preconstruction activities are outside the NRC's regulatory authority, nearly all of them are
23 within the regulatory authority of local, State, or other Federal agencies.

24 Because the preconstruction activities are not part of the NRC action, their impacts are not
25 reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction
26 activities are considered in the context of cumulative impacts. In addition, certain
27 preconstruction activities that propose to construct structures in and under navigable waters and
28 to discharge dredged, excavated, and/or fill material into waters of the United States, including
29 jurisdictional wetlands that require permits from the Corps, are viewed by the Corps as direct
30 effects related to its Federal permitting action. Chapter 4 describes the relative magnitude of
31 impacts related to construction and preconstruction activities.

32 **1.1.3 Cooperating Agencies**

33 NEPA lays the groundwork for coordination between the lead agency preparing an EIS and
34 other Federal agencies that may have special expertise regarding an environmental issue or
35 jurisdiction by law. These other agencies are referred to as "cooperating agencies."

36 Cooperating agencies have the responsibility to assist the lead agency through early
37 participation in the NEPA process, including scoping, by providing technical input to the
38 environmental analysis, and by making staff support available as needed by the lead agency.

39 In addition to a license from the NRC, most proposed nuclear power plants require a permit
40 from the Corps if work is proposed in navigable waters or the activity involves a discharge of
41 dredged or fill material into the waters of the United States. The NRC and the Corps decided
42 that the most effective and efficient use of Federal resources in the review of new nuclear power
43 projects would be achieved by a cooperative agreement. On September 12, 2008, the NRC
44 and the Corps signed a Memorandum of Understanding (MOU) regarding the review of nuclear
45 power plant license applications (Corps and NRC 2008), and the Fort Worth District of the
46 Corps is participating as a cooperating agency as defined in 10 CFR Part 51.14.

1 As described in the MOU, the NRC is the lead Federal agency, and the Corps is a cooperating
2 agency in the development of the EIS. Under Federal law, each agency has jurisdiction related
3 to portions of the proposed project as major Federal actions that could significantly affect the
4 quality of the human environment. The goal of this cooperative agreement is the development
5 of one EIS that serves the needs of the NRC license decision process and the Corps permit-
6 decision process. While both agencies must comply with the requirements of NEPA, both
7 agencies also have independent or individual mission requirements that must be met. The NRC
8 makes license decisions under the Atomic Energy Act of 1954, as amended (42 USC 2011 et
9 seq.), and the Corps makes permit decisions under the Rivers and Harbors Appropriation Act of
10 1899 and the Clean Water Act. The Corps is cooperating with the NRC to ensure that the
11 information presented in the NEPA documentation is adequate to fulfill the requirements of
12 Corps regulations, the EPA's Clean Water Act Section 404(b)(1) guidelines, which contain the
13 substantive environmental criteria used by the Corps in evaluating discharges of dredged or fill
14 material into waters of the United States, and the Corps public interest review process.

15 As a cooperating agency, the Corps is part of the NRC review team, involved in all aspects of
16 the environmental review, including scoping, public meetings, public comment resolution, and
17 EIS preparation. The NRC public meeting with the Corps serves the dual purpose of both
18 agencies, with the Corps referring to the NRC-defined public meeting as its public hearing. For
19 the purposes of assessment of environmental impact under NEPA, the EIS uses the
20 SMALL/MODERATE/LARGE criteria discussed in Section 1.1.1.1 of this EIS; this approach has
21 been vetted by the Council on Environmental Quality when the NRC established its
22 environmental review framework for the renewal of operating licenses. A cooperating agency
23 may adopt the EIS of a lead Federal agency without recirculating it when the cooperating
24 agency concludes, after an independent review of the EIS, that its comments and suggestions
25 have been satisfied and issues a ROD. One of the goals of the process is that the Corps will
26 have all the information necessary to make a permit decision when the final EIS is issued.
27 However, it is possible that the Corps may still need some information from the applicant to
28 complete the permit documentation, information that the applicant could not make available by
29 the time of final EIS issuance.

30 **1.1.4 Concurrent NRC Reviews**

31 In reviews that are separate from but parallel to the EIS process, the NRC analyzes the safety
32 characteristics of the proposed site and emergency planning information. These analyses are
33 documented in a Safety Evaluation Report (SER) issued by the NRC. The SER presents the
34 conclusions reached by the NRC regarding (1) whether there is reasonable assurance that two
35 US-APWR reactors can be constructed and operated at the CPNPP site without undue risk to
36 the health and safety of the public, (2) whether the emergency preparedness program meets the
37 applicable requirements in 10 CFR Part 50, 10 CFR Part 52, 10 CFR Part 73, and 10 CFR Part
38 100, and (3) whether site characteristics are such that adequate security plans and measures
39 as referenced in the above CFRs can be developed. The Final SER for the Luminant COL
40 application has not yet been issued but will be issued following publication of the Final EIS. The
41 NRC staff anticipates publication of the final SER for Luminant's COL application in
42 December 2011.

43 The reactor design referenced in the application is the MHI US-APWR, which is undergoing
44 design certification review. The design certification process is separate from the EIS process. If
45 the final design of the US-APWR is different from the design considered in the EIS, the staff will
46 determine whether the changes are significant enough to warrant an additional environmental
47 review. The final rulemaking for the US-APWR is anticipated to be published in
48 September 2011.

1.2 The Proposed Federal Actions

The proposed NRC Federal action is issuance, under the provisions of 10 CFR Part 52, of COLs authorizing the construction and operation of two new US-APWR units at the CPNPP site. This EIS provides the NRC's analyses of the environmental impacts that could result from building and operating two proposed new units at the CPNPP site or at one of the three alternative sites. The NRC staff analyzes these impacts to determine if the proposed site is suitable for the addition of the new units and whether any of the alternative sites is considered obviously superior to the proposed site.

The Corps' Federal action is the decision whether to issue a permit pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899 to authorize certain construction activities potentially affecting waters of the United States and is based on an evaluation of the probable impacts, including cumulative impacts, of the proposed construction activities on the public interest. These impacts are analyzed by the Corps to determine whether there is a practicable alternative with less adverse impact on the aquatic ecosystem, provided that the alternative does not have other significant adverse consequences.

1.3 The Purpose and Need for the Proposed Actions

The purpose and need of the proposed action is to provide 3200 MW(e) of additional baseload electrical power for use in the current regional markets and/or for potential sale on the wholesale market in the Electric Reliability Council of Texas (ERCOT) region to meet the demand projected for 2016 and to maintain the reserve margin that is needed to maintain system reliability (Luminant 2009a, ERCOT 2007). ERCOT is one of eight North American Electric Reliability Corporation regions in the United States and geographically lies wholly within the state of Texas. The need for additional baseload power is discussed in Chapter 8 of this EIS. Chapter 9 of this EIS discusses alternatives to the proposed action, including the no-action alternative.

Two COLs from the NRC are needed to construct and operate the proposed two new units. Preconstruction and certain long lead-time activities, such as ordering and procuring certain components and materials necessary to construct the plant, may begin before the COLs are granted. Luminant must obtain and maintain permits or authorizations from other Federal, State, and local agencies and permitting authorities before undertaking certain activities. The ultimate decision whether or not to build the new units and the schedule for building are not within the purview of the NRC or the Corps and would be determined by the license holder if the authorizations are granted.

1.4 Alternatives to the Proposed Actions

Section 102(2)(C)(iii) of NEPA states that EISs are to include a detailed statement analyzing alternatives to the proposed action. The NRC regulations for implementing Section 102(2) of NEPA provide for including in an EIS a chapter that discusses the environmental impacts of the proposed action and the alternatives (10 CFR Part 51, Subpart A, Appendix A). Chapter 9 of this EIS addresses five categories of alternatives to the proposed action: (1) the no-action alternative, (2) energy source alternatives, (3) alternative sites, (4) system design alternatives, and (5) onsite alternatives to reduce impacts to natural and cultural resources.

In the no-action alternative, the proposed action would not go forward. The NRC would deny Luminant's request for the COLs. The no-action or permit denial alternatives are also available to the Corps. The no-action alternative is one which results in no construction requiring a Corps permit. If the request was denied, the construction and operation of the two new units at the

1 CPNPP site would not occur nor would any benefits intended by the approved COLs be
2 realized. Energy source alternatives include alternative energy sources, focusing on those
3 alternatives that could meet the purpose and need of the project to generate baseload power.
4 The alternative selection process to determine alternate site locations for comparison with the
5 CPNPP site is addressed below. System design alternatives include heat dissipation and
6 circulating water systems, intake and discharge structures, and water-use and treatment
7 systems. Finally, onsite alternatives evaluated by the Corps to reduce potential impacts to
8 wetlands and shoreline resources are described.

9 In its ER, Luminant defines a region of interest for use in identifying and evaluating potential
10 sites for power generation (Luminant 2009a). The NRC staff evaluated the region of interest,
11 the process by which alternative sites were selected by Luminant, and the review team
12 evaluated the environmental impacts of construction and operation of two new power reactors at
13 those sites using reconnaissance-level information. The three alternative sites identified by
14 Luminant in the ER include the Tradinghouse site, approximately 10 mi east of Waco, Texas,
15 and two undeveloped sites, the Coastal site (approximately 20 mi south of Victoria, Texas) and
16 the Pineland site (near Pineland, Texas) (Luminant 2009a). The Tradinghouse site is near two
17 existing natural-gas-fired power-generating units and is owned by Luminant. The two other
18 sites are each owned by private landowners. The objective of the comparison of environmental
19 impacts is to determine if any of the alternative sites are obviously superior to the proposed
20 CPNPP site.

21 As part of the evaluation of permit applications subject to Section 404 of the Clean Water Act,
22 the Corps is required by regulation to apply the criteria set forth in the 404(b)(1) guidelines
23 (33 USC 1344; 40 CFR Part 230). These guidelines establish criteria that must be met in order
24 for the proposed activities to be permitted pursuant to Section 404. Specifically, these
25 guidelines state, in part, that no discharge of dredged or fill material shall be permitted if there is
26 a practicable alternative to the proposed discharge that would have less adverse impact on the
27 aquatic ecosystem, provided the alternative does not have other significant adverse
28 consequences (40 CFR 230.10(a)).

29 **1.5 Compliance and Consultations**

30 Before building and operating new units, Luminant is required to obtain certain Federal, State,
31 and local environmental permits, as well as meet applicable statutory and regulatory
32 requirements. Luminant provided a list of environmental approvals and consultations
33 associated with the proposed CPNPP Units 3 and 4 (Luminant 2009a). Potential authorizations,
34 permits, and certifications relevant to the proposed COLs are included in Appendix H. The NRC
35 staff reviewed the list and contacted the appropriate Federal, State, Tribal, and local agencies to
36 identify any consultation, compliance, permit, or significant environmental issues of concern to
37 the reviewing agencies that may affect the acceptability of the CPNPP site for building and
38 operating the two proposed US-APWR units. A chronology of the correspondence is provided
39 in Appendix C. A list of the key consultation correspondence is provided in Appendix F, which
40 also contains a biological assessment.

41 **1.6 Report Contents**

42 The subsequent chapters of this EIS are organized as follows. Chapter 2 describes the
43 proposed site and discusses the environment that would be affected by the addition of proposed
44 CPNPP Units 3 and 4. Chapter 3 describes the power plant layout, structures and activities
45 related to the building and operation to be used as the basis for evaluating the environmental
46 impacts. Chapters 4 and 5 examine site acceptability by analyzing the environmental impacts of

1 construction (Chapter 4) and operation (Chapter 5) of the proposed units. Chapter 6 analyzes
2 the environmental impacts of the uranium fuel cycle, transportation of radioactive materials, and
3 decommissioning. Chapter 7 discusses the cumulative impacts of the proposed action as
4 defined in 40 CFR Part 1508. Chapter 8 addresses the need for power. Chapter 9 discusses
5 alternatives to the proposed action and analyzes energy sources, alternative sites, and system
6 design alternatives and compares the proposed action with the alternatives. Chapter 10
7 summarizes the findings of the preceding chapters, provides a benefit-cost evaluation, and
8 presents the staff's preliminary recommendation with respect to the Commission's approval of
9 the proposed site for the COLs based on the NRC staff's evaluation of environmental impacts.

10 The appendixes to the EIS provide the following additional information.

- 11 • Appendix A – Contributors to the Environmental Impact Statement
- 12 • Appendix B – Organizations Contacted
- 13 • Appendix C – Chronology of NRC and Corps Staff Environmental Review Correspondence
14 Related to Luminant Generation Company LLC's Application for Combined Licenses at the
15 CPNPP Site
- 16 • Appendix D – Scoping Meeting Comments and Responses
- 17 • Appendix E – Draft Environmental Impact Statement Comments and Responses (Reserved)
- 18 • Appendix F – Key Consultation Correspondence Regarding the CPNPP Units 3 and 4 COLs
- 19 • Appendix G – Supporting Documentation
- 20 • Appendix H – List of Authorizations, Permits, and Certifications
- 21 • Appendix I – Severe Accident Mitigation Alternatives
- 22 • Appendix J – Carbon Dioxide Footprint Estimates for a 1000 MW(e) Light Water Reactor
23 (LWR)

24 **1.7 References**

25 10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of
26 Production and Utilization Facilities."

27 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental
28 Protection Regulations for Domestic Licensing and Related Regulatory Functions."

29 10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Licenses,
30 Certifications, and Approvals for Nuclear Power Plants."

31 10 CFR Part 73. Code of Federal Regulations, Title 10, *Energy*, Part 73, "Physical Protection of
32 Plants and Materials."

33 10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site
34 Criteria."

35 33 CFR Part 320. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*,
36 Parts 320-330, "General Regulatory Policies to Nationwide Permit Program."

37 33 USC 1344. 2003. U.S. Code Title 33, *Navigation and Navigable Waters*, Sec. 1344,
38 "Permits for Dredged or Fill Material."

39 40 CFR Part 230. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 230,
40 "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material."

41 40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*,
42 Part 1508, "Terminology and Index."

- 1 72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants,"
2 *Federal Register*. U.S. Nuclear Regulatory Commission.
- 3 73 FR 77076-8. December 18, 2008. "Luminant Generation Company LLC; Comanche Peak
4 Nuclear Power Plant Units 3 and 4 Combined License Application; Notice of Intent to Prepare
5 an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*. U.S.
6 Nuclear Regulatory Commission.
- 7 Atomic Energy Act of 1954. 42 USC 2011, et seq.
- 8 Clean Water Act. (Federal Water Pollution Control Act) 33 USC 1251, et seq.
- 9 Electric Reliability Council of Texas (ERCOT). 2007. Meeting Texas' Future Energy Demands.
10 Sam Jones, President and CEO. February 13; as cited in Chapter 1 of Luminant Generation
11 Company LLC (Luminant). 2009a. *Comanche Peak Nuclear Power Plant Units 3 and 4, COL*
12 *Application; Part 3, Environmental Report* (Rev. 1). Luminant Generation Company LLC, Glen
13 Rose, Texas, November 20. Accession No. ML100081557.
- 14 Luminant Generation Company (Luminant). 2008. Letter from M.L. Lucas, Luminant Power to
15 U.S. Nuclear Regulatory Commission, Washington, D.C., "Combined License Application for
16 CPNPP Nuclear Power Plant, Units 3 and 4, Project No. 0754," Log # TXNB-08024,
17 September 19. Accession No. ML 082680250.
- 18 Luminant Generation Company (Luminant). 2009a. *Comanche Peak Nuclear Power Plant*
19 *Units 3 and 4, COL Application; Part 3, Environmental Report* (Rev. 1). Luminant Generation
20 Company LLC, Glen Rose, Texas, November 20. Accession No. ML100081557.
- 21 Luminant Generation Company (Luminant). 2009b. *Comanche Peak Nuclear Power Plant*
22 *Units 3 and 4, COL Application; Part 2, Final Safety Analysis Report* (Rev. 1). Luminant
23 Generation Company LLC, Glen Rose, Texas, November 20. Accession No. ML100082110.
- 24 Mitsubishi Heavy Industries (MHI). 2007. Letter from M. Kaneda, MHI, Tokyo, Japan, to U.S.
25 Nuclear Regulatory Commission, Washington, D.C., "Submittal of US-APWR Design Control
26 Document in Support of Mitsubishi Heavy Industries, Ltd.'s Application for Design Certification
27 of the US-APWR Standard Plant Design," MHI Reference No. UAP-HF-07170, December 31.
28 Accession No. ML08000070.
- 29 Mitsubishi Heavy Industries (MHI). 2009. *Design Control Document for the US-APWR, Tier 1,*
30 *MUAP-DC020, Rev. 2, Docket No. 52-021, Mitsubishi Heavy Industries, Ltd., Tokyo, Japan,*
31 *October 27. Accession No. ML093070208.*
- 32 National Environmental Policy Act of 1969, as amended (NEPA). 42 USC 4321, et seq.
- 33 Rivers and Harbors Appropriation Act of 1899, as amended. 33 USC 403, et seq.
- 34 U.S. Army Corps of Engineers and U.S. Nuclear Regulatory Commission (Corps and NRC).
35 2008. *Memorandum of Understanding: Environmental Reviews Related to the Issuance of*
36 *Authorizations to Construct and Operate Nuclear Power Plants. September 12, 2008.*
37 Accession No. ML082540354.
- 38 U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental*
39 *Reviews for Nuclear Power Plants: Environmental Standard Review Plan. NUREG-1555,*
40 *Washington, D.C. Includes 2007 revisions.*
- 41 U.S. Nuclear Regulatory Commission (NRC). 2009. *Environmental Impact Statement, Scoping*
42 *Process, Scoping Summary Report, Comanche Peak Nuclear Power Plant, Units 3 and 4,*
43 *Combined License Application, Hood and Somervell Counties, Texas. U.S. Nuclear Regulatory*
44 *Commission, Rockville, Maryland. Accession No. ML091390846.*

2.0 Affected Environment

1 The site proposed by Luminant Generation Company LLC (Luminant) for Comanche Peak
2 Nuclear Power Plant (CPNPP) Units 3 and 4 is located in north-central Texas near the border of
3 Hood and Somervell Counties, about 40 mi southwest of Fort Worth (see Figure 2-1). Luminant
4 currently operates two nuclear generating units (existing CPNPP Units 1 and 2) on the CPNPP
5 site. The proposed Units 3 and 4 location is described in Section 2.1, followed by descriptions
6 of the land, water, ecology, socioeconomics, environmental justice, historic and cultural
7 resources, geology, meteorology and air quality, and nonradiological and radiological
8 environment of the site presented in Sections 2.2 through 2.11, respectively. Section 2.12
9 examines related Federal projects, and references are presented in Section 2.13.

10 2.1 Site Location

11 The CPNPP site lies approximately 5 mi north of Glen Rose, Texas, and approximately 9 mi
12 south of Granbury, Texas, outside the city limits of either city (see Figure 2-2). The 7950-ac
13 CPNPP site is owned by Luminant, and Luminant's selected location for the proposed Units 3
14 and 4 is entirely within the CPNPP boundary, approximately 2200 ft northwest of the location of
15 the existing Units 1 and 2 (see Figure 2-3). The proposed new units would be located in areas
16 with a history of previous ground disturbance during development of Units 1 and 2 including
17 former construction lay down areas and temporary parking areas, along with some previously
18 undisturbed areas of land.

19 Figure 2-1 shows the location of the CPNPP site in relationship to the counties and major cities
20 and towns within a 50-mi radius of the site. The population center nearest the proposed site
21 that has more than 25,000 residents is Cleburne, which is located 24 mi to the east. The
22 proposed location for CPNPP Units 3 and 4 is bounded on the north, east, and south by Squaw
23 Creek Reservoir (SCR) (see Figure 2-4). The proposed location for CPNPP Units 3 and 4
24 directly abuts the western boundary of the CPNPP site. Farmland and rural residential
25 properties lie just outside of the boundary.

26 The CPNPP site, including the proposed location for Units 3 and 4, is accessible by both road
27 and rail; however, access to the site and to Squaw Creek Reservoir (SCR) is restricted to those
28 persons granted access rights by Luminant. The site is accessible from the west by Farm-to-
29 Market Road (FM) 56, which connects to U.S. Highway 67, and by County Road 213 (also
30 known as Coates Road), which connects to Texas State Highway 144 (SH 144). The site is
31 also accessible by a rail spur, which connects to the Fort Worth and Western Railroad Company
32 main line at Tolar, Texas, approximately 9 mi to the northwest.

33 SCR is located entirely within the CPNPP site boundary. The reservoir has an approximate
34 pool elevation of 775 ft above mean sea level (MSL), and it is owned by Luminant. It does not
35 provide barge access to the site. SCR is an impoundment on Squaw Creek, a tributary of the
36 Paluxy River, which flows into the Brazos River. Upstream of the confluence of the Paluxy
37 River and the Brazos River lays Lake Granbury, an impoundment on the Brazos River. Cooling
38 water for CPNPP Units 1 and 2 is supplied from Lake Granbury into SCR through existing
39 pipelines (see Figure 2-5).

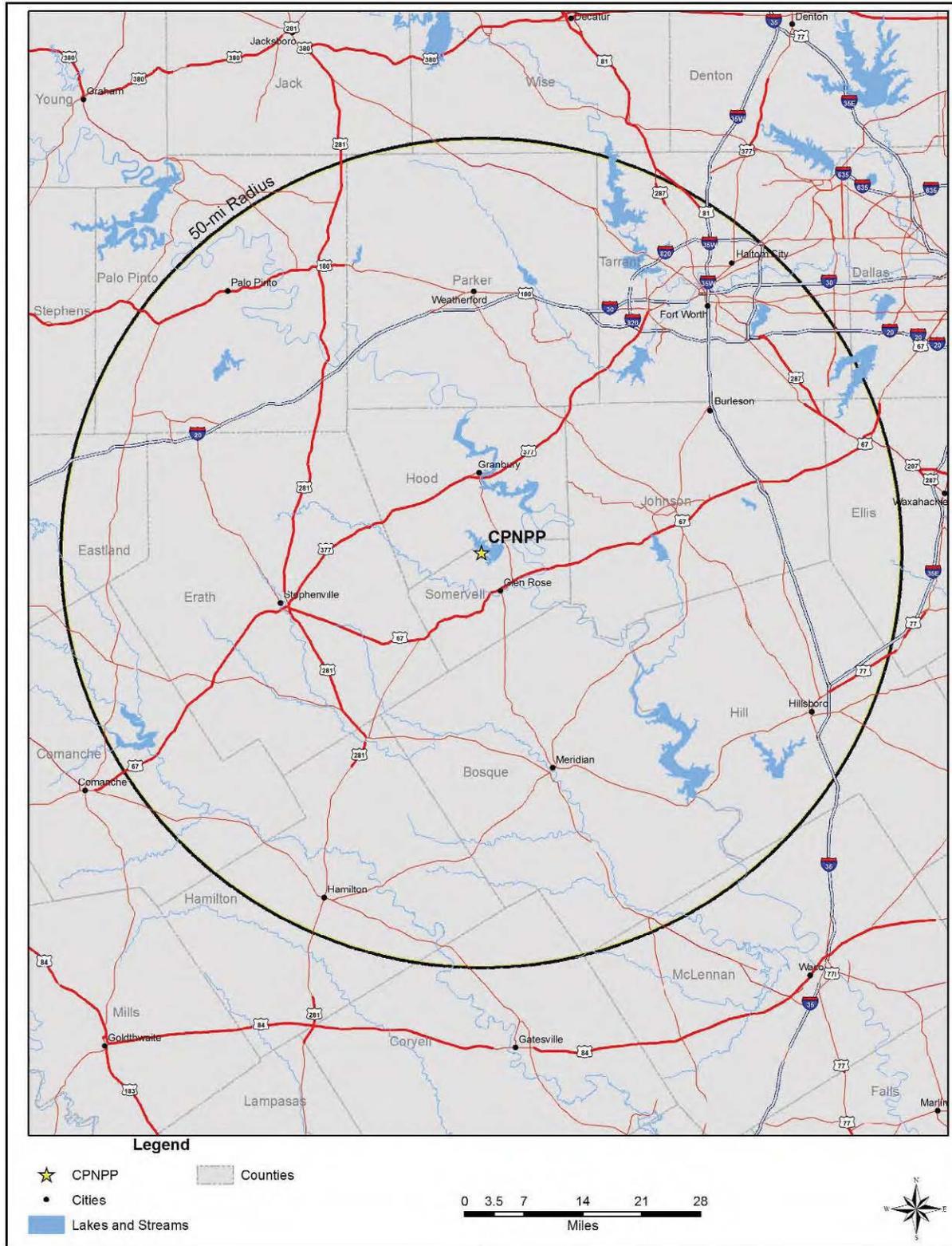


Figure 2-1. 50-mi regional location of the CPNPP site (Luminant 2009a).

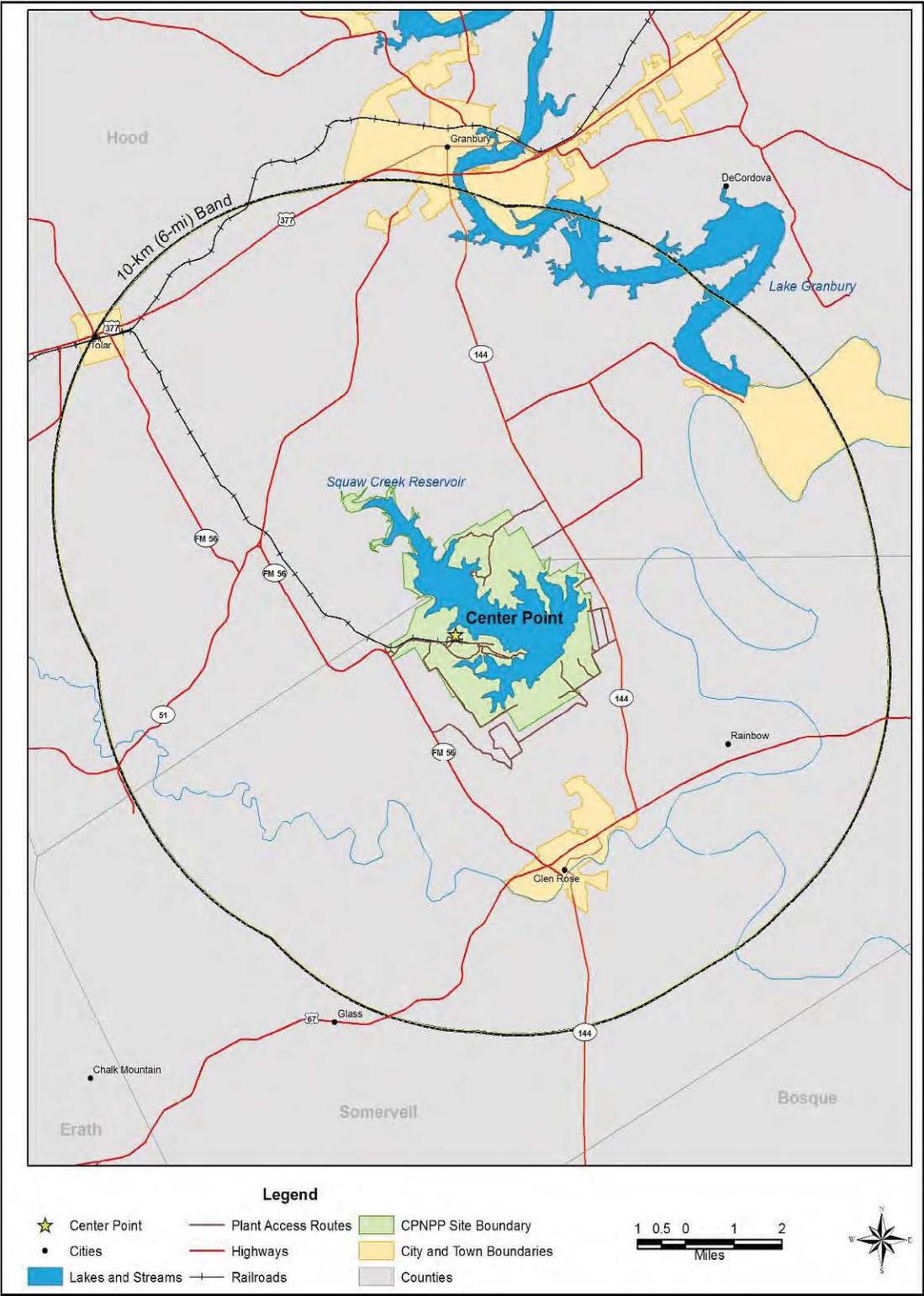


Figure 2-2. Location of the CPNPP site within Hood and Somervell Counties, Texas (Luminant 2009a).

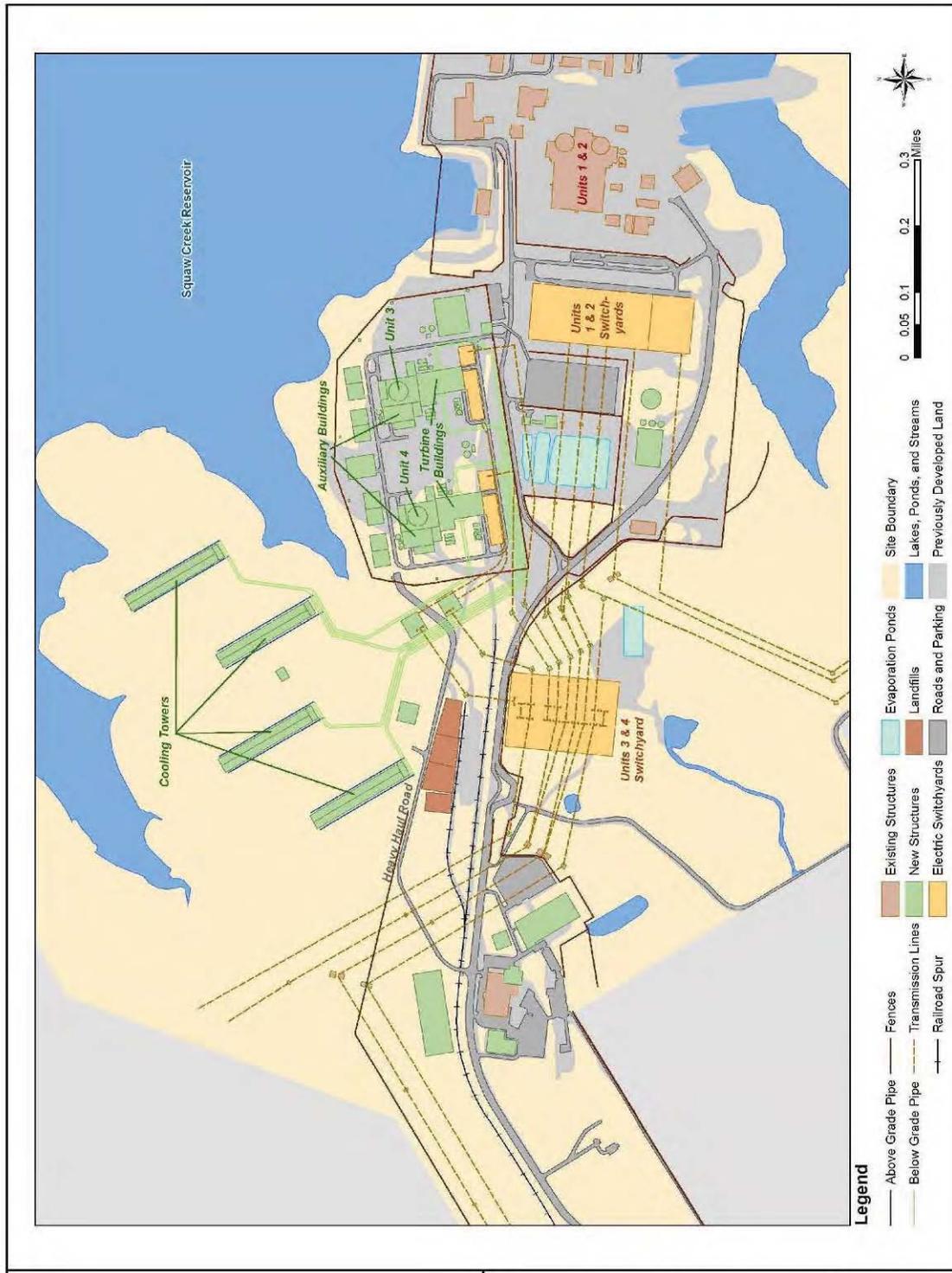


Figure 2-3. The site plan for CPNPP Units 3 and 4 (Luminant 2009a).

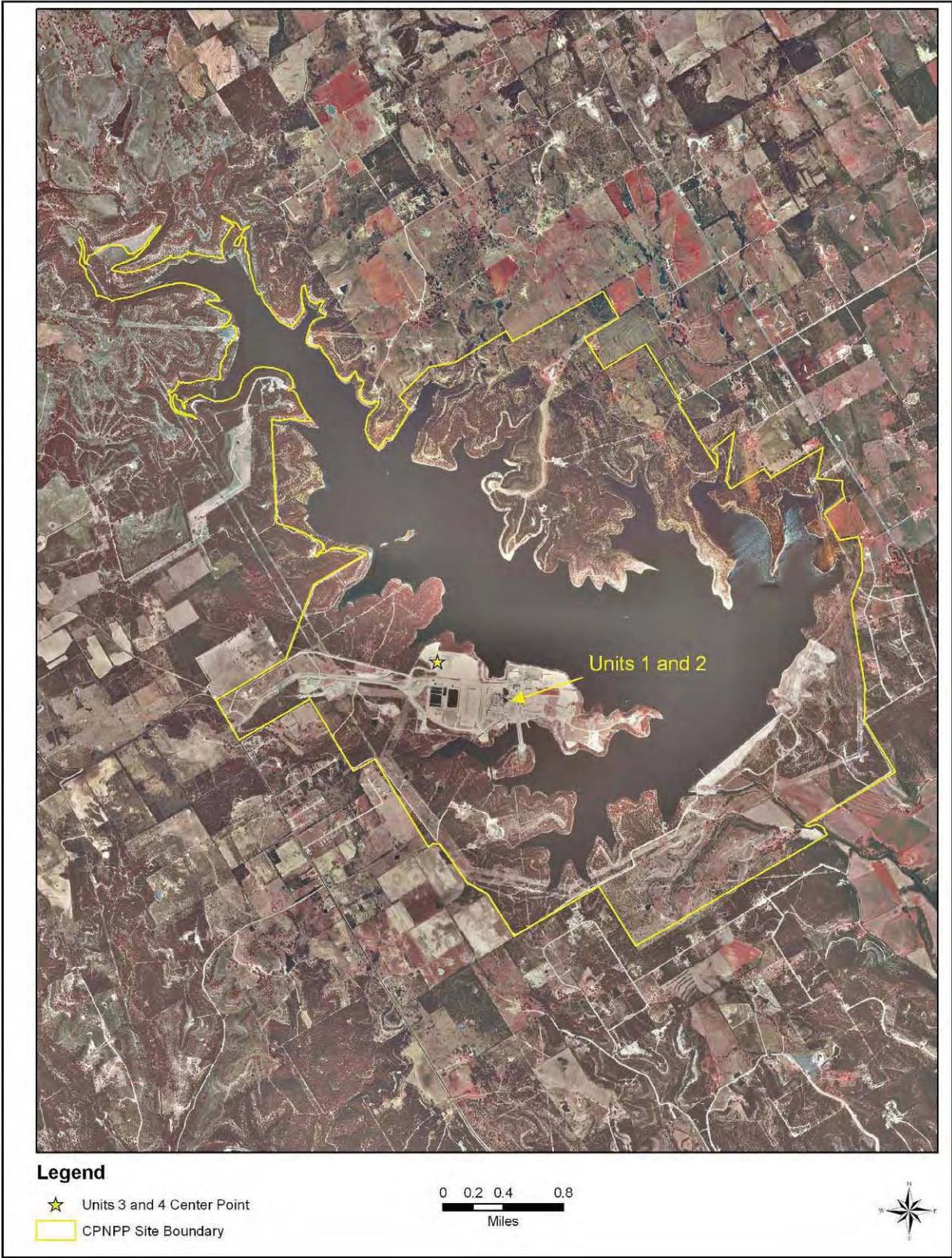


Figure 2-4. Location of proposed CPNPP Units 3 and 4 in relation to existing Units 1 and 2 on the CPNPP site (Luminant 2009a).

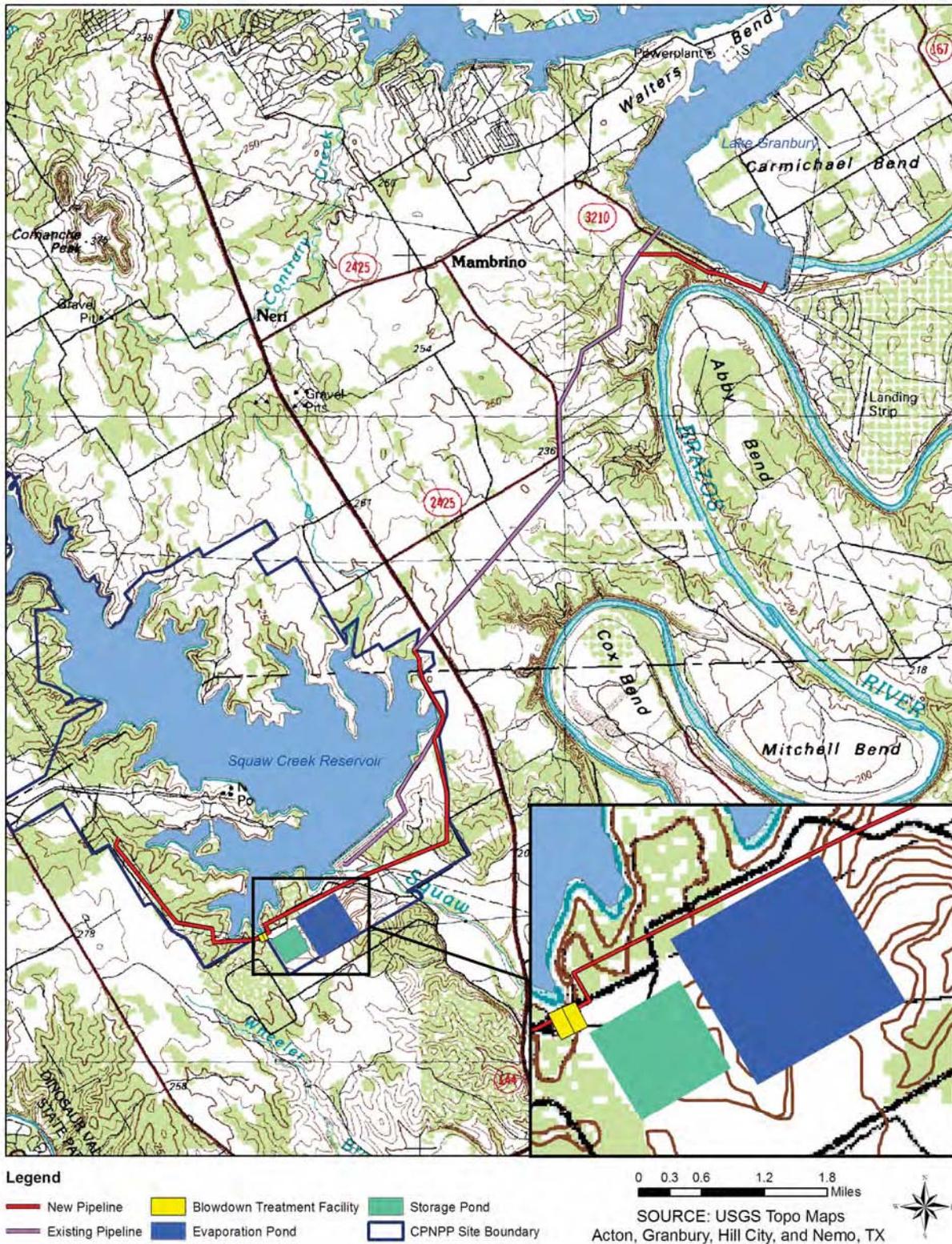


Figure 2-5. Existing and proposed water pipelines from Lake Granbury to the CPNPP site (Adapted from Luminant 2010c).

2.2 Land Use

This section discusses existing land uses and land-related issues for the CPNPP site, including the proposed location for Units 3 and 4. Section 2.2.1 describes the site and vicinity, which is defined as the area encompassed within 6-mi radius of the CPNPP. Section 2.2.2 discusses the existing and proposed transmission line and pipeline corridors, portions of which traverse the vicinity and portions of which extend into the region outside the vicinity. Section 2.2.3 discusses the region, defined as the area within 50 mi of the CPNPP site boundary.

2.2.1 The Site and Vicinity

The CPNPP site comprises approximately 7950 ac in an unincorporated area of Hood and Somervell Counties, Texas. The site is approximately 40 mi southwest of Fort Worth and 5.2 mi north of the City of Glen Rose (Luminant 2009a). The site, including the center point of the proposed Unit 3 and 4 facilities, is shown in Figure 2-4. SCR, which was constructed to provide cooling water for CPNPP Units 1 and 2, is entirely within the site boundary. The site is owned by the project Applicant, Luminant Generation Company LLC (Luminant 2009a).

Figure 2-6 depicts existing land use on the CPNPP site. The site contains two existing nuclear generating units, CPNPP Units 1 and 2, which are licensed by the U.S. Nuclear Regulatory Commission (NRC) and which have a combined net electric generating capacity of approximately 2300 MW(e). Unit 1 began commercial operation in 1990, and Unit 2 began commercial operation in 1993. Together, the two existing nuclear units and supporting facilities occupy approximately 203 ac of the CPNPP site. Based on the U.S. Geological Survey's National Land Cover Database, approximately 3328 ac (41.8 percent) of the site are covered by the waters of SCR. Other major land cover categories on the site include evergreen forest (1870 ac or 23.5 percent of the site), grassland/herbaceous vegetation (1101 ac or 13.8 percent, and woody wetlands (100.1 ac or 1.3 percent) (Luminant 2009a). Approximately 1064 ac of the site are classified as prime farmland according to U.S. Department of Agriculture soil survey criteria; however, none of this land is currently used for agricultural purposes. Some subsurface mineral rights on the site are not owned by Luminant; however, deed restrictions would prevent the placement of drill rigs or other mining equipment within the perimeter of the Exclusion Area Boundary (EAB) of proposed Units 3 and 4 (Luminant 2009a). The proposed site of Units 3 and 4 is outside 100-year and 500-year floodplains (Luminant 2009a).

Primary vehicular access to the site is provided by an access road connecting to FM 56. A rail spur line, dating from construction of Units 1 and 2, connects the site to the Fort Worth and to the Western Railroad Company main line at Tolar, Texas, approximately 6 mi north-northwest. Eight natural gas pipelines and one crude oil pipeline are located in the vicinity. None of the natural gas or crude oil pipelines serve the CPNPP facilities. Four of these pipelines cross the CPNPP site, including a 26-in. crude oil pipeline, which encroaches on the western edge of the EAB of proposed Units 3 and 4.

Figure 2-7 shows features in the vicinity of the CPNPP site. The NRC defines the vicinity of a site for a nuclear power plant as areas within a 6-mile radius (NRC 2000). Notable public facilities in the vicinity include Dinosaur Valley State Park, a 1525-ac scenic park on the Paluxy River approximately 3 mi southwest of the site; Wheeler Branch Reservoir, a potable water supply and developing recreation area approximately 1 mi south of the site; and Oakdale Park, a small municipal park approximately 5.2 miles south of the site in the City of Glen Rose. A significant non-public land use in the vicinity is the Fossil Rim Wildlife Center, a 1700-ac facility located about 6.6 miles to the south. This not-for-profit facility specializes in captive breeding of indigenous and exotic endangered and threatened species, efforts which are partly financed from fees charged for recreational use of the site (Fossil Rim Wildlife Center 2010).

1 Communities within the vicinity include the City of Glen Rose (population 2771), and portions of
2 the cities of Tolar (population 658), Granbury (population 8029), and Pecan Plantation (USCB
3 2009a).

4 Land use in the vicinity of the CPNPP site is depicted on Figure 2-8. Reflecting the rural
5 character of the area, principal land uses in the vicinity are grasslands/herbaceous
6 (50.0 percent), evergreen forest (17.8 percent), and deciduous forest (12.6 percent) (Luminant
7 2009a). Approximately 1.8 percent of the land in the vicinity is classified as woody wetlands. In
8 the immediate vicinity of the site, a rural residential area of approximately 310 ac is located
9 along FM 56, immediately south of the site entrance. At its nearest point, this community of
10 mobile homes and single-family dwellings is about 0.8 mi from the center point of proposed
11 Units 3 and 4. A second nearby rural residential area is located along County Roads 313 and
12 313 Loop immediately south and west of the proposed Blowdown Treatment Facility (BDTF) for
13 Units 3 and 4 (see Section 3.2.2 of this DEIS). This rural residential area covers approximately
14 620 ac and includes mobile homes and single-family dwellings. Several of the residential
15 properties abut the proposed BDTF boundary and security fence.

16 Land use plans and zoning ordinances in Somervell and Hood Counties are limited to
17 incorporated areas and therefore do not address land use on the CPNPP site or unincorporated
18 portions of the vicinity.

19 **2.2.2 Transmission Lines and Other Offsite Corridors**

20 Section 2.2.2.1 below discusses transmission lines and Section 2.2.2.2 discusses pipelines.

21 **2.2.2.1 Transmission Lines**

22 The existing power transmission system for CPNPP Units 1 and 2 is owned by Oncor Electric
23 Delivery Company and comprises four circuits. One 345-kV circuit and a 138-kV circuit follow
24 parallel rights of way to connect CPNPP to the DeCordova Switching Station in Hood County. A
25 second 345-kV circuit runs to the Parker Switch in Parker County, and a third runs to the Venus
26 Switch in Johnson County (AEC 1974, NRC 1981, Luminant 2009a). Lattice-type galvanized
27 steel towers are used for the 345-kV lines, and wooden poles are used for the 138-kV circuit.

28 As described in Section 3.2.2.3 of this DEIS, power generated by the proposed CPNPP Units 3
29 and 4 would be carried from the site using several existing transmission line corridors described
30 above plus two new transmission lines on new corridor locations. While specific routes have not
31 been identified for the proposed new lines, land use in the areas they would traverse is typical of
32 the CPNPP region, consisting mostly of grassland with lesser amounts of deciduous forest,
33 evergreen forest, and developed land (Luminant 2009a). Approximately 149 ac of right-of-way
34 (ROW) would be acquired for a 17-mile transmission line to the DeCordova Switch, of which
35 approximately 108 ac is covered by grassland, 11 ac by water, 11 ac by open development, and
36 10 ac by deciduous forest. A proposed 45-mile transmission line corridor to the Whitney Switch
37 would require acquisition of approximately 954 ac of ROW, of which approximately 550 ac is
38 covered by grassland, 176 ac by deciduous forest, and 137 ac by evergreen forest (Luminant
39 2009a).

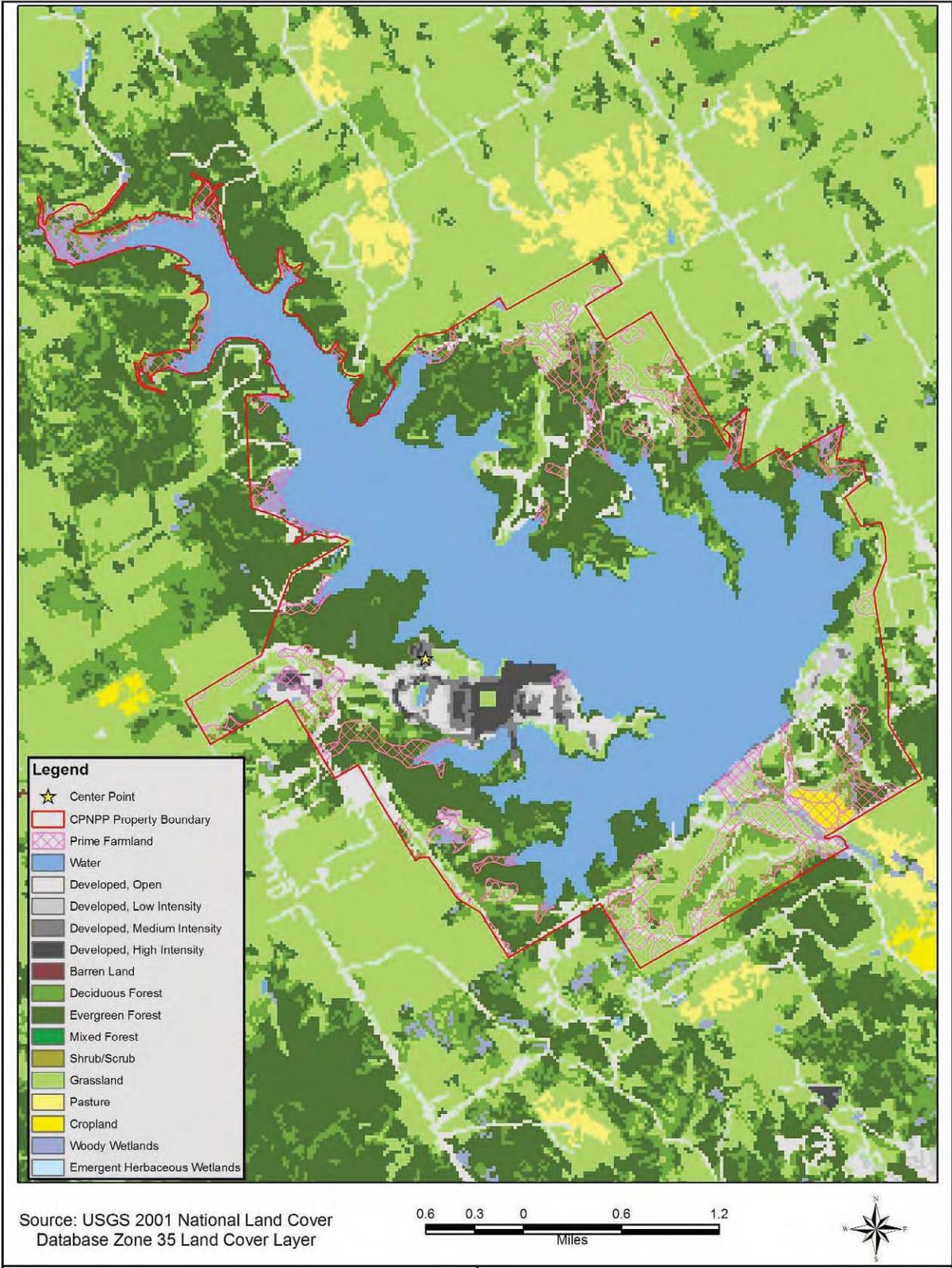


Figure 2-6. Land use on CPNPP site (Luminant 2009a).

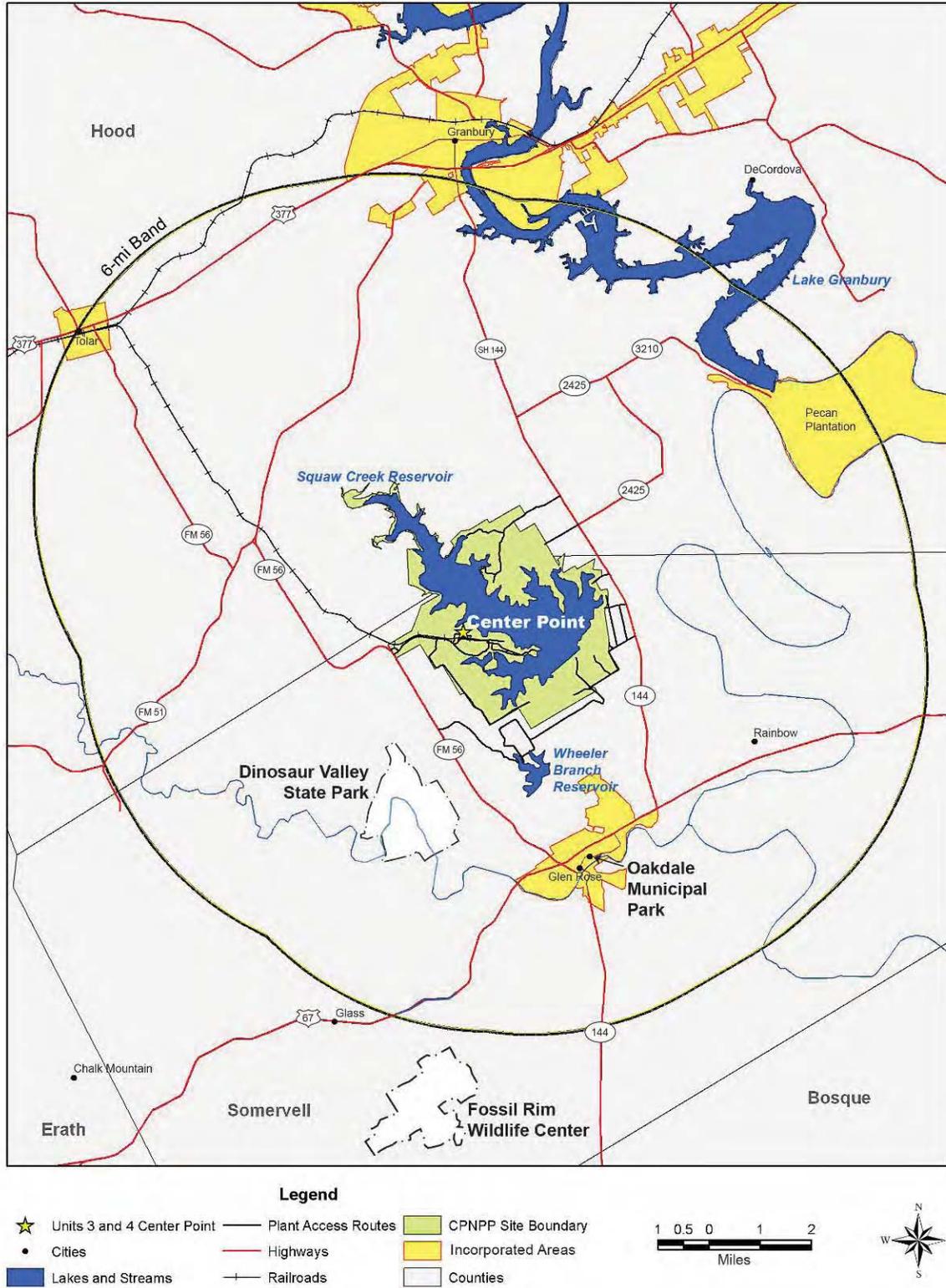


Figure 2-7. Land use features in project vicinity (Adapted from Luminant 2009a)

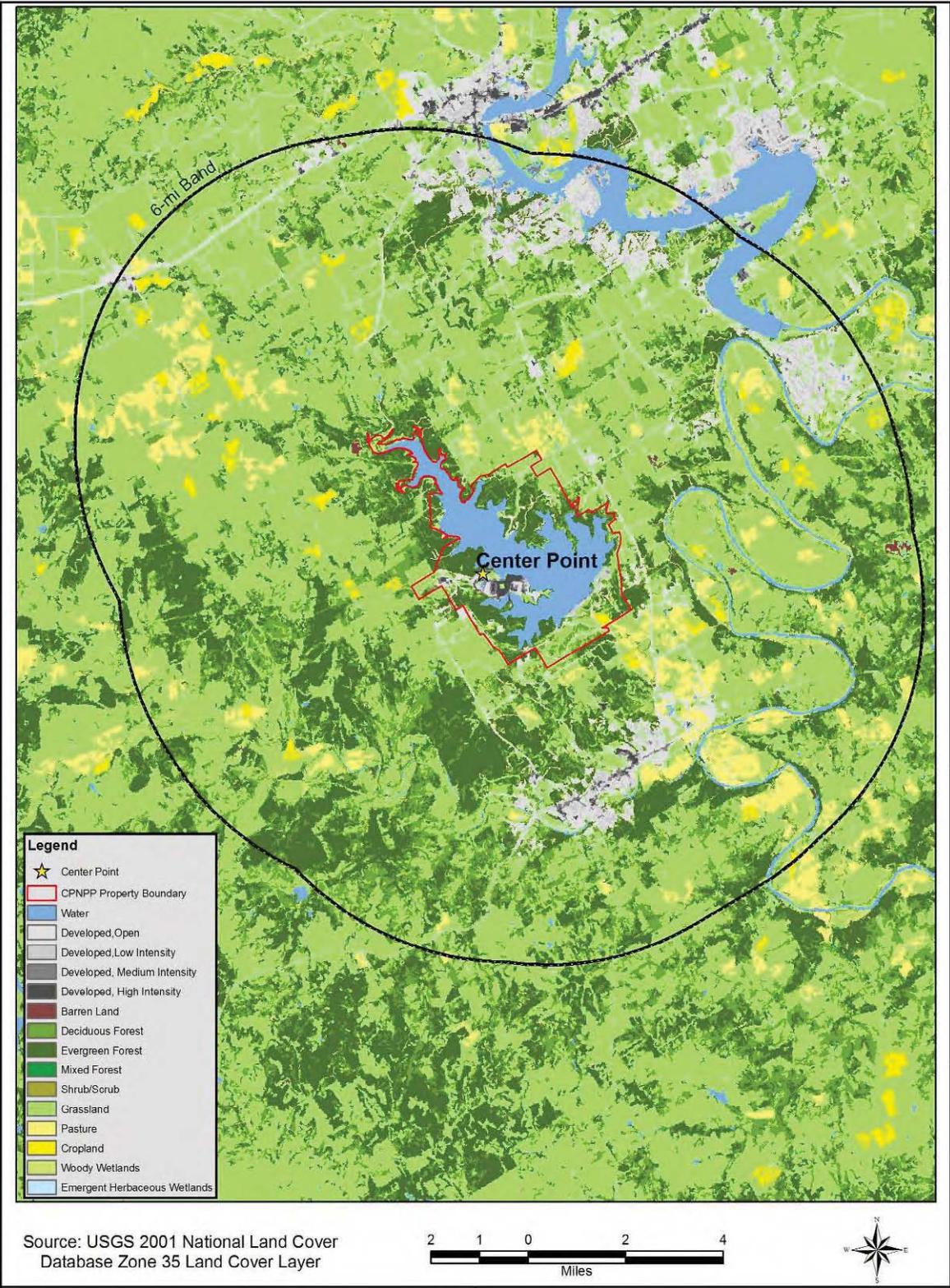


Figure 2-8. Vicinity land use (Luminant 2009a).

1 **2.2.2.2 Pipelines**

2 As part of the cooling system for CPNPP Units 1 and 2, an existing buried pipeline carries
3 makeup water to SCR from Lake Granbury. A second existing buried pipeline, running adjacent
4 to the first, was constructed to return water to Lake Granbury, but this pipeline has never been
5 used and is not expected to be used in the future (Luminant 2009a). These pipelines occupy a
6 50-ft wide right-of-way over a distance of approximately 8 mi.

7 Section 3.3.1.13 of this DEIS describes proposed new intake and discharge water pipelines that
8 would be installed between Units 3 and 4 and Lake Granbury to provide cooling water to the
9 new units. The new pipelines would share the ROW of the existing pipelines. Approximately
10 49.7 ac would be affected by installation of the pipelines, of which approximately 31.4 ac is
11 covered by grassland, 6.3 ac by deciduous forest, and 6.2 ac by open development.
12 Approximately 0.1 ac of woody wetlands is within the corridor (Luminant 2009a).

13 **2.2.3 The Region**

14 Figure 2-1 depicts incorporated areas, county boundaries, water bodies, and principal highways
15 within the 50-mi region surrounding the CPNPP site. All or portions of 19 counties are within
16 50 mi of the site. Figure 2-9 shows Federal land holdings and State parks in the region.
17 Regional land use is shown on Figure 2-10. Major land cover categories in the region include
18 grassland/herbaceous (49.8 percent), evergreen and deciduous forest (20.8 percent),
19 shrub/scrub (6.9 percent), pasture/hay (5.6 percent), and cultivated crops (5.4 percent)
20 (Luminant 2009a).

21 Woody wetlands cover approximately 1.5 percent of the region (Luminant 2009a). There are no
22 lands of Tribal entities recognized and eligible for funding and services from the U.S. Bureau of
23 Indian Affairs within the region (73 FR 18553).

24 **2.3 Water**

25 This section describes the surface and groundwater features of the CPNPP site and the
26 surrounding region that could be affected by construction and operation of proposed CPNPP
27 Units 3 and 4. Subsections cover hydrology (Section 2.3.1), water use (Section 2.3.2), and
28 water quality (Section 2.3.3).

29 **2.3.1 Hydrology**

30 This section describes the site-specific and regional hydrological features that could be affected
31 by construction and operation of the proposed CPNPP Units 3 and 4. A description of the site's
32 hydrological features was presented in Section 2.3.1 of the Environmental Report (ER)
33 (Luminant 2009a). Hydrological features of the site related to site safety (e.g., probable
34 maximum flood) are described by Luminant in the final safety analysis report (FSAR) (Luminant
35 2009b). A summary of the hydrologic conditions of the site for the proposed CPNPP Units 3
36 and 4 is provided in Section 2.3 of the ER (Luminant 2009a). Both the FSAR and the ER were
37 informed by the hydrologic characterization conducted for the construction of existing CPNPP
38 Units 1 and 2, as well as the results of investigations performed in support of the COL
39 application for the proposed Units 3 and 4. The following descriptions are based on information
40 from these sources.

41 **2.3.1.1 Surface-Water Hydrology**

42 The site for the proposed CPNPP Units 3 and 4 is on the northwestern portion of a peninsula
43 that extends into the west side of SCR, between the southern shore of the reservoir and the

1 CPNPP Units 1 and 2 Safe Shutdown Impoundment (Figures 2-3 and 2-4). SCR is formed by
2 the impoundment of Squaw Creek, a tributary of the Paluxy River. Squaw Creek enters the
3 Paluxy immediately upstream from the confluence of the Paluxy with the Brazos River. Makeup
4 water to replace that used for the Units 3 and 4 cooling tower blowdown would be obtained from
5 Lake Granbury, an impoundment of the Brazos River. Figure 2-11 shows the predominant
6 surface-water hydrologic features of the CPNPP site area, Lake Granbury, and SCR.

7 The Brazos River and its tributaries drain a total area of about 45,700 mi², of which about 9,570
8 mi² in the upper part of the basin does not contribute to streamflows. Streamflow in the Brazos
9 River is regulated by a series of dams that were built on the river and its tributaries beginning in
10 the 1940s. Upstream from the CPNPP site on the main stem of the Brazos River is the Morris
11 Sheppard Dam, which was completed in 1941 and forms Possum Kingdom Lake. Figure 2-12
12 shows the locations of Possum Kingdom Lake (reservoir) and several other Brazos River
13 reservoirs. Possum Kingdom Lake has a storage capacity of approximately 750,000 ac-ft of
14 water.

15 About 7.5 mi northeast of the CPNPP site, is DeCordova Bend Dam on the Brazos River main
16 stem. This dam, which was completed in 1969, forms Lake Granbury. Lake Granbury has a
17 total drainage area of 16,113 mi² and a storage capacity of 136,823 ac-ft. Approximately
18 100 river mi below DeCordova Dam is Whitney Dam, which forms Lake Whitney, a U.S. Army
19 Corps of Engineers (USACE) flood-control reservoir with a capacity of 1.3 million ac-ft.

20 Two principal streams enter the 145-mi-long segment of the Brazos River between Possum
21 Kingdom Lake and DeCordova Bend Dam. Palo Pinto Creek is 60 mi long, has a drainage area
22 of 461 mi², and enters at Brazos River Mile (BRM) 609.5. Rock Creek is 24 mi long, has a
23 drainage area of 63 mi², and enters at BRM 599.7. In addition, six named intermittent streams
24 are minor tributaries to Lake Granbury.

25 Squaw Creek has a drainage area of 70.3 mi², of which approximately 64 mi² is above Squaw
26 Creek Dam. SCR has a surface area of 3,297 ac at its conservation pool level of 775 ft MSL
27 and a storage capacity of 151,418 ac-ft. Six intermittent streams, five named and one
28 unnamed, flow into SCR within a 6-mi radius of the proposed locations for CPNPP Units 3 and
29 4. Squaw Creek enters the Paluxy River at Glen Rose, immediately upstream from the Paluxy's
30 confluence with the Brazos River.

31 The Paluxy River is a 38-mi-long stream that flows from northeastern Erath County through
32 Hood and Somervell Counties (TPWD 1974) and enters the Brazos River at Glen Rose,
33 approximately 37 river mi below DeCordova Bend Dam. At U.S. Geological Survey (USGS)
34 Gauge 08091500 near Glen Rose, 5.1 river mi upstream from the Brazos, the Paluxy River has
35 a drainage area of 410 mi² (USGS 2007).

36 The nearest upstream gauge on the Brazos River, USGS Gauge 08090800 in the Brazos River
37 near Dennis, Texas, is approximately 45 river mi northwest of DeCordova Bend Dam
38 (Figure 2-11). It is below Morris Sheppard Dam and above Lake Granbury and has a drainage
39 area of 15,671 mi². Streamflow at this location is controlled by reservoir releases from Possum
40 Kingdom Lake at Morris Sheppard Dam. The average mean monthly streamflow at this gauge
41 for the period May 1968 through September 2006 was 975 cfs. The maximum monthly mean
42 flow during this period was 17,690 cfs (in October 1981) and the minimum monthly mean flow
43 was 15 cfs (in September 1984). The maximum recorded streamflow at the Brazos River
44 Dennis station for the period of record was 96,640 cfs (recorded on October 14, 1981) and the
45 minimum daily streamflow was 1.2 cfs (recorded on August 2, 1978).

Affected Environment

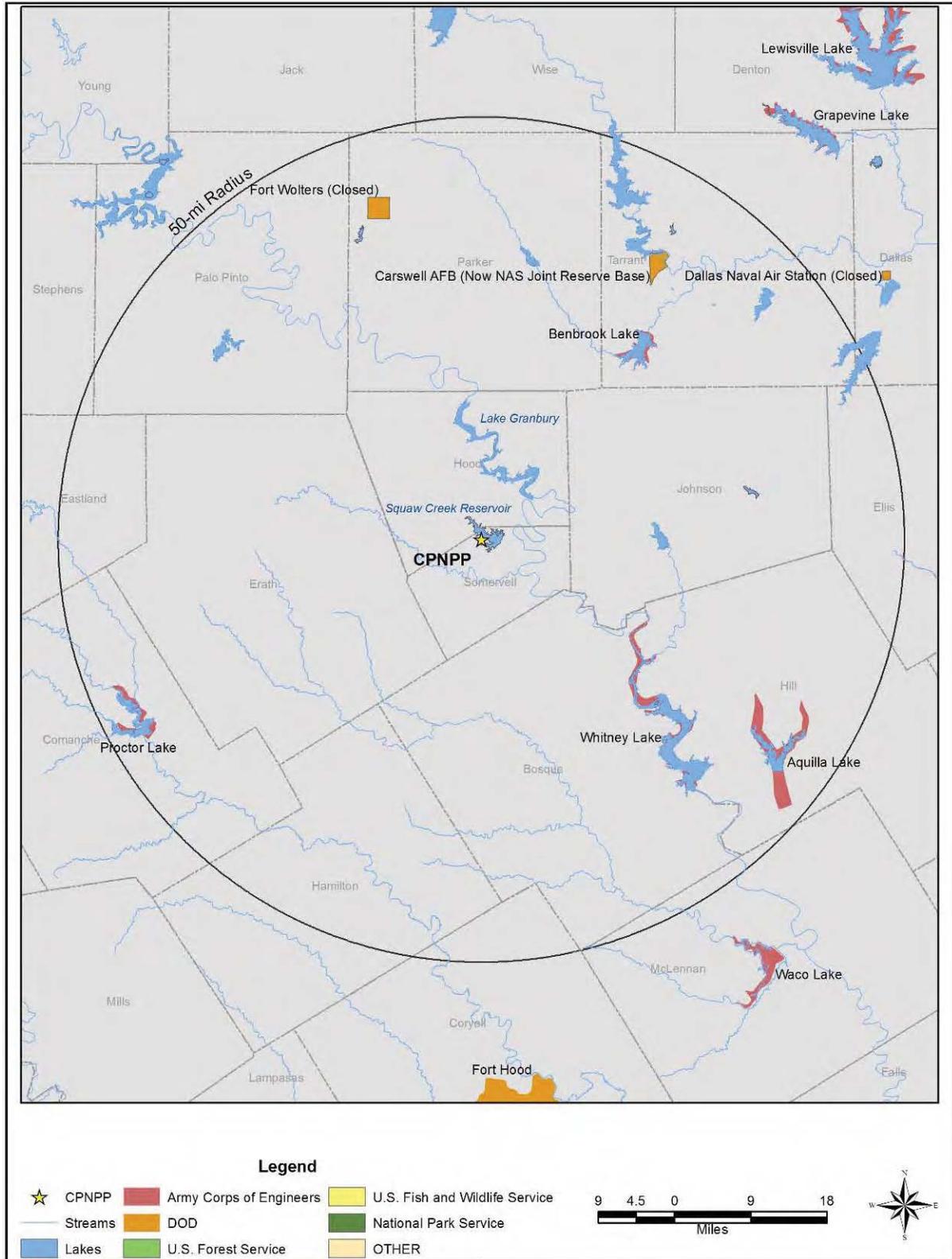


Figure 2-9. Federal lands and State parks in the region (Luminant 2009a).

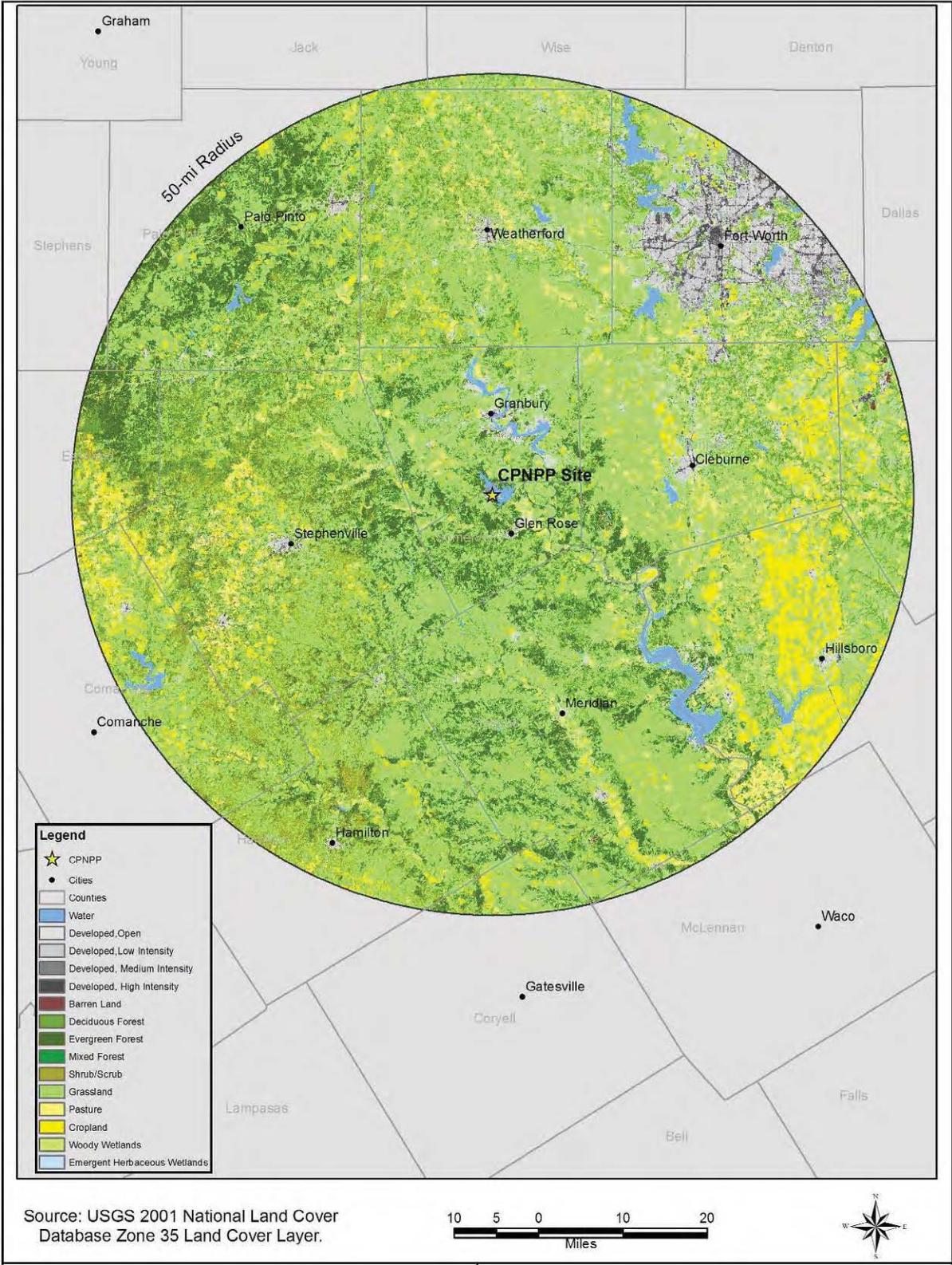


Figure 2-10. Regional land use (Luminant 2009a).

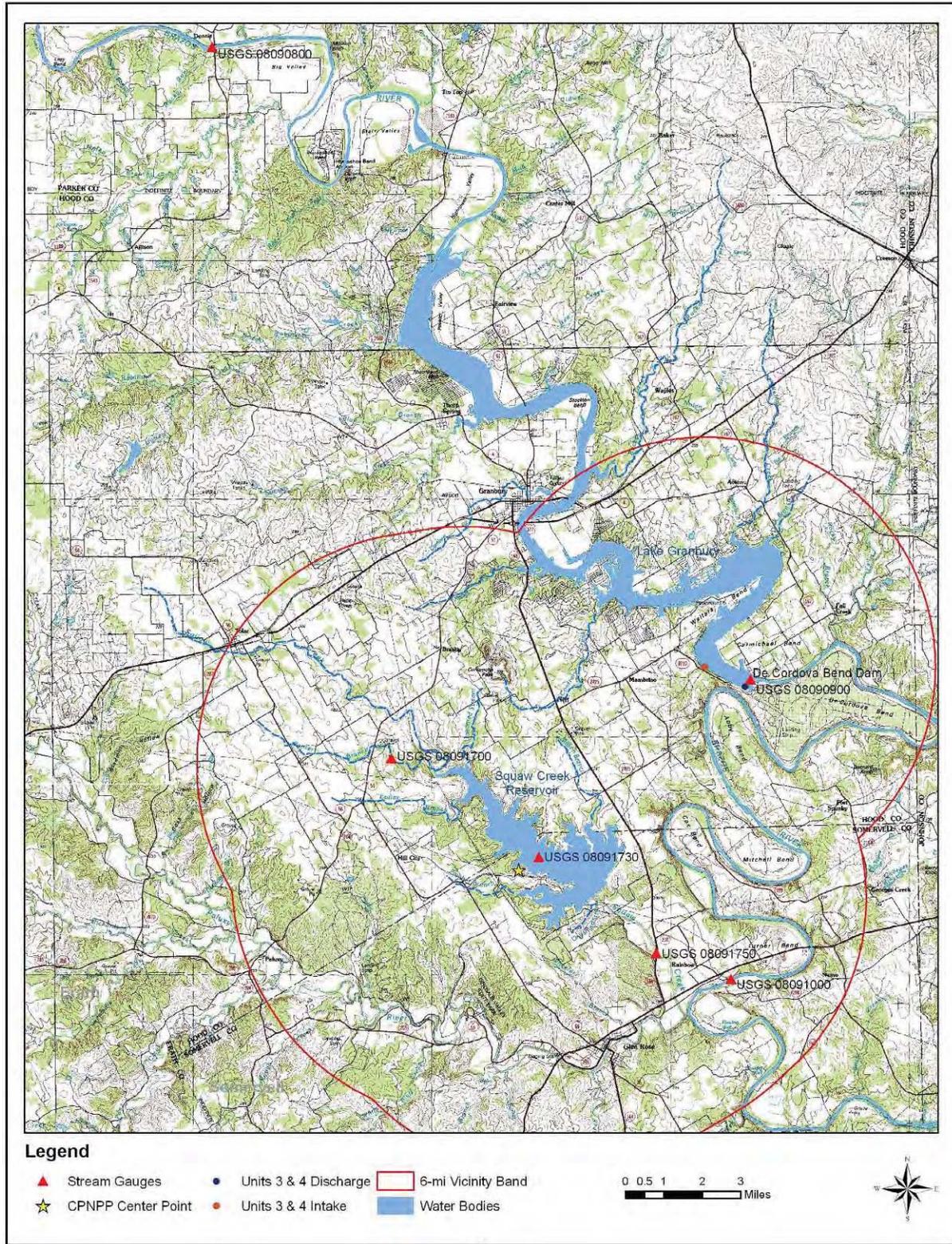


Figure 2-11. Predominant surface-water hydrologic features of the CPNPP site area, including locations of gauging stations (Luminant 2009a).

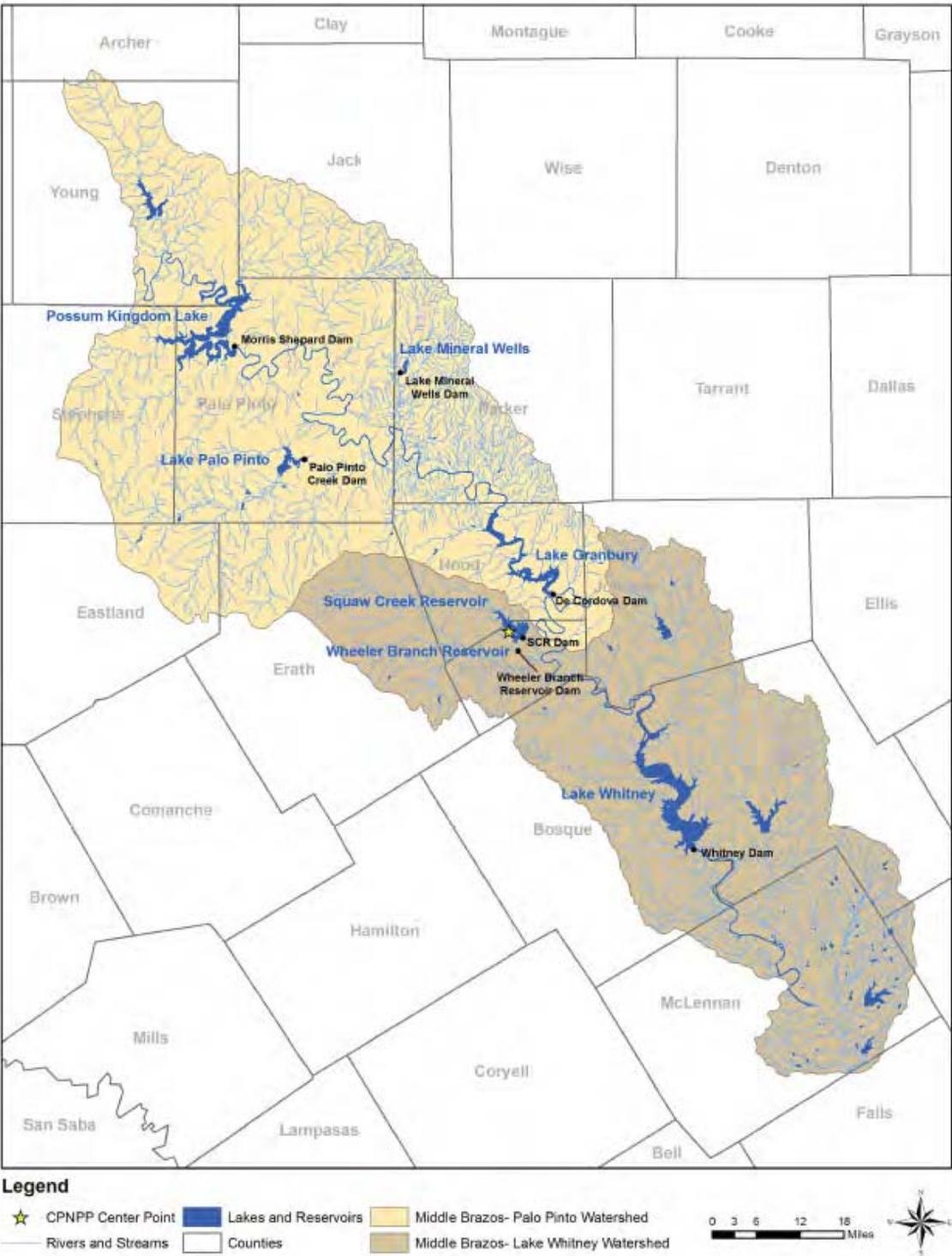


Figure 2-12. Map of the middle Brazos River watershed, including locations of Possum Kingdom Lake (Reservoir), Lake Granbury, Lake Whitney, and several other Brazos River reservoirs (Luminant 2009a).

1 The calculated 7Q10 flow rate for the Brazos River Dennis station is 14.7 cfs [CPNPP Units 3
2 and 4 Final Safety Analysis Report (FSAR) Subsection 2.4.11 (Luminant 2009b)]. The 7Q10
3 flow rate is defined as the lowest streamflow that occurs over a period of 7 consecutive days
4 once every 10 years on average.

5 At USGS Gauge 08090900 at DeCordova Dam, the average monthly mean streamflow for the
6 period October 1969 through December 2006 was 1031 cfs. The maximum monthly mean flow
7 was 19,269 cfs (in June 1982) and the minimum monthly mean flow was 15 cfs (in September
8 1988). The maximum recorded flow for the period of record was 72,585 cfs, on October 15,
9 1981. Minimum flows are controlled by the Brazos River Authority (BRA). There is no minimum
10 flow requirement at this dam, but under normal operating conditions, the BRA maintains a flow
11 of at least 28 cfs. Lower flows can, however, occur during dam maintenance. Extended periods
12 of the 28 cfs minimum flow are evident in the historical record for this gauge.

13 The nearest gauging station on the Brazos River downstream from DeCordova Bend Dam is
14 USGS Gauge 08091000, near Glen Rose, approximately 35 river mi south of DeCordova Bend
15 Dam and 2 mi upstream from the mouth of the Paluxy River. The station has a contributing
16 drainage area of 16,252 mi². Record-keeping at the site began in 1924. The average mean
17 monthly streamflow from October 1940 through September 2006 is 1234 cfs. The maximum
18 streamflow at Gauge 08091000 before completion of the Morris Sheppard Dam was 97,600 cfs,
19 on May 18, 1935. The maximum streamflow from 1942 to 1969 (after Morris Sheppard Dam
20 was built but before DeCordova Bend Dam formed Lake Granbury) was 87,400 cfs, on May 27,
21 1957. The maximum streamflow from the completion of DeCordova Bend Dam through 2006
22 was 89,600 cfs, on December 21, 1991. There were several days of zero or minimal streamflow
23 at this site during the period of record. Based on flow data from 1969 through 2006, the
24 calculated 7Q10 flow rate for the Brazos River Glen Rose station is 6.3 cfs.

25 Streamflow in Squaw Creek below SCR was measured at USGS Gauge 08091750 near Glen
26 Rose from 1977 to 2006. The average mean monthly flow during this period was 21 cfs. This
27 flow is controlled by SCR operations.

28 Mean annual streamflow in the Paluxy River at USGS Gauge 08091500 near Glen Rose from
29 1982 to 2008 was 94.1 cfs (USGS 2007). Zero-flow periods of 7 days or longer were recorded
30 during 4 of the 13 years from 1983 to 1995 (Raines and Asquith 1997).

31 Evaporation is the principal cause of water loss from both Lake Granbury and SCR. Based on
32 USACE pan evaporation data for Lake Granbury for the years 1993–2006, the estimated water
33 loss from Lake Granbury due to evaporation is 61.74 in/yr. No evaluations of leakage or
34 seepage have been performed for either reservoir. Both reservoirs are on bedrock of the Glen
35 Rose Formation, which lacks evidence of dissolution effects and has been tested and found to
36 have low permeability [FSAR, Section 2.5.4.6.10 (Luminant 2009b)]. Luminant has concluded
37 that significant loss of water from seepage is improbable.

38 The CPNPP site has gently to steeply rolling topography. The majority of the proposed site for
39 CPNPP Units 3 and 4 drains in a northerly direction into SCR.

40 No portions of the proposed site for CPNPP Units 3 and 4 or the pipeline corridor between Lake
41 Granbury and the CPNPP site are within 100- or 500-year floodplains (Luminant 2009a).

42 Erosion and sedimentation patterns in free-flowing reaches of the Brazos River are typical of a
43 meandering stream, with erosion occurring on the outside bends of meanders and deposition
44 occurring on the inner bends. The river carries an increased sediment load during high-flow
45 periods after rainfall events, but sediment loads quickly return to baseline conditions after these
46 events. There is an area of deltaic accretion in Lake Granbury where the Brazos River enters

1 the reservoir. Volumetric surveys of Lake Granbury found that it lost only about 2 percent of its
2 volume due to sedimentation between 1993 and 2003.

3 The existing CPNPP water intake on Lake Granbury is a reinforced concrete box-type structure
4 located 1.31 mi upstream from the DeCordova Bend Dam. The bottom of the intake structure is
5 at elevation 666 ft MSL, which is 9 ft below the minimum pool elevation of 675 ft MSL [FSAR
6 Section 2.4.1 (Luminant 2009b)]. At the conservation pool elevation of 693 ft MSL, water depth
7 in this area is approximately 50 ft. The proposed CPNPP Units 3 and 4 cooling water intake
8 structure would be located adjacent to this intake on the southwest bank of Lake Granbury [ER
9 Section 2.3.1.2.5 (Luminant 2009a)].

10 Lake Granbury and SCR bathymetry data and temperature profiles are found in ER
11 Section 2.3.1.2.5 (Luminant 2009a).

12 **2.3.1.2 Groundwater Hydrology**

13 This section provides all physical information on the site needed to support an assessment of
14 potential groundwater impacts in the areas of hydrological alterations, groundwater use, and
15 groundwater quality. The geology of the CPNPP site region is described in Section 2.8.

16 ***Groundwater Occurrence***

17 Most of the groundwater in the site region occurs in bedrock. The principal groundwater source
18 in the vicinity of the CPNPP site is the Trinity Group aquifer, a bedrock aquifer composed in the
19 site vicinity of the Cretaceous-age Paluxy, Glen Rose, and Twin Mountains Formations. Some
20 groundwater is also present in the shallow floodplain alluvium along stream valleys and
21 undifferentiated fill beneath the CPNPP site, but it is not withdrawn for use.

22 The Trinity aquifer is characterized by the Texas Water Development Board (TWDB) as a major
23 aquifer. The aquifer occurs in a north-south-trending band in a region that extends from central
24 Oklahoma through central Texas and into Mexico. The CPNPP site is located on the aquifer's
25 outcrop area, which occurs mostly in Callahan, Eastland, Erath, Hood, Somervell, Comanche,
26 Hamilton, Coryell, and Lampasas Counties. Most aquifer recharge occurs in the outcrop belt.
27 East (down-dip) of its outcrop belt the aquifer is present in the subsurface as a confined aquifer,
28 mostly in Johnson Hill, Bosque, McLennan, Coryell, Bell, and Williamson Counties. In the
29 Trinity aquifer, groundwater percolates slowly along bedrock joints and fractures, and through
30 interstices in the rock fabric. Regional movement of water is down-dip to the east. At distances
31 of 20 to 50 mi down-dip from the outcrop, the groundwater becomes saline, and the formations
32 lose their importance as sources of fresh water.

33 In the CPNPP site vicinity, the Twin Mountains Formation, the lowermost unit in the Trinity
34 aquifer, is the only moderately productive bedrock zone, though the Paluxy Formation has
35 nominal pumpage near the site. The Glen Rose Formation yields very little water in the site
36 area.

37 Locally, CPNPP and SCR are situated on the Glen Rose Formation outcrop, which, in turn, is
38 underlain by the Twin Mountains Formation. The Glen Rose Formation is approximately 230 ft
39 thick beneath unexcavated portions of the site, but excavation has reduced its thickness to
40 approximately 160 ft beneath CPNPP Units 1 and 2. This unit produces very little groundwater
41 and therefore, has very few production wells constructed within it. Field testing of the Glen
42 Rose Formation found it to have low permeability. Slug tests measured hydraulic conductivities
43 of 6×10^{-6} to 1×10^{-5} cm/s (Luminant 2009b). Vertical hydraulic conductivity, which in layered
44 rock typically is lower than the overall conductivity, ranged from 1×10^{-9} cm/s to 4×10^{-7} cm/s

1 (Luminant 2009b). The Glen Rose Formation is not used for groundwater supply in the vicinity
2 of the CPNPP site.

3 Most local production wells are constructed within the 220-ft-thick Twin Mountains Formation
4 located beneath the Glen Rose Formation. The nearest offsite well is located about 1-1/4 mi to
5 the west. There are no sole source aquifers in the vicinity of the CPNPP.

6 At the proposed site for CPNPP Units 3 and 4, shallow groundwater occurs within perched
7 aquifers consisting of undifferentiated fill, regolith, and the upper Glen Rose Formation. These
8 perched zones are not used for groundwater supply in the vicinity of the CPNPP site.

9 Eleven existing water wells were identified on the CPNPP site. The wells include: six potable
10 water wells that support CPNPP Units 1 and 2 operations; four observation wells, one of which
11 was identified as a converted domestic well; and one privately owned stock well. Onsite
12 groundwater withdrawal information for 2006 was obtained from an annual report provided by
13 Luminant (Luminant 2007). The report indicated onsite withdrawals of 27.9 ac-ft (9,092,700 gal)
14 from five active wells in 2006, which is a use rate of 24,900 gpd or approximately 17 gpm,
15 primarily from the Twin Mountains Formation.

16 **2.3.2 Water Use**

17 This section describes existing water uses, and projected future water uses and projected future
18 water uses in the region that could be affected by water use and discharges from the proposed
19 CPNPP Units 3 and 4. Consideration is given to both non-consumptive water uses, which do
20 not result in a reduction in the available water supply, and consumptive uses, which result in a
21 net reduction of supply because water is consumed by processes such as evaporation.

22 The CPNPP site is located in the TWDB Brazos Region G, one of 16 water management
23 planning regions established under Texas State law and given responsibility for developing
24 regional water plans. Brazos Region G is a 37-county area that extends generally along the
25 Brazos River from Kent, Stonewall, and Knox Counties in the northwest to Washington and Lee
26 Counties in the southeast. Over 90 percent of the region is in the Brazos River basin.

27 Surface water sources account for over 75 percent of the existing water supply in Brazos
28 Region G (TWDB 2007b). Principal surface water sources in the region are the Brazos River,
29 its tributaries, and 41 major reservoirs. The TWDB's annual survey of surface water and
30 groundwater use by Texas municipal and industrial entities identifies consumptive withdrawals
31 for six categories of uses: (1) municipal; (2) manufacturing; (3) steam-electric power; (4)
32 mining; (5) livestock; and (6) irrigated agriculture. The survey covers only consumptive
33 withdrawals; it does not include non-consumptive water uses or return flows. In 2006 water
34 consumption in Brazos River Region G totaled 783,495 ac-ft, of which 42, 31, and 11 percent
35 was used by municipalities, irrigated agriculture, and steam-electric power plants, respectively
36 (TWDB 2009a) The TWDB has projected that annual consumptive water demand in the region
37 would increase to 835,691 ac-ft in 2010, with requirements for steam-electric power plants
38 increasing to 147,734 ac-ft per year, or nearly 18 percent of the total demand (TWDB 2007b).
39 Potential requirements for CPNPP Units 3 and 4 and for expanded development of natural gas
40 from the Barnett Shale (Section 2.8) are not included in these regional water demand
41 projections.

42 Total water supply in the region as of 2010 is estimated at 1,150,098 ac-ft annually, of which
43 76 percent is surface water. Available supply is projected to decline about 3 percent between
44 2010 and 2060, to 1,112,155 ac-ft annually, due to sedimentation in surface-water reservoirs
45 and increased emphasis on long-term sustainability in groundwater management (TWDB
46 2007b). During the same period, annual demand is expected to increase to 1,150,098 ac-ft,

1 with the majority of the increase due to increased municipal use to serve a growing population
2 (TWDB 2007b).

3 **2.3.2.1 Surface-Water Use**

4 In 2006, surface water withdrawals (including both consumptive use and return flows) in the six-
5 county region of Bosque, Hill, Hood, Palo Pinto, Parker, and Somervell Counties totaled
6 3,601,774 ac-ft. Somervell County accounted for more than 93 percent of this total, with
7 withdrawals from SCR, Panther Branch, and Lake Granbury that totaled 3,367,805 ac-ft
8 [Table 2-1 (Luminant 2009a)]. Withdrawals by the BRA in Hood County accounted for
9 1.6 percent of the total.

10 Lake Granbury is an important source of drinking water and recreation to the surrounding
11 communities. The BRA has rights to store up to 155,000 ac-ft in the reservoir and divert up to
12 64,712 ac-ft annually for municipal, irrigation, industrial, and mining uses. Up to 100,000 ac-ft
13 may be diverted annually under a System Operation Order that authorizes the BRA to manage
14 its several reservoirs as a system (Albright 2010a). According to the BRA, in 2006, surface
15 water diversions from Lake Granbury totaled 59,816 ac-ft, of which approximately 77 percent
16 was for steam electric use, about 6 percent was for other industrial uses, 11 percent was for
17 municipal use, 6 percent was for irrigation, and less than one percent was for mining. The
18 principal municipal user is the Lake Granbury Surface Water and Treatment System (SWATS),
19 which is operated by the BRA to supply Lake Granbury water to five municipal water systems
20 (Luminant 2009a). The SWATS water intake is approximately 3.45 mi upstream of the CPNPP
21 Intake Structure. Water is treated by reverse osmosis to make it suitable for municipal use
22 (TWDB 2007b).

23 Steam-electric users reported in 2006 included CPNPP Units 1 and 2, the Wolf Hollow electric
24 power plant, and the DeCordova Bend power plant. Water for use at CPNPP Units 1 and 2 is
25 withdrawn from SCR, which is replenished by water from Squaw Creek and by water diverted
26 from Lake Granbury. In 2006, water diversions from Lake Granbury for use in CPNPP Units 1
27 and 2 totaled 46,750 ac-ft. The Wolf Hollow electric power plant has an intake located
28 approximately 150 ft downstream from the existing CPNPP Lake Granbury intake, and the
29 DeCordova Bend electric power plant withdraws water through an intake located approximately
30 1.56 mi upstream from the CPNPP Lake Granbury intake.

31 A total of 3,321,000 ac-ft was withdrawn from SCR for CPNPP Units 1 and 2 in 2006. Of this
32 total, 19,900 ac-ft was consumed by evaporation and 3,301,000 ac-ft was discharged back to
33 SCR. Discharge from SCR to Squaw Creek for the year totaled 21,100 ac-ft.

Table 2-1. Surface Water Withdrawals in the Vicinity of the CPNPP Site in 2006
(numerical values are in acre-feet)

County	User Name	Stream Name	Use Type	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Palo Pinto	Brazos River Authority	Brazos River	1,2,3, 4,5,6	4,852	1761	4657	7436	32,815	12,630	24,703	21,601	1298	30,973	11,882	5703	160,311
Palo Pinto	Palo Pinto MWD 1	Palo Pinto Creek	1	365	288	322	366	416	497	561	577	385	377	323	324	4800
Palo Pinto	Rocking W Ranch, LP	Brazos River	3	0	0	0	0	18	0	217	231	133	47	0	0	647
Palo Pinto	W. J. Rhodes	Brazos River	3	0	0	0	0	0	8	10	5	0	0	0	0	23
Parker	City of Mineral Wells	Rock Creek	1	0	2	0	0	0	6	19	27	0	0	0	0	54
Parker	Operations, TXI LP	Brazos River	2,3	NR												
Hood	Brazos River Authority	Brazos River	1,2,3,	1542	2769	2966	5399	5410	6775	7155	7710	6771	5574	4123	610	56,815
Somervell	TXU Electric	Squaw Creek Reservoir, Panther Branch, Lake Granbury	2	227,102	210,025	269,807	296,577	305,253	297,050	306,579	306,898	297,130	253,082	295,190	303,111	3,367,805
Somervell	Somervell County Water District	Paluxy River	1,2,3	NR												

Table 2-1. (contd)

County	User Name	Stream Name	Use Type	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Bosque	City of Clifton	North Bosque River	1	63	8	65	38	0	26	0	0	0	9	28	21	256
Bosque	City of Meridian	North Bosque River	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bosque	Chisholm Trails Ventures, LP	Brazos River	3	141	141	345	345	576	576	576	435	345	141	0	0	3621
Bosque	Lakeview Recreation Association Inc.	Brazos River, Rock Branch	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Bosque	John McPherson Smith	Brazos River	3	0	0	0	0	0	35	35	35	35	0	0	0	140
Bosque	Bend Ranch, Ltd.	Brazos River	3	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hill	Brazos River Authority	Brazos River	1,2	109	107	122	113	120	140	184	229	5854	137	69	118	7302

Notes:

Total 2006 reported surface water withdrawals for the six county area is 3,601,774 acre-feet.

Use Types

- 1 - Municipal
- 2 - Industrial
- 3 - Irrigation
- 4 - Mining
- 5 - Hydroelectric
- 6 - Other
- NR - Not Reported

Source: Luminant 2009a.

1 Wheeler Branch Reservoir (WBR), located approximately 2 mi south of the site for CPNPP
2 Units 3 and 4, is a water-supply reservoir on Wheeler Branch, a minor tributary of the Paluxy
3 River. The reservoir, which is owned and operated by the Somervell County Water District
4 (SCWD), was completed in 2007 to provide water for the City of Glen Rose, other smaller
5 Somervell County communities, and some private users in Somervell County. It has a surface
6 area of 180 ac and a capacity of 4,118 ac-ft, and is filled primarily by water diverted from the
7 Paluxy River. The SCWD has rights to divert 5000 ac-ft/yr from the Paluxy River for storage in
8 WBR and to use 2000 ac-ft/yr of water from the WBR (Albright 2010b). The reservoir is
9 expected to supply water for municipal, industrial, and irrigation users [ER Section 4.2.1.3
10 (Luminant 2009a)]. Luminant is being allocated 350 gpm (about 565 ac-ft/yr) from WBR
11 (Albright 2010b). Other expected allocations of WBR water under the Texas Water Plan include
12 340 ac-ft/yr to the City of Glen Rose and 200 ac-ft/yr to other Somervell County users (TWDB
13 2009b). Unallocated portions of the 2,000 ac-ft/yr authorized diversion could be available for
14 use following future completion of additional pipelines, treatment facilities, and related projects
15 (Freese and Nichols, Inc. 2008).

16 Recreation is a major non-consumptive use of surface water in the area. Water-related
17 recreational activities on Lake Granbury include boating, camping, fishing, and swimming.
18 Navigation on Lake Granbury and the Brazos River in the vicinity of Lake Granbury is limited to
19 use of small watercraft, primarily for recreational uses such as waterskiing, cruising, and fishing.
20 In 2005 Lake Granbury had 6000 private boat slips and boat ramp access at 12 launch ramps
21 (Luminant 2009a). In June of 2010, Luminant opened the SCR for limited public use to include
22 boating and fishing. Flow in the Paluxy River typically is insufficient for recreational use, but the
23 river can support whitewater boating during high-flow periods after a rainfall event
24 (TPWD 1974).

25 **2.3.2.2 Groundwater Use**

26 Groundwater use in Texas is managed locally by groundwater conservation districts that have
27 their own rules, permitting programs, and permit records. Somervell County is not part of a
28 groundwater conservation district, but Hood County is within the jurisdiction of the Upper Trinity
29 Groundwater Conservation District. Although groundwater from the Trinity aquifer is regionally
30 important as a source of drinking water for numerous communities, homes, and farms in central
31 Texas, and irrigation water for many farms, especially in Comanche and Erath Counties, it is a
32 relatively minor source of water supply in the CPNPP site area.

33 The primary groundwater source for Hood and Somervell Counties is the Twin Mountains
34 Formation in the Trinity aquifer. Groundwater from the Twin Mountains Formation currently is
35 the source of municipal water supply for the City of Glen Rose, located 5.2 mi south of the
36 CPNPP site. Additional future municipal water supply for the City of Glen Rose is planned to be
37 obtained from surface water in the WBR. TWDB identifies a total of 394 wells in Somervell and
38 Hood Counties, with total pumpage from the Trinity aquifer in 2003 of 1726 ac-ft in Somervell
39 County and 5729 ac-ft in Hood County. Municipal uses accounted for 82 percent of the
40 groundwater withdrawals in the two counties.

41 There are eleven existing water wells on the CPNPP site, including seven potable water wells
42 and four observation wells. Five of the potable water wells are actively used to support CPNPP
43 Units 1 and 2 operations, with groundwater withdrawals that totaled 28 ac-ft in 2006 (equivalent
44 to an average withdrawal rate of about 17 gpm). Conservation implemented at CPNPP through
45 voluntary environmental commitments with the Texas Council on Environmental Quality (TCEQ)
46 Clean Texas Program and the U.S. Environmental Protection Agency (EPA) Performance Track
47 Program has reduced site groundwater use from approximately 50 gpm in the mid-1990s to

1 approximately 16 gpm in 2007. Further reductions in groundwater use are expected within the
2 next few years, as Luminant plans to supply all CPNPP site potable water needs with water
3 from WBR.

4 **2.3.3 Water Quality**

5 The following sections describe the water quality of surface-water and groundwater resources in
6 the vicinity of the proposed CPNPP Units 3 and 4 sites. Monitoring programs for thermal and
7 chemical water quality are also described.

8 **2.3.3.1 Surface-Water Quality**

9 Surface-water quality throughout the Brazos River basin is strongly influenced by conditions in
10 the upper Brazos River basin where saline water enters the river from natural salt deposits. As
11 a result, surface waters in the basin are often characterized by high concentrations of chloride
12 and other dissolved solids. High water temperatures and high concentrations of nutrients also
13 are common. Some of the water quality criteria established by TCEQ for specific stream
14 reaches and reservoirs within the Brazos River reflect the natural conditions of the stream
15 segments, rather than statewide criteria based on general water quality objectives.

16 Total dissolved solids (TDS) levels in Lake Granbury have varied from 500 to nearly 3000 mg/L
17 (Ward 2008). The highest TDS concentrations occurred during a long period of low flow in
18 2005–2006, but dissolved solids concentrations are generally not correlated with flow rate
19 (Ward 2008). Chemical analyses of surface water samples collected in Lake Granbury from
20 2001 to 2008 are reported in the ER. Table 2-2 summarizes some of the analyses from a
21 sampling station in the reservoir near DeCordova Dam (Luminant 2009a). The high nutrient
22 levels (nitrogen and phosphorus) and temperatures in turn may support excessive growths of
23 algae. Designated uses of Lake Granbury (Brazos River Segment 1205) are for public water
24 supplies, fish consumption, general use, the support of aquatic life, and contact recreation.
25 TCEQ water quality standards for Lake Granbury include a maximum chloride concentration of
26 1000 mg/L and a maximum TDS concentration of 2500 mg/L. Several areas within Lake
27 Granbury do not meet these Texas water quality standards because of high chloride levels
28 (TCEQ 2008). Chloride concentrations exceeding the water quality standard of 1000 mg/L were
29 found in all three sampled areas of Lake Granbury (see Table 2-2), and the reach of the Brazos
30 River between Possum Kingdom Lake and the headwaters of Lake Granbury (Brazos River
31 Segment 1206) is also impaired because of chloride concentrations (TCEQ 2008). The high
32 chloride levels require increased treatment of public water supplies, including operation of the
33 Lake Granbury Surface Water and Treatment System (SWATS), a desalinization-type water
34 treatment plant (BRA 2008a). Lake Granbury was identified by the TCEQ as a candidate on the
35 2008 303(d) list of impaired waters because of chloride concentrations (MNES and Enercon
36 2009).

37 Rapid population growth in Hood County has resulted in developments around Lake Granbury
38 that do not have centralized sewage collection systems (BRA 2008b). Instead, many of the
39 developments (unincorporated subdivisions) rely on septic systems. Approximately 9,000 septic
40 tanks are located around Lake Granbury, particularly around man-made coves. Sewage from
41 the drainage fields of the septic systems contributes to elevated concentrations of *E. coli*
42 bacteria and nutrients and localized impairment of State water quality standards for contact
43 recreation. A Lake Granbury Watershed Protection Plan is being developed to address the
44 concerns about high levels of bacteria found in certain coves. The elevated *E. coli*
45 concentrations appear to be limited to coves and canals that have little mixing or interaction with
46 the main body of the reservoir.

1 Seven sewerage systems discharge to Lake Granbury with a combined mean daily flow limit of
2 2.962 MGD (Table 2-3). Other discharges include the DeCordova Steam Electric Station (SES)
3 with a permitted daily discharge (once-through cooling) of 1041.48 gpd and the Lake Granbury
4 SWATS facility with an average daily discharge of 2.5 MGD. There are presently no swimming
5 advisories, fish consumption advisories, or fish consumption bans in Lake Granbury or CCNPP
6 area.

7 The Brazos River immediately below Lake Granbury (Brazos River Segment 1204) is
8 designated for aquatic life use, contact recreation use, general use, and fish consumption. This
9 52-mile-long river reach fully supports all designated uses, and the TCEQ has not identified any
10 water quality concerns (TCEQ 2008). Table 2-4 displays the ranges of water quality
11 constituents measured in water samples collected in Lake Granbury (near the dam) and four
12 river sites downstream from Lake Granbury. Owing to dilution of dissolved salts by tributary
13 inflows, the salinity of the Brazos River below Lake Granbury is lower than within the lake, and
14 the water quality standard for chloride is set at a lower value of 750 mg/L (MNES and Enercon
15 2009). Other related parameters, such as conductivity, salinity, and total dissolved solids, are
16 also lower in the Brazos River below Lake Granbury, reflecting dilution from tributary inflows
17 such as the Paluxy River. The majority of water use in Segment 1204 is for irrigation and
18 mining, and is not used for public water supply.

19 Table 2-3 shows the Texas Pollutant Discharge Elimination System (TPDES)-permitted
20 discharges to the Brazos River below Lake Granbury. Six sewerage systems discharge to the
21 Brazos River below Lake Granbury (Segment 1204) either directly or by way of a reservoir or
22 stream; these discharges have a combined daily flow limit of 1.302 million gpd (MNES and
23 Enercon 2009). Other discharges to Segment 1204 include groundwater discharges from a
24 mining operation on George's Creek and effluents from the Wolf Hollow Power Plant and
25 CPNPP Units 1 and 2 by way of Squaw Creek.

Table 2-2. Chemical analysis of surface water samples collected in Lake Granbury near DeCordova Dam, January 2001 through September 2006
11860 - Lake Granbury DeCordova Dam (01/01-09/06)

Analysis	Units	N	Minimu m	Maximum	Mean	Median	Texas Surface Water Quality Criteria	N Exceedin g	% Exceedin g
Water temperature	°C	372	9.2	29.96	19.2	19.9	34	0	0%
Specific conductance	µS/cm ²	372	1047	4712	2678	2572	N/A		
Dissolved oxygen	mg/L	245	1.4	11.4	8.02	8.2	5.0	15	6%
pH		372	6.9	8.59	7.93	8.06	6.5 – 9.0	0	0%
Salinity	ppt	372	0.81	2.58	1.45	1.4	N/A		
Total suspended solids	mg/L	53	2	120	11.21	6	N/A		
Nitrite nitrogen	mg/L N as NO ₂	47	0.01	0.03	0.01	0.01	N/A		
Nitrate nitrogen	mg/L N as NO ₃	43	0.01	0.11	0.02	0.01	0.37		
Nitrite + nitrate nitrogen	mg/L N	47	0.01	0.12	0.03	0.02	0.32	0	0%
Total Kjeldahl nitrogen	mg/L	13	0.1	4.23	1.38	1.38	N/A		
Total phosphorus	mg/L	13	0.03	0.2	0.07	0.03	0.18	2	15%
Orthophosphate phosphorus	mg/L P as OPO ₄	21	0.02	0.05	0.02	0.02	0.05	0	0%
Chlorophyll a	µg/L	25	7.6	78.6	22.8	17.9	21.4	10	40%
Fecal coliform	cfu/100 mL	18	1	16	3	2	200	0	0%
<i>Escherichia coli</i>	mpn/100 mL	17	1	24	2	2	126	0	0%
Chloride	mg/L	52	409	1783	925	867	1000		
Sulfate	mg/L	52	146	595	295	279	600		
Total dissolved solids	mg/L	27	836	2734	1590	1494	2500		

Source: Luminant 2009a.

Table 2-3. TPDES-permitted discharges to Lake Granbury and the Brazos River below Lake Granbury

Facility name	Discharge type	Distance (mi) upstream or downstream from proposed CPNPP Units 3 and 4 discharge	Average daily flow limit (mgd)	Water quality parameters monitored ^(a)
Monarch (Oak Trail Shores)	Sewerage system	22.45 upstream	0.16	pH, Q, Al, TDs
City of Granbury	Sewerage system	11.75 upstream	2.00	pH, Q, TSS, AN, FC, CBOD
Acton MUD 1 (DeCordova Bend Estates)	Sewerage system	6.25 upstream	0.60	pH, Q, TSS, AN, CBOD
TXU (DeCordova Steam Electric Station)	Utility wastewater	7.30 upstream	1041.48	pH, Q, Temp, TRC
Texas H ₂ O (Canyon Creek)	Sewerage system	7.65 upstream	0.042	pH, Q, BOD, TSS
Lake Granbury SWATS	Water treatment waste	4.50 upstream	2.5	pH, Q, chlorides, sulfates
Hood County (Aqua Utilities, Inc.)	Sewerage system	1.70 upstream	0.088	pH, Q, BOD, TSS
Ridge Utilities	Sewerage system	1.45 upstream	0.06	pH, Q, BOD, TSS
Fall Creek	Sewerage system	Unknown upstream	0.012	pH, Q, BOD, TSS, DO
Aquasource—Treaty Oaks	Sewerage system	Unknown downstream	0.055	pH, Q, CBOD, AN TSS
Acton MUD 2 (Pecan Plantation)	Sewerage system	13.00 downstream	0.487	pH, Q, BOD, TSS
Wolf Hollow	Utility wastewater	16.00 downstream	1.10	pH, Q, Temp, TRC, CBOD, TDS, sulfates, chlorides
Unimin Corporation (George's Creek)	Groundwater	Unknown downstream	1.50	pH, Q, TSS
Tolar via Squaw Creek	Sewerage system	35.00 downstream	0.10	pH, Q, BOD, TSS
CPNPP 1&2 via Squaw Creek	Power generation	35.00 downstream	3168	pH, Q, Temp, FAC, TRC, TSS, O, FC, TDS, Fe, Cu
Bill Briley Inactive	Sewerage system	Unknown downstream	Unknown	Unknown
Glen Rose (via Paluxy River)	Sewerage system	35.00 downstream	0.60	pH, Q, DO, TSS, CBOD, TRC, AN
Tarrant Baptist	Sewerage system	41.00 downstream	0.06	pH, Q, DO, TSS, BOD, TRC

Source: MNES and Enercon 2009.

(a) Q = flow; DO = dissolved oxygen; FAC = free available chlorine; TRC = total residual chlorine; TSS = total suspended solids; O = oil and grease; BOD = biochemical oxygen demand; CBOD = carbonaceous biochemical oxygen demand; FC = fecal coliform; AN = ammonia nitrogen; Fe = Iron; Cu = copper; Al = aluminum; Temp = temperature.

1

Table 2-4. Range of concentrations of chemical constituents in water samples collected in Lake Granbury and other monitoring stations in the Brazos and Paluxy Rivers. Data from BRA for the period between January 1, 1997 and September 29, 2009. Applicable Texas surface water quality criteria are shown in parentheses below the range values.

Chemical constituent	Monitoring station 11860—Lake Granbury near Dam (Segment 1205)	Monitoring station 11856—Brazos River at US 67 (Segment 1204)	Monitoring station 11976—Paluxy River in City Park (Segment 1257)	Monitoring station 12044—Brazos River at FM 2114 (below Lake Whitney) (Segment 1257)	Monitoring station 12030—Brazos River at SH 105 (below Lake Whitney) (Segment 1242)
Chloride (mg/L)	646–1783 (1000)	109–1030 (750)	6–39 (450)	29–1121 (450)	10–821 (350)
Chlorophyll a (µg/L)	4–79	4.9–8.9	–	–	–
Conductivity (µS/cm)	661–4712	600–3912	290–603	775–3492	104–2199
Dissolved oxygen (% saturation)	1–>100	59–>100	33–>100	22–>100	29–>100
Dissolved oxygen (mg/L)	<0.5–11.7 (5.0)	4.–11.6 (5.0)	2.6–15.1 (5.0)	1.9–13.5 (5.0)	3.0–16.9 (5.0)
<i>E. coli</i> (mpn/100 ml)	<1–326 (126)	3–8 (126)	1–816 (126)	3–2400 (126)	<1–1986 (126)
Nitrate (mg/L)	<0.02	<0.05–0.52	<0.02–0.66	<0.02–1.52	<0.02–2.53
pH	6.9–8.7 (6.5–9.0)	7.7–8.6 (6.5–9.0)	7.7–9.3 (6.5–9.0)	7.3–8.6 (6.5–9.0)	7.3–8.6 (6.9–9.0)
Phosphate, ortho (mg/L)	<0.04–0.05	<0.05–0.74	<0.04–0.05	<0.04–0.1	<0.04–0.36
Salinity (ppt)	0.34–2.58	0.3–2.1	0.14–0.3	0.3–1.9	0.1–1.35
Sulfate (mg/L)	253–595 (600)	54–369 (380)	9–71 (250)	59–372 (250)	14–291 (200)
Total dissolved solids (mg/L)	416–2734 (2500)	1576–2222 (1600)	32–405 (1450)	442–882 (1450)	– (1000)
Turbidity (NTU)	1.1–103.5	3.0–3.6	1.4–2.0	1.2–332	7.7–323
Temperature (°C)	7.8–29.7 (34)	5.9–29.2 (33)	4.1–35.5 (35)	5.4–30.8 (35)	6.7–32.5 (35)

2 2.3.3.2 Groundwater Quality

3 Potable groundwater in the CPNPP site area occurs in the Paluxy, Glen Rose, and Twin
4 Mountains Formations of the Trinity Group aquifer. In the vicinity of the CPNPP site, the Paluxy
5 Formation is present only on ridge tops in the immediate site area and is not a source of
6 groundwater, but there are several domestic water wells completed within the formation south of
7 the Paluxy River. It typically delivers hard calcium bicarbonate type water. The quality of water
8 obtained from the Glen Rose Formation is variable; in some localized areas it is not potable.

1 Water in the Twin Mountains Formation is a sodium bicarbonate type with total dissolved solids
2 content typically between 200 and 900 mg/L.

3 Onsite groundwater quality was investigated in a baseline monitoring program conducted in
4 2007. Water samples were collected quarterly during 2007 from 10 monitoring wells in 8 of the
5 20 monitoring well clusters that were installed in October and November 2006. (Other wells
6 were dry or did not yield quantities of water consistently enough to permit sampling.) Most of
7 the sampling points are in fill or regolith. The water samples were analyzed for a standard list of
8 water quality parameters. The analytical results show a large variation in water quality, both
9 between wells and between sampling dates (Luminant 2009a).

10 **2.3.4 Water Monitoring**

11 **2.3.4.1 Surface-Water Monitoring**

12 The USGS monitors water quantity at stream-gauging stations in several locations in the vicinity
13 of the CPNPP site (USGS 2007). The nearest upstream stream gauge on the Brazos River is
14 the USGS Gauge 08090800 near Dennis, Texas, and the nearest gauging station downstream
15 of DeCordova Dam is USGS Gauge 08091000 near Glen Rose, Texas and upstream of the
16 confluence of the Paluxy River. Record keeping at these stations began in 1968 and 1924
17 respectively. USGS Gauge 08090900 is located at the DeCordova Dam on Lake Granbury, and
18 record keeping at this site began in 1972. USGS Gauge 08091750 is located on Squaw Creek
19 downstream the SCR near Glen Rose, Texas. Record keeping has been conducted at this site
20 since 1973. USGS Gauge 08091730 is located on the SCR near the CPNPP site.

21 Measurements of reservoir storage and elevation of reservoir water surface have been
22 conducted since 1994. The TWDB uses data from these gauges as part of the water resource
23 planning for the State of Texas (TWDB 2007a).

24 The TCEQ is responsible for the administration of TPDES monitoring requirements in the State
25 of Texas (Luminant 2009a). Table 2-3 lists TPDES permitted facilities that discharge to Lake
26 Granbury and the Brazos River below Lake Granbury and the water quality parameters that they
27 monitor in their effluents. CPNPP Units 1 and 2 discharge to the Brazos River below Lake
28 Granbury via Squaw Creek and are required by their TPDES permit to monitor water quality
29 parameters at six effluent streams.

30 As part of the Radiological Environmental Monitoring Program (REMP) for surface water and
31 surface drinking water in the vicinity of CPNPP Units 1 and 2, Luminant performs analysis for:
32 gamma emitters, tritium, gross beta radioactivity, and iodine-131 at six locations on Lake
33 Granbury, the SCR, and the Brazos River (Luminant 2009a). Of these radiological parameters
34 only tritium in the SCR is present in quantities that exceed the lower limits of detection that can
35 be attributed to CPNPP Units 1 and 2. The results of the analyses are reported annually to the
36 NRC.

37 **2.3.4.2 Groundwater Monitoring**

38 Seventeen piezometers are installed near CPNPP Units 1 and 2 to investigate groundwater
39 conditions in the upper Glen Rose Formation. Water levels were monitored for a period of
40 1 year. Water levels observed in these wells are variable and representative of perched
41 conditions. In 2005, radiological water quality monitoring was initiated in several of these
42 piezometers to monitor potential radionuclide releases in the immediate vicinity of CPNPP
43 Units 1 and 2. Groundwater samples were collected for analysis to determine possible
44 presence of gamma-emitting radionuclides and tritium. No other water quality parameters were

1 measured. All radiological parameters were found to be below detection limits or below
2 minimum detected activity levels (Luminant 2009a).

3 Twenty 100-ft-deep well clusters were installed in the fall of 2006 for baseline groundwater
4 monitoring for CPNPP Units 3 and 4. Eleven of the well clusters include wells to measure water
5 conditions at multiple depths within the fill, the regolith, the shallow Glen Rose Formation, and
6 the deeper Glen Rose Formation; five include two wells at different depths; and four have just
7 one well. Water-level monitoring has been conducted from late 2006 through mid-2008. Water
8 levels in these wells also indicate perched conditions; water levels in some of the wells have not
9 reached equilibrium levels and are still increasing.

10 **2.4 Ecology**

11 This section describes the terrestrial, aquatic and wetland ecology of the site and vicinity that
12 might be affected by the design, siting, building, operation, and maintenance of two additional
13 units at the CPNPP site. Most of the site is located within Somervell County. The northern
14 portion of SCR extends the site into neighboring Hood County, and all of Lake Granbury is in
15 Hood County. These counties are in north central Texas, within the Western Cross Timbers
16 subdivision of the Grand Prairie physiographic province (Texas Bureau of Economic Geology
17 1996). This area is also classified as part of the Cross Timbers ecoregion (Griffith et al. 2004).

18 Sections 2.4.1 provides a general description of the terrestrial environment, and Section 2.4.2
19 provides a general description of aquatic and wetland environments on and in the vicinity of the
20 CPNPP site and corridors for proposed water pipeline and transmission line rights-of-way
21 (Luminant 2009a). Two double-circuit expansions would require the construction of new towers
22 on a 160-ft-wide transmission right-of-way (ROW). The first would be a 45-mi line to Whitney,
23 and the second, a 17-mi line to DeCordova. Three additional circuits, named Parker, Johnson,
24 and Everman, would be added on a presently maintained right-of-way and therefore do not
25 require additional rights-of-way (see Figure 2-13).

26 Additional cooling water intake and discharge pipelines would be constructed for CPNPP
27 Units 3 and 4 extending from the proposed units plant to Lake Granbury. The new pipelines
28 would generally follow an existing 48-in water pipeline for Units 1 and 2 that connects Lake
29 Granbury to SCR (Figure 2-5), and would be placed within the existing 50-ft right-of-way. New
30 rights-of-way for the discharge pipeline between the intake and discharge structures would be
31 required (see Figure 2.5).

32 Detailed descriptions are provided where needed to support the analysis of potential
33 environmental impacts from building, operation, and maintenance of new nuclear power
34 generating facilities and the new transmission line and pipeline rights-of-way. These
35 descriptions also support the evaluation of mitigation activities and monitoring programs
36 identified during the assessment to avoid, reduce, minimize, rectify, or compensate for potential
37 impacts.

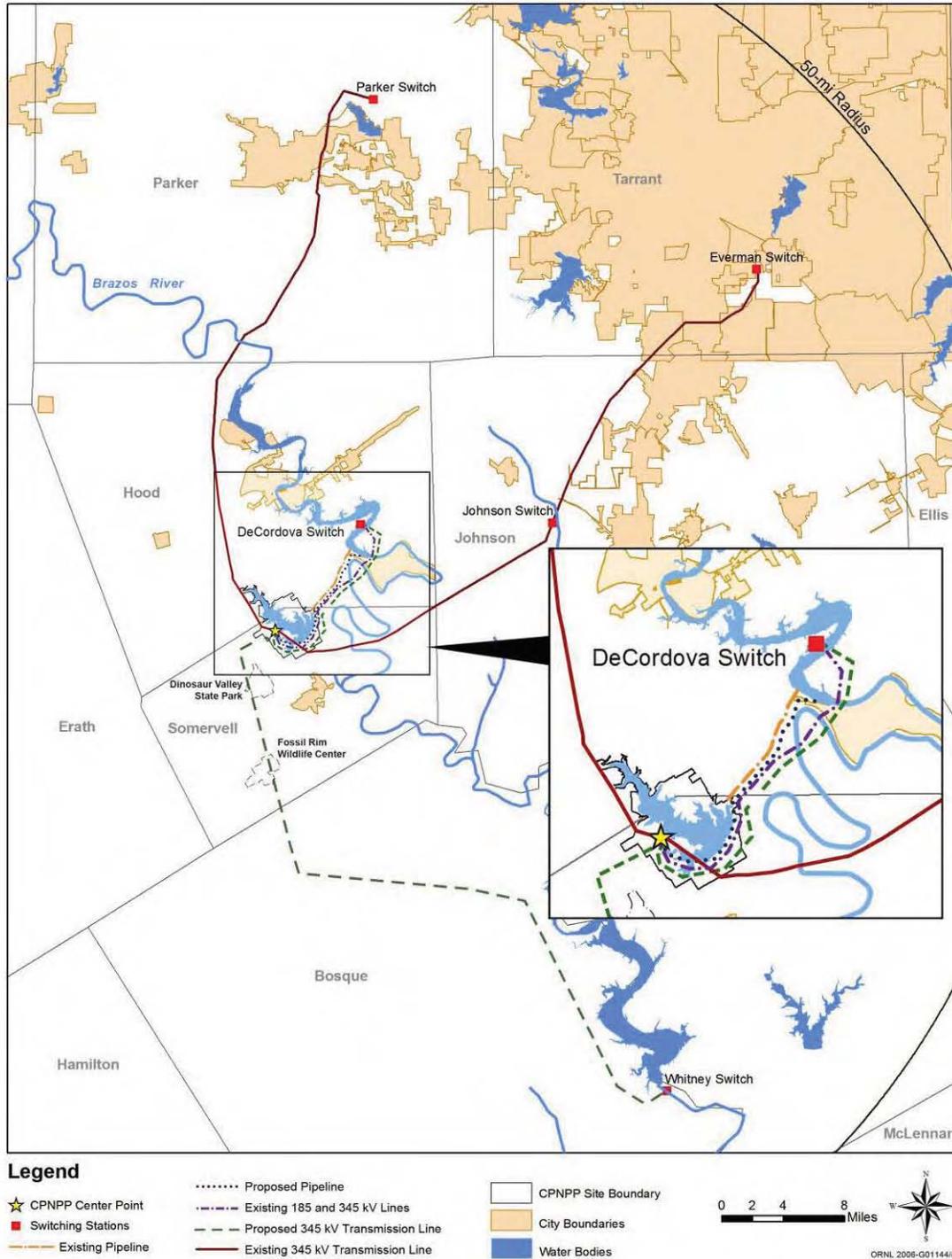


Figure 2-13. Existing and proposed transmission line rights-of-way and pipeline routes. Note: All routes are approximate, and the proposed routes have yet to be determined. The existing 185 and 345-kV transmission lines would not be modified. (Adapted from Luminant 2009a)

1
2

1 2.4.1 Terrestrial Ecology

2 This section identifies terrestrial ecological resources and describes species composition and
3 other structural and functional attributes of biotic assemblages that could be affected by the
4 construction, operation, and maintenance of the proposed CPNPP Units 3 and 4 and associated
5 water intake and discharge pipelines and transmission lines. It also identifies important
6 terrestrial resources, such as wildlife sanctuaries and natural areas that might be affected by the
7 proposed action.

8 2.4.1.1 Terrestrial Resources-Site and Vicinity

9 **Vegetation**

10 The CPNPP site is approximately 7950 ac in size within the Western Cross Timbers subdivision
11 of the Grand Prairie physiographic province (Texas Bureau of Economic Geology 1996). The
12 province is transitional between the vast prairies to the west and the forested hills or low
13 mountains to the east. It is characterized by a mosaic of forest, woodland, savanna, and prairie
14 with dominant vegetation that includes little bluestem (*Schizachyrium scoparium*) with scattered
15 stands of blackjack oak (*Quercus marilandica*) and post oak (*Q. stellata*) (Griffith et al. 2004).
16 Historical records indicate that much of the region existed as a grassland or open live oak
17 savanna that supported herds of bison (*Bison bison*) and other herbivores dependent on the tall
18 grasses that dominated the region (TPWD 2007a). The introduction of domestic livestock,
19 farming operations, and wildfire control changed the landscape of much of the region. These
20 practices created a landscape that experienced invasion and domination in some areas by
21 problematic brush species such as mesquite (*Prosopis* spp.), Ashe juniper (*Juniperus ashei*),
22 and other native woody species. Overgrazing by livestock and elimination of naturally occurring
23 fire also reduced native grass cover and allowed the invasion of other, less-desirable annual
24 grasses and forbs.

25 Vegetation communities, also referred to as vegetation cover types, found at CPNPP are
26 common elements of the Cross Timbers physiographic province. Two general vegetation cover
27 types that currently dominate the region are (1) silver bluestem (*Bothriochloa saccharoides*)-
28 Texas wintergrass (*Nassella* (= *Stipa*) *leucotricha*) grassland and (2) oak-mesquite-juniper
29 savanna and woodlands. Species characterizing the silver bluestem-Texas wintergrass cover
30 type are listed in Table 2-5; those characterizing the oak-mesquite-juniper savanna and
31 woodlands cover type are listed in Table 2-6.

32 Silver bluestem-Texas wintergrass grasslands are a medium-tall, rather dense grassland that
33 has as dominants the two species for which the cover type is named. A variety of other prairie
34 grasses occurs as well, along with forbs such as Texas bluebonnet (*Lupinus texensis*).

1

Table 2-5. Species characterizing the silver bluestem – Texas wintergrass grassland cover type

Common Name	Genus and species	Growth Form
Silver bluestem	<i>Bothriochloa saccharoides</i>	Perennial grass
Texas wintergrass	<i>Nassella (=Stipa) leucotricha</i>	Perennial grass
Little bluestem	<i>Schizachyrium scoparium</i>	Perennial grass
Sideoats grama	<i>Bouteloua curtipendula</i>	Perennial grass
Texas grama	<i>Bouteloua rigidiseta</i>	Perennial grass
Hairy grama	<i>Bouteloua hirsuta</i>	Perennial grass
Tall dropseed	<i>Sporobolus compositus</i> var. <i>compositus</i>	Perennial grass
Buffalograss	<i>Buchloe dactyloides</i>	Perennial grass
Windmillgrass	<i>Chloris verticillata</i>	Perennial grass
Hairy tridens	<i>Erioneuron pilosum</i>	Perennial grass
Tumblegrass	<i>Schedonnardus paniculatus</i>	Perennial grass
Western ragweed	<i>Ambrosia psilostachya</i>	Perennial herb
Broom snakeweed	<i>Gutierrezia sarothrae</i>	Perennial herb
Texas bluebonnet	<i>Lupinus texensis</i>	Annual herb
Live oak	<i>Quercus virginiana</i>	Tree
Post oak	<i>Quercus stellata</i>	Tree
Mesquite	<i>Prosopis</i> spp.	Tree

Source: Luminant 2009a.

Table 2-6. Species characterizing the oak-mesquite-juniper savanna and woodlands cover type

Common name	Genus and species	Growth Form
Post oak	<i>Quercus stellata</i>	Tree
Ashe juniper	<i>Juniperus ashei</i>	Tree
Shin oak	<i>Quercus harvardii</i>	Tree
Texas oak	<i>Quercus buckleyi</i>	Tree
Blackjack oak	<i>Quercus marilandica</i>	Tree
Live oak	<i>Quercus virginiana</i>	Tree
Cedar elm	<i>Ulmus crassifolia</i>	Tree
Agarito	<i>Berberis trifoliata</i>	Shrub
Soapberry	<i>Sapindus saponaria</i> var. <i>drummondii</i>	Tree
Sumac	<i>Rhus</i> spp.	Shrub, tree
Hackberry	<i>Celtis</i> spp.	Tree
Texas pricklypear	<i>Opuntia engelmannii</i> var. <i>lindheimeri</i>	Cactus, erect or spreading
Mexican persimmon	<i>Diospyros texana</i>	Shrub or small tree
Purple three-awn	<i>Aristida purpurea</i>	Perennial grass
Hairy grama	<i>Bouteloua hirsuta</i>	Perennial grass
Texas grama	<i>Bouteloua rigidiseta</i>	Perennial grass
Sideoats grama	<i>Bouteloua curtipendula</i>	Perennial grass
Mesquite	<i>Prosopis</i> spp.	Tree
Texas wintergrass	<i>Nassella (=Stipa) leucotricha</i>	Perennial grass

Source: Luminant 2009a.

2 Oak-mesquite-juniper savanna and woodlands occur on uplands and prairies as a mixture of
 3 individual stands of woody species with interspersed grasses and forbs (Diggs, Lipscomb, and
 4 O’Kennon 2000; Stubbendieck, Hatch, and Butterfield 1994; McMahan, Frye, and Brown 1984).
 5 Due to protection from fire since the 1970s, some areas have developed into thick woodlands,
 6 and juniper-dominated stands have increased (Luminant 2009a). Although Ashe juniper is an

1 important native species for wildlife food and cover, it is also invasive and can form dense
2 thickets.

3 Species composition of the CPNPP site has remained generally unchanged since construction
4 of existing Units 1 and 2 (Luminant 2009a). An ecological vegetation cover type map was
5 created and updated in 2006 through 2009 based on interpretation of aerial photographs
6 showing the current spatial distribution of vegetation types and aquatic habitats at the CPNPP
7 site (Figure 2-14). The two general regional vegetation cover types (oak-mesquite-juniper
8 savanna and woodlands and silver bluestem-Texas wintergrass) were further classified into
9 more site-specific descriptions using 1999 infrared aerial photography and ground-truthing in
10 2006 and 2007 (Luminant 2009a). Table 2-7 summarizes the total acres occupied by each
11 cover type. Figure 2-14 also shows that terrestrial cover of the site consists mostly of juniper
12 woodland and open fields.

13 **Ashe Juniper Woodland - Savanna.** Stands of Ashe juniper woodland - savanna are
14 evergreen, dominated by mature Ashe juniper trees or a combination of mature and immature
15 Ashe juniper trees and saplings. Mature Ashe juniper trees are over 15 ft high with 5 in. or more
16 diameter at breast height (DBH), approximately 4.5 ft above the ground. Hardwood species
17 occupy 10 percent or less of the tree canopy. This cover type is the most common terrestrial
18 habitat type at CPNPP and occupies a total of about 3071 ac or approximately 39 percent of the
19 site (Table 2-7). Protection of the CPNPP site from wildfire has created the current unnatural
20 condition where Ashe juniper woodland has replaced oak-juniper savanna and, in some cases,
21 prairie grassland over time. This has resulted in lowering the overall wildlife habitat value of the
22 site by decreasing both vertical structure within individual stands and species diversity across
23 the site as a whole (Luminant 2009a). Ashe juniper woodland-savanna covers most of the
24 peninsula where new cooling towers for Units 3 and 4 would be located. This area, just to the
25 northwest of, and adjacent to, the peninsula on which existing Units 1 and 2 are located
26 (Figures 2-5 and 2-14), is an area of major proposed project development activities.

27 **Mixed Hardwood Forest.** Mixed hardwood forests are dominated by a combination of
28 hardwood tree species including live oak (*Quercus virginiana*), cedar elms (*Ulmus crassifolia*),
29 mesquite, hackberry (*Celtis spp.*), Texas ash (*Fraxinus texensis*), chittamwood
30 (*Sideroxylon lanuginosa*), and occasional persimmon (*Diospyros texana*) trees. Ashe junipers
31 comprise 30 percent or less of the tree canopy in mixed hardwood stands. The shrub layer
32 includes buckbrush (*Ceanothus cuneatus*), agarito (*Berberis trifoliata*), lemon sumac
33 (*Rhus aromatica*), and Mexican buckeye (*Ungradia speciosa*). These are the most biologically
34 diverse natural terrestrial communities on the CPNPP site. They are often found on south-
35 facing slopes and along drainages within the site.

36 Mixed hardwood forest occupies a total of about 528 ac at CPNPP or approximately 7 percent
37 of the site (Table 2-7). Quantitative vegetation data were collected along 100-m (109-yd) line-
38 intercept transects on the peninsula where new cooling towers would be located. These data
39 show that mixed hardwood forest covers approximately 16 percent of the transect lines
40 surveyed (Luminant 2009a).

41 **Grassland.** Grasslands on the site are dominated by either a variety of native grasses, such as
42 big (*Andropogon gerardii*), little, and silver bluestem; gramas (*Bouteloua spp.*); Texas
43 wintergrass; and some forbs, or by monocultures of introduced turf grasses such as Bermuda
44 grass (*Cynodon dactylon*) or fescues (*Festuca spp.*).

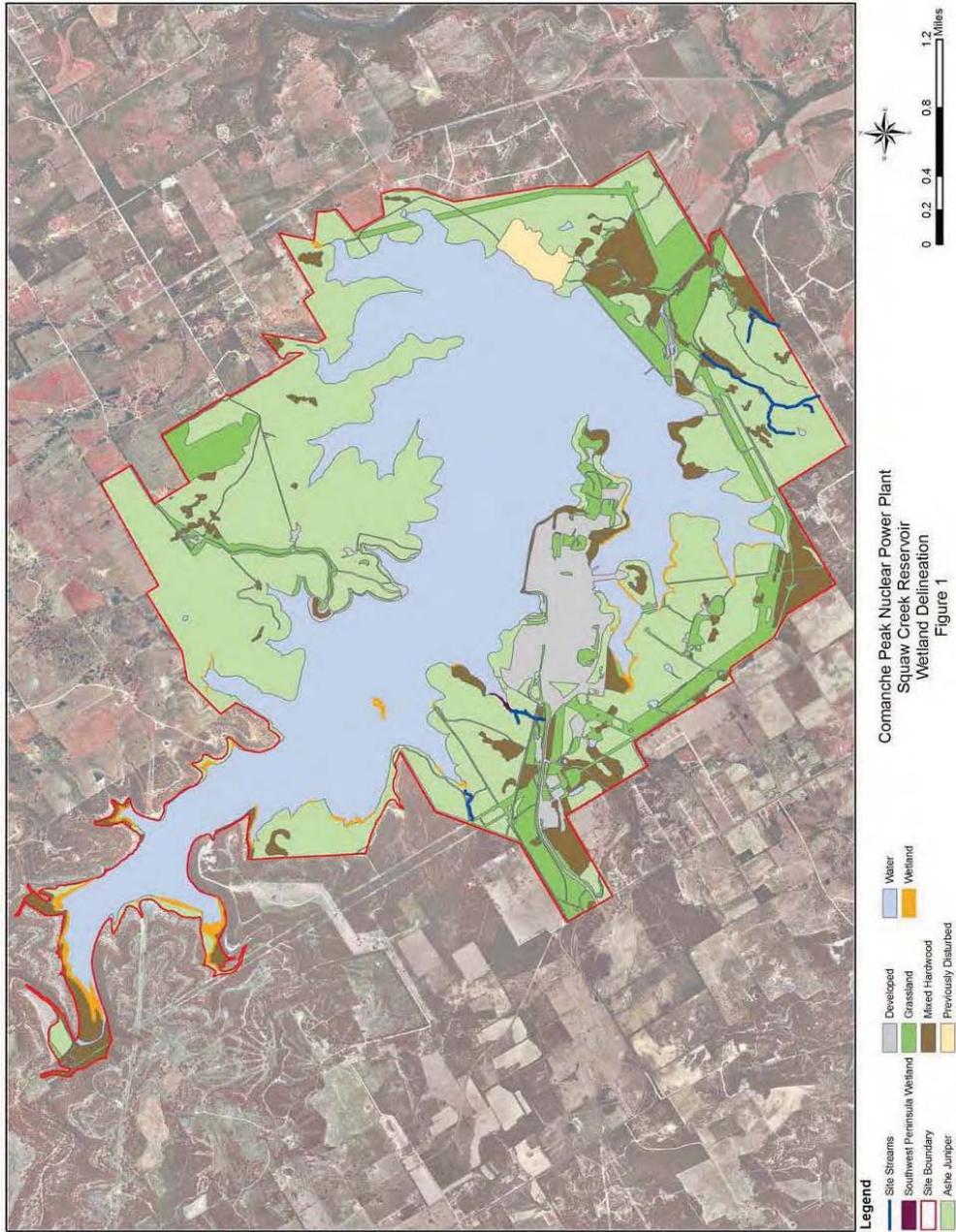


Figure 2-14. Ecological cover type vegetation map (Luminant 2009a; Enercon 2009).

1

Table 2-7. Distribution of cover types and acreage totals at CPNPP

Vegetation Type	Total Acres	Percent Cover
Open Water	3125	39
Ashe Juniper Woodland - Savanna	3071	39
Grassland	698	9
Mixed Hardwood Forest (Including Bottomlands)	528	7
Developed	439	6
Previously Disturbed	60	<1
Wetland	53	<1
Total	7974 ^[a]	

[a] Total differs from that of 7950 ac reported elsewhere in Luminant ER; the difference is assumed to be due to a rounding error.

Source: Luminant 2009a.

2 Bermuda grass lawns are common at the site near the facility entrance and around buildings.
 3 Fescue is a genus of more than 300 species of tufted grasses commonly planted to supplement
 4 pastures. Native grasslands are found dotted across the site and are intermixed with the juniper
 5 forests. In addition to grasses, forb species found in this cover type include Indian paintbrush
 6 (*Castilleja indivisa*), ragweeds (*Ambrosia spp.*), milkweeds (*Asclepias spp.*), wild carrot
 7 (*Daucus carota*), fleabanes (*Erigeron spp.*), rose verbena (*Glandularia canadensis*), spiderwort
 8 (*Tradescantia sp.*), cut-leaf germander (*Teucrium laciniatum*), trailing ratany
 9 (*Krameria lanceolata*), liatris (*Liatris spp.*), skullcaps (*Scutellaria spp.*), black-eyed Susan
 10 (*Rudbeckia hirta*), wooly vervain (*Verbana stricta*), yuccas (*Yucca spp.*), and prickly pear cactus
 11 (*Opuntia macrorhiza*). This cover type occupies a total of about 698 ac at CPNPP or
 12 approximately 9 percent of the site (Table 2-7). Transect data collected on the peninsula where
 13 new cooling towers would be located show that grassy openings cover about 24 percent of the
 14 transect lines surveyed.

15 **Previously Disturbed.** These are areas within the site that are either mechanically or naturally
 16 disturbed and consist either of bare ground or are dominated by weedy plant species that are
 17 indicators of disturbance. This cover type occupies a total of about 60 ac at CPNPP or less
 18 than 1 percent of the site (Table 2-7).

19 **Developed Areas.** Developed areas within the site consist of office buildings, reactors, and
 20 related facilities, switchyards, and storage facilities as well as pavement or gravel for parking
 21 lots and roads. Also included within this cover type are the dam, spillway, structures related to
 22 the dam, and the Safe Shutdown Impoundment and its equalization channel. This cover type
 23 occupies a total of about 439 ac at CPNPP or approximately 6 percent of the site (Table 2-7).

24 **Open Water.** The open water at CPNPP consists mostly of SCR, the Safe Shutdown
 25 Impoundment, evaporation ponds for nonradioactive waste water, and an emergency spillway.
 26 Because of SCR, open water is the dominant cover type and occupies a total of about 3125 ac
 27 or approximately 39 percent of the site (Table 2-7). As an aquatic habitat, the ecology of SCR is
 28 discussed in more detail in Subsection 2.4.2.

29 **Wetlands.** Wetlands are areas transitional between land and open water. At CPNPP small
 30 areas of wetland occur primarily along the shoreline of coves on SCR. Wetlands are discussed
 31 in detail in Subsection 2.4.2.

1 **Wildlife**

2 The diversity of habitat types at the CPNPP site support a wide diversity of wildlife species.
 3 Luminant supplemented data collected in the 1970s, prior to the construction of Units 1 and 2,
 4 with new field surveys conducted from 2007 to 2009.

5 **Mammals.** In 1974 and 1975, 24 native and 2 non-native mammals were observed through
 6 surveys at the CPNPP site (TUGC 1974, TUGC 1975). In part due to larger body size and
 7 resulting ease in observation, opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), coyote
 8 (*Canis latrans*), bobcat (*Lynx rufus*), blacktail jackrabbit (*Lepus californicus*), white-tailed deer
 9 (*Odocoileus virginianus*), and nine-banded armadillo (*Dasypus novemcinctus*) were readily
 10 reported (TUGC 1974). Small mammals trapped on the site include deer mice
 11 (*Peromyscus* spp.) and cotton rats (*Sigmodon* spp.) (TUGC 1974).

12 Direct observation of numerous mammal species or species signs occurred during fieldwork in
 13 2007 and included white-tailed deer, bobcat, nine-banded armadillo, eastern cottontail
 14 (*Sylvilagus floridanus*), black-tailed jackrabbit, fox squirrel (*Sciurus nigra*), and domestic cat
 15 (*Felis domesticus*). Indirect signs indicated that additional mammals on the site included
 16 raccoon, opossum, striped skunk (*Mephitis mephitis*), beaver (*Castor canadensis*), and coyote.

17 **Birds.** As many as 421 species of birds can occur in Somervell and Hood Counties (Freeman
 18 2003). Many are either at the southern or northern extreme of their range within central Texas.
 19 Most of these birds prefer specific habitat types and are not found throughout the entire Cross
 20 Timbers Ecoregion (Freeman 2003). Some with specific breeding habitat requirements are
 21 present on or near the site only during the breeding season; others are temporary residents on
 22 the CPNPP site as they migrate through the area twice each year. From August to December
 23 1972, a total of 118 species were observed at CPNPP during directed field surveys (TUGC
 24 1974). General field surveys for birds were conducted at CPNPP during February, April, May
 25 and July of 2007 (Luminant 2009a). A comparison between the number of bird species
 26 observed during the general field surveys and the number that have the potential to occur at the
 27 site showed lower diversity than expected. A combination of factors, including habitat losses
 28 due to impoundment of SCR, lack of active Ashe juniper control, and the subsequent near
 29 monoculture of this invasive, native tree species may contribute to this relatively low diversity of
 30 bird species (Yiming and Wilcove 2005, Drake and Todd 2002).

31 SCR provides habitat for an array of shorebirds, wading birds, and waterfowl. Water-dependent
 32 species observed during general field surveys in 2007 are listed in Table 2-8 (Luminant 2009a).

33 Texas lies within the Central migratory flyway (Birdnature 2010), and SCR would be expected to
 34 support significant numbers of waterfowl during migration. Upland game birds, perching birds,
 35 birds of prey, and woodpeckers (Table 2-9) were also observed at CPNPP in 2007 (Luminant
 36 2009a).

37 **Reptiles.** During surveys of the CPNPP site prior to, and during, development of CPNPP Units
 38 1 and 2, five turtle, seven lizard, and nine snake species were observed on the site (TUGC
 39 1974, TUGC 1975). During general field surveys conducted in 2007, the only reptiles observed
 40 were the western diamond-backed rattlesnake (*Crotalus atrox*), diamondback water snake
 41 (*Nerodia rhombifera*), slider (*Trachemys scripta*), and the American alligator
 42 (*Alligator mississippiensis*), which occurs at CPNPP outside its normal range (Luminant 2009a).

43 **Amphibians.** Five species of amphibians, all toads and frogs, were found in surveys conducted
 44 in 1973. During those surveys, Woodhouse's toad (*Bufo woodhousii*) and the Gulf Coast toad
 45 (*Bufo valliceps*) were collected on the CPNPP site. Along Squaw Creek (in the reach now

Table 2-8. Water-dependent bird species observed at CPNPP in 2007

Common Name	Genus and Species
Great blue heron	<i>Ardea herodias</i>
Green heron	<i>Butorides virescens</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Great egret	<i>Ardea alba</i>
Snowy egret	<i>Egretta thula</i>
Cattle egret	<i>Bubulcus ibis</i>
Belted kingfisher	<i>Megaceryle (=Ceryle) alcyon</i>
Double crested cormorant	<i>Phalacrocorax auritus</i>
Neotropic cormorant	<i>Phalacrocorax brasilianus</i>
Spotted sandpiper	<i>Actitis macularius</i>
Killdeer	<i>Charadrius vociferus</i>
Blue-winged teal	<i>Anas discors</i>
Wood duck	<i>Aix sponsa</i>
Eared grebe	<i>Podiceps nigricollis</i>
American coot	<i>Fulica americana</i>

Source: Luminant 2009a.

1

Table 2-9. Upland game birds, birds of prey, and woodpeckers observed at CPNPP in 2007

Common Name	Genus and Species
<i>Upland Game Birds</i>	
bobwhite quail	<i>Colinus virginianus</i>
wild turkey	<i>Meleagris gallopavo</i>
<i>Perching Birds</i>	
American robin	<i>Turdus migratorius</i>
barn swallow	<i>Hirundo rustica</i>
Carolina wren	<i>Thryothorus ludovicianus</i>
purple martin	<i>Progne subis</i>
red-winged blackbird	<i>Agelaius phoeniceus</i>
savanna sparrow	<i>Passerculus sandwichensis</i>
<i>Birds of Prey</i>	
turkey vulture	<i>Cathartes aura</i>
Black vulture	<i>Coragyps atratus</i>
red-tailed hawk	<i>Buteo jamaicensis</i>
osprey	<i>Pandion haliaetus</i>
<i>Woodpeckers</i>	
red-bellied	<i>Melanerpes carolinus</i>
northern flicker	<i>Colaptes auratus</i>

Source: Luminant 2009a.

1 inundated by SCR), cricket frogs (*Acris* spp.), bullfrogs (*Rana catesbeiana*), and Rio Grande
2 leopard frogs (*Rana berlandieri*) were captured. During general field surveys conducted in 2007
3 all these species except the Gulf Coast toad were observed.

4 **Nuisance Species.** Nuisance species are those of concern because they are disease vectors
5 or pests. These include a large number of terrestrial wildlife species that can be pests in urban/
6 suburban or even rural settings such as raccoons, white-tailed deer, moles
7 (*Scalopus aquaticus*), voles (*Microtus* sp.), beavers, feral hogs (*Sus scrofa*), gophers
8 (*Geomys* spp.), snakes, American crow (*Corvus brachyrhynchos*), pigeons (*Columba livia*),
9 starlings (*Sturnus vulgaris*), nutria (*Myocastor coypus*), and others. Large- and medium-size
10 mammals such as deer and coyote that occur in the vicinity have limited opportunity to move
11 across

12 CPNPP boundaries due to a chain-link fence enclosing a portion of the site. Should beaver and
13 deer populations show substantial increases onsite, biological control of these species at
14 CPNPP may become necessary. Nuisance species also include mosquitoes, ticks, wasps, and
15 termites. Field reconnaissance failed to reveal any noticeable evidence of serious infestations
16 of nuisance species such as mosquitoes or ticks or potential vectors for such diseases as West
17 Nile virus and Lyme disease (Luminant 2009a).

18 **Travel Corridors**

19 Travel corridors provide numerous essential functions needed for the survival of wildlife species.
20 Corridors can be viewed at three scales: (1) local, (2) regional, and (3) migratory corridors.
21 Local corridors are travel lanes linking daily resource needs such as food, water, and bedding
22 sites. Local corridors exist within CPNPP for numerous species. High-perimeter fencing likely
23 diminishes travel offsite of larger mammalian species. Birds, reptiles, and amphibians, on the
24 other hand, are not impeded by fencing and can move about more freely within the landscape.
25 Localized fragmentation of the area surrounding CPNPP due to residential development is
26 expected to act as a barrier to more habitat-specialized species.

27 Regional travel corridors enable travel of animals between core areas and help to ensure
28 genetic diversity of wildlife species by allowing new individuals into the populations. No known
29 regional corridors exist for large mammals in the vicinity of CPNPP.

30 Migratory corridors are used as seasonal migration routes for large-ranging mammals and
31 migratory birds. Migratory stop-over by bird species, especially waterfowl, occurs on the
32 CPNPP site.

33 **Wildlife Sanctuaries, Refuges, and Preserves**

34 Table 2-10 lists ecologically oriented recreational areas within the 50-mi radius of CPNPP, and
35 four of these are wildlife protection areas (Luminant 2009a). These are: (1) Dinosaur Valley
36 State Park, (2) Glen Rose Bird Sanctuary, (3) Fossil Rim Wildlife Center, and (4) Quail Ridge
37 Ranch/Chalk Mountain Conservation Area. The closest of the listed areas to CPNPP, Dinosaur
38 Valley State Park, is approximately 3 mi southwest of the site.

39 **2.4.1.2 Terrestrial Resources—Transmission Lines and Cooling Water Pipelines**

40 Electric transmission lines originating from CPNPP cross forested and grassland habitats typical
41 of north-central Texas, predominantly grassland with patches of deciduous and evergreen
42 forest, as discussed in Section 2.4.1.1. Transmission line rights-of-way are maintained in an
43 open grassland successional stage. Acreages of vegetation types likely to be crossed by new
44 or expanded transmission line right-of-way are shown in Table 2-11.

Table 2-10. Ecological Oriented Public Recreation Areas within a 50-mi Radius of CPNPP

Name of Property	Type of Property	Approximate Distance and Direction from the Site
Recreation Area	Dinosaur Valley State Park	3.5 mi SSW
	Somervell County Park	4.4 mi S
	Big Rocks City Park	4.7 mi S
	Tres Rios Ranch River Resort	4.8 mi S
	Cleburne State Park	13 mi E
	Meridian State Park	28 mi S
	Lake Whitney State Park	35 mi SE
	Lake Mineral Wells State Park	38 mi NNW
	Aquila Wildlife Management Area	38 mi SE
Campground	Dinosaur Valley State Park	See above
	B Street RV Park	4.5 mi S
	Oakdale Park	See above
	Glen Lake Methodist Camp	4.7 mi SSE
	Leslie's RV Park Campground	4.8 mi SSW
	Tres Rios Ranch River Resort ⁷	See above
	Cleburne State Park	See above
	Meridian State Park	See above
	Lake Whitney State Park	See above
	Lake Mineral Wells State Park	See above
Fishing	Dinosaur Valley State Park	See above
	Big Rocks City Park	See above
	Lake Granbury	7 mi NE
	Cleburne State Park	13 mi E
	Meridian State Park	28 mi S
	Lake Whitney State Park	35 mi SE
	Lake Mineral Wells State Park	38 mi NNW
	Aquila Wildlife Management Area	38 mi SE
Heritage Preserve	Glen Rose Heritage Park	4.8 mi S
	Somervell County Courthouse	5.0 mi S
	Barnard's Mill	5.0 mi S
	Acton State Historical Park	13 mi NE
Boating Areas	Lake Granbury	See above
	Cleburne State Park	13 mi E
	Meridian State Park	28 mi S
	Lake Whitney State Park	35 mi SE
	Lake Mineral Wells State Park	38 mi NNW
	Aquila Wildlife Management Area	38 mi SE
Wildlife Viewing	Dinosaur Valley State Park	See above
	Glen Rose Bird Sanctuary	4.8 mi S
	Fossil Rim Wildlife Center	8 mi SSW
	Quail Ridge Ranch/Chalk Mountain Conservation Area	9 mi SW
	Vivian J. Malone Preserve	25 mi E

Source: Luminant 2009a.

Table 2-11. Acreages of vegetation types that would be crossed by expanded existing transmission lines on existing towers.

Vegetation Type	Transmission Corridor													
	DeCordova ^(a)			Whitney ^(a)			Parker ^(b)			Johnson ^(b)			Everman ^(b)	
	Acreage	Percent	Percent	Acreage	Percent	Percent	Acreage	Percent	Percent	Acreage	Percent	Percent	Acreage	Percent
Water	11.0	7.4	0.3	3.1	0.3	0.4	3.3	0.4	0.4	1.6	0.4	0.4	0.0	0.0
Developed, Open	11.0	7.4	2.1	19.8	2.1	3.6	28.4	3.6	1.1	4.0	1.1	46.4	10.5	
Developed, Low Intensity	0.2	0.2	0.1	0.9	0.1	1.1	8.4	1.1	0.1	0.2	0.1	9.6	2.2	
Developed, Medium Intensity	0.4	0.3	0.0	0.0	0.0	0.1	0.9	0.1	0.0	0.0	0.0	0.2	0.1	
Developed, High Intensity	1.3	0.9	0.0	0.0	0.0	0.1	1.1	0.1	0.0	0.0	0.0	0.9	0.2	
Barren Land	0.9	0.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Deciduous Forest	10.1	6.8	18.5	176.1	18.5	14.9	116.5	14.9	8.0	28.9	8.0	47.8	10.8	
Evergreen Forest	3.1	2.1	14.4	137.0	14.4	7.1	55.2	7.1	8.1	29.4	8.1	0.2	0.1	
Mixed Forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Scrub/Shrub	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.7	
Grassland	107.5	72.3	57.7	550.0	57.7	66.7	520.2	66.7	73.5	266.4	73.5	262.9	59.4	
Pasture	1.3	0.9	3.8	35.8	3.8	4.1	31.9	4.1	6.2	22.5	6.2	63.8	14.4	
Cropland	0.0	0.0	0.8	7.6	0.8	0.4	3.1	0.4	1.6	5.8	1.6	7.1	1.6	
Woody Wetlands	1.6	1.1	2.4	22.9	2.4	1.3	10.4	1.3	1.0	3.8	1.0	0.9	0.2	
Total	148.7	100.0	100.0	953.6	100.0	100.0	779.6	100.0	100.0	362.6	100.0	442.7	100.0	

Source: Luminant 2009a

(a) New ROWs

(b) Existing ROWs

Table 2-12. Pipeline corridor land use and cover types

Land Use Type	Acreage	Percent
Water	0.2	0.4
Developed, Open	6.2	12.4
Developed, Low Intensity	1.2	2.3
Developed, Medium Intensity	0.3	0.5
Barren Land	0.2	0.4
Deciduous Forest	6.3	12.6
Evergreen Forest	3.7	7.5
Grassland	31.4	63.1
Cropland	0.4	0.7
Woody Wetlands ^(a)	0.1	0.1
Total	49.7	100.0

Source: Luminant 2009a; USGS 2001.

(a) Field check of the entire ROW in April and July of 2007 showed no wetlands to be present (Luminant 2009a).

1

2 The acreage likely to be impacted by new or expanded transmission line ROWs will be
 3 determined once actual right-of-way boundaries are finally determined with precision. No
 4 information has been collected on important species for these areas. Oncor will perform
 5 terrestrial ecology surveys and collect the information required by the State of Texas for
 6 approval of the transmission lines once the right-of-way boundaries are formally determined,
 7 and before initiation of ground disturbing activities on the rights-of-way.

8 The new water intake and discharge pipelines for Units 3 and 4 would generally follow an
 9 existing 48-in. water pipeline for Units 1 and 2 that connects Lake Granbury to SCR
 10 (Figure 2-5). This route follows existing transmission/pipeline rights-of-way generally consisting
 11 of grassland and Ashe juniper or previously disturbed areas. A new right-of-way would be
 12 required for a discharge structure at Lake Granbury, and within the CPNPP site.

13 The existing pipeline for Units 1 and 2 is located along the centerline of a right-of-way that is
 14 approximately 7 mi long and 50 ft wide; where the new pipeline would parallel the existing
 15 pipeline, it would be placed within the existing right-of-way. New right-of-way approximately
 16 1.2 mi long to the discharge structure at Lake Granbury would also be required. The entire
 17 length of the pipeline right-of-way was surveyed for potential wetlands and habitat for protected
 18 wildlife species in April and July 2007. No wetlands or habitat for protected wildlife species
 19 were found (Luminant 2009a). Acreages of vegetation types, predominantly grassland that
 20 would be crossed by the new pipeline are shown in Table 2-12 (Luminant 2009a).

21 **2.4.1.3 Important Terrestrial Species and Habitats**

22 ***Important Terrestrial Species—Site and Vicinity***

23 This section describes important species and habitats as defined by the NRC in NUREG 1555
 24 that may occur in the vicinity of the CPNPP site and new transmission line and pipeline rights-
 25 of-way. Important species as defined by the NRC include, but are not limited to, commercially
 26 and recreationally valuable species, ecologically important species, Federally and State-listed,
 27 proposed, and candidate threatened and endangered terrestrial species, and designated and
 28 proposed critical habitats.

1 **Commercially and Recreationally Valuable Species**

2 Texas Parks and Wildlife Department (TPWD) divides the State of Texas into eight wildlife
3 districts. CPNPP is located within the Cross Timbers Wildlife District. Hunting regulations for
4 the district are set by TPWD to specify the methods of harvest, bag limits, and other
5 requirements for hunting on wildlife management areas and private land (TPWD 2007d).

6 Commercial trapping or hunting of furbearers is permitted in the district all year. TPWD's
7 regulations (TPWD 2007b) legally classify badger (*Taxidea taxus*), beaver, fox, mink
8 (*Neovison vison*), nutria, opossum, otter (*Lutra canadensis*), raccoon, ring-tailed cat
9 (*Bassariscus astutus*), spotted skunk (*Spilogale* spp.), and striped skunk as furbearers subject
10 to commercial harvest by hunting and trapping. Coyotes and bobcats are not considered
11 furbearers. Bobcat pelts require tagging with a TPWD-issued Convention on International
12 Trade in Endangered Species tag. Except for otter and badger, most of these furbearer species
13 are likely to inhabit the site, based on the availability of suitable habitat (Davis and Schmidly
14 1994).

15 CPNPP does not allow hunting or trapping within the site boundary. State-protected game
16 potentially occurring at the CPNPP site include habitat generalists such as bobcat, white-tailed
17 deer, red fox (*Vulpes vulpes*), opossum, eastern cottontail, and weasel (*Mustela frenata*);
18 species associated with brushy and disturbed areas such as feral hog, black-tailed jackrabbit,
19 and striped skunk; forest species such as gray fox (*Urocyon cinereoargenteus*), raccoon,
20 spotted skunk, and squirrel (*Sciurus* spp.); and species associated with aquatic habitat such as
21 mink, and muskrat (*Ondatra zibethicus*). Avian game species include waterfowl (i.e., goose
22 [*Branta* spp.], double-crested cormorant [*Phalacrocorax auritus*], or duck [Family *Anatidae*]);
23 bobwhite quail (*Colinus virginianus*); mourning dove (*Zenaida macroura*), rails (*Rallidae* spp.);
24 American coot (*Fulica americana*); gallinule (*Porphyrio* spp.); American crow; and wild turkey
25 (*Meleagris gallopavo*) (Freeman 2003, Davis and Schmidly 1994). Of these species, white-
26 tailed deer and wild turkey are highly sought after by hunters and are considered important
27 species.

28 **Species Critical to Structure and Function of the Ecosystem**

29 As discussed in Subsection 2.4.1.1, the western Cross Timbers ecoregion is a mosaic of forest,
30 woodland, savanna, and grasslands of highly variable floristic composition. Active and
31 abandoned agricultural fields and pastures are also common. Most species at CPNPP are
32 common in southern plains and woodlands and associated streams that flow through them.
33 Regionally, the plant communities are highly variable and offer habitat for a wide variety of
34 animal species that vary in abundance depending primarily on local physiography.

35 Because of the wide variety of ecological communities within the region, individual species
36 abundance, especially plants, can vary significantly from location to location where different
37 species serve similar ecological roles in the community. Accordingly, there is no evidence
38 suggesting that any individual species is critical to structure or function at the ecosystem level.

39 **Species that Serve as Indicators**

40 The EPA describes biological indicators as groups or types of biological resources that can be
41 used to assess environmental conditions (EPA 2007). Typically, such organisms at or near a
42 site can be selected to characterize the current ecological status of the site or to track or predict
43 significant change in the future.

44 Terrestrial organisms that inhabit the CPNPP site are common inhabitants of southern plains
45 and woodlands. There is little population information available for those that are less common

1 to track possible changes in their status in the future. There are no species at the site that
2 might function as true biological indicators.

3 **Federally and State-Listed Species**

4 Table 2-13 presents the terrestrial species that are 1) State listed as threatened or endangered;
5 2) species of State concern and designated as rare, but with no regulatory listing [In Texas
6 species of concern are priority species in greatest need of conservation as determined by the
7 Texas Wildlife Action Plan (TPWD 2009a, 2009j)]; or 3) Federally listed as threatened or
8 endangered or are candidates for listing in counties within which CPNPP Units 3 and 4
9 (Somervell and Hood Counties) and the proposed new transmission and pipeline rights-of-way
10 (Somervell, Hood, and Bosque Counties) would be located. This list is composed of the
11 following.

- 12 • species listed for these counties on the TPWD website (TPWD 2009h);
- 13 • species listed for these counties on the USFWS website (USFWS 2009);
- 14 • species with recorded occurrences in the Texas Natural Diversity Database (TXNDD) that
15 are within 10 mi of CPNPP and new power transmission rights-of-way (TPWD 2009f); and
- 16 • species potentially present when suitable habitat is present in the project area
17 (USFWS 2006, TPWD 2007c).

18 No designated USFWS critical habitat for threatened or endangered species exists on the
19 CPNPP site and vicinity or within or adjacent to existing or new transmission or pipeline
20 corridors (USFWS 2007). No Federally or State-listed threatened or endangered species were
21 detected during informal site surveys conducted in spring, summer, and fall 2007 (Luminant
22 2009a).

23 **Federally-listed species.** This section describes the Federally-listed threatened and
24 endangered species in the vicinity of the site and the proposed new transmission and pipeline
25 rights-of-way. The terrestrial species that are Federally listed as threatened or endangered, or
26 that are designated as candidates for listing, in counties within which CPNPP Units 3 and 4
27 (Hood and Somervell Counties) and the proposed new transmission and pipeline rights of way
28 (Hood, Somervell and Bosque Counties) would be located are presented in Table 2-13). Of the
29 Federally-listed species, only two birds, black-capped vireo, and golden-cheeked warbler (both
30 endangered), have recorded occurrences in these counties (TPWD 2009f). These species are
31 also State-listed as endangered. In support of the Section 7 consultation with the USFWS, the
32 Biological Assessment for these two species is in Appendix F.

33 **Black-capped vireo (*Vireo atricapillus*) (Federally and State-listed as endangered).** Black-
34 capped vireos are small, about 4.5 in in size, insectivorous songbirds found only in Oklahoma
35 and Texas. Black-capped vireos prefer patchy woodlands or shrublands. Males are
36 characterized by olive-green backs, white stomachs, and black caps with a white patch around
37 a reddish eye. Females are more cryptic in color than males with dark coloration along their
38 backs (Campbell 2003, Grzybowski 1995, USFWS 1991).

39 Black-capped vireos nest in areas with 30 to 60 percent cover of deciduous trees. Their
40 preferred habitat contains trees in excess of 6 ft high with cover extending to the ground. Open
41 grasslands play an important role in habitat, providing foraging areas for the vireos (Campbell
42 2003, Graber 1961). Male vireos return to nesting areas starting in mid-March, and females
43 arrive shortly thereafter. Home ranges vary from 3 to 10 ac (Campbell 2003, Graber 1961).

Table 2-13. Threatened, endangered, or rare terrestrial plant and animal species listed in Somervell, Hood, and Bosque Counties

Species Group	Common Name	Scientific Name	Federal Status ^(a)	State Status ^(b)
Birds	American peregrine falcon	<i>Falco peregrinus anatum</i>	–	T
	Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	–	Rare
	Baird’s sparrow			Rare
	Bald Eagle	<i>Haliaeetus leucocephalus</i>	–	T
	Black-capped vireo	<i>Vireo atricapillus</i>	E	E
	Golden-cheeked warbler	<i>Dendroica chrysoparia</i>	E	E
	Interior least tern	<i>Sterna antillarum athalassos</i>	E	E
	Mountain plover	<i>Charadrius montanus</i>	–	Rare
	Western burrowing owl	<i>Athene cunicularia hypugaea</i>	–	Rare
	Whooping crane	<i>Grus americana</i>	E	E
Mammals	Black bear	<i>Ursus americanus</i>	T/SA	T
	Gray wolf	<i>Canis lupus</i>	E	E
	Plains spotted skunk	<i>Spilogaes putorius interrupta</i>		Rare
	Red wolf	<i>Canis rufus</i>	E	E
Reptiles	Texas garter snake	<i>Thamnophis sirtalis annectens</i>	–	Rare
	Texas horned lizard	<i>Phrynosoma cornutum</i>	–	T
	Timber (Canebreak) Rattlesnake	<i>Crotalus horridus</i>	–	T
	Comanche Peak prairie clover	<i>Dalea reverchonii</i>	–	Rare
Plants	Glen Rose yucca	<i>Yucca necopina</i>	–	Rare

Sources: USFWS 2006, 2009a; TPWD 2007c, 2009f, 2009h.

(a) Federal Status: E = Endangered; T/SA = Threatened by Similarity of Appearance

(b) State Status: E = endangered; T = Threatened; Rare = Rare, but with no regulatory listing

1 Males and females both contribute to nest building and site selection, often in a fork of a
 2 deciduous branch. Habitat modifications from range management practices and fire
 3 suppression, along with cowbird (*Molothrus alter*) nest parasitism, have probably led to their
 4 decline (Grzybowski 1995).

5 This species has been observed foraging and nesting in Dinosaur Valley State Park within
 6 about 3.5 mi of the CPNPP site, but no individuals or nests have been identified at the CPNPP
 7 (Luminant 2009a). Informal surveys for the black-capped vireo were conducted during April
 8 2007 at various times of day over the course of 3 days over the CPNPP site, concentrating on
 9 the peninsula area proposed for construction of the new cooling towers. Survey methods
 10 consisted of walking transects on east/west axes spaced approximately 100 m (109 yd) apart.
 11 Black-capped vireos were not observed, and no suitable breeding habitat was noted
 12 (Luminant 2009a).

13 **Golden-cheeked warbler (*Dendroica chrysoparia*) (Federally and State-listed as**
 14 **endangered).** Upland sites within CPNPP may provide appropriate habitat for the golden-
 15 cheeeked warbler. Golden-cheeked warblers winter in Mexico and Central America but breed
 16 only in Texas. They are small migratory songbirds, about 5 in long and are characterized by

1 yellow cheeks bisected by a black streak extending across the eye. Males and females are
2 similar in appearance, although females are drabber (Campbell 2003, Ladd and Gass 1999).

3 Golden-cheeked warblers are dependent on Ashe juniper, but also require stands mixed with
4 oaks, elms, and other hardwoods in relatively moist (mesic) areas such as steep canyons and
5 slopes, and adjacent uplands (USFWS 1992). Kroll (1980) reported that occupied golden-
6 cheeked warbler habitats had a lower juniper-oak ratio (1.35:1), contained junipers over
7 40 years old, and had lower understory diversity than unoccupied areas. Older Ashe junipers
8 have peeling bark, an important component of golden-cheeked warbler nest construction. Older
9 Ashe junipers are utilized as calling sites during mating.

10 After females arrive in March, mating begins and extends until April or May. Decline of golden-
11 cheeked warblers is attributed to habitat loss and fragmentation due to range improvement
12 practices, rapid urban development, flood control, and construction of impoundments (Ladd and
13 Gass 1999). Nest parasitism by the brown-headed cowbird and competition with blue jays has
14 also contributed to population declines (Campbell 2003, Engels and Sexton 1994). The
15 USFWS along with TPWD have implemented landowner management plans and Safe Harbor
16 Agreements to protect and enhance existing and potential golden-cheeked warbler habitat
17 (Campbell 2003, Ladd and Gass 1999, USFWS 1992).

18 The golden-cheeked warbler has been observed foraging and nesting in Dinosaur Valley State
19 Park within about 3.5 mi of the CPNPP site, but no individuals or nests have been identified at
20 the CPNPP (Luminant 2009a). This species was not observed on the site during a survey in
21 April 2007 (PBS&J 2007), or during a targeted presence or absence survey conducted in May
22 2007. A study was conducted using USFWS protocol during breeding season in April/May
23 2008, concentrating on the peninsula area proposed for construction of the new cooling towers,
24 to determine the presence or absence of the species and whether suitable habitat was present
25 (PBS&J 2008). Neither golden-cheeked warblers nor suitable habitat was present (PBS&J
26 2008). Most of the habitat present lacked the 20-percent mixture of hardwoods considered
27 necessary for the species (PBS&J 2007); a 3.7 ac area along a stream confluence exhibited
28 more favorable characteristics, but was considered too highly fragmented and small in size to
29 support favorable nesting conditions (PBS&J 2008). In the area proposed for development of
30 the BDTF, a habitat survey was performed in November 2007 and compared to a reference site
31 where known golden-cheeked warbler populations exist. Additional site reconnaissance was
32 performed on February 4, 2009. Both surveys confirmed that favorable golden-cheeked warbler
33 habitat is absent from the area of the BDTF (Luminant 2009a). Canopy cover in and adjacent to
34 the BDTF was found to be only about 20 percent, which is less than the minimum thought to be
35 required of 35 percent (Luminant 2010a). See the Biological Assessment in Appendix F for
36 further details.

37 **Whooping crane (*Grus americana*) (Federally and State-listed as endangered).** The
38 whooping crane is the tallest bird in North America and has a wingspan of 7.5 ft. Whooping
39 cranes are white with rust colored patches on the top and on the back of the head. They lack
40 feathers on both sides of the head, and have yellow eyes, and long black legs and bills.
41 Whooping cranes breed in the wetlands of Wood Buffalo Park in northern Canada and spend
42 the winters on the Texas coast at Aransas National Wildlife Refuge near Rockport (TPWD
43 2009m). Although the whooping crane could possibly be a migrant over the proposed project
44 location, no natural heritage records of occurrences exist for Hood, Somervell, or Bosque
45 Counties (NatureServe 2009, TPWD 2009f). No known occurrences of whooping cranes have
46 been reported within a 10-mi radius of the CPNPP site, or the proposed powerline and pipeline
47 corridors (TPWD 2009f), and they are not likely to use the inland habitats found on the CPNPP
48 site for foraging, roosting, or nesting.

1 **State-listed species.** This section describes the Texas State-listed threatened and
 2 endangered terrestrial species in the vicinity of the site and the proposed new transmission and
 3 pipeline rights-of-way. Table 2-13 presents the terrestrial species that are State-listed as
 4 threatened or endangered, or that are species of concern and designated as rare, but with no
 5 regulatory listing, in counties within which CPNPP Units 3 and 4 (Somervell and Hood Counties)
 6 and the proposed new transmission and pipeline rights-of-way (Somervell, Hood and Bosque
 7 Counties) would be located. The State-listed and rare species potentially occurring in the
 8 vicinity of the proposed CPNPP Units 3 and 4, and the proposed new transmission line rights-of-
 9 way (Somervell, Hood, and Bosque Counties) would be located, are described below. A
 10 species is described only if there is a recorded occurrence in one of the three counties, or if the
 11 Texas Coastal Watershed Program (TCWP) stated that it could be present where suitable
 12 habitat exists in one of the three counties even though there have been no recorded
 13 occurrences (TPWD 2007c).

14 Two birds, the black-capped vireo and the golden-cheeked warbler, are the only State-listed
 15 species with recorded occurrences (TPWD 2009f) in the counties potentially affected by the
 16 proposed CPNPP Units 3 and 4 facilities (Somervell and Hood Counties) or the two proposed
 17 new transmission line rights-of-way (Somervell, Hood, and Bosque Counties). These two bird
 18 species are also Federally-listed as endangered and have been described above. Three other
 19 State-listed species, bald eagle (*Haliaeetus leucocephalus*), Texas horned lizard
 20 (*Phrynosoma cornutum*), and timber (canebreak) rattlesnake (*Crotalus horridus*), although
 21 without recorded occurrences, could be present and affected by the project where suitable
 22 habitat is present (TPWD 2007c).

23 Occurrences of three species that are species of concern and designated as rare, but with no
 24 regulatory listing, have been reported from the counties crossed by the new rights-of-way: one
 25 reptile, the Texas garter snake (*Thamnophis sirtalis annectens*), and two plants, Comanche
 26 Peak prairie clover (*Dalea reverchonii*), and Glen Rose yucca (*Yucca necopina*).

27 **Bald eagle (*Haliaeetus leucocephalus*) (State-listed as threatened).** The bald eagle is a
 28 large predatory bird that occupies large trees along major water bodies such as lakes and rivers
 29 (Buehler 2000). Bald eagles nest in tall (40–120 ft) trees, usually within 1 or 2 mi of large rivers
 30 and streams where fish are abundant. SCR and Lake Granbury may provide appropriate
 31 habitat for the bald eagle. Wintering bald eagles are reported by CPNPP site personnel to
 32 forage and perch along the shore of SCR. No nests have been identified in the trees along the
 33 shoreline (Luminant 2009a). Bald eagles have dark body feathers, a distinctive white head, and
 34 a yellow beak at maturity. Adult female body size can reach 3 ft head to tail with an 8-ft
 35 wingspan. Males are slightly smaller (Campbell 2003, Buehler 2000).

36 Over-wintering bald eagle range extends into central Texas, including Hood and Somervell
 37 Counties (Campbell 2003). Fish are the main prey. Waterfowl, mammals, and carrion are other
 38 bald eagle food sources (Campbell 2003, Buehler 2000).

39 Habitat loss, shooting, and use of the insecticides such as DDT are the primary factors
 40 contributing to the historic decline of the bald eagle (Campbell 2003, Buehler 2000). Protection
 41 through laws and extensive conservation efforts led to recovery of the bald eagle. The bald
 42 eagle is currently listed as State-threatened in Texas. It was Federally delisted on July 9, 2007
 43 (72 FR 37346). Bald eagles are still provided protection by the Bald and Golden Eagle
 44 Protection Act and the Migratory Bird Treaty Act. This species had previously been observed at
 45 CPNPP, but was not observed on the site during field visits conducted in 2006 and 2007
 46 (Luminant 2009a).

1 **Texas garter snake (*Thamnophis sirtalis annectens*) (Considered Rare by TPWD, but with**
 2 **no regulatory listing).** The Texas garter snake has a greenish black back with a broad orange
 3 stripe down the center and yellowish stripes on either side of the body. They are usually found
 4 in marshy, flooded pastureland or meadows and grassy or brushy terrain near hill country
 5 streams and ponds in eastern and central Texas, with an isolated population in southwestern
 6 Kansas. According to NatureServe, there are no existing natural heritage records of Texas
 7 garter snake occurrences for Hood, Somervell, or Bosque Counties (NatureServe 2009).
 8 However, TPWD recorded an occurrence of the Texas garter snake within 10 mi of one of the
 9 proposed new power transmission line rights-of-way (TPWD 2009f).

10 **Texas horned lizard (*Phrynosoma cornutum*) (State-listed as Threatened).** The Texas
 11 horned lizard is dorsoventrally flattened and cryptically colored with two occipital spines on the
 12 head (Pianka and Hodges 1998). Texas horned lizards are found in arid to semiarid sandy
 13 areas with bunchgrass and low vegetation cover of around 60 percent (Henke and Fair 1998).
 14 Adult Texas horned lizards are small (>2.75 inches long from snout to vent) and breed from
 15 March to July (Henke and Fair 1998, Pianka and Parker 1975).

16 Texas horned lizards feed only on harvester ants (*Pogonomyrmex* sp.). Insecticide use and
 17 interspecific competition from imported red fire ants reduce harvester ant density. Reduced
 18 prey availability may contribute to the decline of Texas horned lizard populations in Texas.
 19 Other factors that may contribute to population decline include habitat loss and overcollecting
 20 (Henke and Fair 1998). During a May 2007 survey harvester ant colonies were identified in
 21 certain areas on site. These areas were carefully examined for presence of the Texas horned
 22 lizard. None was found then or in a follow-up visit in July 2007 (Luminant 2009a).

23 **Timber (canebrake) rattlesnake (*Crotalus horridus*) (State-listed as Threatened).** The
 24 timber or canebrake rattlesnake is the second largest pit viper found in Texas. Adults range
 25 between 40 and 60 in. long (TPWD 2007e, Werler and Dixon 2000). They have lightly colored
 26 bodies with darker colored jagged stripes and solid black tails, culminating with a rattle. Though
 27 venomous, timber rattlesnakes rely on their cryptic coloration or avoidance when presented with
 28 danger, biting only when escape is not possible (TPWD 2007e, Werler and Dixon 2000).

29 Timber rattlesnakes are most frequently associated with riparian and bottomland forest or in
 30 partially wooded hillsides. Timber rattlesnakes are sit-and-wait predators, sometimes waiting for
 31 several hours by fallen trees for small mammals, their primary food source, to come along
 32 (TPWD 2007e, Werler and Dixon 2000). Ground-nesting birds, frogs, and other small
 33 vertebrates are also eaten.

34 Population decline of timber rattlesnakes has been blamed on habitat destruction, hunting,
 35 logging, and mortality induced while crossing roads (TPWD 2007e, Werler and Dixon 2000).
 36 This species was not observed on the site during field visits in 2007 (Luminant 2009a).

37 **Comanche Peak prairie clover (*Dalea reverchonii*) (Considered Rare by TPWD, but with**
 38 **no regulatory listing).** The Comanche Peak prairie-clover is endemic to Texas and is a low,
 39 spreading perennial, which appears as a dense, mat-forming rosette up to 16 inches in
 40 diameter. Numerous thick, 3-inch long spikes of rose-pink to magenta-purple flowers bloom
 41 from May through June (CPC 2009, TPWD 2009k). It is often found among sparse vegetation
 42 in barren, exposed sites, sometimes in roadway rights-of-way (TPWD 2008a). The species is
 43 restricted to shallow-soil prairies where the Western Cross Timbers meet the Grand Prairie of
 44 north-central Texas, occurring mostly where Goodland Limestone lies at or near the surface
 45 (Poole et al. 2007). This prairie-clover is only known from about 20 occurrences within a very
 46 small geographic area in north central Texas and is considered extirpated from the Comanche
 47 Peak area (NatureServe 2009). One occurrence of Comanche Peak prairie clover is within

1 10 miles of the CPNPP site, but is more than 3 miles to the north of areas to be affected by
2 project activities based on the map provided by TPWD (TPWD 2009f).

3 **Glen Rose yucca (*Yucca necopina*) (Considered Rare by TPWD, but with no regulatory**
4 **listing).** The Glen Rose yucca is endemic to Texas and is found in the sandy soils of the
5 Western Cross Timbers. It is easily distinguished by its white leaf margins bearing white curly
6 threads and its branched flower stalk. The stalk may rise to 9 ft with white to greenish white
7 flowers. It flowers in April through June (TPWD 2009k). The Glen Rose yucca is on the Watch
8 List as a rare species, having either low population numbers or a restricted range in Texas
9 (TNPDP 2009I). This yucca is in grasslands on sandy soils and limestone outcrops (TPWD
10 2009I). This species was not observed during informal field surveys conducted in 2007 by
11 Enercon Services, Inc. However, a recorded occurrence of Glen Rose yucca lies in the vicinity
12 of the new right-of-way required for the discharge structure at Lake Granbury (TPWD 2009f).

13 ***Important Terrestrial Habitats***

14 Important terrestrial habitats as defined in NUREG 1555 (NRC 2000) include

- 15 • wildlife sanctuaries, refuges, and preserves;
- 16 • habitats identified by State or Federal agencies as unique, rare, or of priority for protection;
- 17 • land areas designated as critical habitat for species listed as threatened or endangered by
18 USFWS; and
- 19 • wetlands if these areas might be adversely affected by plant or transmission or pipeline
20 construction or operation (NRC 2000).

21 Wetlands are discussed in Section 2.4.2. The other groups are discussed further below.

22 ***Wildlife Sanctuaries, Refuges, and Preserves***

23 Of the four wildlife protection areas discussed in Section 2.4.1.1 (see Table 2-10), which also
24 function as ecologically oriented recreational areas and occur within the 50-mi radius of CPNPP,
25 Dinosaur Valley State Park is the only one that could potentially be affected by new
26 transmission line construction. The proposed Whitney transmission line right-of-way might pass
27 very close to, or possibly through, a small portion in the northwest corner of the park.

28 ***Unique and Rare Habitats or Habitats with Priority for Protection***

29 Literature review, map review, and field reconnaissance performed by Luminant (Luminant
30 2009a), revealed no unique or rare habitats with priority for protection on or in the vicinity of
31 CPNPP or potential new or expanded powerline right-of-way (USFWS 2007).

32 ***Critical Habitat***

33 Although there is the potential presence of Federally and State-listed species, such as the
34 black-capped vireo and golden-cheeked warbler, within Somervell, Hood, and Bosque Counties,
35 no critical habitat has been designated for either of these species within a 50-mi radius of the
36 site, and transmission and pipeline rights-of-way (USFWS 2007).

37 **2.4.1.4 Terrestrial Monitoring**

38 Additional environmental review would be conducted prior to development of transmission lines
39 on new right-of-way and cooling water pipeline on expanded right-of-way. After Oncor secures
40 State approval, the new rights-of-way would be subjected to pre-disturbance investigations as
41 required by Federal and State regulatory requirements.

1 Other than the above, no additional preoperational or operational terrestrial ecological
2 monitoring is planned or necessary for construction and operation of CPNPP Units 3 and 4,
3 unless required as a condition of a non-NRC permit or regulatory approval from another
4 government agency (Luminant 2009a).

5 **2.4.2 Aquatic Ecology**

6 This section describes the aquatic environment and biota in the vicinity of the CPNPP site and
7 other areas likely to be affected by the building, operation, or maintenance of the proposed
8 Units 3 and 4 and the associated transmission line and pipeline ROWs. This section describes
9 the spatial and temporal distribution, abundance, and other structural and functional attributes of
10 biotic assemblages on which the proposed action and the associated transmission line and
11 pipeline ROWs could have an impact, and the section identifies important or irreplaceable
12 aquatic natural resources that might be affected by the proposed action. The physical
13 characteristics, including hydrology and water quality, of the aquatic resources in the vicinity of
14 the CPNPP site are described in Section 2.3.

15 The aquatic resources associated with the CPNPP site include reservoirs, rivers, creeks, and
16 wetlands. The CPNPP site is located on SCR approximately 7 mi southwest of Lake Granbury,
17 which is the largest and most important aquatic resource in the vicinity of the facility and the one
18 with the greatest potential to be affected by the proposed action. Farther away, over 100 mi
19 upstream of Lake Granbury, is the dam for Possum Kingdom Lake (PKL) (Figure 2-12). PKL
20 may be affected by the proposed action indirectly through changes in water management within
21 the Brazos River Basin as a result of the proposed withdrawal from Lake Granbury for the
22 proposed Units 3 and 4. Other aquatic resources in the vicinity of the site include the streams
23 on which these reservoirs were constructed—Squaw Creek and the Brazos River. In addition,
24 SCWD recently built the WBR on a tributary of the Paluxy River approximately 1 mi south of
25 SCR, and CPNPP (including the proposed units) would be among the users it would supply.
26 There are no sanctuaries or preserves that could be affected by the proposed action. The
27 nearest such managed area is Dinosaur Valley State Park on the Paluxy River, 3.3 mi
28 southwest of the CPNPP site.

29 **2.4.2.1 Aquatic Resources—Site and Vicinity**

30 ***Lake Granbury***

31 Lake Granbury was created in 1969 by completion of the DeCordova Bend Dam on the Brazos
32 River. The reservoir was built by the BRA to provide water for industrial, municipal, and
33 irrigation uses. Lake Granbury is approximately 35 mi long and has a drainage area of
34 16,113 sq mi. It has an average depth of about 18 ft and a maximum depth of 74 ft
35 (Luminant 2009a). Lake Granbury has a volume of 129,011 ac-ft and a surface area of 7,945
36 ac at the conservation pool elevation of 693 ft MSL (Luminant 2009a). It is located between two
37 other major Brazos River impoundments: PKL, whose dam is approximately 120 river mi
38 upstream of the upper reaches of Lake Granbury to the northwest, and Lake Whitney, whose
39 upper reaches are approximately 75 river mi downstream of the DeCordova Bend Dam to the
40 southeast (TPWD 1974).

41 Surface water is withdrawn from Lake Granbury and diverted to SCR to supplement water
42 losses associated with the operation of CPNPP Units 1 and 2 and to assist in maintaining the
43 elevation and temperature of SCR. Proposed CPNPP Units 3 and 4 would utilize Lake
44 Granbury as the source of their cooling water, so future withdrawals for that purpose would be in
45 addition to the ongoing withdrawals of makeup water for Units 1 and 2. Blowdown from the
46 cooling towers for Units 3 and 4 would be discharged back into Lake Granbury. During

1 operation of all four reactors, the net consumptive loss from Lake Granbury would be
2 approximately 95,745 ac-ft/yr (Luminant 2009a).

3 An ecological study was conducted to characterize the aquatic community of lower Lake
4 Granbury throughout the four seasons. This study involved four sampling events (in May,
5 September, and November 2007 and January 2008) at four locations along the west bank in the
6 most-downstream reach of the lake, the area encompassing the proposed intake and discharge
7 locations. The locations of the sample sites ranged from 330 m (1,083 ft) to 2.6 km (1.6 mi)
8 upstream of the dam. The site nearest the dam (LG-4) was sampled from shore to 11 m out
9 into the lake, where depths were 5 m to 7 m. The next site upstream was an open-water site
10 (LG-3) that was 110 m to 120 m offshore with depths of 13 m to 15 m. The third site upstream
11 of the dam (LG-2) was 10 m to 30 m from shore with depths of 7 m to 9 m, and the most
12 upstream site (LG-1) was 12 m from shore with depths of 11 m to 17 m.

13 The aquatic biological community of Lake Granbury comprises plankton, benthic
14 macroinvertebrate, and fish communities, which are discussed below.

15 **Plankton Community.** Plankton are very small organisms (plants and animals) that float or
16 swim weakly and move within a body of water mainly at the mercy of waves and currents
17 (Goldman and Horne 1983). Data on the plankton community of Lake Granbury were collected
18 in conjunction with a 9-month ecological study of Lake Granbury completed in 2008 (Bio-West
19 2008a). Zooplankton were sampled at four locations in lower Lake Granbury in May,
20 September, and November 2007 and January 2008 using a vertically towed plankton net with
21 80-micron mesh. In addition, an extra sample was collected at one location (LG-1) during the
22 summer (September) sampling event to look for golden alga (*Prymnesium parvum*), but golden
23 alga cells were not found. The dominant planktonic organisms collected in all four seasons
24 were copepods (crustaceans of the subclass Copepoda), with the majority in the larval
25 (nauplius) stage. Copepods were followed in abundance by rotifers (phylum Rotifera) in
26 summer and winter, and by water fleas (crustaceans of the order Cladocera) in spring and fall
27 (Bio-West 2008a).

28 The alga *P. parvum* is the plankton species of predominant concern in Lake Granbury due to its
29 history of causing toxic effects in other aquatic organisms in the reservoir. *P. parvum* has
30 become common in western Texas and other parts of the American Southwest, where it is
31 referred to as “golden alga.” Golden alga is a single-celled, microscopic, primitive plant that
32 swims using a pair of flagella and usually occurs suspended in the water column. It also has a
33 shorter, stiff, hair-like structure (haptonema) with which it can attach to surfaces. When
34 stressed by unfavorable conditions, golden alga, like many other algae, can form a resting cyst
35 and become dormant. Resting cysts typically sink to the bottom. When conditions improve,
36 cysts may be able to become active cells again, with the ability to swim and produce toxins, but
37 very little is known about the characteristics of golden alga cysts. The yellow-green color of the
38 golden alga comes from the pigment within its two chloroplasts. In addition to performing
39 photosynthesis, it can engulf and digest bacteria and algae. Golden alga cells release toxins
40 that may assist them in catching and ingesting these other cells (Sager et al. 2007,
41 TPWD 2009c).

42 The toxins released by golden alga also affect nonprey organisms that breathe using gills.
43 Susceptible organisms in inland Texas include all fish species, bivalve mollusks (such as
44 clams), gill-breathing amphibians (such as tadpoles), crustaceans (such as crayfish), and some
45 plankton (Sager et al. 2007). Golden alga releases at least two compounds that become toxic
46 when they combine with positively charged ions (cations) in the water [such as calcium (Ca^{+2}),
47 magnesium (Mg^{+2}), and potassium (K^{+1})]. Thus, the nature of the toxins formed is dependent on

1 local water chemistry, and there usually is a combination of toxins present in the water
2 (TPWD 2009c).

3 The golden alga toxins affect gill-breathing organisms by disrupting the selective permeability of
4 exposed cells, such as those on the surface of the gills. The outer cell layers are damaged
5 initially as excess water and chemicals enter the cells, causing them to die or rupture. As the
6 damage extends inward, the gills become unable to function, their blood vessels leak, and the
7 gills hemorrhage into the water. Bleeding also occurs from other exposed tissues, such as the
8 fins. Cells of internal tissues can be damaged as well through exposure to toxins that have
9 entered the fish's systemic circulation. The toxins have not been shown to affect humans or
10 other organisms without gills. Wildlife have been observed to be unaffected by contacting or
11 drinking water or eating fish containing the toxin, probably because of the protection provided by
12 their relatively impermeable skin and the breakdown of the toxins by the acidic conditions in the
13 stomach (TPWD 2009c).

14 *P. parvum* occurs worldwide in estuarine waters, and it also occurs in certain bodies of fresh
15 water that have relatively high salt or mineral content, as is the case for the inland waters where
16 it has caused fish kills in Texas. Fish kills described in Texas as early as the 1950s may have
17 been caused by golden alga. This species was first documented in the United States in 1985 in
18 conjunction with a fish kill on the Pecos River in Texas, and it has since caused fish kills in the
19 Brazos, Canadian, Colorado, and Red River basins of Texas. It is not known if golden alga is
20 native or an invasive species that was introduced to North America unintentionally, but it was
21 not identified prior to 1985 (TPWD 2009c).

22 A bloom is an explosive increase in the population of one or more alga species. As the
23 percentage of golden alga within the algal community of a waterbody increases beyond
24 50 percent and the species becomes dominant, there is a possibility of a golden alga bloom,
25 which may result in a fish kill. However, a fish kill may not occur even when golden alga
26 dominates the phytoplankton community, depending on whether certain conditions are present
27 (TPWD 2009c).

28 The conditions that promote fish kills by golden alga are not well understood and are the subject
29 of ongoing research by scientists. Certain conditions that are stressful to golden alga have
30 been found to be associated with increased toxicity, such as low temperatures, low nutrient
31 levels, low salinity, and high pH (TWRI 2009, Wythe 2008). It is an apparent paradox that
32 golden alga grows optimally at warm temperatures of 25 to 30°C (77 to 86°F), yet it blooms in
33 Texas mainly in winter. Thus, the majority of fish kills due to golden alga take place during
34 winter when the water is cold. This may be because such conditions are not favorable for the
35 growth of green algae, resulting in reduced competition for golden alga under cold conditions
36 (TPWD 2009c). Recent field experiments in the area of Lake Granbury also suggest that
37 cyanobacteria (often referred to as blue-green algae), which produce a variety of cyanotoxins
38 that impair competitors, may suppress the growth of golden alga and prevent or reduce golden
39 alga blooms in lakes with high cyanobacteria populations (TWRI 2009, Wythe 2008). Thus, if
40 cyanobacteria proliferate in warmer water, golden alga blooms could be suppressed.

41 Golden alga has been reported in at least 16 states, and blooms appear to have been occurring
42 with increasing frequency in inland waters, particularly in west Texas. Golden alga has caused
43 fish kills in five major river systems in Texas. In the Brazos River basin, fish kills have occurred
44 in Possum Kingdom Reservoir, Lake Granbury, Lake Whitney, and the Brazos River itself, as
45 well as in two smaller lakes and two creeks. Millions of fish have been killed by golden alga in
46 the Brazos River basin since the 1980s. Lake Granbury has relatively recently experienced
47 major fish kills as a result of golden alga blooms. Over 4 million fish died in a bloom on Lake
48 Granbury in the winter and spring of 2005 (TPWD 2009c, TWRI 2009). There currently is no

1 effective method for controlling golden alga blooms in large reservoirs and rivers
2 (TPWD 2009c).

3 **Benthic Macroinvertebrate Community.** The community of bottom-dwelling, macroscopic
4 invertebrates inhabiting Lake Granbury was sampled in conjunction with a 9-month ecological
5 study of the lake completed in 2008 (Bio-West 2008a). This study involved four seasonal
6 sampling events (in 2007 and 2008) at four sites in the lower reach of the lake, as described
7 above. At each site, the benthic invertebrate community was sampled using a Ponar sampler to
8 collect three grab samples of substrate from the lake bottom. The three grab samples were
9 combined to produce one composite sample representative of each site. At a laboratory, the
10 benthic invertebrates present in the composite samples were identified and counted. Insects
11 were identified to the level of genus, and non-insects were identified to the lowest taxonomic
12 level possible.

13 The 2007–2008 survey of the lower reach of Lake Granbury (Bio-West 2008a) found the benthic
14 macroinvertebrate community to be limited in diversity and abundance. The organisms
15 collected were dominated by three families of Dipteran insects: midges (Chironomidae),
16 phantom midges (Chaoboridae), and black flies (Simuliidae). Other insect orders were
17 represented by only a few individuals. Similarly, only one or two individuals were collected from
18 other major invertebrate taxa: water fleas (class Crustacea), snails (class Gastropoda), and
19 segmented worms (phylum Annelida) (Bio-West 2008a).

20 Populations of invertebrates in Lake Granbury have been adversely affected by golden alga
21 (TPWD 2009c). Most aquatic insects are not affected by golden alga toxins. Invertebrates
22 inhabiting ponds and reservoirs in Texas that may be susceptible to the toxins include bivalve
23 mollusks, such as clams, and crustaceans, such as crayfish (Sager et al. 2007).

24 **Fish Community.** The fish community of Lake Granbury has been characterized since 1998 by
25 routine surveys conducted by the TPWD in conjunction with its Statewide Freshwater Fisheries
26 Monitoring and Management Program. The most recent TPWD survey was performed in 2005–
27 2006 (Baird and Tibbs 2006). It collected data at 38 sampling stations in the middle reaches of
28 Lake Granbury. The most downstream TPWD station was located about 7 mi upstream of the
29 dam.

30 The TPWD survey focused on major sport fish species and important prey species. The TPWD
31 report described the habitat of Lake Granbury as moderately eutrophic (waters containing
32 moderate levels of nutrients), with few species of aquatic vegetation. A few parts of the upper
33 reservoir support areas of emergent vegetation such as cattail (*Typha* spp.) and bulrush
34 (*Scirpus* spp.), but there is little to no submerged vegetation, and nuisance macrophytes are not
35 a problem in the lake. Physical structure providing habitat within the littoral zone of the lake
36 includes extensive shoreline bulkheads; riprap; natural bluffs; boat docks; and stumps, dead
37 trees, and standing timber (Baird and Tibbs 2006).

38 Lake Granbury was initially stocked in 1969 with largemouth bass (*Micropterus salmoides*) and
39 channel catfish (*Ictalurus punctatus*). Largemouth bass subsequently were stocked in 1970,
40 1972, and 1993. A subspecies, the Florida largemouth bass (*M. salmoides floridanus*) also was
41 stocked on a limited basis in 1986 and extensively in 1989, 1994, 1995, 2003, 2004, and 2008.
42 Channel catfish were stocked only one additional time in 1993. Striped bass (*Morone saxatilis*)
43 fingerlings were stocked into Lake Granbury in 1972 and, with few exceptions, have been
44 stocked annually since then. Blue catfish (*I. furcatus*) were stocked, with limited success, only
45 in 1991. Prey species of fish were never stocked into Lake Granbury (Baird and Tibbs 2006,
46 TPWD 2009e).

1 The 2005–2006 TPWD survey utilized three methods, trap netting, gillnetting, and electrofishing,
 2 to collect fishes from multiple locations randomly selected within the middle reaches of Lake
 3 Granbury. Gillnetting and trap netting were each conducted for ten nights at ten stations, and
 4 catch per unit effort (CPUE) was recorded for each method as the number of fish caught per net
 5 night. Electrofishing was conducted for 5 minutes at each of 18 stations (a total of 1.5 hr), and
 6 CPUE was recorded as the number of fish caught per hour of electrofishing.

7 Table 2-14 summarizes catch rates from the surveys since 1998 and, as an indication of relative
 8 numbers collected recently, provides the numbers of fish of each target species collected in
 9 2005–2006. The sport fishes collected included the stocked species identified above (except for
 10 blue catfish) as well as white bass (*Morone chrysops*), white crappie (*Pomoxis annularis*),
 11 bluegill (*Lepomis macrochirus*), green sunfish (*L. cyanellus*), longear sunfish (*L. megalotis*), and
 12 redear sunfish (*L. microlophus*). The forage species collected were gizzard shad
 13 (*Dorosoma cepedianum*) and threadfin shad (*D. petenense*) (Baird and Tibbs 2006).

Table 2-14. Fish Numbers and Catch Rates from 2005–2006 and Previous TPWD Surveys of Lake Granbury

Species	Total CPUE and Number of Fish Collected ^{(a)(b)}					
	2005–2006	2004	2003	2002	2001	1998
Gizzard shad	99.3 (149)	–	68.0 (102)	55.3 (83)	102.7 (154)	84.7 (127)
Threadfin shad	14.0 (21)	–	–	–	–	–
Channel catfish	2.4 (24)	4.8 (48)	4.5 (49)	5.0 (50)	5.5 (55)	3.9 (39)
White bass	2.7 (27)	5.6 (56)	0.5 (6)	2.3 (23)	1.9 (19)	2.3 (23)
Striped bass	0.2 (2)	1.7 (17)	0.2 (2)	1.9 (19)	0.4 (4)	1.7 (17)
Green sunfish	8.7 (13)	–	–	–	–	–
Warmouth	2.0 (3)	–	–	–	–	–
Bluegill	103.3 (155)	–	151.3 (227)	232.7 (349)	194.7 (292)	239.3 (359)
Longear sunfish	8.0 (12)	–	–	–	–	–
Redear sunfish	4.0 (6)	–	–	–	–	–
Largemouth bass	30.7 (46)	–	65.3 (98)	44.0 (66)	60.0 (90)	83.3 (125)
White crappie	2.5 (25)	–	2.0 (20)	4.4 (44)	3.3 (33)	9.3 (93)

Adapted from Baird and Tibbs (2006).

(a) CPUE = catch per unit effort

(b) CPUE is followed by the number of fish collected (in parentheses).

14 Fish populations in Lake Granbury have been adversely affected since 2001 by golden alga
 15 (TPWD 2009c), as discussed above as part of the plankton community. The monitoring results
 16 indicated that catch rates for largemouth bass were reduced to well below the levels from before
 17 2001. Catch rates for striped bass also were reduced considerably. White bass catch rates
 18 historically have been highly variable, and 2005 rates were slightly above average. White
 19 crappie catch rates were low and indicative of a low-density population, although the individuals
 20 were relatively large and similar in size to those in previous surveys. Channel catfish catch
 21 rates in 2006 were reduced relative to previous years, although the population continues to
 22 recruit young fish to legal sizes. Bluegill catch rates were much reduced in 2005, and the
 23 population continued to be dominated by smaller fish. Other sunfish were a minimal component
 24 of the prey base of the lake. The prey base was dominated by the gizzard shad population,

1 which had returned to a level similar to that present before golden alga fish kills began, while
 2 threadfin shad catch rates remained low (Baird and Tibbs 2006).
 3 Additional fisheries data were collected separately in conjunction with a 9-month ecological
 4 study of Lake Granbury completed in 2008 (Bio-West 2008a). This study involved four seasonal
 5 sampling events (in 2007 and 2008) at four locations in the lower reach of the lake, as described
 6 above. The area of the reservoir sampled in this study is about 5 mi downstream of the area
 7 included in the 2005–2006 TPWD study. The fish community of the lake was sampled in three
 8 of the four sampling events, but not in spring 2007. The fish community was sampled at each of
 9 the four sample sites using an experimental gill net with a length of 38.1 m (125 ft) and mesh
 10 sizes ranging from 2.5 to 7.6 cm (1.0 to 3.0 in.). The nets were set and left overnight for a
 11 duration of 13 hr to 16 hr. For each fish captured, total length (mm) and weight (gm) were
 12 recorded prior to release (Bio-West 2008a). The fish species known to currently occur in Lake
 13 Granbury based on this study and the 2005–2006 TPWD survey are summarized in Table 2-15.

Table 2-15. Fish Species Occurring in Lake Granbury^(a)

Scientific Family	Scientific Name	Common Name
Catostomidae	<i>Ictiobus bubalus</i>	Smallmouth buffalo ^(c)
Centrarchidae	<i>Lepomis cyanellus</i>	Green sunfish ^(b)
	<i>Lepomis gulosus</i>	Warmouth ^(b)
	<i>Lepomis macrochirus</i>	Bluegill ^(b, c)
	<i>Lepomis megalotis</i>	Longear sunfish ^(b, c)
	<i>Lepomis microlophus</i>	Redear sunfish ^(b)
	<i>Micropterus salmoides</i>	Largemouth bass ^(b)
	<i>Pomoxis annularis</i>	White crappie ^(b, c)
Clupeidae	<i>Dorosoma cepedianum</i>	Gizzard shad ^(b, c)
	<i>Dorosoma petenense</i>	Threadfin shad ^(b)
Cyprinidae	<i>Cyprinus carpio</i>	Common carp ^(b)
Ictaluridae	<i>Ictalurus punctatus</i>	Channel catfish ^(b, c)
Moronidae	<i>Morone chrysops</i>	White bass ^(b, c)
	<i>Morone saxatilis</i>	Striped bass ^(b, c)
Sciaenidae	<i>Aplodinotus grunniens</i>	Freshwater drum ^(c)

(a) These species were collected in the two most recent surveys:

(b) in 2005–2006 (Baird and Tibbs 2006)

(c) in 2007-2008 (Bio-West 2008a).

14 All fish species in the lake potentially are susceptible to being affected and killed by the toxins
 15 released by golden alga blooms. The numbers of fish killed is dependent on the amount of toxin
 16 present in the water, which is affected by the duration of the bloom. Fish kills can last for days,
 17 weeks, or months, and the locations in a waterbody that are affected can change rapidly, even
 18 daily. All populations of the fish community may be reduced if a toxic bloom lasts many months
 19 and fish are killed in large portions of the waterbody (TPWD 2009c). Algal blooms have been
 20 found not to occur simultaneously throughout Lake Granbury (Wythe 2008), and most fish kills
 21 do not affect an entire lake for the entire duration of the event (TPWD 2009c). When a toxic
 22 bloom lasts only a month or less, the fish community usually is only partially affected and can
 23 recover more quickly (TPWD 2009c).

1 Small forage fish (such as shad, sunfish, and minnows) usually are the first to die. The
2 numbers of fish killed in Texas have been dominated by forage species, mainly gizzard shad
3 and threadfin shad. Forage fish produce large numbers of eggs and grow quickly, allowing their
4 populations to recover rapidly if there is sufficient time between golden alga blooms that cause
5 fish kills (TPWD 2009c). Thus, the populations of smaller fish composing the prey base of these
6 sport fish generally have rebounded each year from the effects of golden alga toxicity. Although
7 the gizzard shad population in 2005 had returned to pre-golden-alga levels, populations of
8 threadfin shad, as well as bluegill and other sunfish, remained relatively low (Baird and Tibbs
9 2006). Larger species, including most game fishes (such as largemouth bass, striped bass,
10 white bass, crappie, and catfish), reproduce more slowly and are dependent on forage fishes for
11 food, so recovery of the populations of larger species can take years and may require stocking
12 (TPWD 2009c). Populations of game fish in Lake Granbury have been reduced annually since
13 2001 by toxic golden alga blooms. To mitigate these losses to the most important game fish
14 species in the lake, striped bass have been stocked annually, and Florida largemouth bass have
15 been stocked intermittently, including in 2008 (Baird and Tibbs 2006).

16 ***Squaw Creek Reservoir***

17 SCR was formed when a dam on Squaw Creek was completed in 1977 at a point approximately
18 7 mi southwest of the DeCordova Bend Dam on Lake Granbury. From the Squaw Creek Dam,
19 Squaw Creek flows approximately 4.3 mi southeast to the Paluxy River, immediately above its
20 confluence with the Brazos River, about 35 river mi downstream of Lake Granbury. When at its
21 conservation pool elevation of 775 ft MSL, SCR is approximately 5 mi long and has 36 mi of
22 shoreline, a volume of 151,418 ac-ft, and a surface area of 3,297 ac (Luminant 2009a). SCR
23 has an average depth of about 46 ft and a maximum depth of 135 ft and drains an area of
24 64 mi² (Luminant 2009a). Squaw Creek is a small stream with seasonal flows and provides
25 very little inflow to SCR. Water is routinely discharged from the lake via the spillway to maintain
26 a minimum flow of 1.5 cfs in Squaw Creek below SCR (Luminant 2009a). As described in
27 Chapter 3, CPNPP Units 3 and 4 would not utilize SCR for cooling water; consequently, the
28 proposed facility would have only a minimal potential to affect the aquatic ecology of SCR or
29 Squaw Creek.

30 An ecological study was conducted in 2007-2008 to characterize the aquatic community of SCR
31 throughout the four seasons. This study involved four principal sampling events, in February,
32 May, September, and November 2007, at six locations within the lake, as well as one location
33 on Squaw Creek 1.4 km below the dam. The six lake locations included three in shallow, littoral
34 areas in coves (depths ranging from less than 1 m to 7 m) and three in deeper, open-water
35 areas (depths ranging from 8 m to 22 m) of the lake (Bio-West 2008b). The aquatic biological
36 community of SCR includes plankton, benthic macroinvertebrate, and fish communities, which
37 are discussed below.

38 **Plankton Community.** Data on the plankton community of SCR were collected in conjunction
39 with a 9-month ecological study of SCR completed in 2007 (Bio-West 2008b). Plankton were
40 sampled in February, May, September, and November 2007 using a vertically towed plankton
41 net with 80-micron mesh. Rotifers were the dominant planktonic animals collected in all
42 seasons except summer. Juvenile copepods were by far the most abundant species in summer
43 and were the next most numerous species in other seasons. Two families of water fleas
44 (crustaceans of the order Cladocera) also were represented. Additional samples were collected
45 at all seven sites during the summer sampling event to look for golden alga, but no golden alga
46 cells were found (Bio-West 2008b).

47 **Benthic Macroinvertebrate Community.** The invertebrate community of SCR was sampled in
48 February, May, September, and November 2007 using a Ponar sampler and D-frame nets. Six

1 locations in the lake were sampled: three shallow-water (littoral) and three deep-water (open-
2 water) sites. The most abundant invertebrates collected in all seasons were insects of the order
3 Diptera (flies), which were dominated by midges (family Chironomidae). The next most
4 numerous taxa by season were snails in winter, amphipods in spring, other Dipteran insect
5 families in summer, and damselflies (family Coenagrionidae) in fall. Benthic macroinvertebrates
6 were rare at the open-water sites; only midges were collected. The littoral sites exhibited
7 greater abundance and diversity, with highest numbers in spring (Bio-West 2008b).

8 **Fish Community.** Data characterizing the fish community of SCR were collected in conjunction
9 with the four-season ecological study of SCR completed in 2008 (Bio-West 2008b). Fishes
10 were collected at the six lake sampling locations in two seasons, winter (February 2007) and
11 summer (September 2007). In addition, a supplemental winter survey (January 2008) was
12 performed at the two locations, one littoral and one open-water, nearest the CPNPP facility.
13 The fish community was sampled at each of the four sample sites using an experimental gill net
14 with a length of 38.1 m (125 ft) and mesh sizes ranging from 2.5 to 7.6 cm (1.0 to 3.0 in.). The
15 nets were set and left overnight for a duration of 14 to 17 hr. Captured fish were identified to
16 species, and their total length and weight were recorded before their release (Bio-West 2008b).
17 The fishes collected in this 2007-2008 survey are identified in Table 2-16.

18 A previous survey of the fish community of SCR was performed in 1987, prior to operation of
19 CPNPP Units 1 and 2 (Luminant 2009a). The species identified in that study also are included
20 in Table 2-16, providing an indication of species that were present in the reservoir historically.
21 Some of these species, although not collected in the most recent survey, potentially could still
22 be present. However, many species (including walleye [*Sander vitreus*], smallmouth bass
23 [*Micropterus dolomieu*] and hybrid striper [*Morone saxatilis* X *M. chrysops*]) likely are no longer
24 present due to temperatures in the lake during the summer that exceed their upper tolerances.
25 The dominant species in terms of the number of individuals collected in all locations and both
26 seasons was the channel catfish (270 individuals). The next most common species collected
27 were freshwater drum (*Aplodinotus grunniens*) (25) at the open-water locations and largemouth
28 bass (45) at the littoral locations.

29 The fish community of Squaw Creek downstream of SCR was surveyed in conjunction with the
30 four-season ecological study of SCR completed in 2008 (Bio-West 2008b). One location on
31 Squaw Creek, 1.4 km below the dam, was sampled when the reservoir was sampled, in winter
32 (February 2007) and summer (September 2007). Sampling took place within a 55 m reach of
33 the creek using a backpack electrofisher and several types of seines with variable mesh sizes.
34 Captured fish were identified to species, and their total length (millimeters) and weight (grams)
35 were recorded before their release. The most numerous species collected in the creek was
36 gambusia (*Gambusia* sp.), of which 60 individuals were found only in winter. The next most
37 numerous species at the creek location was inland silverside (*Menidia beryllina*), of which 6
38 individuals were found only in winter. Other species collected in the creek included bluegill (5),
39 largemouth bass (2), and green sunfish (1) (Bio-West 2008b).

40 **Brazos River**

41 The Brazos River is the longest river in Texas. Its main stem originates at the confluence of its
42 two upper forks, the Double Mountain Fork and Salt Fork, in Stonewall County and is joined
43 downstream by the Clear Fork. From its origin in northwestern Texas, the Brazos flows
44 generally southeast to its mouth on the Gulf of Mexico near Freeport, extending about 840 river
45 mi across the state. Its watershed, which reaches from New Mexico to the Gulf, covers over
46 44,600 sq mi (Hendrickson 2002).

Table 2-16. Fish Species Occurring in Squaw Creek Reservoir^(a)

Scientific Family	Scientific Name	Common Name
Atherinopsidae	<i>Menidia beryllina</i>	Inland silverside ^(b)
Catostomidae	<i>Carpiodes carpio</i>	River carpsucker ^(b)
	<i>Moxostoma carinatum</i>	Redhorse sucker ^(b)
Centrarchidae	<i>Lepomis auritus</i>	Redbreast sunfish ^(b)
	<i>Lepomis cyanellus</i>	Green sunfish ^(b, c)
	<i>Lepomis gulosus</i>	Warmouth ^(b)
	<i>Lepomis macrochirus</i>	Bluegill ^(b, c)
	<i>Lepomis megalotis</i>	Longear sunfish ^(b)
	<i>Lepomis microlophus</i>	Redear sunfish ^(b)
	<i>Micropterus dolomieu</i>	Smallmouth bass ^(b)
	<i>Micropterus salmoides</i>	Largemouth bass ^(b, c)
	<i>Pomoxis annularis</i>	White crappie ^(b)
	Clupeidae	<i>Dorosoma cepedianum</i>
<i>Dorosoma petenense</i>		Threadfin shad ^(b, c)
Cyprinidae	<i>Cyprinus carpio</i>	Common carp ^(b, c)
	<i>Notemigonus crysoleucas</i>	Golden shiner ^(b)
Ictaluridae	<i>Ameiurus melas</i>	Black bullhead ^(b)
	<i>Ameiurus natalis</i>	Yellow bullhead ^(b)
	<i>Ictalurus furcatus</i>	Blue catfish ^(c)
	<i>Ictalurus punctatus</i>	Channel catfish ^(b, c)
	<i>Pylodictis olivaris</i>	Flathead catfish ^(c)
Moronidae	<i>M. saxatilis</i> X <i>M. chrysops</i>	Hybrid striper ^(b)
	<i>Morone chrysops</i>	White bass ^(b)
Percidae	<i>Etheostoma chlorosoma</i>	Bluntnose darter ^(b)
	<i>Etheostoma gracile</i>	Slough darter ^(b)
	<i>Percina caprodes</i>	Log perch ^(b)
	<i>Sander vitreus</i>	Walleye ^(b)
Sciaenidae	<i>Aplodinotus grunniens</i>	Freshwater drum ^(b, c)

(a) These species were collected in the two most recent surveys:

(b) In 1987 (Luminant 2009a).

(c) In 2007–2008 (Bio-West 2008b).

- 1 Water released to Squaw Creek from SCR flows into the Paluxy River near its confluence with
2 the Brazos River. During the period 1994 to 2006, an average of 34,128 ac-ft/yr was diverted
3 from the Brazos River at Lake Granbury and pumped to SCR to provide makeup water. Also
4 during this period, an average of 21,678 ac-ft/yr of surface water from SCR was released
5 through the spillway to flow back into the Brazos River near Glen Rose (Luminant 2009a), about
6 35 river mi downstream of Lake Granbury. Thus, the operation of CPNPP Units 1 and 2
7 resulted on average in the net removal of approximately 12,450 ac-ft/yr from the Brazos River
8 drainage.
- 9 The Brazos River below Lake Granbury and above the backwaters of Lake Whitney has been
10 described as being scenic and meandering extensively as it flows through rolling hills covered

1 with oaks and cedar. Substrates in this reach are mainly sand and rocks, with several limestone
2 outcroppings present, especially near the mouth of the Paluxy River (TPWD 1974).

3 In conjunction with the 2007–2008 survey of Lake Granbury, an ecological study was conducted
4 to characterize the aquatic community of the Brazos River downstream of Lake Granbury
5 throughout the four seasons. One location (BR-1) on the river 2.9 km (1.8 mi) below the
6 DeCordova Bend Dam was sampled. As for the lake, the survey of the river location involved
7 four seasonal sampling events (in May, September, and November 2007 and January 2008).
8 Site BR-1 extended approximately 75 m along the river to encompass a range of riverine
9 habitats, including riffles, runs, pools, backwaters, and side channels. Substrates in these
10 habitats included gravel, cobble, and bedrock in the main channel and silt in the backwaters.
11 The width of the river in this reach ranges from 33 m to 115 m and varies with flow conditions
12 (Bio-West 2008a).

13 The aquatic biological community of the Brazos River includes plankton, benthic
14 macroinvertebrate, and fish communities, which are discussed below.

15 **Plankton Community.** Data on the plankton community of the Brazos River were collected in
16 conjunction with the 2007–2008 ecological study of Lake Granbury (Bio-West 2008a).
17 Zooplankton were sampled at site BR-1 in May, September, and November 2007 and January
18 2008. A vertically towed plankton net with 80-micron mesh was utilized. The dominant
19 planktonic organisms collected in all four seasons were copepods, with the majority in the larval
20 (nauplius) stage. As in Lake Granbury, copepods were followed in abundance by rotifers and
21 water fleas (crustaceans of the order Cladocera) (Bio-West 2008a).

22 **Invertebrate Community.** To characterize the invertebrate community downstream of the
23 DeCordova Bend Dam, benthic invertebrates were collected in conjunction with the 2007–2008
24 ecological study. Benthic invertebrates were sampled at site BR-1 in May, September, and
25 November 2007 and January 2008 using D-frame nets in the various habitats within the site
26 reach, including riffles, runs, pools, backwaters, and side channels. All organisms collected
27 were preserved in the field and identified in the laboratory. Insects were identified to genus,
28 non-insects were identified to the lowest taxon possible, and the number of individuals in each
29 taxon was recorded (Bio-West 2008a).

30 The invertebrate sampling in the Brazos River downstream from Lake Granbury identified
31 insects as the dominant class. The greatest insect diversity was recorded in the summer
32 sampling, with 29 genera identified. The greatest abundance of aquatic insects was recorded in
33 the fall, when the preponderance of individuals counted were black flies (family Simuliidae) and
34 caddisflies (family Hydropsychidae). The abundance and diversity of caddisflies
35 (Order Trichoptera) and mayflies (Order Ephemeroptera) observed are considered indications of
36 a relatively healthy aquatic environment in this reach of the river. Other than insects, the only
37 invertebrates collected were freshwater snails and a mud crab (*Rhithropanopeus* sp.)
38 (Bio-West 2008a).

39 **Fish Community.** The fish community within the middle reaches of the Brazos River has been
40 affected by habitat alterations downstream of three major reservoirs: PKL, Lake Granbury, and
41 Lake Whitney. PKL is impounded by the Morris Sheppard Dam, which contains hydroelectric
42 generators. Depending on pool elevation and the local need for power, the dam releases colder
43 water from the hypolimnion of the reservoir to generate power. These releases have altered the
44 thermal regime of the river up to 75 mi downstream and, in conjunction with the associated
45 effects on water chemistry, are likely responsible for the extirpation of at least four fish species
46 downstream. Lakes Granbury and Whitney also have contributed to habitat modifications within
47 the middle and lower Brazos River and affected the ability of river habitats in these reaches to
48 support certain native fishes (USFWS 2008a).

1 To characterize the species composition of the fish community in the Brazos River between
2 Lake Granbury and Lake Whitney, the staff initially identified a list of fish species that occur in
3 the greater Brazos River drainage, extending from the headwaters to the coast (Hassan-
4 Williams and Bonner 2007). A subset of species then was identified by reviewing range maps
5 for these species (Lee et al. 1980) to determine their potential for occurrence in the vicinity of
6 the river reach between Lakes Granbury and Whitney. This group of species was further
7 refined by evaluating the degree of similarity between their preferred habitats (Hassan-Williams
8 and Bonner 2007) and the habitats likely to be available in this river reach. The potentially
9 occurring fishes thus identified are listed in Table 2-17.

10 To characterize the fish community immediately downstream of the DeCordova Bend Dam, fish
11 were collected in conjunction with the 9-month ecological study of Lake Granbury completed in
12 2008 (Bio-West 2008a). As described above, this study involved four seasonal sampling events
13 (in 2007 and 2008) at four sites in the lower reach of the lake, and it also included one site
14 (BR-1) on the Brazos River 2.9 km (1.8 mi) below the dam. The fish community was sampled at
15 site BR-1 using a backpack electrofisher and several types of seines, including bag seines and
16 straight seines. For each fish captured, total length and weight were recorded prior to release
17 (Bio-West 2008a). Fish identified in this survey are included in Table 2-14.

18 ***Possum Kingdom Lake***

19 PKL was created in 1941 by completion of the Morris Sheppard Dam on the Brazos River
20 northwest of Fort Worth in Palo Pinto County, with the upper reaches of the lake extending into
21 Stephens and Young Counties. The reservoir was built primarily for water conservation and
22 flood control, but it also is a hydroelectric generating facility, with two 11,250-kW generators that
23 supply electricity during periods of peak demand. The dam is 190-ft high and 2,700-ft long.
24 PKL has a surface area of approximately 17,700 ac, 310 mi of shoreline, and a drainage area of
25 14,030 sq mi. It has an average depth of about 37 ft, a maximum depth of 145 ft, and a depth of
26 approximately 100 ft at the dam (BRA 2010; TPWD 2009g). The volume of PKL is
27 556,200 ac-ft, and its conservation pool elevation is 1,000 ft MSL (BRA 2010). The PKL dam is
28 approximately 122 river mi upstream of the upper end of Lake Granbury to the southeast
29 (TPWD 1974).

30 Most of the shoreline of PKL is covered by cobble and larger-size rock. The lower portion of the
31 lake has rock cliffs and bluffs, while the upper reaches extend into shallower areas with
32 vegetation along the shoreline. Points and drop-offs occur throughout the lake, and there are
33 many boat docks present. Physical structure providing habitat within the littoral zone of the lake
34 includes natural rock and riprap; natural bluffs; boat docks; and stumps, fallen dead trees, and
35 standing timber. Aquatic vegetation in PKL includes emergent rushes at depths of 2 ft to 3 ft in
36 the middle to upper portions of the lake, and submerged vegetation throughout littoral areas of
37 the lake in late summer and fall (TPWD 2009g). PKL has no significant history of
38 vegetation/habitat management and has no problems with noxious vegetation (Howell and
39 Mauk 2007).

40 The aquatic biological community of PKL comprises plankton, benthic macroinvertebrate, and
41 fish communities that are likely to be similar to those described above for Lake Granbury,
42 including the presence of golden alga in the plankton community. As is the case for Lake
43 Granbury, the fish community of PKL has been characterized since 1999 by routine surveys
44 conducted by the TPWD in conjunction with its Statewide Freshwater Fisheries Monitoring and
45 Management Program. The most recent TPWD survey was performed in 2006–2007. It
46 collected data in PKL by gill netting and net trapping at 15 sampling stations and by
47 electrofishing at 24 stations (Howell and Mauk 2007).

Table 2-17. Fish Species Potentially Occurring in the Brazos River between Lake Granbury and Lake Whitney^(a)

Scientific Family	Scientific Name	Common Name
Atherinopsidae	<i>Menidia beryllina</i>	Inland silverside ^(b)
Catostomidae	<i>Carpionodes carpio</i>	River carpsucker
	<i>Ictiobus bubalus</i>	Smallmouth buffalo
Centrarchidae	<i>Lepomis cyanellus</i>	Green sunfish ^(b)
	<i>Lepomis macrochirus</i>	Bluegill ^(b)
	<i>Lepomis megalotis</i>	Longear sunfish ^(b)
	<i>Lepomis microlophus</i>	Redear sunfish ^(b)
	<i>Micropterus punctulatus</i>	Spotted bass
	<i>Micropterus salmoides</i>	Largemouth bass ^(b)
Clupeidae	<i>Dorosoma cepedianum</i>	Gizzard shad ^(b)
	<i>Dorosoma petenense</i>	Threadfin shad
Cyprinidae	<i>Campostoma anomalum</i>	Central stoneroller
	<i>Cyprinella lutrensis</i>	Red shiner ^(b)
	<i>Cyprinella venusta</i>	Blacktail shiner ^(b)
	<i>Cyprinus carpio</i>	Common carp ^(b)
	<i>Hybognathus placitus</i>	Plains minnow
	<i>Notropis buchanani</i>	Ghost shiner
	<i>Notropis potteri</i>	Chub shiner
	<i>Notropis volucellus</i>	Mimic shiner
	<i>Pimephales vigilax</i>	Bullhead minnow ^(b)
Fundulidae	<i>Fundulus zebrinus</i>	Plains killifish
Ictaluridae	<i>Ameiurus melas</i>	Black bullhead
	<i>Ameiurus natalis</i>	Yellow bullhead
	<i>Ictalurus furcatus</i>	Blue catfish ^(b)
	<i>Ictalurus punctatus</i>	Channel catfish ^(b)
	<i>Noturus nocturnus</i>	Freckled madtom
	<i>Pylodictus olivaris</i>	Flathead catfish ^(b)
Lepisosteidae	<i>Atractosteus spatula</i>	Alligator gar
	<i>Lepisosteus osseus</i>	Longnose gar ^(b)
Moronidae	<i>Morone chrysops</i>	White bass ^(b)
Percidae	<i>Etheostoma spectabile</i>	Orangethroat darter ^(b)
	<i>Percina sciera</i>	Dusky darter ^(b)
Poeciliidae	<i>Gambusia</i> sp.	Gambusia ^(b)
Sciaenidae	<i>Aplodinotus grunniens</i>	Freshwater drum ^(b)

(a) Species list developed by identifying from a list of species occurring in the greater Brazos River drainage (Hassan-Williams and Bonner 2007) those species that may occur in this reach based on range maps (Lee et al. 1980), then considering the potential presence in this river reach of habitat types preferred by each species (Hassan-Williams and Bonner 2007).

(b) These species were identified in fish surveys in 2007–2008 at a sample location on the Brazos River 1.8 mi downstream of the Lake Granbury dam (Bio-West 2008a).

1 The TPWD survey focused on major sport fish species and important prey species. PKL has
2 been stocked at irregular intervals since 1966 with largemouth bass, Florida largemouth bass,
3 smallmouth bass, striped bass, channel catfish, and blue catfish. A prey species, threadfin
4 shad, was stocked into PKL in 1980 and 2001 (Howell and Mauk 2007, TPWD 2009g). The fish
5 species collected in the TPWD survey included the species identified above for Lake Granbury
6 in Tables 2-12 and 2-13 as well as small numbers of black crappie (*Pomoxis nigropunctatus*),
7 blue catfish, longnose gar (*Lepisosteus osseus*), and river carpsucker (*Carpionodes carpio*). As
8 was discussed for Lake Granbury, fish populations in PKL also have been adversely affected
9 since at least 2001 by fish kills resulting from golden alga. In particular, striped bass
10 populations have been reduced drastically by golden alga (Howell and Mauk 2007).

11 ***Wheeler Branch Reservoir***

12 WBR is shown in Figure 2-7 and discussed in Section 2.3.2.1. This water supply reservoir was
13 built by the SCWD to provide water for the City of Glen Rose, the CPNPP site, and other
14 Somervell County users. The allocation for the CPNPP site is 28 percent of the total available
15 annual supply from the reservoir. WBR was built on a small tributary of the Paluxy River, and a
16 low channel dam was built on the Paluxy River at Glen Rose to allow water to be pumped from
17 the river to help fill and maintain the water level of the reservoir. The Wheeler Branch Dam was
18 completed in 2007, and filling of the reservoir was completed in 2008. The reservoir has a
19 surface area of 180 ac and a depth of 80 ft at the dam. Florida largemouth bass, smallmouth
20 bass, bluegill, and channel catfish fingerlings were first stocked in WBR in 2007. These species
21 were again stocked in 2008, and in 2009 smallmouth bass fingerlings and walleye fry were
22 released (TPWD 2010f).

23 **2.4.2.2 Aquatic Resources—Transmission Lines and Cooling-Water Pipelines**

24 This section describes the aquatic resources with the potential to be affected by the
25 transmission lines and cooling-water pipelines proposed for installation and operation in
26 conjunction with CPNPP Units 3 and 4. These transmission lines are described in Section 3.4,
27 and the land uses within the ROWs are described in Section 2.2.2. Of the four new
28 transmission lines, two would be added to vacant positions on existing towers, and two would
29 require ROW clearance and tower building. The exact routes to be followed by the two new
30 lines (DeCordova and Whitney) have not been determined pending completion of transmission
31 routing studies, so this description is based on the approximate routes shown in Figure 2-14.
32 The transmission line ROWs would not cross any designated critical habitats for aquatic
33 species.

34 As it leaves the CPNPP Units 3 and 4 switching station, the DeCordova transmission line would
35 cross Squaw Creek and several inlets along the shoreline of SCR (Figure 2-14). Its northern
36 end would cross the Brazos River near the DeCordova Bend Dam and Lake Granbury
37 approximately 1.7 mi upstream of the dam. Based on an ROW width of 160 ft, the total water
38 area within this ROW would be approximately 11 ac, 7.4 percent of the total ROW area
39 (Table 2-11). The areas of wooded wetlands that would be crossed are small, totaling about
40 1.6 ac, 1.1 percent of the ROW area (Table 2-11).

41 The Whitney transmission line would cross only one major waterbody, the Paluxy River. In
42 addition, it likely would cross several small tributaries of the Brazos River and Lake Whitney
43 (Figure 2-14). Based on an ROW width of 160 ft, the total water area within this ROW would be
44 approximately 3.1 ac, 0.3 percent of the total ROW area (Table 2-11). The areas of wooded
45 wetlands that would be crossed total about 23 ac, 2.4 percent of the ROW area (Table 2-11).

1 The cooling-water intake and blowdown discharge pipelines for the proposed CPNPP Units 3
2 and 4 mainly would follow an existing ROW containing the 48-in. water pipeline for Units 1 and 2
3 that connects Lake Granbury to SCR (Figure 2-5). ROWs for the new pipelines would diverge
4 from the existing ROW at each end: where they would extend around the south side of SCR,
5 and where the discharge pipeline would extend southeast from the intake location on Lake
6 Granbury to the discharge location near the dam. Aquatic resources within the ROW areas
7 where the pipelines potentially would be installed include stock ponds, several small tributaries
8 of the Brazos River, and Squaw Creek. The stock ponds are small, isolated, man-made
9 impoundments that provide minimal habitat for aquatic species. The tributaries are small,
10 intermittent streams (HDR 2008), which typically lack surface flow during dry periods and
11 support minimal aquatic communities. Squaw Creek immediately below the dam is a small
12 stream in which a minimum flow of 1.5 cfs is maintained by routine discharges from the dam
13 (Luminant 2009a). The pipeline ROWs would not cross any designated critical habitats for
14 aquatic species. A field check of the entire pipeline ROW in April and July of 2007 showed no
15 wetlands to be present (Luminant 2009a).

16 **2.4.2.3 Aquatic Resources—Wetlands**

17 Wetlands include swamps, marshes, and similar areas that are transitional between aquatic and
18 terrestrial communities. Wetlands are inundated or saturated by surface water or groundwater
19 at a frequency and duration sufficient to support, and that normally do support, a prevalence of
20 vegetation adapted for life in saturated soil conditions (Cowardin et al. 1979). Thus, a wetland
21 typically exhibits the following three characteristics (Mitsch and Gosselink 2000): water at the
22 surface or within the root zone, unique soil conditions different from adjacent uplands, and
23 hydrophytic vegetation with an absence of species intolerant of flooding.

24 Near Lake Granbury, wetlands have not been identified along the western bank in the areas
25 where the CPNPP Units 3 and 4 intake or discharge structures would be located. Near SCR,
26 emergent wetland vegetation along the shore of the SCR peninsula was delineated using Global
27 Positioning System (GPS) point coordinates obtained during a survey of the lake shoreline by
28 boat in February and May 2007 (Luminant 2009a). An April study focused on evaluating
29 emergent wetlands associated with the on-site ponds and SCR (Luminant 2009a). Wetlands at
30 the CPNPP site are dominated by a variety of emergent plant species. The herbaceous layer is
31 dominated by southern cattail (*Typha domingensis*) and broadleaf cattail (*T. latifolia*), along with
32 Roosevelt weed (*Bacharris neglecta*), bushy bluestem (*Andropogon glomeratus*), and spikerush
33 (*Eleocharis* sp.). The tree and shrub layers are dominated by black willow (*Salix nigra*),
34 buttonbush (*Cephalanthus occidentalis*), cottonwood (*Populus deltoides*), and saltcedar
35 (*Tamarix chinensis*).

36 A subsequent wetland delineation was undertaken to identify wetlands and other waterbodies
37 subject to the jurisdiction of the USACE in the vicinity of the proposed action (Enercon 2009).
38 These investigations documented the locations in SCR of emergent, littoral wetlands, which
39 occur in shallow water along the edges of lakes and reservoirs. Forty-eight littoral wetlands,
40 with a cumulative area of approximately 53 ac, were found to occur along the shoreline of SCR
41 (Figure 2-15). Due to inundation, a complete soil profile could not be obtained for all wetlands.
42 Thus, inundated wetlands were conservatively assumed to be hydric on the basis of the other
43 two positive indicators – hydrophytic vegetation and hydrology (Enercon 2009). Luminant has
44 not requested a wetland jurisdictional determination from the USACE (Luminant 2009a).

45 The majority of the wetlands associated with SCR are located along the shore of the reservoir
46 and are dominated by cattails. Wetland functionality is influenced by the time necessary for
47 water to move through the wetland, the size of the wetland, and the diversity of vegetation the
48 wetland supports. The functionality of the narrow, littoral wetlands on SCR is limited, and they

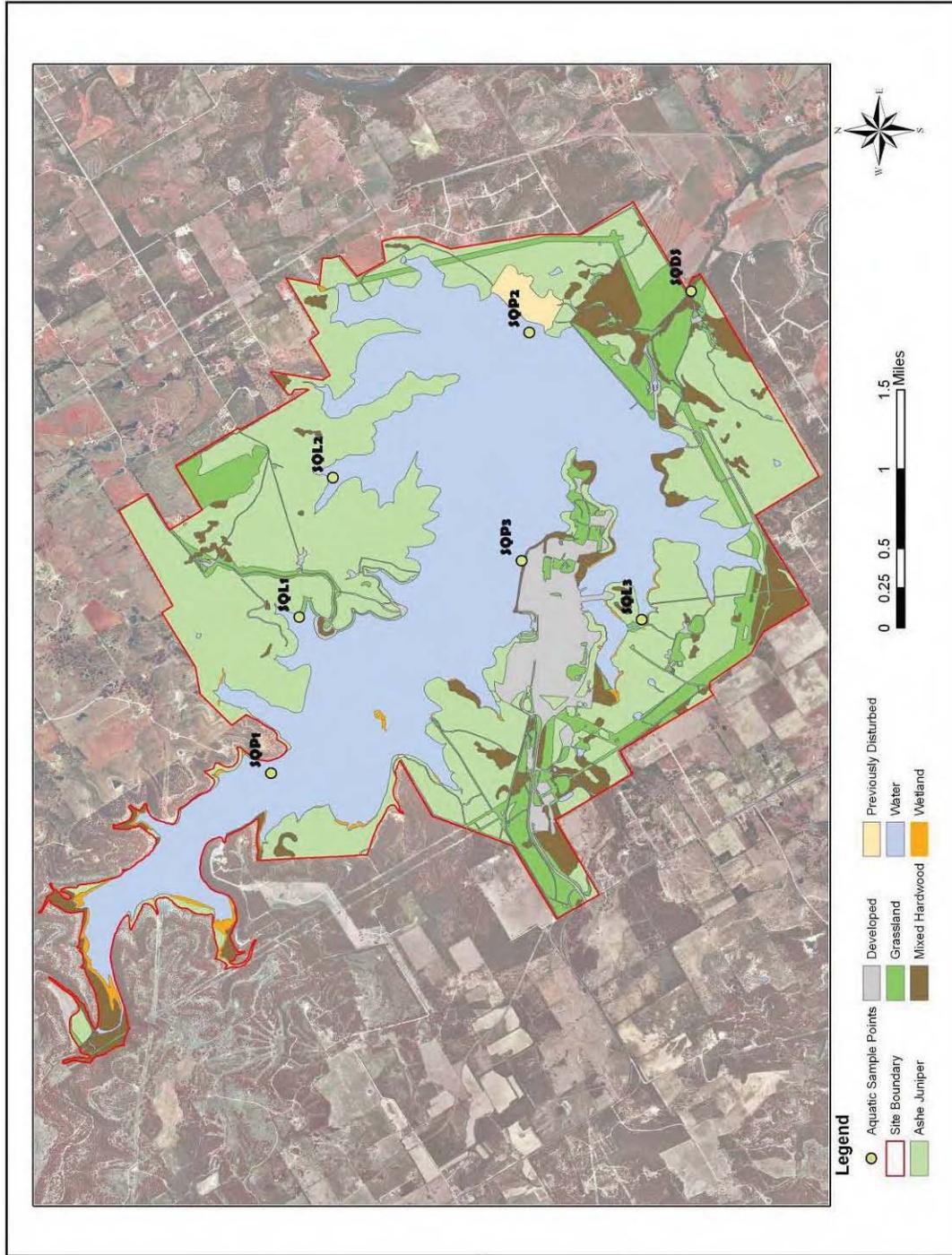


Figure 2-15. Vegetative cover of the CPNPP site (Luminant 2009a).

1 are considered to be of relatively low quality (Enercon 2009). Wetlands that are located at the
 2 inlets of streams that consistently flow into SCR, such as those at the north end of SCR where
 3 Squaw Creek enters the reservoir, are larger in area, have greater plant species diversity,
 4 support aquatic plant and animal species, and help to stabilize sediments. These wetlands are
 5 considered of higher quality than the narrower, fringe wetlands along the SCR shoreline
 6 (Enercon 2009).

7 In the area of the proposed construction for CPNPP Units 3 and 4, one littoral wetland with an
 8 area of 0.78 ac (Figure 2-16) was identified at the mouth of an intermittent stream along the
 9 southeast shoreline of the peninsula where the proposed cooling tower structures would be
 10 located. Portions of this wetland would be affected by construction activities. Dominant
 11 vegetation associated with this wetland includes black willow, saltcedar, and Texas ash in the
 12 tree and shrub layer. The herbaceous layer includes southern cattail, broadleaf cattail, bushy
 13 bluestem, and Roosevelt weed. Although this wetland is likely jurisdictional, it is considered to
 14 be a marginally functional wetland because it is dominated by cattails, is small in size, and the
 15 stream leading through the wetland into SCR has only intermittent flow (Enercon 2009).

16 Field reconnaissance in the area where a proposed blowdown treatment facility would be
 17 located west of the Squaw Creek dam identified a small area (0.25 acre) that may be affected
 18 by seepage below a dam that created an old stock pond. The pond itself is isolated and likely
 19 non-jurisdictional, having no hydrological connection to any potentially jurisdictional waterbody
 20 (Enercon 2009). The area below the pond does not appear to have wetland characteristics.
 21 The most common vegetation species in this area include an unidentified rush, annual ragweed
 22 (*Ambrosia psilostachya*), and smartweed (*Polygonum* sp.).

23 In the vicinity of the proposed location of CPNPP Units 3 and 4 on SCR, there are two
 24 intermittent streams that drain into the lake, one on either side of the peninsula on which the
 25 cooling towers would be constructed (Enercon 2009) (Figure 2-16). In addition, two intermittent
 26 streams in the area of the proposed BDTF drain into Squaw Creek below the SCR dam.

27 **2.4.2.4 Important Aquatic Species and Habitats**

28 ***Fishery Species***

29 There are no commercial fisheries in Lake Granbury, SCR, PKL, the Brazos River between
 30 Lake Granbury and Lake Whitney, or WBR. Recreational fishing historically has occurred in all
 31 of these waterbodies except WBR, which was recently completed and first stocked with
 32 immature game fish in 2007 so its recreational fishery is in development. Although SCR was
 33 stocked with fish and opened for public fishing soon after its completion, fishing by the public
 34 was banned in SCR for security reasons in September 2001. CPNPP employees and certain
 35 invited groups were allowed to fish from the banks of SCR, but boats were not permitted
 36 (Luminant 2009a). In June 2010, the SCR was reopened to the public for recreational uses,
 37 including fishing and boating, but access will be controlled. Water-based recreation is among
 38 the uses for which Lake Granbury is operated by the BRA, and five public access areas are
 39 maintained to facilitate its use by recreational fishermen (BRA 2009). There also are several
 40 private boat ramps, but access for bank fishing is poor (Baird and Tibbs 2006). The overall
 41 fishing opportunities provided by Lake Granbury are rated by TPWD as good for largemouth
 42 bass, striped bass, white bass, catfish, and sunfish and fair for crappie (TPWD 2009e). As
 43 discussed above in describing the fish community of Lake Granbury, game fish populations
 44 have been reduced annually since 2001 by toxic blooms of golden alga, and stocking has been
 45 used to mitigate the losses of striped bass and largemouth bass (Baird and Tibbs 2006). PKL
 46 also is used for recreational fishing, and available facilities include eight public boat

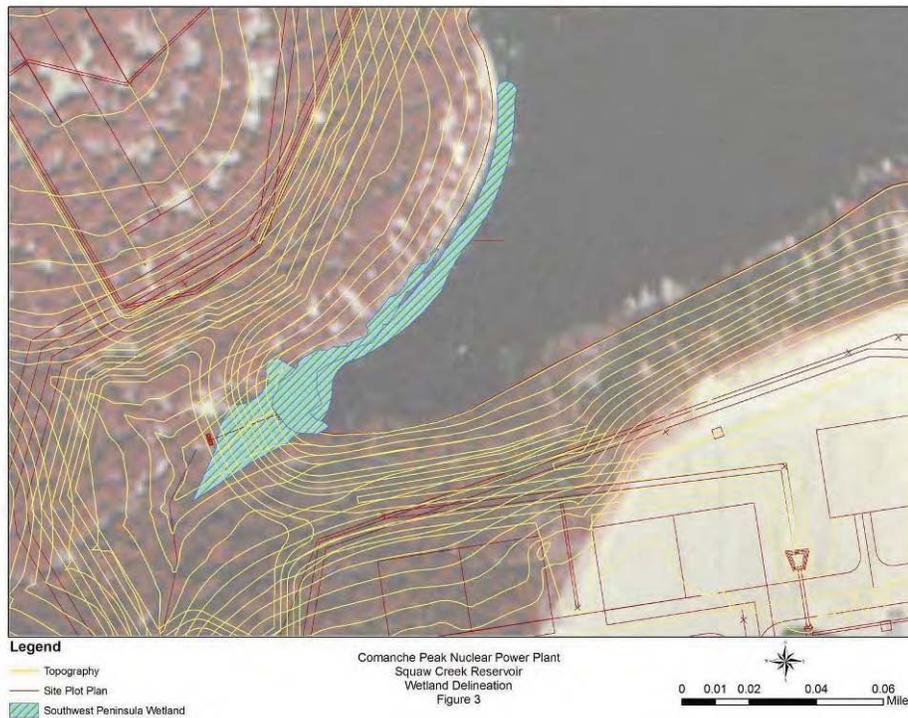


Figure 2-16. Squaw Creek Reservoir wetland delineation. Upper: Proposed cooling tower locations on the peninsula to the north of the proposed site of Units 3 and 4. Lower: Closeup of wetland in inlet south of the peninsula (Enercon 2009).

1 ramps, 15 private boat ramps, two fishing piers, and publicly accessible areas for bank fishing.
2 Similar to Lake Granbury, PKL has been affected since 2001 by golden alga blooms, and
3 stocking is used to maintain striped bass and largemouth bass numbers (Howell and Mauk
4 2007). The overall fishing opportunities provided by PKL are rated by TPWD as fair for
5 largemouth bass, crappie, striped bass, and sunfish; good for catfish; and excellent for white
6 bass (TPWD 2009g). The Brazos River below Lake Granbury supports recreational fishing from
7 its banks, by wading, or from canoes. Descriptions of five species representative of the
8 recreational fisheries of Lake Granbury, SCR, PKL, and/or the Brazos River below Lake
9 Granbury are provided below.

10 **Largemouth Bass**

11 The largemouth bass is a large member of the family Centrarchidae (sunfish and black basses),
12 and a top predator in freshwater ecosystems. It is native to most of the United States east of
13 the Rocky Mountains, including many rivers and lakes in Texas. It is the most popular game
14 fish in Texas, which has led to its introduction into many waterbodies. The native subspecies in
15 Texas is *Micropterus salmoides salmoides*, but the Florida subspecies (*M. salmoides floridanus*)
16 also has been introduced into many Texas lakes, including Lake Granbury. This bass matures
17 at 22 to 25 cm (9 to 10 in.) in length and in the southeastern United States can reach a length of
18 up to 50 cm (20 in.) by 6 years of age. The diet of the largemouth bass when young consists
19 mainly of small invertebrates and, as the fish increases in age and size, transitions to mainly fish
20 (such as shads, sunfishes, and darters) and larger invertebrates. Its reproductive strategy
21 involves the male building a nest in a shallow, protected area; deposition of eggs and sperm
22 over the nest; and the demersal eggs adhering to and remaining in the nest, where they are
23 guarded by the male. The male guards the nest for several weeks, and during this period, the
24 eggs hatch after about 3 days, the newly hatched larvae remain within the nest substrate for up
25 to 7 days, and the larvae grow and begin to feed in the water column (Hassan-Williams and
26 Bonner 2007). The largemouth bass is the most preferred sport fish among licensed anglers in
27 Texas (TPWD 2009b).

28 **Striped Bass**

29 The striped bass is the largest member of the family Moronidae (true or temperate basses). It is
30 a marine and coastal species that moves upstream into freshwater rivers during spawning
31 migrations. Due to its popularity as a game fish and its ability to live in fresh water, it has been
32 introduced into lakes for sport fishing. Although it is not native to Texas, it has been stocked
33 extensively, and fisheries are maintained in many reservoirs, including Lake Granbury. The
34 striped bass matures at 17 to 43 cm (7 to 17 in.) in length and in Florida lakes were found to
35 reach a length of up to 105 cm (41 in.) by 12 years of age. The diet of the striped bass when
36 young consists mainly of small invertebrates and, as the fish increases in age and size,
37 transitions to mainly fish (especially shads) and larger invertebrates. Its reproductive strategy
38 involves producing very large number of eggs (up to tens of millions) that are semibuoyant,
39 nonadhesive, and broadcast by the female into the water column, where they are fertilized by
40 males. Spawning occurs in upstream portions of rivers, frequently where the current is strong
41 and turbulent and the substrate is rock and/or gravel. Survival of the fertilized eggs largely
42 depends on a current sufficient to keep the eggs suspended in the water column until hatching.
43 Although eggs that settle on a coarse substrate can hatch, eggs that settle on silt, clay, or mud
44 and detritus rarely hatch (Hassan-Williams and Bonner 2007). At least 50 mi of stream
45 generally are required to allow successful hatching. Consequently, most reservoir populations,
46 including those in Lake Granbury, are not self-sustaining and must be maintained by stocking.
47 The striped bass is the fourth most preferred sportfish among licensed anglers in Texas
48 (TPWD 2009b).

1 White Bass

2 The white bass also is a member of the family Moronidae (temperate basses). It is a freshwater
3 species that is native to the central United States, extending southwest to the Red River
4 drainage in Texas. It has been widely introduced into reservoirs and other waterbodies in
5 Texas, including Lake Granbury. The white bass matures at 23 to 26 cm (9 to 10 in.) in length
6 and in the southeastern United States can reach a length of up to 44 cm (17 in.) by 5 years of
7 age. The diet of the white bass when young consists mainly of small invertebrates and, as the
8 fish increases in age and size, transitions to mainly fish (especially shads) and larger
9 invertebrates. Its reproductive strategy involves producing large number of eggs (approaching a
10 million) that are demersal, adhesive, and released by the female into the water column, where
11 they are fertilized by males then sink to the bottom and adhere to rocks, plants, and other
12 substrates. Spawning occurs in shallow water (usually 3 m or less) that has a coarse substrate
13 in small streams or on shoals or points of reservoirs (Hassan-Williams and Bonner 2007; TPWD
14 2009b). The white bass is the fifth most preferred sport fish among licensed anglers in Texas
15 (TPWD 2009b).

16 White Crappie

17 The white crappie is a member of the family Centrarchidae (sunfish and basses). It is native to
18 the central United States, including the eastern two-thirds of Texas, and has been introduced
19 statewide except for the upper portions of the Pecos and Rio Grande River basins. The white
20 crappie matures at 17 to 22 cm (7 to 9 in.) in length and in Mississippi was found to reach a
21 length of up to 36 cm (14 in.) by 8 years of age. The diet of the white crappie when young
22 consists mainly of small invertebrates and, as the fish increases in age and size, transitions to
23 mainly small fish and insects. Its reproductive strategy involves the male clearing a nest in a
24 shallow area (less than 1.5 m) near shore (generally within 10 m) on hard clay, gravel, or plant
25 roots; deposition of eggs and sperm over the nest; and the demersal eggs adhering to and
26 remaining in and near the nest, where they are guarded by the male (Hassan-Williams and
27 Bonner 2007). Crappies, including both white and black crappies, are the third most preferred
28 sport fishes among licensed anglers in Texas (TPWD 2009b).

29 Channel Catfish

30 The channel catfish is a member of the family Ictaluridae (bullhead catfishes). It is native to
31 most of the United States east of the Rocky Mountains, including most of Texas, with the
32 possible exception of the upper portions of the Pecos and Rio Grande River basins. The
33 channel catfish matures at about 30 cm (12 in.) in length and in Mississippi reservoirs was found
34 to reach a length of about 42 cm (17 in.) by 7 years of age. The diet of the channel catfish when
35 young consists mainly of small invertebrates and, as the fish increases in age and size, expands
36 to include larger invertebrates (insects, mollusks, crustaceans), small fishes, and some plant
37 material. Its reproductive strategy involves the male locating a suitable hole for nesting in a
38 cavity or crevice of a stream channel or the muddy bottom of a reservoir; deposition of eggs by
39 the female in the bottom of the nest; and the demersal eggs remaining in the nest, where they
40 and the fry are guarded by the male (Hassan-Williams and Bonner 2007, TPWD 2009b). After
41 basses and crappie, the channel catfish is the most preferred fish to be caught by anglers in
42 Texas (TPWD 2009b).

43 Non-Native and Nuisance Species

44 With the exception of golden alga, nonnative and nuisance species of aquatic plants are not
45 currently a problem in Lake Granbury (Baird and Tibbs 2006), SCR, PKL, WBR, or the Brazos
46 River in the vicinity of the CPNPP site (Luminant 2009a). It is uncertain whether golden alga is

1 non-native. However, as described in detail above when discussing the plankton community of
2 Lake Granbury, golden alga is a nuisance species that can develop toxic blooms that cause
3 extensive fish kills.

4 An aquatic animal that is both a non-native and a nuisance species and is known to occur in
5 three waterbodies of the study area is the Asian clam (*Corbicula fluminea*). Its presence has
6 been reported throughout the Brazos River system, including SCR (Luminant 2009a), Lake
7 Granbury, and the Brazos River below Lake Granbury (USGS 2009). The Asian clam is native
8 from southern Asia to the Mediterranean, Africa, and Australia. It was first collected alive in the
9 United States in 1938 and has since spread to at least 38 states and the District of Columbia. It
10 likely was introduced to North America as a result of its use as a food item by Chinese
11 immigrants, and the primary means of its dispersal has likely been human transport, either
12 intentionally for food or unintentionally such as in bait buckets or in containers with other
13 aquaculture specimens. Once introduced to a waterbody, it can move passively with the current
14 (Foster et al. 2007). The Asian clam was first collected in Texas in 1958 in the Neches River,
15 and by 2005 it was present in 180 of 257 counties in both flowing and still waterbodies. It has
16 been found in Texas more often in larger reservoirs and streams. It is one of the most
17 aggressive freshwater invasive species in the world and one of the most important molluscan
18 pests in the United States (Sewell 2005). It competes with native species and alters benthic
19 substrates. However, the principal adverse impact of the Asian clam in the United States is
20 biofouling, in which living clams and the shells of dead clams clog and reduce water flow
21 through the intakes and pipes of power plants and other users of raw water, including industrial
22 and drinking water systems and irrigation systems. In power plants, it can clog heat
23 exchangers, raw service water pipes, and firefighting equipment (Foster et al. 2007).

24 Another bivalve mollusk that potentially could occur in waterbodies of the study area in the
25 future, possibly within the period of construction and/or operation of the proposed facility, is the
26 zebra mussel (*Dreissena polymorpha*). The zebra mussel is a non-native, invasive species that
27 recently has been found in Texas in Lake Texoma (on the Texas-Oklahoma border) and Lake
28 Lavon (northeast of Dallas and south of Lake Texoma). The zebra mussel has been spreading
29 from the Great Lakes region and is likely to eventually spread throughout much of Texas,
30 possibly including the waterbodies of the study area. It causes problems similar to those
31 discussed for the Asian clam, particularly biofouling (TPWD 2010g).

32 Another aquatic animal that is a nuisance species, though it is native to Texas, is the estuarine
33 mud crab (*Rhithropanopeus harrisi*). This crab is a common resident of estuaries in Texas and
34 Florida, and it has been introduced into estuaries throughout the world. It is known to migrate
35 upstream in estuaries, and it can tolerate fresh water. It was thought not to be able to
36 reproduce at extremely low salinities, but there is strong evidence that this crab has established
37 reproducing populations in eight freshwater reservoirs in Texas, including Lake Granbury, SCR,
38 Lake Whitney, and PKL. The route by which the estuarine mud crab was introduced to these
39 reservoirs is uncertain (Keith 2005). It is suspected to have involved fish stocking activities,
40 using fish from a coastal hatchery where the crab occurs naturally, or accidental releases by
41 anglers or boaters, such as from bait buckets. The crabs have caused biofouling problems in
42 water intakes at lakeshore homes and have been found on the intake screens for CPNPP Units
43 1 and 2, and there is some evidence that they may be altering the benthic community by
44 replacing native crayfish (Keith 2005, Perry 2006).

45 **Federally and State-Listed Aquatic Species**

46 This section describes the Federally and Texas State-listed threatened and endangered aquatic
47 species potentially inhabiting aquatic or wetland habitats in the vicinity of the site and the
48 proposed new transmission line ROWs. Table 2-18 presents the aquatic species that are

1 Federally and/or State-listed as threatened or endangered, or that are designated as State
 2 species of concern, in counties within which CPNPP Units 3 and 4 (Hood and Somervell
 3 Counties) and the proposed new transmission line ROWs (Somervell and Bosque Counties)
 4 would be located. Also included are designated species for counties upstream of Lake
 5 Granbury that could be affected by hydrological changes due to alterations in water
 6 management practices such counties include: Palo Pinto County, in which PKL is
 7 predominantly located, and Parker County, through which the Brazos River flows between PKL
 8 and Lake Granbury.

Table 2-18. Federally and State-Listed Aquatic Species Occurring in the Vicinity of Proposed CPNPP Units 3 and 4 and Proposed New 345-kV Transmission Line ROWs

Scientific Name	Common Name	Federal Status ^(a)	State Status ^(b)	Counties ^(c)
<u>Fishes</u>				
<i>Notropis oxyrhynchus</i>	Sharpnose shiner	FC	SSC	Hood, Somervell, Palo Pinto, Parker
<i>Notropis buccula</i>	Smalleye shiner	FC	SSC	Hood, Somervell, Palo Pinto, Parker
<i>Micropterus treculii</i>	Guadalupe bass		SSC	Bosque, Palo Pinto
<u>Mussels</u>				
<i>Tritogonia verrucosa</i>	Pistolgrip		SSC	Hood, Somervell, Bosque, Palo Pinto, Parker
<i>Arcidens confragosus</i>	Rock pocketbook		SSC	Hood, Somervell, Bosque, Palo Pinto, Parker
<i>Truncilla macrodon</i>	Texas fawnsfoot		ST	Hood, Somervell, Bosque, Palo Pinto, Parker
<i>Quadrula mitchelli</i>	False spike		ST	Bosque
<i>Quadrula houstonensis</i>	Smooth pimpleback		ST	Bosque
<u>Reptiles</u>				
<i>Nerodia harteri</i>	Brazos water snake		ST	Hood, Somervell, Bosque, Palo Pinto, Parker

(a) Federal status definitions: FC = Federal candidate for listing;

(b) State status definitions: ST = State-listed – threatened; SSC = State species of concern.

(c) Counties listed are those in which components of the proposed action would be located and where TPWD has identified the potential for occurrence of the species based on evidence such as recorded occurrences, historic ranges, field guides, staff expertise, and scientific publications. Sources: TPWD 2010a, 2010b, 2010c, 2010d, and 2010e.

9 As shown in Table 2-18, there are no Federally listed aquatic species recorded as occurring in
 10 the three counties in which CPNPP Units 3 and 4 (Hood and Somervell Counties) and the
 11 proposed new transmission line ROWs (Somervell and Bosque Counties) would be located, or
 12 the two upstream counties that could be affected by changes in hydrology. However, there are
 13 two aquatic species potentially occurring in Hood, Somervell, Palo Pinto, and Parker Counties
 14 that are designated by USFWS as Federal candidates for listing: the sharpnose shiner
 15 (*Notropis oxyrhynchus*) and the smalleye shiner (*N. buccula*). Candidate species are under
 16 consideration for listing but are not currently legally protected under the Endangered Species

1 Act. These Federally designated candidate species potentially occurring in the vicinity of the
2 proposed CPNPP Units 3 and 4 are described below.

3 The Brazos water snake (*Nerodia harteri*) and three species of freshwater mussels are the only
4 State-listed aquatic species with potential or recorded occurrences in one or more of the
5 counties that may be affected by the proposed CPNPP Units 3 and 4 facilities (Hood and
6 Somervell Counties), the two proposed new transmission line ROWs (Hood, Somervell, and
7 Bosque Counties), or upstream changes in hydrology (Palo Pinto and Parker Counties). All four
8 species are State-listed as threatened. The three mussel species are the Texas fawnsfoot
9 (*Truncilla macrodon*), false spike mussel (*Quadrula mitchelli*), and smooth pimpleback
10 (*Q. houstonensis*) (TPWD 2010a, 2010b, 2010c, 2010d, and 2010e). Species that do not have
11 a legal listing status in Texas may be designated as State species of concern. Species of
12 concern are priority species in greatest need of conservation as determined by the Texas
13 Wildlife Action Plan (TPWD 2005). Occurrences of three species of concern have been
14 reported from two or more of these three counties: the Guadalupe bass (*Micropterus treculii*)
15 and two mussels, the pistolgrip (*Tritogonia verrucosa*) and rock pocketbook
16 (*Arcidens confragosus*) (TPWD 2010a, 2010b, 2010c, 2010d, and 2010e). Species that are
17 State-listed or are designated as State species of concern and have the potential to occur in the
18 vicinity of the proposed CPNPP Units 3 and 4 or the proposed new transmission line ROWs or
19 to be affected by related changes in upstream hydrology are described below.

20 **Sharpnose Shiner**

21 The sharpnose shiner is designated by USFWS as a candidate species and is considered a
22 species of concern (high priority) by the State of Texas in Somervell, Hood, and Bosque
23 Counties. This slender, silvery minnow is endemic to the Brazos River basin in Texas, where it
24 prefers the shallow water habitat of broad, open, sandy channels with moderate current
25 (USFWS 2008a). It is suspected to forage primarily among the sediment, based on the large
26 quantities of sand/silt that it ingests, but it also may consume organisms drifting in the water
27 column. Aquatic and terrestrial invertebrates compose the majority of the diet (approximately
28 70 percent), which also includes plant material, detritus, and sand (USFWS 2008a). Little is
29 known about the life history of the sharpnose shiner, but spawning likely occurs from mid May
30 through September in open-water areas. Durham (2007) reported that the reproductive strategy
31 of this species likely was to broadcast-spawn multiple batches of semibuoyant, nonadhesive
32 eggs in areas of open substrate.

33 Historically, this strictly riverine species occurred throughout the Brazos River basin, including
34 several major drainages within the watershed. Recent studies indicate that sharpnose shiner
35 populations in the upper Brazos River drainage (upstream of PKL) remain stable, while in the
36 middle and lower Brazos River drainage the species may exist only in remnant areas of suitable
37 habitat but is likely extirpated (USFWS 2008a). Within the last decade, two independent
38 sampling studies that focused on middle and lower reaches of the Brazos River were
39 conducted, and both failed to find any sharpnose shiners (USFWS 2008a). The data suggest
40 that the range of this species may have been reduced by as much as 70 percent relative to its
41 historical range. This reduction in range and distribution likely is attributable to anthropogenic
42 factors such as reservoir construction, sedimentation, municipal discharges, and agricultural
43 activities within the basin (USFWS 2008a).

44 The addition of impoundments within the middle and lower Brazos River basin has altered
45 historical habitat in the basin and is thought to be a primary contributor to range reduction for
46 this species. The construction of reservoirs can alter thermal, physical, and morphological
47 characteristics of existing habitats to such an extent that they are no longer suitable for the

1 shiner, as evidenced by the near or complete extirpation of this species downstream of the three
2 major reservoirs on the main stem of the Brazos River (PKL, Lake Granbury, and Lake
3 Whitney). Small areas of suitable habitat likely still exist and possibly could contain remnant
4 sharpnose shiner populations, but continued effects from existing reservoirs and possible future
5 water management plans indicate that recovery of this species in the middle to lower Brazos
6 River is highly unlikely (USFWS 2008a). Based on its habitat requirements, the sharpnose
7 shiner would not occur in reservoirs such as Lake Granbury, SCR, or PKL. Based on its current
8 distribution within the Brazos River drainage, it is unlikely to occur in the river downstream of
9 Lake Granbury, downstream of PKL, in Squaw Creek, or in other streams in the vicinity of the
10 proposed facilities.

11 ***Smalleye Shiner***

12 The smalleye shiner was first designated as a Federal candidate for listing by USFWS in 2002.
13 In addition, this fish is a State-designated species of concern (high priority) in the Hood and
14 Somervell Counties where the proposed CPNPP Units 3 and 4 would be located. The smalleye
15 shiner is a small, straw-colored minnow that is morphologically similar to the sharpnose shiner
16 and is also endemic to the Brazos River drainage. Habitat requirements of this species are
17 almost identical to those of the sharpnose shiner, and the smalleye shiner is tolerant of high
18 salinity, high temperatures, and low dissolved oxygen concentrations (Ostrand and Wilde 2001).
19 Within their preferred habitat, they seek out the center of channels with turbid waters and
20 shifting sand, often avoiding the shallow depths and slow velocities of stream edges. Their diet
21 consists of aquatic and terrestrial insects (38 percent of diet), detritus, plant material, and
22 sand/silt, an indication that they forage in the substrate (USFWS 2008b).

23 The smalleye shiner is thought to have a relatively short life span, with most living to 1 year and
24 some surviving up to 2 years of age (Durham 2007). Its reproductive strategy is similar to that
25 of the sharpnose shiner. The smalleye shiner releases semi-buoyant eggs in areas of open
26 substrate. It likely spawns in periodic batch-spawn events in open water from April through
27 September, but spawning may occur continuously from April to August (Wilde and Durham
28 2007).

29 The smalleye shiner originally was present throughout the Brazos River system, including the
30 lower reaches as far south as Hempstead, Texas (northwest of Houston). However, this
31 species has been completely extirpated from the middle Brazos region and reduced to relict
32 populations within the lower portion of the river (USFWS 2008b). Smalleye shiners have not
33 been collected from these areas of the Brazos River since 1986, indicating their historical range
34 has been reduced by approximately 54 percent. The Texas Natural Diversity Database
35 (TPWD 2009i) indicates that the only reported sighting of a smalleye shiner within 10 mi of the
36 proposed CPNPP Units 3 and 4 site occurred in 1953. Population declines downstream of PKL
37 are attributable to factors that include river impoundments, sand and gravel mining, water
38 diversions, irrigation, agricultural activities, and the spread of the invasive, exotic plant
39 saltcedar. Invasion of saltcedar upstream of PKL may adversely affect native fish assemblages
40 by reducing flood water velocities, resulting in increased sediment deposition and narrower
41 channels (Blackburn et al. 1982).

42 As described for the sharpnose shiner, the major reservoirs of the Brazos River have altered
43 water quality parameters substantially enough to affect downstream habitat. Upstream of PKL,
44 smalleye shiner populations in the upper reaches of the Brazos drainage appear to be stable or
45 increasing (Wilde and Durham 2007). Based on its habitat requirements, the smalleye shiner
46 would not occur in reservoirs such as Lake Granbury, SCR, or PKL. Based on its current
47 distribution within the Brazos River drainage, it is unlikely to occur in the river downstream of

1 Lake Granbury, downstream of PKL, in Squaw Creek, or in other streams in the vicinity of the
2 proposed facilities.

3 **Brazos Water Snake**

4 The Brazos water snake (also referred to as Harter's water snake) is a State-listed threatened
5 species in Texas, and its status is currently under review by FWS for possible Federal listing.
6 The Brazos water snake, a member of the family Colubridae, is a medium-sized, brown to olive-
7 colored, non-venomous snake endemic to the Brazos River system in north-central Texas
8 (Ernst and Ernst 2003). This mostly aquatic species typically inhabits open, vegetation-free
9 areas near the water's edge within rocky, fast-flowing streams (Werler and Dixon 2000) or along
10 the shorelines of reservoirs (Ernst and Ernst 2003). While adults are often found in riffles,
11 pools, and lakes, juveniles use rocky shallows for foraging and flat rocks in unshaded areas of
12 the shore for hiding (Scott et al. 1989). Adults forage primarily between dawn and dusk and
13 feed mostly on small fishes such as minnows (Tennant 1984). This snake bears live young, as
14 do other species of the genus *Nerodia*, and gives birth to approximately 7 to 23 young between
15 September and October (NatureServe 2009).

16 The State-threatened conservation status of this species is attributed to its limited range and
17 specific habitat requirements (McAllister and Bursey 2008). Threats to the species' range and
18 distribution include barriers, such as dams, which can inundate streams, thereby reducing
19 potential riverine habitat. However, the standing waterbodies that result from such barriers may
20 also provide suitable habitat for the Brazos water snake. Although the Brazos water snake has
21 historically occurred in Somervell, Hood, and Bosque Counties, review of available records in
22 the Texas Natural Diversity Database (TPWD 2009i) indicates that there have been no reported
23 observations of this species within 10 mi of the CPNPP site since 1989. According to the
24 database maintained by the TPWD, three Brazos water snakes were sighted within 10 mi of the
25 CPNPP site between 1984 and 1989. A study by McAllister and Bursey (2008) reported that
26 seven individuals of this species (juveniles and adults) were collected in Somervell County in
27 July 1987 and between May and July 1988.

28 **Mussels**

29 Three species of freshwater mussels that are State-listed as threatened are designated by
30 TPWD as potentially occurring or having been recorded in at least one of the three counties in
31 which proposed facilities would be located: the Texas fawnsfoot in Hood, Somervell, and
32 Bosque Counties; and the false spike and smooth pimpleback in Bosque County (TPWD 2010a,
33 2010c, and 2010e). The Texas fawnsfoot also has been recorded in Palo Pinto and Parker
34 Counties. The habitat requirements of the Texas fawnsfoot are not well known – it appears to
35 occur in rivers and larger streams with moderate flows, to be intolerant of impoundments, and to
36 utilize substrates that may include gravel, sand, or sandy mud. The false spike, which possibly
37 has been extirpated in Texas, probably occurred in medium to large rivers (including the
38 Brazos) and utilized substrates ranging from mud to mixtures of sand, gravel, and cobble. It has
39 not been found to persist in the Brazos River and is unlikely to be present. The smooth
40 pimpleback occurs in rivers and streams of moderate to small size and moderate-sized
41 reservoirs; it prefers substrates of mixed mud, sand, and fine gravel; it tolerates moderate to
42 very slow flows; and it appears not to tolerate dramatic fluctuations in water levels or substrates
43 of scoured bedrock or shifting sand (TPWD 2010a).

44 Two species of freshwater mussels, the pistolgrip and rock pocketbook, are State species of
45 concern designated by TPWD as potentially occurring or having been recorded in all three
46 counties in which proposed facilities would be located and in the two upstream counties. The
47 pistolgrip inhabits stable substrates of rock, hard mud, silt, or soft bottoms in medium to large

1 rivers. The rock pocketbook inhabits mud, sand, or gravel substrates within medium to large
2 rivers, usually in standing or slow-moving waters, but it also may occur in moderate currents
3 and some reservoirs (TPWD 2010b).

4 The Texas Natural Diversity Database includes no reported observations of any of these
5 mussels within 10 mi of the CPNPP site or the proposed new transmission line ROWs
6 (TPWD 2009i). Although habitats supportive of all five species potentially could be present in
7 the Brazos River between Lake Granbury and Lake Whitney, these mussels are not known to
8 occur in this river segment and were not found in recent biological surveys at a location
9 downstream of the DeCordova Bend Dam (Bio-West 2008a). Although the smooth pimpleback
10 and rock pocketbook may occur in reservoirs, they have not been reported in recent surveys of
11 invertebrate organisms in Lake Granbury and SCR. WBR was recently built on a very small
12 stream that drains to the Paluxy River and would not have provided suitable habitat for these
13 mussels. Although the rock pocketbook is capable of inhabiting reservoirs, it would not be
14 expected to have occurred in Wheeler Branch prior to the building of the dam or to have
15 colonized the reservoir.

16 The Brazos River upstream of Lake Granbury and below PKL potentially could provide habitat
17 suitable for the pistolgrip, rock pocketbook, and Texas fawnsfoot. PKL potentially could provide
18 habitat suitable for the rock pocketbook.

19 ***Guadalupe Bass***

20 The Guadalupe bass is a State species of concern that occurs only in Texas and is the official
21 state fish. It reaches a weight of approximately 4 pounds and utilizes habitats with flowing
22 water, preferring downstream segments of small streams, especially riffles or the heads of pools
23 where the water is shallow and swift. The range of the Guadalupe bass is limited to the
24 northern and eastern parts of the Edwards Plateau region of south-central Texas, including
25 portions of the Brazos River drainage well downstream of Lake Whitney, such as the Lampasas,
26 Leon, and Little Rivers (Lee et al. 1980, TPWD 2009d). Thus, the Guadalupe bass does not
27 occur in the Brazos River drainage in Hood or Somervell Counties, and review of available
28 records in the Texas Natural Diversity Database indicates that its last reported observation
29 within 10 mi of the proposed new CPNPP Units 3 and 4 transmission line ROWs in Bosque
30 County was in 1979 (TPWD 2009i).

31 **2.4.2.5 Aquatic Monitoring**

32 Preapplication investigations were performed in 2007 and 2008 to characterize the aquatic
33 communities of Lake Granbury and SCR. The results of these field studies were utilized in the
34 descriptions of these communities provided above. No additional preoperational ecological
35 monitoring is planned. The TPWD has been monitoring the fish communities of Lake Granbury
36 since 1998 and PKL since 1999 through periodic surveys conducted in conjunction with its
37 Statewide Freshwater Fisheries Monitoring and Management Program, which is supported by
38 the Federal Aid in Sport Fish Restoration Act. Under this program, Lake Granbury and other
39 large public reservoirs are surveyed every 4 years, and the results are reported. The most
40 recent TPWD survey of Lake Granbury was performed in 2005–2006 (Baird and Tibbs 2006),
41 and the most recent TPWD survey of PKL was in 2006–2007. If funding is maintained, this
42 monitoring program may continue into the period of construction and operation of the proposed
43 CPNPP Units 3 and 4.

44 Specific operational monitoring requirements have not yet been established for CPNPP Units 3
45 and 4, but they are expected to be similar to and/or modifications of existing monitoring
46 programs for Units 1 and 2. Thus, monitoring in conjunction with the operation of Units 3 and 4

1 with respect to aquatic resources is expected to include monitoring of surface water relative to
 2 water quality standards and TPDES permit requirements, including thermal requirements.
 3 Monitoring of fish and other components of the ecological communities of Lake Granbury, SCR,
 4 PKL, and the Brazos River also may be required by State regulatory agencies
 5 (Luminant 2009a).

6 **2.5 Socioeconomics**

7 This section describes the socioeconomic baseline for the proposed Units 3 and 4 to be built
 8 and operated by Luminant at the existing CPNPP site. The scope of the review of demographic
 9 and community characteristics is guided by the magnitude and nature of the expected impacts
 10 of the building and operation of the proposed project.

11 The review team reviewed the ER prepared by Luminant and verified the data sources used in
 12 its preparation by examining cited references (Luminant 2009a). The review team requested
 13 clarifications and additional information from Luminant where needed to verify data in the ER.
 14 Unless otherwise specified in the following sections, the review team used verified data from
 15 Luminant’s ER and responses to requests for additional information. Where the review team
 16 used different analytical methods or additional data or information for its own analysis, the
 17 following sections include explanatory discussions and citations for additional sources.

18 The discussion of socioeconomic impacts considers the area within a 50-mi radius of the
 19 proposed site for Units 3 and 4 (the region), with a focus on Somervell and Hood Counties,
 20 Texas. The discussion emphasizes the socioeconomic characteristics of Somervell and Hood
 21 Counties because

- 22 • they are the two counties in which the CPNPP site is located;
- 23 • based on the relatively shorter commutes and the availability of other amenities in
 24 Somervell and Hood Counties’ population centers, the review team expects most of the
 25 in-migrating construction and operations workers will choose to live in these two counties
 26 (currently over two-thirds of the current CPNPP workforce resides in Somervell or Hood
 27 Counties);
- 28 • the review team expects the project’s locally available construction and operations work
 29 forces will be primarily drawn from these two counties; and
- 30 • Somervell and Hood Counties would receive almost all of the social and economic
 31 impacts from building and operations activities.

Table 2-19. Counties entirely or partially located within the 50-mi CPNPP region

Bosque	Ellis	Jack	Somervell
Comanche	Erath	Johnson	Stephens
Coryell	Hamilton	McLennan	Tarrant
Dallas	Hill	Palo Pinto	Wise
Eastland	Hood	Parker	

Source: Luminant 2009a.

32 However, almost 30 percent of the current CPNPP workers reside four other Texas counties—
 33 —Bosque, Erath, Johnson, and Tarrant Counties. While the review team expects each of these
 34 counties will receive negligible impacts from building and operations activities at the proposed

1 site, when appropriate, this EIS also includes information about them. The six counties of
 2 Somervell, Hood, Bosque, Erath, Johnson, and Tarrant Counties make up this analysis'
 3 Economic Impact Area. Finally, the discussion includes some data for the region. Table 2-19
 4 lists the 19 counties within the 50-mi CPNPP region; all of the counties are in Texas.

5 **2.5.1 Demographics**

6 For the purposes of this analysis, the review team divided the total population within the CPNPP
 7 region into three major groups: residents, who live permanently in the area; transients, who
 8 may temporarily live in or visit the area but have permanent residence elsewhere; and migrant
 9 workers, who travel into the area to work and then leave after their job is done. The U.S.
 10 Census Bureau (USCB) does not fully characterize transient and migrant populations, but
 11 focuses on data about resident populations.

12 The data used in this section are from the USCB and the Texas State Data Center (TSDC).
 13 The most recent data and information are used where possible, with 2000 Census of Population
 14 data used in some cases to allow comparisons among multiple jurisdictions.

15 **2.5.1.1 Resident Population**

16 In 2007, the resident population in the region was 1.5 million. Table 2-20 provides population
 17 totals for the EIA and the State of Texas from 1970 through 2000. The table also provides
 18 population projections for these jurisdictions through 2040, based on estimates developed by
 19 the TSDC (TSDC 2009).

20 As indicated in Table 2-20, the EIA and the State of Texas all experienced considerable
 21 population growth between 1970 and 2000, and are projected to continue growing, although at a
 22 slower rate, between 2000 and 2040. The two counties with the most rapid population growth
 23 between 1970 and 2000, Hood and Johnson, both grew faster than the State of Texas and are
 24 projected to continue to do so through 2040. Somervell and Tarrant Counties experienced more
 25 rapid growth than the State of Texas between 1970 and 2000, but are not projected to do so
 26 through 2040. Erath and Bosque Counties have experienced slower growth than the State of
 27 Texas since 1970 and are projected to continue to do so through 2040.

28 The CPNPP site is located in Somervell and Hood Counties. Fort Worth, Texas, is the largest
 29 city within 50 mi, with a 2007 estimated population of 681,818 (USCB 2009a). Smaller cities
 30 within the region include North Richland Hills (2007 population of 64,408), Mansfield (44,061),
 31 Haltom City (40,111), Burleson (33,359), Cleburne (29,552), Watauga (23,873),

32 Weatherford (25,749), and Benbrook (22,691). Several cities have 2007 estimated populations
 33 between 10,000 and 20,000. These include Azle, Forest Hill, Mineral Wells, Saginaw,
 34 Stephenville, and White Settlement. Many other small towns, cities, and urban areas with
 35 populations of less than 10,000 are distributed within the 50-mi region. The towns closest to the
 36 CPNPP site are Glen Rose (2007 population of 2,771) in Somervell County and Granbury
 37 (8,029) in Hood County (USCB 2009a).

38 **2.5.1.2 Transient Population**

39 Transient populations include people who work in or visit large workplaces, schools, hospitals
 40 and nursing homes, correctional facilities, hotels and motels, recreational areas, or special
 41 events where there may be seasonal and workday variations in population. The largest
 42 transient populations within the region include people attending special events, visitors to State
 43 parks, and visitors to major tourist attractions (e.g., museums, aquariums, theme parks, retail

1 outlet centers). Figure 2-17 shows the locations of contributors to transient populations in the
2 region.

3 The total annual transient population within the region was 10.5 million in 2007. For an average
4 day in 2007, the transient population for the region was 352,219. Given that the resident
5 population for the region in 2007 was 1.5 million, the total nonmigrant population within the
6 region (i.e., resident plus transient) was 1.85 million people.

7 **2.5.1.3 Migrant Labor**

8 The USCB defines a migrant laborer as someone who works seasonally or temporarily and
9 moves one or more times to perform seasonal or temporary work. During scheduled refueling
10 outages at CPNPP Units 1 and 2, there is an influx of workers to the area who are hired by
11 Luminant to carry out fuel reloading activities, equipment maintenance, and other projects
12 associated with the outage. Luminant employs approximately 800 to 1200 workers for
13 approximately 24 days during each refueling outage, which occurs every 18 months for each
14 existing unit. Even if 1200 workers are assumed to in-migrate into the EIA with two additional
15 family members [the average number of persons per household in Texas in 2000 was 2.74
16 (USCB 2009b)], the total population increase (3600 people) would represent less than 0.2
17 percent of the EIA's estimated 2010 resident population of more than 1.9 million. For the Hood
18 and Somervell, where the review team expects 66.6 percent of in-migrating workers would
19 locate, the two family member scenario would result in a negligible increase of about 1.7
20 percent (814 outage workers and their families) in Hood County, but a more noticeable 20.6
21 percent (about 1584 outage workers and their families), increase in Somervell County.

22 Because of the seasonal fluctuation in labor requirements, the agricultural sector can be another
23 source of migrant workers. The most recent source for data on agricultural migrant workers is
24 the 2002 Census of Agriculture, which provides the number of farms in the region that employ
25 migrant labor (173 farms) but only provides data on the number of workers "working less than
26 150 days" per year (10,860 workers). Assuming the upper bound (i.e., that all of the 10,806
27 workers who work less than 150 days are migrant workers), the population of migrant
28 agricultural workers is still negligible compared with the resident population of the region. Even
29 if 10,860 workers are assumed to in-migrate with two additional family members, the total
30 population increase (32,418 people) would represent only 2.2 percent of the region's 2007
31 resident population of more than 1.5 million.

Table 2-20. Population and percent population change in the EIA and the State of Texas (1970–2040)

Year	County												State of Texas			
	Somervell		Hood		Bosque		Erath		Johnson		Tarrant		Pop.	Pop.	% Change	
	Pop.	% Change	Pop.	% Change	Pop.	% Change	Pop.	% Change	Pop.	% Change	Pop.	% Change				
1970	2,793	–	6,368	–	10,966	–	18,141	–	45,769	–	716,317	–	11,196,730	–	–	–
1980	4,154	48.7	17,714	178.2	13,401	22.2	22,560	24.4	67,649	47.8	860,880	20.3	14,229,191	27.1	27.1	27.1
1990	5,360	29.0	28,981	63.6	15,125	12.9	27,991	24.1	97,165	43.6	1,170,103	35.9	16,986,510	19.4	19.4	19.4
2000	6,809	27.0	41,100	41.8	17,204	13.7	33,001	17.9	126,811	30.5	1,446,219	23.6	20,851,820	22.8	22.8	22.8
2010 (est.)	7,693	13.0	48,396	17.8	18,609	8.2	38,410	16.4	152,115	20.0	1,662,201	14.9	24,330,646	16.7	16.7	16.7
2020 (est.)	8,659	12.6	56,847	17.5	20,444	9.9	42,617	11.0	181,951	19.6	1,895,533	14.0	28,005,740	15.1	15.1	15.1
2030 (est.)	9,429	8.9	65,089	14.5	22,025	7.7	46,341	8.7	213,911	17.6	2,152,155	13.5	31,830,575	13.7	13.7	13.7
2040 (est.)	10,032	6.4	73,429	12.8	23,353	6.0	50,032	8.0	249,889	16.8	2,437,327	13.3	35,761,165	12.3	12.3	12.3

Sources: Luminant 2009a; USCB 1970; USCB 1980; USCB 1990; TSDC 2009.

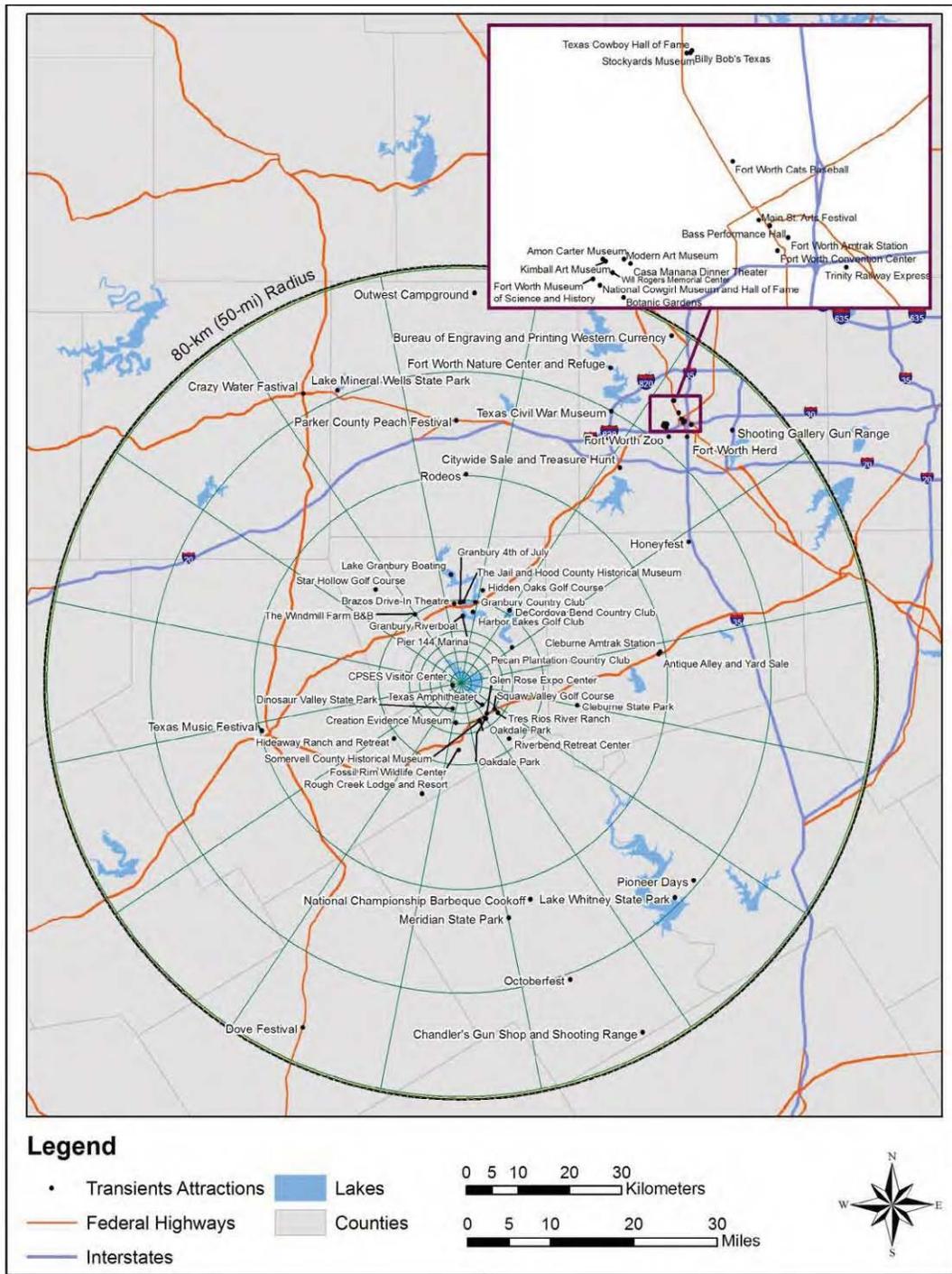


Figure 2-17. Locations of the contributors to transient populations in the region (Luminant 2009a).

1 2.5.2 Community Characteristics

2 This section consists of seven subsections that characterize the communities that may be
 3 affected by building and operating CPNPP Units 3 and 4. The characteristics evaluated include
 4 the economy, tax-based revenue, transportation, aesthetics and recreation, housing, public

1 services (water and wastewater, solid waste, police, fire, and medical services, and social
2 services), and education.

3 **2.5.2.1 Economy**

4 This section provides information on the labor force, employment, and income within the EIA.
5 Labor force and employment data include labor force size, total employment and
6 unemployment, and employment by major industry type. Income data are provided at the per
7 capita level and as the total within the EIA.

Table 2-21. Annual average labor force, employment, and unemployment in the EIA and the State of Texas (2008)

	Labor Force	Employed	Unemployed	Unemployment Rate
Hood County	25,273	24,200	1,073	4.2
Bosque County	8,349	7,960	389	4.7
Erath County	18,513	17,802	711	3.8
Johnson County	72,968	69,562	3,406	4.7
Tarrant County	884,611	841,316	43,295	4.9
State of Texas	11,701,584	11,126,436	575,148	4.9

Sources: BLS 2009a; BLS 2009b.

8 The local economic centers near CPNPP are the towns of Glen Rose and Granbury. However,
9 the largest economic center within the CPNPP region is the city of Fort Worth in Tarrant County.
10 Table 2-21 details labor force size, employment and unemployment levels, and unemployment
11 rates for the EIA and the state of Texas in 2008.

12 The Barnett Shale is a fertile area of natural gas production in northern Texas. In 2007, the
13 Barnett Shale contributed \$5 billion to the 14 counties atop the region, including Hood, Erath,
14 Johnson, and Tarrant, among others. An estimated 55,000 permanent jobs have been created
15 by Barnett Shale exploration (Business Wire 2007). A study commissioned by the Fort Worth
16 Chamber of Commerce estimates that the Barnett Shale would be responsible for an average of
17 108,000 jobs and \$10.4 billion in output each year through 2015. An estimated \$3 billion in
18 retail sales are generated per year due to the Barnett Shale (Business Wire 2007). In 2006,
19 revenue to local governments including schools was approximately \$227.7 million. According to
20 the study, the economic impact of the Barnett Shale expanded by 50 percent from 2006 to
21 2007, with peak productivity forecast in 2014 or 2015 (Business Wire 2007).

22 Employment associated with the Barnett Shale has contributed to the relatively low
23 unemployment numbers in the region. Unemployment rates of 4.0 percent or below are
24 considered full employment by the Texas Workforce Commission, and annual average
25 unemployment rates in the region were below 5.0 percent in 2008 (Table 2-21). Competition for
26 workers in the region, especially those with technical skills, has reduced the availability of
27 workers for projects such as CPNPP Units 3 and 4 (Luminant 2009a).

28 Table 2-22 provides data on total non-farm employment by industry type in the EIA in 2007. In
29 Somervell County, in which CPNPP Units 1 and 2 are located and in which Units 3 and 4 would
30 be located, non-farm employment in 2007 was highest in local government (12.7 percent),
31 construction (8.7 percent), and retail trade (7.5 percent) (Table 2-22). These data are
32 somewhat misleading, however, because the largest single employer in Somervell County is

1 Luminant, with 977 employees at the CPNPP site alone. These Luminant employees are
2 included as “Not Shown” in the “Utilities” category in Table 2-22.

3 Table 2-23 shows the current pattern of residence for the operations workers at CPNPP Units 1
4 and 2. Most of the workers live in the nearby communities of Granbury (41.0 percent) and Glen
5 Rose (19.9 percent), but many live in more distant cities and towns such as Cleburne
6 (10.2 percent) and Fort Worth (6.1 percent). Based on this distribution of Units 1 and 2 workers,
7 the review team expects that most of the construction and operations workers at Units 3 and 4
8 would live in Hood and Somervell Counties.

9 In Hood County, in which part of the CPNPP site is located, the non-farm sectors with the
10 largest employment in 2007 were retail trade (14.5 percent), local government (10.6 percent),
11 and construction (10.3 percent) (Table 2-22). The largest single employer in Hood County is
12 Granbury Independent School District with 1230 employees. Table 2-22 also provides data on
13 non-farm sector employment for the four other counties in the EIA.

14 Table 2-24 provides data on total personal and per capita income for the EIA and the State of
15 Texas in 2007. Total personal income in the EIA ranged from a high of almost \$65.9 billion in
16 Tarrant County to a low of \$245.1 million in Somervell County. Per capita income in the EIA
17 ranged from a high of \$38,538 in Tarrant County to a low of \$27,274 in Bosque County. In the
18 EIA, only one (Tarrant) had a higher per capita income in 2007 than the State of Texas
19 (\$37,083).

20 **2.5.2.2 Taxes**

21 The State of Texas has no personal or corporate income taxes. There is a corporate margin
22 tax, under which a company owes 1.0 percent of gross receipts less compensation or the costs
23 of goods sold. The rate is reduced to 0.5 percent for retailers and wholesalers, while sole
24 proprietorships, general partnerships, and businesses with total revenues of under \$300,000 are
25 exempt.

26 Sales and use tax is imposed on all retail sales, leases and rentals of goods, and taxable
27 services in the State of Texas. The State’s tax rate is 6.25 percent. Local governments can
28 add an additional 0.25 to 2.0 percent, with the State tax rate plus local tax rate not to exceed
29 8.25 percent. Bosque, Erath, and Hood Counties impose a sales and use tax of 0.5 percent.
30 Johnson, Somervell, and Tarrant Counties do not charge a sales and use tax. The cities of
31 Granbury, Cleburne, Stephenville, and Tolar tax at a rate of 1.5 percent, while Glen Rose has a
32 sales and use tax of 2.0 percent. The City of Fort Worth has a tax rate of 1.0 percent, while the
33 Fort Worth Metropolitan Transit Authority and the Fort Worth Crime Control Special Purpose
34 District each charge a 0.5 percent tax. The maximum tax rate in the region is 8.25 percent.

35 Texas has no State property tax. Property taxes are levied by counties, cities, school districts,
36 and special districts (junior colleges, hospitals, road districts, and others). As indicated in
37 Table 2-25, Somervell County collected more than \$8.4 million in property taxes in 2007, while
38 Hood County collected over \$14.4 million.

39 In Texas, schools are funded solely through local property taxes. The largest school districts in
40 Somervell and Hood Counties collected significantly more in property taxes in 2007 than did the
41 other counties: Glen Rose Independent School District (ISD) collected over \$24.8 million while
42 Granbury ISD collected over \$40.6 million (Table 2-25). Texas school districts are designated
43 either “property rich” (Chapter 41) or “property poor” (Chapter 42) based on a wealth
44 benchmark, calculated as the district’s total assessed property valuation divided by the total
45 number of students. Those districts with a total wealth per student above the State benchmark
46 are considered Chapter 41 and those below the benchmark are considered Chapter 42.

1 Chapter 41 districts are required to send a portion of their local property tax revenue to the State
2 for redistribution to Chapter 42 districts. Both the Glen Rose and Granbury ISDs are Chapter 41
3 districts (see Section 2.5.2.7).

4 Currently, Luminant pays ad valorem taxes on CPNPP Units 1 and 2 to Somervell and Hood
5 Counties and to smaller jurisdictions within those counties. Table 2-26 shows the amount of ad
6 valorem taxes paid to each jurisdiction for 2006. The ad valorem taxes are paid in two
7 categories, personal property and real property. The taxed amounts were phased in through
8 the years of development, with the total market value assessed on January 1 of 1990 and 1993,
9 the years the units became operational. CPNPP Units 3 and 4 are expected to pay ad valorem
10 taxes at the same rate and to the same jurisdictions as Units 1 and 2. However, the tax rates
11 for CPNPP Units 3 and 4 have not been finalized.

12 Based on the data in Tables 2-26 and 2-27, the ad valorem taxes paid to Somervell County and
13 Glen Rose ISD in 2006 were nearly comparable to the amounts those jurisdictions received
14 from property taxes. In contrast, the amount of ad valorem taxes paid to Hood County and
15 Granbury ISD in 2006 were only a fraction of the amounts those jurisdictions received from
16 property taxes.

17 **2.5.2.3 Transportation**

18 The region is accessible by a transportation network of FM roads, Federal and State highways,
19 rail, and a public airport. Due to the predominantly rural setting and the small sizes of the cities
20 and towns near the CPNPP site, most traffic is by personal vehicle or tractor/trailer transport.
21 Thus, this description of the existing transportation network focuses primarily on roads in
22 Somervell and Hood Counties near the CPNPP site.

23 Figure 2-18 illustrates the road and highway system in Somervell and Hood Counties. U.S.
24 Highway 67 (US 67) is located south of the CPNPP site and runs from northeast to southwest
25 through the town of Glen Rose. In Hood County, US 377 is a four-lane divided highway that
26 runs northeast to southwest through Granbury. Texas State Highway 144 (SH 144) passes to
27 the east of the CPNPP site and connects US 67 to US 377.

28 Numerous FM roads traverse both counties, providing rural access to the larger populated
29 areas. FM 56, located just west of the CPNPP site, is a two-lane highway that runs from north
30 to south, connecting US 377 at Tolar to US 67 at Glen Rose. FM 56 provides the only road
31 access to the CPNPP site. For CPNPP workers who live in Somervell County, FM 56 north
32 from Glen Rose provides access to the CPNPP site. For CPNPP workers who live in Hood
33 County, FM 56 south from Tolar or FM 51 (a two-lane highway southwest from Granbury) to
34 FM 56, provides access to the CPNPP site.

35 The roadways in Somervell and Hood Counties are best described as primarily rural, with some
36 urban roadways in and near the major population centers of each county. Data on vehicle
37 volume on these roads are obtained from estimated Annual Average Daily Traffic (AADT)
38 counts from the Texas Department of Transportation (TxDOT). These bidirectional traffic
39 counts from TxDOT were last revised in 2007.

Table 2-22. Total non-farm employment by industry type in the EIA (2007)

Industry	County											
	Somervell		Hood		Bosque		Erath		Johnson		Tarrant	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Forestry, fishing, related activities, and other	NS ¹	-	87	0.5	88	1.0	669	2.9	NS	-	687	0.1
Mining	78	1.5	654	3.6	80	1.0	205	0.9	1,758	2.7	12,749	1.2
Utilities	NS	-	126	0.7	63	0.8	78	0.3	195	0.3	1,554	0.2
Construction	448	8.7	1,883	10.3	735	8.8	1,586	6.8	7,107	10.9	67,404	6.6
Manufacturing	92	1.8	624	3.4	560	6.7	1,493	6.4	6,327	9.7	93,225	9.1
Wholesale trade	NS	-	368	2.0	262	3.2	692	3.0	2,153	3.3	45,747	4.5
Retail trade	382	7.5	2,659	14.5	816	9.8	2,391	10.3	8,142	12.5	117,035	11.4
Transportation and warehousing	317	6.2	279	1.5	149	1.8	588	2.5	3,565	5.5	68,048	6.6
Information	23	0.4	224	1.2	57	0.7	149	0.6	710	1.1	18,966	1.8
Finance and insurance	131	2.6	769	4.2	302	3.6	663	2.9	1,991	3.1	52,971	5.2
Real estate and rental and leasing	234	4.6	892	4.9	358	4.3	725	3.1	2,931	4.5	43,474	4.2
Professional, scientific, and technical services	197	3.8	763	4.2	235	2.8	755	3.2	2,464	3.8	58,534	5.7
Management of companies and enterprises	0	0.0	NS	-	NS	-	NS	-	316	0.5	5,507	0.5
Administrative and waste services	337	6.6	NS	-	NS	-	NS	-	3,628	5.6	82,467	8.0
Educational services	13	0.3	144	0.8	141	1.7	105	0.5	845	1.3	17,192	1.7
Health care and social assistance	NS	-	1,459	7.9	503	6.0	1,829	7.9	4,556	7.0	84,523	8.2

Table 2-22. (contd)

Industry	County											
	Somervell		Hood		Bosque		Erath		Johnson		Tarrant	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Arts, entertainment, and recreation	90	1.8	517	2.8	78	0.9	382	1.6	NS	-	19,747	1.9
Accommodation and food services	313	6.1	1,529	8.3	277	3.3	1,940	8.4	3,384	5.2	74,172	7.2
Other services, except public administration	265	5.2	1,377	7.5	564	6.8	1,639	7.1	4,221	6.5	58,950	5.7
Federal government, civilian	17	0.3	111	0.6	76	0.9	78	0.3	265	0.4	15,086	1.5
Federal government, military	17	0.3	110	0.6	40	0.5	80	0.3	336	0.5	4,961	0.5
State government	25	0.5	58	0.3	47	0.6	2,044	8.8	201	0.3	9,595	0.9
Local government	652	12.7	1,947	10.6	1,078	13.0	1,431	6.2	6,382	9.8	73,649	7.2
Total	5,124		18,357		8,308		23,232		65,235		1,027,657	

Sources: Luminant 2009a; BEA 2009.

Table 2-23. Place of residence for CPNPP Units 1 and 2 workers

County	Number of Workers	Percent of Total Workers	City/Town	Number of Workers	Percent of Total Workers
Somervell County	221	22.6	Glen Rose	194	19.9
			Rainbow	14	1.4
			Nemo	13	1.4
Hood County	430	44.0	Granbury	401	41.0
			Tolar	29	3.0
Bosque County	43	4.4	Walnut Springs	27	2.8
			Meridian	11	1.2
			Iredell	5	0.5
Erath County	47	4.8	Stephenville	42	4.3
			Bluff Dale	5	0.5
Johnson County	108	11.1	Cleburn	100	10.2
			Burleson	8	0.8
Tarrant County	90	9.2	Fort Worth	60	6.1
			Benbrook	20	2.0
			Arlington	5	0.5
			Crowley	5	0.5
Hamilton County	25	2.6	Hico	25	2.6
Parker County	13	1.3	Weatherford	13	1.3
Total	977	100.0		977	100.0

Source: Luminant 2009a.

1

Table 2-24. Total personal and per capita income in the EIA and the State of Texas (2007)

	Total personal Income (\$1,000)	Per Capita Income (\$)
Somervell County	245,109	31,676
Hood County	1,772,377	36,142
Bosque County	486,096	27,274
Erath County	1,008,206	28,331
Johnson County	4,383,404	29,347
Tarrant County	65,870,354	38,538
State of Texas	884,190,552	37,083

Source: BEA 2009.

2

Table 2-25. Property tax rates and revenues in Somervell and Hood Counties (2007)

	Total Tax Rate (\$)	Total Levy (\$)
Somervell County	0.313	8,483,358
Glen Rose	0.4669	606,652
Somervell County Water District	0.1266	3,431,275
Glen Rose ISD ^(a)	0.8784	24,839,584
Hood County	0.367	14,412,633
Granbury	0.415	3,621,038
Lipan	0.4	51,267
Tolar	0.46	82,081
Acton Municipal Utility District	0.1025	27,866
Granbury ISD	1.1712	40,667,901
Lipan ISD	1.2343	1,146,053
Tolar ISD	1.2493	1,764,950

(a) Independent school district

Source: Luminant 2009a.

3

1

Table 2-26. Ad valorem taxes paid by CPNPP Units 1 and 2 (2006)

	Net Taxes (\$)
Somervell County	5,124,604
Glen Rose	35
Somervell County Water District	1,882,099
Glen Rose ISD	17,355,171
Hood County	8,595
Tolar	37
Granbury ISD	18,734
Tolar ISD	15,073
Hood County Library District	255

Source: Luminant 2009a.

2

Table 2-27. Housing data for the EIA (2000 or 2007)^(a)

	Total Housing Units	Occupied	Owner Occupied	Renter Occupied	Vacant Units	Vacancy Rate (%)
Somervell County	2,750	2,438	1,825	613	312	11.3
Hood County	20,340	17,460	13,404	4,056	2,880	14.2
Bosque County	8,644	6,726	5,225	1,501	1,918	22.2
Erath County	15,223	12,750	7,703	5,047	2,473	16.2
Johnson County	51,628	46,920	36,150	10,770	4,708	9.1
Tarrant County	657,259	591,745	375,675	216,070	65,514	10.0

(a) Data are for 2007 except for 2000 data used for Somervell and Bosque Counties.

Sources: USCB 2007; USCB 2009c.

3

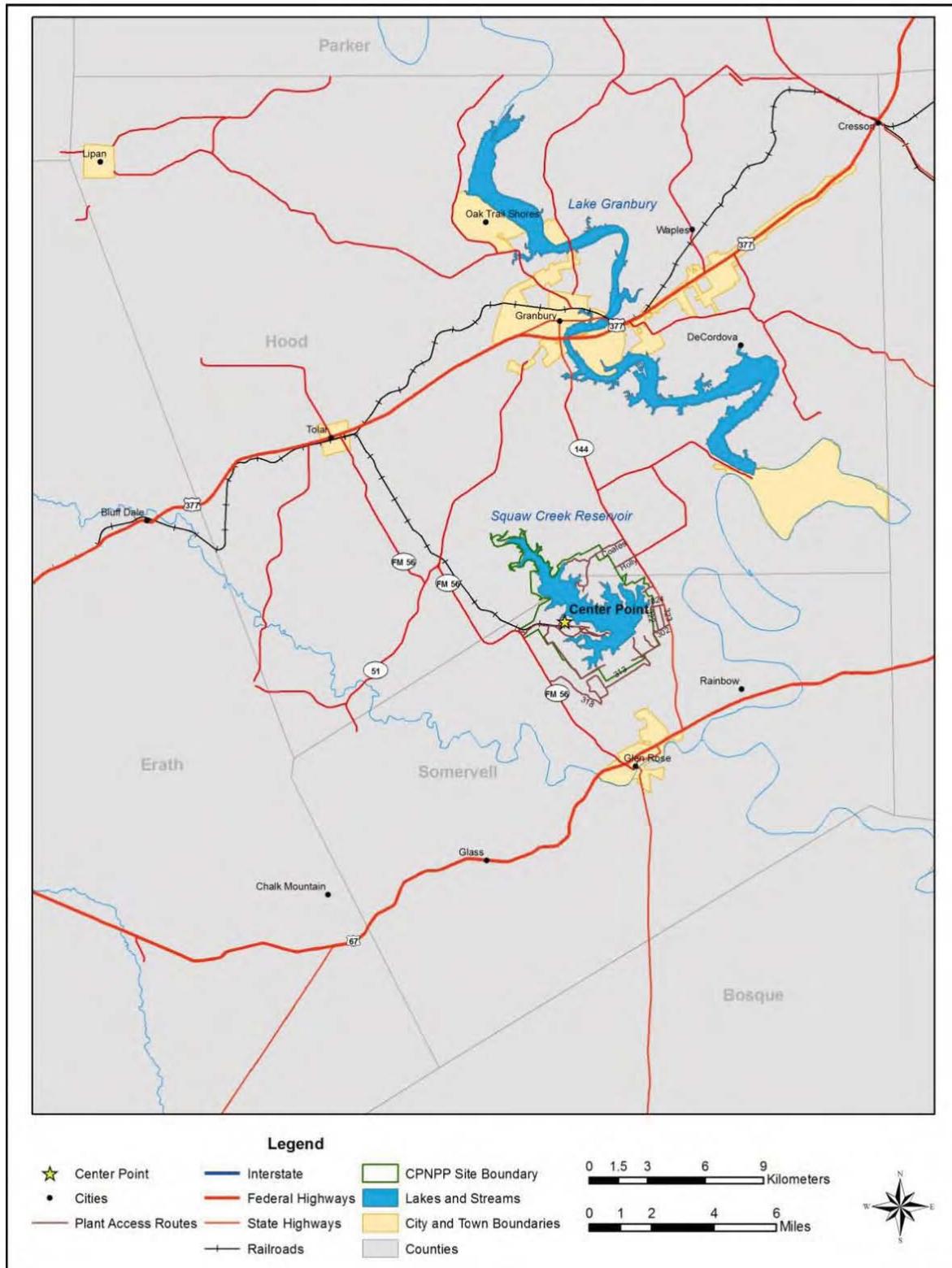


Figure 2-18. Road and highway system in Somervell and Hood Counties (Luminant 2009a).

1 According to TxDOT data for 2007, FM 56 has an AADT count of 3500 vehicles just south of the
2 CPNPP entrance between mile markers 310 and 312. The AADT count on FM 56 southbound
3 from FM 51 is 8500 vehicles between mile markers 304 and 306. Heading north on FM 56 from
4 Glen Rose, the AADT count is 5000 vehicles just north of the city between mile markers 314
5 and 316. Travelling south from Granbury, FM 51 has an AADT count of 6000 vehicles just
6 south of US 377, between mile markers 320 and 322. This decreases to 3300 vehicles just
7 before FM 56, between mile markers 328 and 330. Traveling south on FM 56 from Tolar, the
8 AADT count is 4400 vehicles between mile markers 298 and 300, increasing to 4700 vehicles
9 just before FM 51, between mile markers 302 and 304.

10 Luminant has provided no information about the specific capacities of roads in Somervell and
11 Hood Counties in the vicinity of CPNPP. However, Luminant reports that FM 51 and FM 56
12 have a Level of Service of "A," meaning that there are no traffic delays.

13 Based on a traffic study conducted in 1987 during development of CPNPP Units 1 and 2
14 (DeShazo, Starek and Tang, Inc. 1987), TxDOT made some improvements in traffic signals,
15 lane width, turn lanes, and signage in the near the CPNPP site to handle the large volume of
16 traffic. These improvements included adding the following:

- 17 • a 12-ft-wide, 360-ft-long right turn lane into the site from northbound FM 56;
- 18 • a 12-ft-wide, 750-ft-long acceleration lane from the site onto northbound FM 56; and
- 19 • a 12-ft-wide, 430-ft-long left turn lane into the site from southbound FM 56.

20 According to local officials, the roads in Somervell and Hood Counties are in good condition and
21 are well maintained. In particular, US 67, FM 56, and SH 144 are in good condition, and there
22 are no plans to make improvements on those roads in the next few years (Luminant 2009a). In
23 Hood County, TxDOT has approved a contract to add a hot mix overlay to the road surface and
24 shoulders of US 377. This overlay would not add any length to the road system, but it would
25 provide a new surface on the existing road. TxDOT is also planning two improvement projects
26 for US 377, but neither project has received funding. The first project would affect US 377 west
27 of Granbury through Tolar to the Erath County line. This section of US 377 is currently a two-
28 lane highway, but TxDOT plans to widen it to a four-lane divided highway. The second project
29 would involve US 377 east of Granbury from SH 144 to FM 167. This section of US 377 is
30 currently a five-lane highway (four lanes with a turn lane in between), but TxDOT plans to
31 expand it to a six-lane highway (four lanes with two designated turn lanes) (Luminant 2009a).

32 Figure 2-18 shows the railways in the immediate vicinity of the CPNPP site. The Ft. Worth
33 Western Railroad Company owns and operates the railroad line that runs through Tolar
34 approximately 10 mi northwest of the CPNPP site. An average of two trains use this railway
35 each day, with four to five cars of hazardous materials from various sources transported each
36 month. The spur line that provides rail access to the CPNPP site connects with this main line in
37 Tolar.

38 There are three private airports and one public airport within three miles of the CPNPP site, and
39 five more private airports and one private heliport within 10 mi of CPNPP. The closest airport is
40 Parker Airport, located 3.5 mi north of the site. Parker is home to one single-engine airplane
41 and has a 200-ft turf runway and a 610-ft turf runway. The closest public airport is Granbury
42 Municipal Airport, located approximately 10 mi north. Granbury Municipal Airport has one
43 3603-ft asphalt runway and is home to 54 single-engine aircraft, three multi-engine aircraft, and
44 two helicopters. Granbury Municipal Airport averages 33 aircraft operations a day. There are
45 plans to begin construction on a new 5300-ft runway.

1 **2.5.2.4 Aesthetics and Recreation**

2 The CPNPP site is located in north central Texas in the Grand Prairie and North-Central Plains
3 physiographic regions. The Grand Prairie region ranges in elevation from 450 to 1250 ft and is
4 characterized by low hills. The western portion of the Grand Prairie region includes the Western
5 Cross Timbers, a forested area of predominately post oaks. The North-Central Plains region
6 ranges from 900 to 3000 ft in elevation and is characterized by low north-south ridges. The land
7 around the CPNPP site is primarily rural, consisting of grasslands, deciduous and evergreen
8 forests, and some agricultural cropland.

9 The reactor domes at CPNPP Units 1 and 2 are visible for several miles in most directions,
10 including views from Dinosaur Valley State Park (3.3 mi to the southwest) and Oakdale Park
11 (5.2 mi to the southeast). In response to local residents' complaints about not being able to see
12 the stars at night, Luminant installed low-sodium lighting on CPNPP Units 1 and 2 to reduce
13 light pollution. Luminant would install the same type of low-sodium lights on Units 3 and 4
14 (Luminant 2009a).

15 The region is well situated geographically for outdoor activities. Lake Granbury hosts numerous
16 water sports activities throughout the year, including boating, swimming, and fishing. Other
17 large parks and outdoor attractions within the region include Cleburne State Park, Dinosaur
18 Valley State Park, the Fort Worth Nature Reserve, Fossil Rim Wildlife Center, Lake Mineral
19 Wells State Park, Lake Whitney State Park, and Meridian State Park. A new recreational site is
20 planned for Wheeler Branch Reservoir, about 1 mi south of the CPNPP, including a boat launch,
21 fishing pier, swim area, and biking or walking trails.

22 The nearest State park to the CPNPP site is Dinosaur Valley State Park. The Glen Lake Camp
23 and Retreat Center is located 5.3 mi southeast of the CPNPP site and hosts various retreats,
24 summer camps, and events. Oakdale Park and Tres Rios Park, which are located 5.7 mi
25 southeast of CPNPP, both host outdoor events throughout the year and provide camping
26 facilities. The Texas Amphitheatre, located 3.7 mi east of CPNPP, hosts outdoor events.
27 Additional parks and venues in the area surrounding CPNPP include Squaw Creek Golf Course
28 5.0 mi to the southeast, Pecan Plantation Country Club 7.5 mi to the northeast, and Nutcracker
29 Golf Club 8.2 mi to the northeast.

30 Outdoor activities in the area include backpacking, climbing, camping, and hunting. Several of
31 the State parks within the region provide numerous facilities and recreational opportunities,
32 including camping facilities, beach complexes, boating access, and hiking trails.

33 **2.5.2.5 Housing**

34 As discussed in Section 2.5.2.1, most of the current CPNPP employees (over 66 percent) live in
35 Hood and Somervell Counties, and over 96 percent live in the EIA. Most of the construction
36 workers and almost all of the operations workers for Units 3 and 4 are expected to follow a
37 similar residential pattern. Thus, this section describes housing in the EIA.

38 Table 2-27 provides data from the USCB on the total number of housing units, types of
39 occupancies, and vacancies in the EIA. In some cases, the data in Table 2-27 are from the
40 2000 U.S. Census (the latest housing data available from the USCB for Somervell and Bosque
41 Counties); in others the data are from the 2007 American Community Survey (USCB 2007).

42 As indicated in Table 2-27, Tarrant and Johnson Counties had the most total housing units and
43 the lowest vacancy rates in the EIA in 2007. Near the CPNPP site, most of the residents are
44 clustered in residential neighborhoods in Glen Rose and Granbury. Outside of these city limits,
45 residents generally live in scattered, single-family homes or mobile homes. Table 2-28 provides

1 2000 USCB data on housing in the communities closest to the CPNPP: Glen Rose, Granbury,
 2 Pecan Plantation Census Designated Place (CDP), and Tolar.

3 The four jurisdictions listed in Table 2-28 had a total of 562 vacant units and a vacancy rate of
 4 10.4 percent in 2000. Combined, the two cities in which most of the current CPNPP workers
 5 reside, Glen Rose and Granbury, had 438 vacant units and a vacancy rate of 12.1 percent.

Table 2-28. Housing data for Glen Rose, Granbury, Pecan Plantation CDP, and Tolar (2000)^(a)

	Total Housing Units	Occupied	Owner Occupied	Renter Occupied	Vacant Units	Vacancy Rate (%)
Glen Rose	903	801	474	327	102	11.3
Granbury	2,727	2,391	1,321	1,070	336	12.3
Pecan Plantation CDP ^(a)	1,568	1,475	1,410	65	93	5.9
Tolar	217	186	140	46	31	14.3
Total	5,415	4,853	3,345	1,508	562	10.4

(a) Census designated place

Source: USCB 2009d.

6 Temporary housing is available at one of the many local hotels and motels in the Glen Rose and
 7 Granbury areas. In 2009, Glen Rose had eight hotels with 471 rooms, and Granbury had 746
 8 hotel or motel rooms (with construction of another hotel planned, which will add 88 more
 9 rooms). With the exception of one hotel, all the hotels in the area accept long-term occupants
 10 and are frequented by the outage workers from CPNPP Units 1 and 2. Hotel rooms are
 11 available on a first-come, first-served basis, and only two hotels reserve spaces for recreational
 12 users. Thus, during outages, CPNPP outage workers and transients compete for temporary
 13 housing, and this competition is expected to increase when the construction workers for Units 3
 14 and 4 enter the area.

15 There are also several hotels and motels in the surrounding communities. Stephenville and
 16 Cleburne are both located approximately 30 minutes from the CPNPP site. Cleburne had
 17 260 rooms available in 2008, while Stephenville had 363 rooms available in 2004. The
 18 proximity of these cities to the CPNPP site makes it likely that workers seeking temporary
 19 housing would travel to those hotels for lodging.

20 There are also temporary housing opportunities at local campgrounds and recreational vehicle
 21 (RV) parks. There are six RV parks located in Glen Rose and Rainbow in Somervell County:
 22 B Street RV Park, Cedar Ridge Cabins and RV Park, Dinosaur Valley State Park, Jurassic RV
 23 Park, Oakdale Park, and Tres Rios River Ranch. These six RV parks have a total of 428 RV
 24 spots. Outage workers stay at the RV parks during outages at CPNPP Units 1 and 2. Of these
 25 parks, only Jurassic RV Park intends to expand by adding 30 additional spots if it becomes
 26 consistently full.

27 There are five RV parks located in Granbury in Hood County: 377 Market Place RV Park,
 28 Countryside RV Park, Midway Pines RV Park, The Cove Marina and RV Park (formerly Pier 144
 29 RV Park), and Thorp Spring RV Park. Combined, these parks have a total of 191 RV spots.
 30 CPNPP outage workers stay at all of the parks except for 377 Market Place RV Park. Midway
 31 Pines RV Park even takes reservations solely for outage workers, and intends to add 24 RV
 32 spots to its facility with plans to add another 60 spots in the next 3 to 4 years. Several additional
 33 RV parks are located in the nearby communities of Stephenville, Cleburne, Joshua, and
 34 Alvarado. All of these temporary housing opportunities are also shared by visitors to the area.

1 There are seven RV parks located in and around Stephenville, and four RV parks in Cleburne
2 and surrounding areas. Doc's City RV Park offers 65 spots and has received outage workers in
3 the past. The Ranch Oaks Mobile Home Park in Cleburne also has 65 spots that are solely for
4 long-term rent.

5 **2.5.2.6 Public Services**

6 The following subsections contain information about the public services provided to residents of
7 the EIA but focus primarily on Somervell and Hood Counties. The public services discussed are
8 water and wastewater; solid waste; police, fire, and medical services; and social services.
9 Educational services are discussed in Section 2.5.2.7.

10 ***Water and Wastewater***

11 In Somervell and Hood Counties, there are various ways for residents to obtain water and
12 wastewater services. Depending on the geographic location, residents of the two counties can
13 get water from a municipality or from private wells.

14 The Somervell County Water District operates the only water treatment plant in Somervell
15 County. Drinking water for the City of Glen Rose and other county residences comes directly
16 from the Trinity aquifer. The existing system has a maximum capacity of 1.426 MGD and an
17 average daily consumption of 488,000 gpd. The City of Glen Rose also has a water distribution
18 system that provides service to 1294 service connections. Residents outside of these water
19 systems are on different systems.

20 In 2008, TCEQ designated five counties including Somervell and Bosque Counties as the
21 Central Texas Trinity Aquifer Priority Groundwater Management Area (PGMA). A PGMA is an
22 area that is experiencing, or is expected to experience, critical groundwater problems including
23 shortage of surface water or groundwater within 25 years. In an effort to decrease Somervell
24 County's dependency on groundwater, the Somervell County Water District recently created
25 Wheeler Branch Reservoir, located north of Glen Rose. The reservoir was completed in 2008,
26 and construction on the water treatment and distribution system is expected to begin in 2010.
27 The reservoir has a capacity of 1.3 billion gal and is expected to provide access to an estimated
28 1.8 MGD of water to the city of Glen Rose and other county users.

29 The City of Glen Rose has the largest wastewater treatment plant in Somervell County. At
30 maximum capacity, the plant can handle 600,000 gpd but only operates at 320,000 gpd. For
31 the rest of Somervell County, wastewater is treated onsite in privately owned septic systems.

32 In Hood County, the Lake Granbury SWATS is run by the Brazos River Authority and can
33 supply water to the City of Granbury and the Acton Municipal Utility District (AMUD), as well as
34 other entities in neighboring Johnson County. The SWATS facility has a water treatment
35 capacity of 10.5 MGD with a current usage of 6.1 MGD. The City of Granbury obtains water
36 from wells and also operates a drinking water treatment facility that draws water from Lake
37 Granbury and the Trinity aquifer. The system has a capacity of 500,000 gpd and currently
38 serves approximately 43,000 connections. Plans are in place for a new 1.5 MGD water
39 treatment plant north of Granbury to serve the growing population. The new plant would be
40 capable of being expanded up to 7.5 MGD and would allow the City of Granbury to discontinue
41 purchasing water from the Lake Granbury SWATS facility. Portions of Hood County around
42 Lake Granbury and the Brazos River receive water from AMUD, including a number of
43 subdivisions and undeveloped agricultural land. The AMUD treatment plant has a maximum
44 capacity of 4.13 MGD and is currently operating at 1.9 MGD. The City of Tolar receives its
45 water from wells and has a maximum capacity of 280,000 gpd with current use at 75,000 gpd.
46 Residents outside of these water systems are on different systems.

1 In 2009, the TCEQ designated 13 counties including Hood, Johnson, and Tarrant Counties as
2 the North-Central Texas and Woodbine Aquifers PGMA. The TCEQ further recommended that
3 eight of those counties including Johnson County form a Groundwater Conservation District
4 (GCD). This shortage is most likely to affect the city of Tolar, as its municipal water is drawn
5 solely from wells.

6 Wastewater processing in Hood County occurs at a facility in Granbury with a 2.0-MGD capacity
7 that typically operates at approximately 1.0 MGD. The Tolar Wastewater Treatment Plant has a
8 capacity of 100,000 gpd and is currently operating at 70 percent capacity. Plans for expansion
9 of the plant are expected to be made within the next few years.

10 In Bosque County, the city of Walnut Springs receives its drinking water from two wells with an
11 average use of 6000 gpd. No capacity numbers are available for the drinking water treatment
12 plant; however, the city currently has 315 connections and could increase to 2000 connections
13 with the existing groundwater supply. The wastewater treatment plant has a current usage of
14 63,000 gpd and an approximate maximum capacity of 120,000 gpd.

15 In Erath County, the City of Stephenville has a water treatment plant with a maximum capacity
16 of 5.5 MGD. The plant provides water to 5,512 connections, and the average daily consumption
17 is 2.3 MGD. The wastewater treatment plant has a capacity of 9.0 MGD and a current utilization
18 of 1.4 MGD.

19 In Johnson County, the City of Cleburne receives its drinking water from Lake Pat Cleburne,
20 Lake Aquilla, and groundwater. However, groundwater supplies are diminishing, so plans are in
21 place to make use of unused water rights to Lake Whitney, with initial capacity of 2.1 MGD in
22 2013. The existing water treatment plant has a capacity of 15 MGD, with plans to expand to
23 20 MGD by 2011 in response to increased population and industrial demand. Average daily
24 consumption is 7.3 MGD with peak demand of 11.3 MGD, usually occurring in August. The City
25 of Cleburne has two wastewater treatment plants with a combined total capacity of 7.5 MGD.
26 The average daily usage is 6.6 MGD. There are plans to increase the plants' capacity using
27 new technology in the next few years, with a plant expansion 4 to 5 years later as demand
28 dictates.

29 In Tarrant County, the City of Fort Worth receives its drinking water from six sources:
30 Benbrook Lake, Cedar Creek Lake, Lake Bridgeport, Eagle Mountain Lake, Richard-Chambers
31 Reservoir, and Lake Worth. Lake Worth is owned by the City of Fort Worth and Benbrook Lake
32 is owned by the Army Corps of Engineers. The other four lakes are owned by the Tarrant
33 Regional Water District. The City of Fort Worth has four water treatment plants. The North and
34 South Holly Water Treatment Plants have a combined capacity of 180 MGD, the Rolling Hills
35 plant has a capacity of 200 MGD, and the Eagle Mountain plant has a capacity of 105 MGD, for
36 a total capacity of 485 MGD. The average daily consumption is 164.8 MGD with a peak of
37 335.2 MGD. Fort Worth has one wastewater treatment plant, the Village Creek Wastewater
38 Treatment Plant. The plant has a capacity of 166 MGD with an average flow of 108.5 MGD.

39 **Solid Waste**

40 There are no active landfills in Somervell or Hood Counties. Solid waste in Somervell County is
41 gathered at the IESI, Inc., Somervell County Transfer Station, and waste in Hood County is
42 gathered at the IESI Granbury Transfer Station. In 2005, the IESI Somervell County Transfer
43 Station handled 14,284 tons of waste, and the IESI Granbury Transfer Station handled 16,153
44 tons. Waste from these two stations is transported to the IEASI Weatherford Landfill in Parker
45 County. The Weatherford Landfill is a Type 1 landfill and received 194,125 tons of waste in
46 2005 with an estimated 1,100,000 tons of space remaining.

1 **Police, Fire, and Medical Services**

2 Police protection in Somervell County is provided mainly by the Somervell County Sheriff's
3 Department, which employed 19 sworn officers in 2004. In addition, the City of Glen Rose has
4 a police chief.

5 Police protection in Hood County is provided mainly by the Hood County Sheriff's Department,
6 which employed 37 sworn officers and 78 civilians in 2006. There are also two other police
7 departments in Hood County: the Granbury Police Department and the Tolar Police
8 Department. The Granbury Police Department has 30 officers, while the Tolar Police
9 Department employs one. The Granbury Police Department plans to augment its force with
10 30 to 35 citizen volunteers who are trained at the Citizen Police Academy in Granbury to aid the
11 officers in disaster and emergency response, including response to situations at CPNPP.

12 Somervell County has a single fire department, the Somervell County Volunteer Fire, Rescue,
13 and Emergency Management Services. The department is served by 40 people: 34 volunteers
14 and 6 paid employees. The department has three engines, two tankers, one ladder truck, six
15 brush trucks, one rescue vehicle, one command vehicle, and three ambulances. The
16 department responds in the event of an emergency at CPNPP.

17 There are a total of nine fire departments with 250 volunteers in Hood County. Each fire
18 department is assigned one of nine response areas in the county but responds to larger
19 emergencies anywhere in or even outside of the county. Each station has at least one 2000-gal
20 pumper truck. The City of Granbury is served by the Granbury Volunteer Fire Department
21 (VFD). The department has 60 volunteers and operates out of two stations. The fire
22 department owns four pumper trucks, one aerial ladder truck, one tanker, three brush trucks,
23 and two rescue trucks. Granbury VFD, Tolar VFD, Indian Harbor VFD, and DeCordova/Acton
24 VFD have a mutual aid agreement with CPNPP to respond to fires. Each department
25 contributes one engine and a squad of approximately 10 people.

26 Somervell County contains one hospital, Glen Rose Medical Center, which also has an
27 associated nursing home. The hospital has 16 beds and the nursing home has 118 beds.
28 Combined, the two facilities employ 280 people. The daily load at the hospital is seven beds.
29 During an emergency, the 16 beds could be augmented with 7-10 additional beds.

30 Hood County also contains one hospital, Lake Granbury Medical Center in Granbury. The
31 Center has 59 beds with 36 doctors on active duty. The daily load is 16 beds and the maximum
32 capacity is 59 beds.

33 **Social Services**

34 Social services in the State of Texas are overseen by the Texas Department of Family and
35 Protective Services (DFPS), which has an office in Granbury. The DFPS provides services
36 such as child and adult protective services, child care licensing, and assistance to adult or
37 elderly disabled. The agency also manages community-based programs targeting the
38 prevention of abuse, neglect, delinquency, and exploitation of children, disabled adults, or the
39 elderly. Other social services in the project area are provided by local non-governmental
40 organizations and religious groups.

41 **2.5.2.7 Education**

42 There are two school districts within Somervell County: Brazos River Charter School and Glen
43 Rose ISD. Brazos River Charter School has one school that provides education for grades
44 9-12, and had a total enrollment of 135 students in the 2006-2007 school year. Glen Rose ISD
45 has four schools which provide PK-12 education. Glen Rose ISD has a maximum capacity of

1 2862 students, with 1657 students enrolled for the 2007–2008 school year. According to Texas
2 House Bill 72, elementary school classes are required to have a student-teacher ratio of 22:1.
3 Brazos River Charter School has a student-teacher ratio of 15.9 while Glen Rose ISD has a
4 student-teacher ratio of 11.6.

5 There are three school districts within Hood County: Granbury ISD, Lipan ISD, and Tolar ISD,
6 each of which provides K–12 education. Granbury ISD has twelve schools with a total
7 maximum capacity of 8665 students. Granbury ISD had a total enrollment of 6882 in 2007–
8 2008. Lipan ISD has one school with a total enrollment of 590 in 2006–2007. Tolar ISD has
9 two schools with a total enrollment of 595 in 2006–2007. Granbury ISD has a student-teacher
10 ratio of 14.2 while Lipan ISD and Tolar ISD have student-teacher ratios of 11.2 and 13.1,
11 respectively.

12 Both Glen Rose ISD and Granbury ISD are categorized as “Chapter 41” school districts (see
13 Section 2.5.2.2), which means they are subject to the redistribution of funds to poorer school
14 districts under State law. The law stipulates that any funds in excess of the state-mandated per
15 student limit be recaptured from wealthier school districts and distributed to poorer school
16 districts. The amounts recaptured are based on the wealth per weighted student in average
17 attendance. Estimates show that Glen Rose ISD’s recapture cost for the 2007–2008 year was
18 \$6,976,397. Granbury ISD did not have any recapture cost for the 2007–2008 school year.

19 **2.6 Environmental Justice**

20 Environmental justice refers to a Federal policy established by Executive Order 12898 that
21 requires each Federal agency to identify and address, as appropriate, disproportionately high
22 and adverse human health and environmental effects of its programs, policies, and activities on
23 minority or low-income populations (59 FR 7629).^a The Council on Environmental Quality (CEQ)
24 has provided guidance for addressing environmental justice (CEQ 1997). Although it is not
25 subject to the Executive Order, the Commission has voluntarily committed to undertake
26 environmental justice reviews. On August 24, 2004, the Commission issued its policy statement
27 on the treatment of environmental justice matters in licensing actions (69 FR 52040).

28 This section describes the existing demographic and geographic characteristics of the proposed
29 site and its surrounding communities. It offers a general description of minority and low-income
30 populations within the 50-mi region surrounding the site. The characterization in this section
31 forms the analytical baseline from which the determination of potential environmental justice
32 effects would be made. The characterization of populations of interest includes an assessment
33 of “populations of particular interest or unusual circumstances,” such as minority communities
34 exceptionally dependent on subsistence resources or identifiable in compact locations, such as
35 Native American settlements.

36 **2.6.1 Methodology**

37 The review team first examined the geographic distribution of minority and low-income
38 populations within 50 mi of the CPNPP site using data from the 2000 Census to identify minority
39 and low-income populations. The review team examined each Census block group^b that is fully

(a) The U.S. Census Bureau defines minority categories: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; or Hispanic ethnicity; “other” may be considered a separate minority category. Low-income refers to individuals living in households meeting the official poverty measure. To see the U.S. Census Bureau definitions and values for 2000, visit the U.S. Census website at <http://ask.census.gov/>.

(b) The U.S. Census Bureau defines a Census block group as a “subdivision of a census tract (or, prior to 2000, a block numbering area)” and as the “smallest geographic unit for which the Census Bureau tabulates sample

1 or partially included in the region to determine for each minority and low-income population
2 group whether

- 3 • the population of interest exceeds 50 percent of the total population for the block group, or;
- 4 • the percentage of the population of interest is 20 percent (or more) greater than the same
5 population's percentage in the block group's state.

6 The identification of Census block groups that meet either of the above criteria is not, in and of
7 itself, sufficient for the review team to conclude that disproportionately high and adverse impacts
8 would occur. Likewise, the lack of Census block groups meeting either of the above criteria
9 cannot be construed as evidence of no disproportionately high and adverse impacts. To reach
10 an environmental justice conclusion, the review team must investigate all populations in greater
11 detail to determine if there are potentially significant environmental impacts that may have
12 disproportionately high and adverse effects on minority or low-income communities. To
13 determine whether disproportionately high and adverse effects may occur, the review team
14 considers the following:

15 ***Health Considerations***

- 16 1. Are the radiological or other health effects significant or above generally accepted norms?
- 17 2. Is the risk or rate of hazard significant and appreciably in excess of the general population?
- 18 3. Do the radiological or other health effects occur in groups affected by cumulative or multiple
19 adverse exposures from environmental hazards?

20 ***Environmental Considerations***

- 21 4. Is there an impact on the natural or physical environment that significantly and adversely
22 affects a particular group?
- 23 5. Are there any significant adverse impacts on a group that appreciably exceed or [are] likely
24 to appreciably exceed those of the general population?
- 25 6. Do the environmental effects occur in groups affected by cumulative or multiple adverse
26 exposure from environmental hazard? (NRC 2007c)

27 If this investigation in greater detail does not yield any potentially disproportionately high and
28 adverse impacts on populations of interest, the review team may conclude that there are no
29 disproportionately high and adverse effects. If, however, the review team finds any potential for
30 disproportionately high and adverse impacts, the review team would fully characterize the
31 nature and extent of those impacts and consider possible mitigation measures that would be
32 used to lessen those impacts.

33 ***Minority and Low-Income Populations***

34 The review team included all the Census blocks that are located either fully or partially within the
35 region to identify minority and low-income populations. The review team used the State of
36 Texas as the geographic area for defining the threshold criteria discussed as items 1 and 2
37 above, and averaged the statewide Census data to derive the specific threshold criteria for
38 minority and low-income populations. The review team then compared the calculated

data. A block group consists of all the blocks within a census tract with the same beginning number." To see more definitions of terms used in the Census, visit the U.S. Census website at http://factfinder.census.gov/home/en/epss/glossary_b.html.

1 percentages of minority and low-income residents derived from Census block data with the
2 specific criteria to identify Census blocks that contain a minority or low-income population.

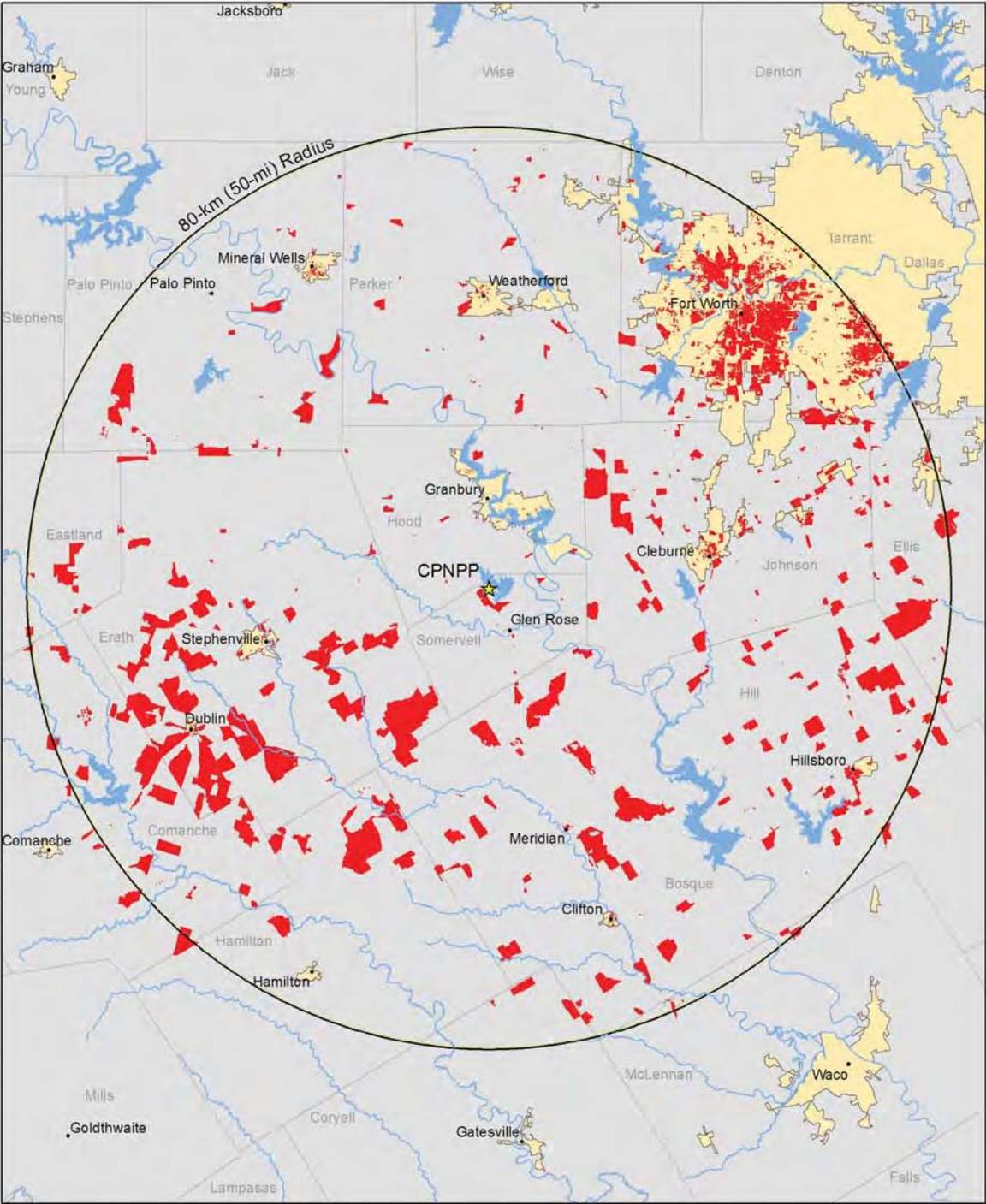
3 In addition to the minority definitions stated above, the review team also considered Hispanic
4 ethnicity in identifying minority populations. According to the USCB, Hispanic ethnicity is not a
5 race; therefore, a Hispanic individual can be counted in any of the race categories as well as the
6 Hispanic ethnicity category. Because both Hispanic ethnicity and minority races are included in
7 the "Aggregate Minority plus Hispanic" category, individuals who reported both a Hispanic
8 ethnicity and a minority race were counted twice.

9 Figure 2-19 shows the Census block groups with minority populations, as defined above, within
10 the region. There are a total of 37,212 Census blocks in the region, of which 10.5 percent had
11 an "Aggregate Minority" (i.e., all minority groups combined) population that exceeded one of the
12 above criteria, and 20.5 percent had an "Aggregate Minority plus Hispanic" population that
13 exceeded one of the above criteria. The closest Census block group to the CPNPP site borders
14 the CPNPP property to the south.

15 Figure 2-20 shows the Census block groups with low-income populations, as defined above,
16 within the 50-mi CPNPP region. Less than one percent of the 37,212 Census blocks in the
17 region had a low-income population that exceeded one of the above criteria. The closest
18 Census block to the site with a low-income population as defined above is more than 35 miles
19 away to the southwest, in Dublin, Texas.

20 Table 2-29 lists the results of the review team's analysis for total minority and low-income
21 individuals as a percentage of the total population within the region. The review team added
22 data from the 2000 Census for the State of Texas for purposes of comparison.

23 As indicated in Table 2-29, the percentage of minority individuals in the region (25.5 percent
24 Aggregate Minority) was slightly lower than the percentage of minority individuals for the State
25 of Texas (29.1 percent Aggregate Minority). Further, the percentage of Hispanic ethnicity (18.8
26 percent) and Aggregate Minority plus Hispanic (44.3 percent) in the region was much lower than
27 the percentage of Hispanic ethnicity (32.0) and Aggregate Minority plus Hispanic (61.1 percent)
28 for the State of Texas. Also, the percentage of households below the poverty level in the region
29 (11.4 percent) was lower than the percentage statewide (14.0 percent).



Legend

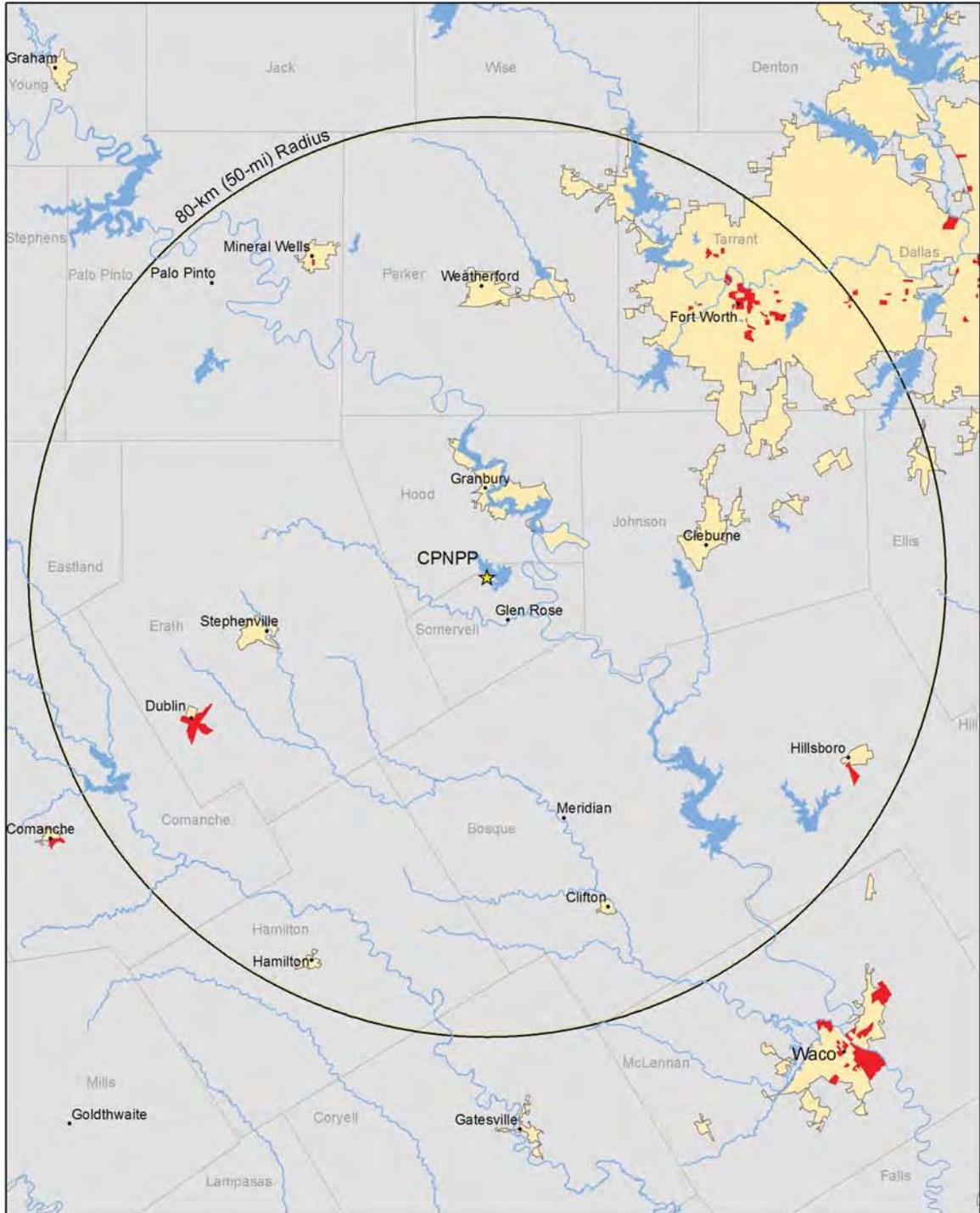
- ★ Center Point
- Cities
- Aggregate Minority Plus Hispanic
- Water Bodies
- Urban Areas
- Counties

0 5 10 20 30 Kilometers

0 5 10 20 30 Miles



Figure 2-19. Census Block Groups with Minority Populations within a 50-mi Radius of CPNPP Units 3 and 4 (Luminant 2009a).



Legend

- ☆ Center Point
- Cities
- Low Income
- Water Bodies
- Urban Areas
- Counties

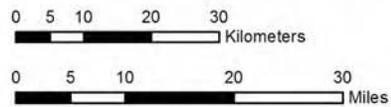


Figure 2-20. Census Block Groups with Low-Income Populations within a 50-mi Radius of CPNPP Units 3 and 4 (Luminant 2009a).

Table 2-29. Minority and low-income population as a percent of total population within 50-mi of CPNPP and for the State of Texas (2000)

Category	Percent of the Total Population within 50 mi of CPNPP	Percent of the Total Population within the State of Texas
American Indian or Alaskan Native	0.6	0.6
Asian	2.6	2.7
Native Hawaiian or other Pacific Islander	0.1	0.1
Black	11.4	11.5
Persons reporting some other race	8.5	11.7
Persons reporting two or more races	2.3	2.5
Aggregate minority	25.5	29.1
Hispanic ethnicity	18.8	32.0
Aggregate minority plus Hispanic	44.3	61.1
Low-income population	11.4	14.0

Sources: Luminant 2009a, USCB 2009b.

1 The closest census block group cluster that contains a minority population of interest shares a
 2 boundary with the CPNPP site to the south and west. Two small Census block group clusters lie
 3 about six mi from the CPNPP. At much greater distances (more than ten miles from the site)
 4 clusters of Census block groups can be found scattered throughout the southwest and the
 5 northeast of the site, with the largest concentrations of minority populations of interest near Fort
 6 Worth. Of these Census blocks, about 1.3 percent had an Aggregate Minority population that
 7 exceeded one of the above criteria, and about 5.1 percent had an Aggregate Minority plus
 8 Hispanic population that exceeded one of the above criteria. The closest Census block group
 9 cluster with a low-income population of interest lies between 30 and 35 mi of the CPNPP to the
 10 southwest, near Dublin in Erath County.

11 **2.6.2 Scoping and Outreach**

12 NRC staff issued advance notice of public EIS scoping meetings in accordance with
 13 Commission guidance^c and conducted public scoping meetings in Glen Rose, Texas, on
 14 January 6, 2009. Also, on February 24, 2009, NRC staff met with local government officials
 15 from Somervell and Hood Counties and with representatives of organizations that serve minority
 16 and low-income communities. One purpose of the February 24, 2009, meeting was to identify
 17 and assess the potential for disproportionately high and adverse effects on minority and low-
 18 income populations. Through these meetings, the review team did not identify any additional
 19 groups of minority or low-income populations or any additional issues that Luminant had not
 20 already identified in its ER.

21 **2.6.3 Subsistence and Communities with Unique Characteristics**

22 For each of the identified minority and low-income populations, it is necessary to determine if
 23 any of those populations appear to have a unique characteristic at the population level that
 24 would cause an impact to be disproportionately high and adverse. Examples of unique

(c) Management Directive 3.5, "Attendance at NRC Staff Sponsored Meetings," NRR Office Instruction COM-202 Rev. 1. Accession No. ML0518800110.

1 characteristics might include lack of vehicles, sensitivity to noise, close proximity to the plant, or
2 subsistence activities, but such unique characteristics need to be demonstrably present in the
3 population and relevant to the potential effects of the plant. If the impacts from the proposed
4 action would appear to affect an identified minority or low-income population more than the
5 general population because of one of these or other unique characteristics, then a determination
6 is made whether the impact is disproportionately high and adverse when compared to the
7 general population. Through its review of the applicant's ER, its own outreach and research,
8 and through scoping comments, the review team did not identify any communities with unique
9 characteristics that would require further consideration.

10 Regarding subsistence populations, the review team did not identify any unusual resource
11 dependencies or practices, or other circumstances that could result in disproportionately high
12 and adverse impacts to minority or low-income populations. Specifically, based on the U.S.
13 Census data discussed above, there are no low-income populations near the CPNPP site,
14 where potential plant-related impacts would be expected to be most significant. Moreover, the
15 low-income populations identified in the region are located principally within urban areas
16 southwest of Fort Worth, where subsistence type dependence on natural resources (e.g., fish,
17 game, agricultural products, and natural water sources) is less likely.

18 **2.6.4 Migrant Populations**

19 Section 2.5.1.3 discusses the two largest migrant populations within the region: migrant
20 workers associated with outages at CPNPP Units 1 and 2 and with agricultural activities in the
21 region. Based on the discussion in Section 2.5.1.3, it does not appear that either of these
22 groups meets the criteria for minority or low-income populations as defined above.

23 **2.6.5 Environmental Justice Summary**

24 As discussed above, the review team found that 10.5 percent of the Census blocks in the 50-mi
25 CPNPP region had an Aggregate Minority population that exceeded one of the criteria
26 established for environmental justice analyses, and that 20.5 percent had an Aggregate Minority
27 plus Hispanic population that exceeded one of the criteria. The review team found that less
28 than one percent of the Census blocks in the region had a low-income population that exceeded
29 one of the criteria. Based primarily on the presence of minority populations, the review team
30 performed analyses in greater detail before making a final environmental justice determination.
31 These analyses can be found in Chapter 4 of this EIS for project development, and in Chapter 5
32 for project operations.

33 **2.7 Historic and Cultural Resources**

34 In accordance with 36 CFR 800.8(c), the NRC staff is using the National Environmental Policy
35 Act (NEPA) process (NEPA 1969) to comply with the obligations imposed under Section 106 of
36 the National Historic Preservation Act of 1966, as amended, (NHPA 1996). The NRC has
37 determined that the Area of Potential Effect (APE) for the COL review is the area at the
38 proposed CPNPP Units 3 and 4 site and the immediate environs that may be impacted by land-
39 disturbing activities associated with building and operating the proposed CPNPP Units 3 and 4.
40 The USACE also considers the transmission line corridors to be within the APE for its permit
41 review.

42 This section discusses the historic and cultural background in the CPNPP site region. It also
43 details the efforts that have been taken to identify cultural resources in the APE and the
44 resources that were identified. A description of the consultation efforts accomplished to date is

1 also provided. The assessments of effects from the proposed construction and operation are
2 found in Sections 4.6 and 5.6, respectively.

3 **2.7.1 Cultural Background**

4 The area in and around the CPNPP site has a diverse cultural history and a substantial record
5 of prehistoric and historic resources (Skinner and Humphries 1973). The Brazos River system
6 flows through the area and has influenced settlement patterns throughout prehistoric and
7 historic times. The following section presents a brief summary of the region's cultural
8 background and a description of known historic and archaeological resources at the CPNPP site
9 and its immediate vicinity. The information presented was collected from area repositories, the
10 Texas State Historic Preservation Office (SHPO), and the Applicant's ER (Luminant 2009a).

11 **2.7.1.1 Prehistoric Overview**

12 ***Paleoindian Period (9200 to 6000 BC)***

13 Paleoindian people in Texas ranged over large areas of land traveling in small bands. Early
14 Paleoindian groups are thought to have lived in small central base camps for varying periods
15 throughout the year. Over the course of the Paleoindian era, occupation of fixed base camps
16 gave way to a mobile foraging lifeway, with bands frequently moving their camps as they
17 exhausted the food supply in their immediate area (Hester and Turner 1997). Most Paleoindian
18 sites that have been excavated in Texas to date are located in the Panhandle Region, northeast
19 of the CPNPP site, and very few Paleoindian finds have been recorded in the Brazos River
20 drainage (Hester and Turner 1997).

21 ***Archaic Period (6000 BC to AD 700)***

22 The Early Archaic period in Texas saw a small increase in population; however, Early Archaic
23 people did not stray greatly from Paleoindian lifeways, continuing to travel in small groups or
24 "bands" hunting wild game and collecting seasonal and perennial edible flora. The climate in
25 north central Texas became increasingly arid during the Middle Archaic, causing food resources
26 to become scarcer. As a result, Middle Archaic people became more resourceful, processing
27 plants and burning rock middens to extract edible foods from previously unusable sources
28 (Black et al. 1997). During the Late Archaic, an increasingly moist climate, similar to today's
29 climate, led to a greater abundance of food resources and to a continued increase in population.
30 Greater technological diversity is also evident in the many new projectile point forms that
31 appeared during this period.

32 ***Late Prehistoric Period (AD 700–1500)***

33 The Late Prehistoric Period in north central Texas is defined by major technological and
34 subsistence developments such as the bow and arrow, pottery, and agriculture. The transition
35 from use of the atlatl and dart for hunting to the bow and arrow was a very important
36 development during this period. Pottery in north central Texas, referred to as Henrietta
37 Complex pottery, consisted mostly of plain shell-tempered jars and bowls (Perttula 2004).
38 Some specimens have been recovered that resemble cups or mugs and have been indented
39 with corn. Though there is evidence for the introduction of agriculture during the Late
40 Prehistoric Period, general subsistence remained geared to broad-based hunter-gatherer
41 strategies (Hester and Turner 1997).

1 **2.7.1.2 Historic Overview**

2 The CPNPP site is located in Somervell County, part of Texas’s historically important Brazos
3 River Area. Somervell County was created from portions of Hood and Johnson Counties in
4 1875 (Nunn 1975). The area was first settled in 1840s by Charles Barnard, and the small
5 settlement that bore his name, Barnard’s Mill, was granted a post office in 1859. Barnard’s Mill
6 was incorporated as Glen Rose in 1872 and currently serves as the Somervell County seat
7 (Nunn 1975). The CPNPP site saw only sparse occupation by settlers during the historic
8 period. Ranchers ran cattle along Squaw Creek and the Brazos River, ranging into portions of
9 the project area. The small community of Hopewell existed in the southeast portion of the
10 CPNPP site and was occupied from the late nineteenth century through the middle of the
11 twentieth century (Skinner and Humphries 1973). Remnants of the community, including
12 foundations of the Hopewell School and other buildings, and a small cemetery are still evident.
13 The population of Somervell County was 3931 in 1910, and more than 600 farms were in
14 operation across the county (Elam 1997). By the middle part of the twentieth century, farming
15 had declined dramatically, and the county began to shift to an industrial and commercial
16 economy. The construction and operation of CPNPP in the mid-1970s led to rapid population
17 growth and financial change. By the mid-1980s the county had nearly \$2 billion of taxable
18 property on the books, and the 2000 Census recorded a population of 6809 (Elam 1997).

19 **2.7.2 Historic and Cultural Resources at the Site**

20 To identify the historic and cultural resources at the CPNPP COL site and associated power
21 lines, the following information was used:

22 CPNPP COL ER (Luminant 2009a) – Luminant’s contractor Enercon subcontracted with Briscoe
23 Consulting Services, a cultural resource contractor to identify and evaluate cultural -resource
24 sites in the area.

25 The Historic and Prehistoric Archaeological Resources of the Squaw Creek Reservoir –this
26 report was submitted to Texas Utilities Services Inc. in 1973, by the Southern Methodist
27 University Department of Anthropology, in advance of construction of the plant and reservoir.

28 NRC Audit – NRC staff conferred with the Texas Historical Commission and also conducted an
29 on-the-ground visit of the COL site.

30 To comply with NRC guidance, National Register-eligible archaeological sites, structures,
31 buildings and districts located within 10 mi of the proposed CPNPP Units 3 and 4 site were
32 identified in the ER (Luminant 2009a). In its ER, Luminant identified 51 sites listed on or
33 considered eligible for inclusion on the *National Register of Historic Places* within 10 miles of the
34 COL site.

35 Luminant contracted with Enercon to identify and evaluate any cultural resources located within
36 the proposed construction areas at the plant. Enercon conducted a Phase 1a cultural resources
37 investigation of the CPNPP project to identify previously recorded archaeological resources and
38 architectural resources and to identify areas with archaeological potential that would require
39 further investigation (Luminant 2009a). Additionally, on behalf of Luminant, Enercon conducted
40 a Phase 1a and 1b survey of proposed water transmission pipelines in August 2007 and
41 February 2008. This survey included investigation of four alternative water transmission
42 pipeline routes on the CPNPP property.

43 The Phase 1a investigation of the CPNPP site resulted in the identification of 28 archaeological
44 sites and four historic cemeteries on or within a one mile radius of CPNPP, recorded during
45 previous surveys. Of these 28 sites, 23 were either inundated by the waters of the SCR or
46 destroyed by construction activity. One site that is eligible for the *National Register*, 41SV30

1 (recorded during Southern Methodist University's 1972 survey), was revisited by Enercon in
2 2007. The site had been extensively excavated by Southern Methodist University
3 archaeologists in 1972, and Enercon found that it no longer retains its archaeological integrity
4 (Luminant 2009a); NRC staff agrees with this assessment.

5 The Phase 1a and 1b cultural resources investigations of the proposed water lines were
6 completed by Enercon in June 2008. This investigation resulted in the identification of six
7 archaeological sites, two of which are associated with the historic-period. All of these sites are
8 either partially or extensively disturbed by electric transmission line and water transmission line
9 construction activity and none is considered eligible for listing in the *National Register of Historic*
10 *Places*.

11 Luminant consulted with the Texas Historical Commission. In a letter dated February 21, 2007,
12 the commission responded with a stamped copy of Enercon's letter, noting that no historic
13 properties would be affected.

14 **2.7.3 Consultation**

15 In December of 2008 the NRC initiated consultation on the proposed action by writing the Texas
16 SHPO and the Advisory Council on Historic Preservation. Also in December of 2008, the NRC
17 initiated communications with 17 tribes (see Appendix F for complete listing). In the letters, the
18 NRC provided information about the proposed action, indicated that review under NHPA would
19 be integrated with the NEPA process in accordance with 36 CFR 800.8, invited participation in
20 the identification and possible decisions concerning historic properties, and invited participation
21 in the scoping process.

22 The regional American Indian Tribes that were invited to participate and the NRC independent
23 evaluation of information sources have not identified traditional cultural properties in the vicinity
24 of the proposed construction area of the plant.

25 On January 6, 2008, NRC conducted two public scoping meetings in Glen Rose, Texas. No
26 comments or concerns regarding historic and cultural resources were made at these public
27 scoping meetings.

28 **2.8 Geology**

29 The geology and associated seismological and geotechnical conditions at the proposed CPNPP
30 Units 3 and 4 site are described in Section 2.5 of the FSAR, which is part of the COL application
31 (Luminant 2009b). Both the FSAR and the ER were informed by the geologic characterization
32 conducted for the existing CNPP Units 1 and 2 and the results of subsurface investigations
33 performed recently to support the COL application. The staff's description of the site and vicinity
34 geological features and the detailed analyses and evaluation of geological, seismological, and
35 geotechnical data, as required for an assessment of the site-safety issues related to the
36 proposed CNPP Units 3 and 4 site, are included in the staff's Safety Evaluation Report. The
37 site is in the Grand Prairie physiographic province (Figure 2-21) (according to the Texas Bureau
38 of Economic Geology). The Grand Prairie province is underlain by relatively flat-lying Lower
39 Cretaceous limestones and shales with intervening sandstone units that mark transgressive
40 events. The limestone–shale sequences are variably resistant to erosion, with the harder, more
41 resistant limestone units forming steeper slopes than the less resistant shale units. This results
42 in a “stairstep” topographic expression that is characteristic of the region.

43 Surface elevations in the CPNPP site area range from about 580 ft MSL southeast of the site in
44 the Brazos River Valley to 1224 ft MSL at the top of Comanche Peak, north of the CPNPP site.
45 Local elevation differences result from stream incision and the differential weathering resistance

1 of site area rocks. Surface elevations of the CPNPP site range from 870 ft MSL on the drainage
2 divide between Squaw Creek and Panther Branch down to the 775 ft MSL pool level of SCR.

3 Figure 2-22 shows the stratigraphic column that represents the geology beneath the CPNPP
4 site. Bedrock stratigraphic units exposed in the site area are sedimentary rocks of Lower
5 Cretaceous age. The oldest unit in the Lower Cretaceous sequence is the Twin Mountains
6 Formation which is principally sandstone, but with shale, limestone, claystone, and siltstone
7 inclusions. The oldest unit exposed in the site area is the Glen Rose Formation, which is
8 immediately above the Twin Mountains Formation and is present under the site. In the site area
9 the Glen Rose Formation consists of carbonates that are interbedded with mudstones and
10 shale. The Paluxy Formation, which is stratigraphically above the Glen Rose, is found only at
11 higher elevations associated with drainage divides. It consists of loosely consolidated to
12 unconsolidated sandstone. Stratigraphically above the Paluxy Formation is the Fredericksburg
13 Group, which includes the Walnut, Comanche Peak, and Edwards Formations.

14 Quaternary alluvial deposits overlie bedrock in drainages, primarily the Brazos River valley in
15 the southeastern portion of the site area, the Paluxy River valley in the southwestern portion of
16 the area, and Squaw Creek. Figure 2-23 is a geologic map of the region within 25 miles of the
17 CPNPP site.

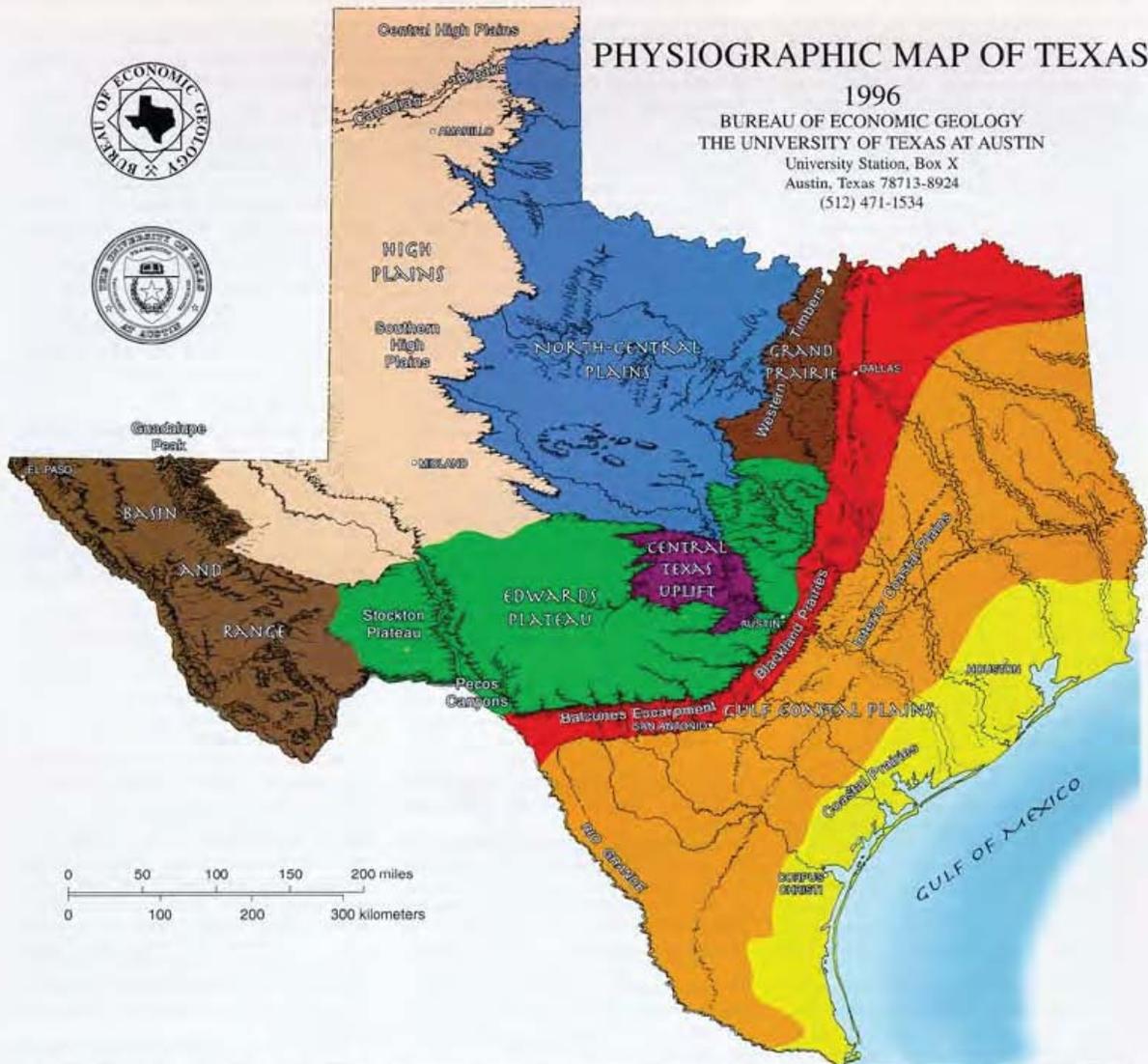
18 The existing terrain at the proposed site for CPNPP Units 3 and 4 site has relatively gentle
19 slopes, with the exception of a steeper slope that descends to SCR along the north margin of
20 the site. Prevalent site soil types are loams and clay loams formed over limestone or sandstone
21 bedrock; sandy loam soils formed on alluvium are present on the southwestern portion of the
22 proposed BDTF site (Enercon 2009). There is no evidence of active karst conditions or related
23 subsidence in the site area.

24 The only active mining in the site area is surface strip mining for aggregate, focusing on the
25 Paluxy Formation for gravel and the Glen Rose Formation for dimension stone. The FSAR
26 identified three aggregate mining and processing operations within about 4 mi of the CPNPP
27 site (Luminant 2009b, Section 2.5.1.2.5.10).

28 The site is in a region where oil and natural gas have been produced for several decades from
29 underlying Paleozoic rocks (Pollastro et al. 2007). Currently most production activity is
30 extraction of natural gas from the Mississippian-age Barnett Shale using hydraulic fracturing and
31 fluid injection to enhance recovery. Figure 2-24 shows the locations of active gas wells in the
32 vicinity of the CPNPP site with their production volumes. In addition to the active production
33 wells shown on the map, there are numerous abandoned production wells in the area, as well
34 as both active and abandoned injection wells (Luminant 2009b, Section 2.5.1.2.5.10.1).

35 **2.9 Meteorology and Air Quality**

36 The following subsections describe the climate and air quality of the CPNPP site. Section 2.9.1
37 describes the climate of the region and area in the immediate vicinity of the site. Section 2.9.2
38 describes the air quality of the region. Section 2.9.3 describes the atmospheric dispersion
39 characteristics of the site, and Section 2.9.4 describes the meteorological monitoring program at
40 the site.



PROVINCE	MAX. ELEV. (ft)	MIN. ELEV. (ft)	TOPOGRAPHY	GEOLOGIC STRUCTURE	BEDROCK TYPES
Gulf Coastal Plains					
Coastal Prairies	300	0	Nearly flat prairie, <1 ft/mi to Gulf	Nearly flat strata	Deltaic sands and muds
Interior Coastal Prairies	800	300	Parallel ridges (questas) and valleys	Beds tilted toward Gulf	Unconsolidated sands and muds
Blackland Prairies	1000	450	Low rolling terrain	Beds tilted south and east	Chalks and marls
Grand Prairie	1250	450	Low stairstep hills west; plains east	Strata dip east	Calcareous east; sandy west
Edwards Plateau					
Principal	3000	450	Flat upper surface with box canyons	Beds dip south; normal faulted	Limestones and dolomites
Pecos Canyons	2000	1200	Steep-walled canyons		Limestones and dolomites
Stockton Plateau	4200	1700	Mesa-formed terrain; highs to west	Unfaulted, near-horizontal beds	Carbonates and alluvial sediments
Central Texas Uplift					
Central Texas Uplift	2000	800	Knobby plain; surrounded by questas	Centripetal dips, strongly faulted	Granites; metamorphics; sediments
North-Central Plains					
North-Central Plains	3000	900	Low north-south ridges (questas)	West dip; minor faults	Limestones; sandstones; shales
High Plains					
Central	4750	2900	Flat prairies slope east and south	Slight dips east and south	Eolian silts and fine sands
Canadian Breaks	3800	2350	Highly dissected; local solution valleys		
Southern	3800	2200	Flat; many playas; local dune fields		
Basin and Range					
Basin and Range	8750	1700	North-south mountains and basins	Some complex folding and faulting	Igneous; metamorphics; sediments

Figure 2-21. Physiographic map of Texas. The CPNPP site is located in the Grand Prairie physiographic province (Texas Bureau of Economic Geology 1996).

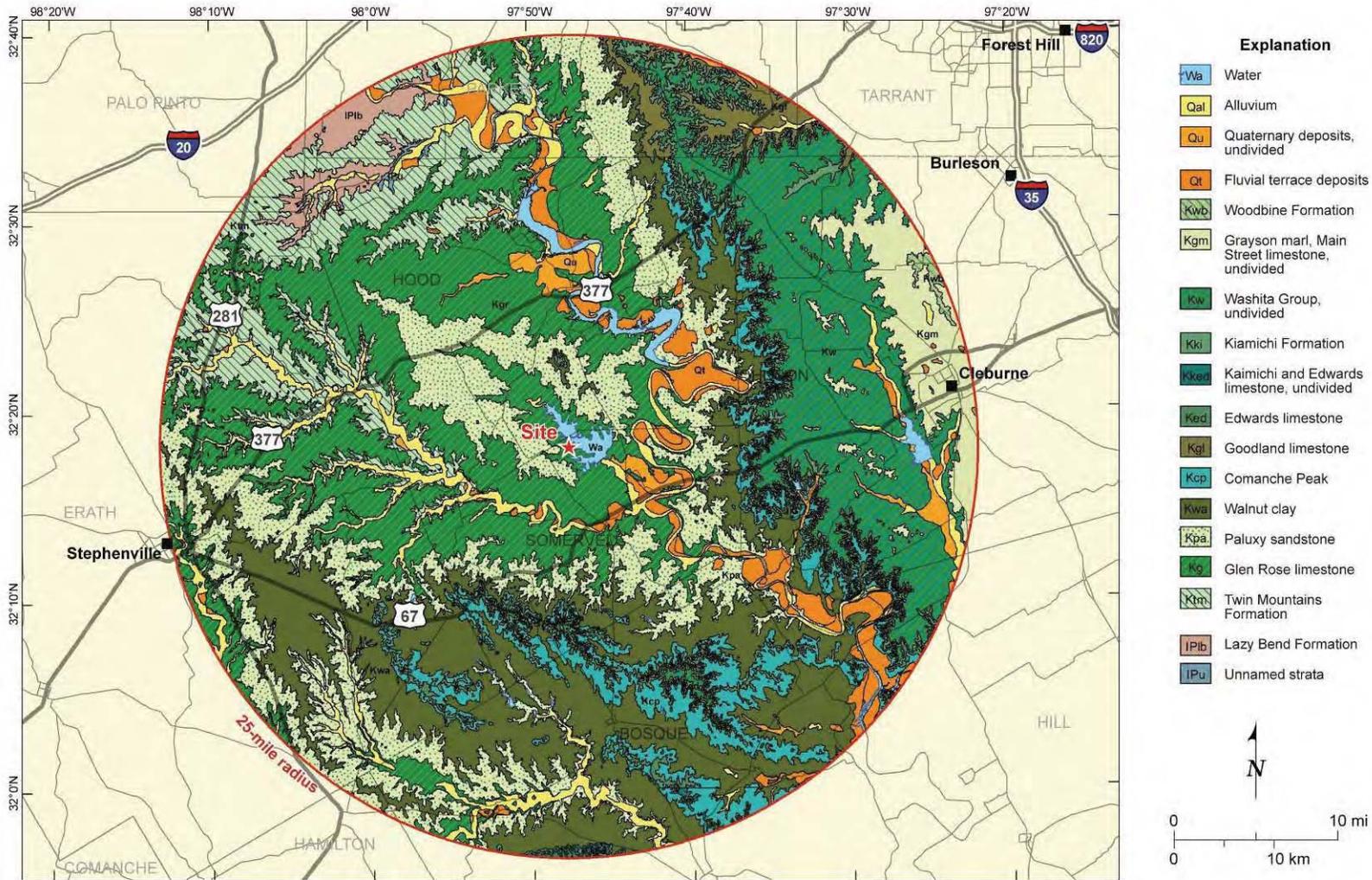
Affected Environment

Geologic Period	Series	Geologic Unit		Depositional Setting
Quaternary	N/A	Quaternary Alluvium		Fluvial deposition and terrace deposits
Early Cretaceous	COMANCHEAN	Fredericksburg Group	Edwards Formation	Passive margin onlap from transgressing Gulf of Mexico
			Comanche Peak Formation	
			Walnut Formation	
		Trinity Group	Paluxy Formation	
			Glen Rose Formation	
			Twin Mountains Formation	
Pennsylvanian	MISSOURI	Strawn Group	Mineral Wells Formation	Filling of Fort Worth Basin with decreased subsidence
	DES MOINES		Brazos River Formation	
			Mingus Formation	
			Grindstone Creek Formation	
			Lazy Bend Formation	
	ATOKA	Atoka Group	Atoka Sand	Foredeep basin subsidence followed by synorogenic clastic facies
	MORROWAN	Marble Falls Limestone	Smithwick	
			Big Saline	
	Mississippian	CHESTERIAN - MERAMECIAN	Barnett Shale	
OSAGEAN		Chappel Limestone		
Late Cambrian to Ordovician	CANADIAN	Viola and Simpson Formations		Laurentian Shelf
		Ellenburger Group	Honeycut Formation	
			Gorman Formation	
			Tanyard Formation	
		Wilberns Formation	San Saba	
			Point Peak	
			Morgan Creek Limestone	
			Welge Sandstone	
		Riley Formation	Lion Mountain Sandstone	
			Cap Mountain Limestone	
			Hickory Sandstone	
Precambrian	Undifferentiated Grenville crystalline Basement		Precambrian North American craton	

Legend:

 = Unconformity

Figure 2-22. Bedrock stratigraphic column for the CPNPP site area (Adapted from Luminant 2009b).



Sources: Adapted from Geologic Atlas of Texas (USGS, 2005)

Projection: NAD83 State Plane, Texas North Central (feet)

Figure 2-23. Geologic map of the region within 25 miles of the CPNPP site (Luminant 2009b).

1

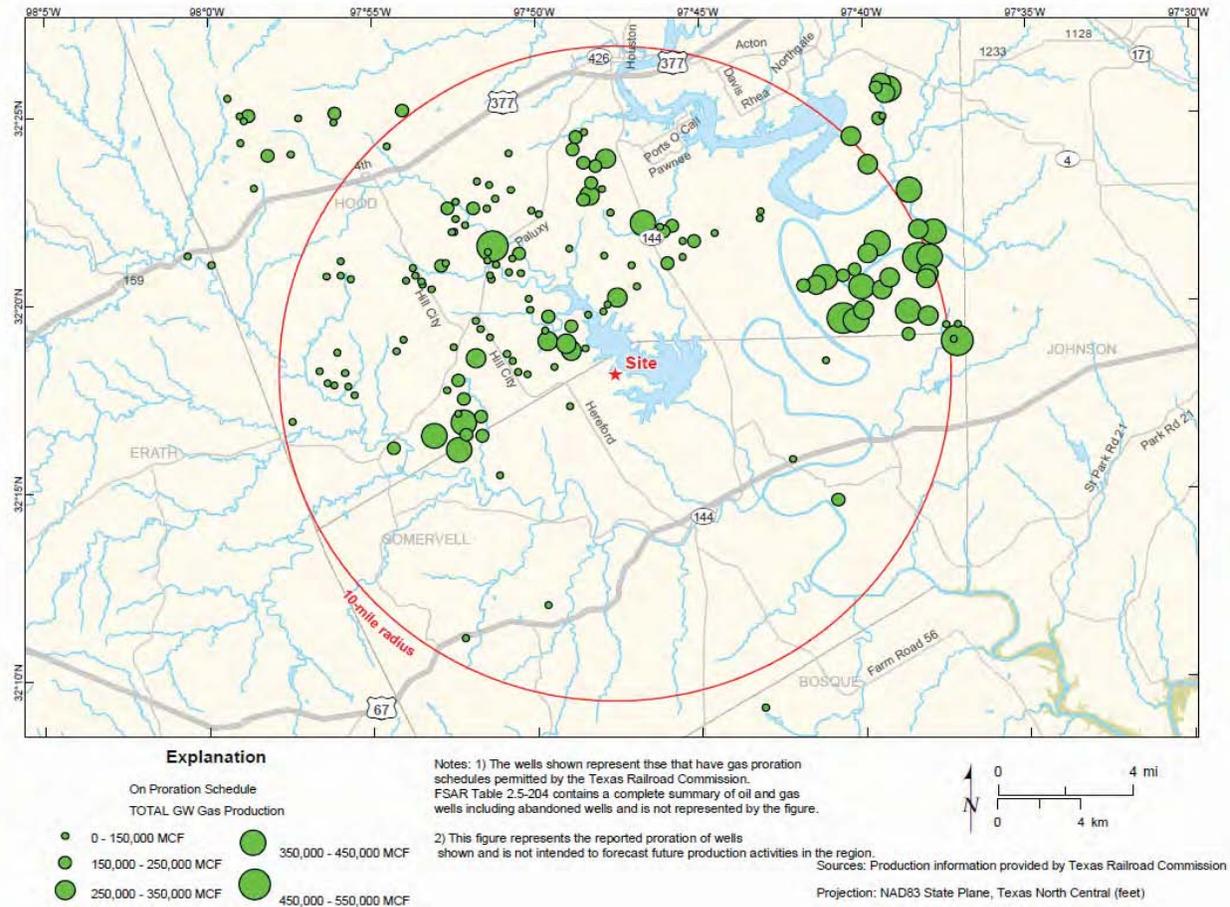


Figure 2-24. Active gas wells in the vicinity of the CPNPP site and production volumes (Luminant 2009b).

2 **2.9.1 Climate**

3 The CPNPP site is located in Somervell County, in the north-central part of Texas. Due to its
 4 large size and topographic variability, the State of Texas exhibits a wide variety of climatic
 5 types. The Texas High Plains, comprising the Panhandle and portions of west Texas, is
 6 characterized by a Continental Steppe climate, which is semi-arid with a large range in daily
 7 temperature extremes and low relative humidity. A Mountain climate predominates in portions
 8 of west Texas, and is characterized by cool temperatures and topographically influenced
 9 precipitation patterns. Most of the State has a Modified Marine climate that is subtropical, and
 10 predominantly influenced by the onshore flow of tropical moisture from the Gulf of Mexico
 11 (TDWR 1983). Within the Modified Marine climate area, the annual average precipitation
 12 increases from west to east. West Texas is arid, with an annual rainfall of 10 in. per year, while
 13 east Texas receives up to 55 in. of precipitation per year (TWDB 2007a).

14 Weather data are collected at a meteorological station located at the CPNPP site, and at
 15 several stations in the region near CPNPP. These stations have measured and reported a
 16 variety of meteorological parameters through different time periods, and therefore, not all of the
 17 data are directly comparable to each other. The onsite monitoring station was initially installed
 18 and operated from 1972 to 1976 to collect preoperational baseline data. The system was again
 19 made operational in 1990, concurrent with start-up of CPNPP Unit 1, and has operated

1 continually from 1990 to the present. The onsite monitoring system includes measurements for
2 wind speed, wind direction, temperature, and precipitation (Luminant 2009b). For short-term
3 climatic records, use of the onsite station data is preferable because of the proximity to the site,
4 and the measurement of all of the necessary parameters. A more detailed description of the
5 monitoring system is presented in Section 2.9.4.

6 The closest offsite monitoring station is in Glen Rose, located 8.3 km (5.2 mi) to the south of the
7 CPNPP site. Data available from the Glen Rose station includes daily temperature and
8 precipitation. However, wind data are not available, and monitoring at this station ceased in
9 2000. Additional stations in the region include Cleburne (39.2 km east), Stephenville (37.9 km
10 southwest), Dublin (57.1 km southwest), Mineral Wells (63.2 km northwest), Weatherford
11 (49.6 km north), Benbrook (52.2 km northeast), Love Field (104.2 km northeast), and Dallas–
12 Ft. Worth Airport (DFW) (81.9 km northeast). The longest duration of measurements from these
13 stations is at Dublin and Weatherford, both from 1896. The parameters measured at these two
14 stations are temperature and precipitation only, with no wind measurements. The datasets from
15 the stations at Mineral Wells and DFW Airport are the most complete. The Minerals Wells
16 station includes temperature, precipitation, and humidity measurements dating back to 1949,
17 and wind data since 2001. The DFW Airport has reported temperature, precipitation, and wind
18 data since 1974, and humidity data since 1997 (NCDC 2009).

19 The datasets from Mineral Wells and DFW Airport are appropriate for longer-term climatic
20 information because they are still close enough to be generally representative of the region,
21 have had numerous parameters (including wind) measured, and include data back to 1949.
22 The CPNPP site is located within the Subtropical/Subhumid subregion of Texas, which is
23 characterized as having hot summers and dry winters (TDWR 1983). Summers typically have
24 more than 90 days in which the temperature exceeds 90°F, with temperatures commonly
25 exceeding 100°F. Winter temperatures drop below 32°F about 30 days per year, but these
26 events typically last only a few days (TDWR 1983). The wettest season is spring, during which
27 frequent and violent thunderstorms may occur. The long-term average annual rainfall is
28 approximately 30 in. per year, as reported at the Weatherford station (NCDC 2009).

29 Due to its proximity to the Gulf of Mexico and the High Plains, the area is prone to severe
30 weather events that may include high rainfall events (associated with the remnants of
31 hurricanes), droughts, and tornadoes.

32 On a larger and longer-term scale, climate change is a subject of national and international
33 interest. The recent compilation of the state of knowledge in this area by the U.S. Global
34 Change Research Program (GCRP), a Federal Advisory Committee (Karl et al. 2009) has been
35 considered in preparation of this EIS. The projected change in temperature from 'present day'
36 (1993-2008) over the period encompassing the licensing action (i.e., to the period of 2040 to
37 2059 in the GCRP report) in the vicinity of the CPNPP site is an increase of between 3 to 5°F.
38 While the GCRP has not incrementally forecasted the change in precipitation by decade to align
39 with the licensing action, the projected change in precipitation from the 'recent past' (1961 to
40 1979) to the period 2080 to 2099 was presented; the GCRP report forecasts a decrease of
41 between 5 to 15 percent (Karl et al. 2009).

42 Based on the assessments of the GCRP and the National Academy of Sciences' National
43 Research Council, the EPA determined that potential changes in climate caused by greenhouse
44 gas (GHG) emissions endanger public health and welfare (74 FR 66496). The EPA indicated
45 that, while ambient concentrations of GHGs do not cause direct adverse health effects (such as
46 respiratory or toxic effects), public health risks and impacts can result indirectly from changes in
47 climate. As a result of the determination by the EPA and the recognition that mitigative actions
48 are necessary to reduce impacts, the review team concludes that the effect of GHG on climate

1 and the environment is already noticeable, but not yet destabilizing. In CLI-09-21, the
2 Commission provided guidance to the NRC staff to consider carbon dioxide and other GHG
3 emissions in its NEPA reviews and directed that it should encompass emissions from
4 constructing and operating a facility as well as from the fuel cycle (NRC 2009). The review
5 team characterized the affected environment and the potential GHG emissions of the proposed
6 action and alternatives in this EIS. Consideration of GHG emissions was treated as an element
7 of the existing air quality assessment that is essential in a NEPA analysis. In addition, where it
8 was important to do so, the review team considered the effects of the changing environment
9 during the period of the proposed action on other resource assessments.

10 **2.9.1.1 Wind**

11 A comparison of the wind data from the stations at CPNPP (10 m measurement), DFW Airport,
12 and Mineral Wells shows regional consistency in average wind speed and direction. The
13 prevailing surface wind direction at all three stations is from the south and southeast, with a
14 secondary wind direction maximum from the north-northwest occurring in winter, associated
15 with southern movement of polar air masses. The average annual wind speeds at the three
16 stations are 10.3 mph at DFW Airport, 9.0 mph at Mineral Wells, and 9.8 mph at CPNPP
17 (NCDC 2009; Luminant 2009a).

18 The topography of the region near CPNPP is relatively flat, with elevations ranging from 600 to
19 1000 ft MSL within 5 miles of the site. Therefore, terrain variation would not be expected to
20 have a significant influence on wind direction due to channeling or cold air drainage. The only
21 local topographic feature that may have the potential to influence wind direction is Squaw
22 Creek, but the maintenance of this creek as a reservoir effectively flattens the topography and
23 eliminates any topographical variation that may have previously affected wind direction.
24 Comparisons of the onsite wind direction data with that from the local stations, as well as
25 comparison of the 10 m and 60 m data at CPNPP, indicate that channeling and cold air
26 drainage along Squaw Creek do not occur (Luminant 2009a).

27 The CPNPP monitoring station measures wind speed and direction at heights of 10 m and
28 60 m. Predominant wind directions are the same at both heights. At the 10 m height, the wind
29 direction is from the southeast, south-southeast, south, and south-southwest 51 percent of the
30 time. At the 60 m height, the wind direction is from the same direction 52 percent of the time.
31 The average annual wind speed at the 60 m height is 12.6 mph. This is slightly higher than the
32 average wind speed at the 10 m height, which would be expected due to the reduction of wind
33 speeds by surface effects near the ground surface (Luminant 2009a).

34 **2.9.1.2 Temperature**

35 The CPNPP site is located within the Subtropical/Subhumid subregion of Texas, which is
36 characterized as having hot summers (TDWR 1983). Summers typically have more than
37 90 days in which temperatures reach 90°F, and temperatures exceeding 100°F are common.
38 The monthly average temperature is approximately 85°F in July and August, and 45°F in
39 January. A comparison of the temperature data for all of the local stations shows that the
40 highest average temperatures are exhibited at the Love Field and DFW Airport stations, which
41 are the two northernmost stations in the area, while the lowest average temperatures are found
42 at the Dublin and Stephenville stations to the south. This is likely to be due to the urban heat
43 island effect, in which temperatures in urbanized areas tend to be higher due to the replacement
44 of vegetated areas with asphalt and concrete-covered areas. Because CPNPP is located in a
45 rural area, the temperature measurements at Dublin and Stephenville are likely to be more
46 representative of those present at the site.

1 **2.9.1.3 Atmospheric Moisture**

2 Common methods of measuring and presenting information on atmospheric moisture include
3 humidity, precipitation, and fog. At the CPNPP onsite monitoring station, only precipitation rates
4 are routinely and continuously measured. Information on humidity and fog is available from
5 measurements at the DFW Airport and Mineral Wells stations. Atmospheric moisture, as
6 measured by precipitation, increases systematically from west to east across the State of
7 Texas. West Texas receives less than 10 in. of rain per year, and east Texas receives more
8 than 55 in. per year. The CPNPP site is located in the center of the state, in the
9 Subtropical/Subhumid subregion. Average annual precipitation at the onsite monitoring tower in
10 the years 2001, 2003, and 2006 was approximately 30 in. per year, a value that is similar to
11 longer term averages from the stations at Dublin and Weatherford (NCDC 2009). The highest
12 monthly average at the CPNPP station during the years 2001, 2003, and 2006 was during
13 March, but this is likely to be an anomaly due to the limited reporting period. Longer term data
14 from the Weatherford and Dublin stations show that highest annual average rates are in May
15 (approximately 4 in.), and the lowest annual average rates are in January and December
16 (1.5 in.) (NCDC 2009).

17 Relative humidity and dew point measurements are available from the DFW Airport and
18 Minerals Wells stations. The average annual relative humidity is 65 percent and 69 percent at
19 DFW Airport and Mineral Wells, respectively (NCDC 2009). In order to establish the
20 applicability of these offsite data to the CPNPP site, Luminant collected onsite humidity
21 measurements during June through September of 2008. The correlation of these onsite
22 measurements with the data from DFW Airport and Mineral Wells indicated that the onsite
23 humidity conditions could be accurately represented by use of the data from Mineral Wells
24 (Luminant 2009a). Average dew point temperatures in the region range from 32°F in January to
25 67°F in July, based on measurements at Weatherford from 1949 to 2006 (NCDC 2009).

26 The region experiences occasional snow or sleet events from December to March. The
27 average annual snowfall amount, based on measurements at DFW Airport, Love Field, Mineral
28 Wells, and Glen Rose is 2.5 in. (NCDC 2009).

29 Recording of fog events is not done at the onsite CPNPP station. Fog records from DFW
30 Airport and Mineral Wells demonstrate the high variability of fog based on location. At DFW
31 Airport, the annual average hours of fog from 1997 to 2006 are 16.2 hr/yr (NCDC 2009). At
32 Mineral Wells, from 2001 to 2006, the annual average was 46.7 hr (NCDC 2009). At both
33 locations, almost all fog events occurred during the months from October to March.

34 **2.9.1.4 Severe Weather**

35 The CPNPP site is located near the High Plains, an area noted for severe thunderstorm and
36 tornado activity, and is also near the Gulf of Mexico, an area of hurricane activity. The effects of
37 severe thunderstorms may include high winds, lightning strikes, hail, and tornadoes. Due to its
38 inland location, any Gulf of Mexico hurricanes approaching the site have generally been
39 downgraded to tropical depressions by the time they reach the area. Therefore, effects of
40 hurricanes are generally related to high rainfall and localized flooding. The site is not expected
41 to be subjected to frequent snow or ice storms.

42 Thunderstorms occur within the five-county area surrounding the site on an average of about 9
43 days per year (NOAA 2009). Of these, most occur during the months of April, May, and June,
44 with very few occurrences in December through February (NOAA 2009). Thunderstorms in this
45 area can be associated with high wind and hail events. Over the period from 1950 to 2006,
46 there was an annual average of 12.8 incidences of large (greater than 0.75 in. in diameter) hail
47 in the five-county area surrounding the site (NOAA 2009).

1 During the same period (1950 to 2006), an annual average of 3 tornadoes was reported in the
 2 five-county area surrounding the site (NOAA 2009). The most common time of year for
 3 tornadoes is the spring. The tornado strike probability at the CPNPP site is estimated using the
 4 methodology provided in NUREG/CR-4461, Revision 2 (NRC 2007b). This document has
 5 developed the expected maximum tornado wind speed and upper limit (95 percent) of the
 6 expected tornado wind speed as a function of the probability of occurrence for the 2-degree
 7 longitude and latitude box that includes the CPNPP site. The corresponding tornado wind
 8 speeds are listed in Table 2-30.

Table 2-30. Expected maximum tornado wind speeds and upper limits

Probability	Expected Maximum Tornado Wind Speed, mph	Upper Limit (95 percent) of the Expected Tornado Wind Speed, mph
10 ⁻⁵	141	146
10 ⁻⁶	178	184
10 ⁻⁷	211	217

Source: NRC 2007b.

9 From 1899 to 2007, a total of 42 tropical storms and hurricanes affected the Texas Gulf Coast
 10 (NOAA 1999; NOAA 2009). In general, these storms lose wind strength as they move inland,
 11 but can still bring heavy rains and flooding to the CPNPP area.

12 **2.9.1.5 Atmospheric Stability**

13 Atmospheric stability is a meteorological parameter that describes the dispersion characteristics
 14 of the atmosphere. It can be determined by the difference in temperature between the surface
 15 (10-m level) and the level of a potential release point. The temperature difference between the
 16 two elevations reflects a density difference that may indicate that the air mass is stable, neutral,
 17 or unstable. A temperature decrease with height indicates that the vertical density structure is
 18 unstable, resulting in higher levels of atmospheric dispersion. Temperature increase with height
 19 indicates a stable density structure, and therefore limited dispersive capability.

20 The procedures to be used to measure the temperature difference are provided in NRC's
 21 Regulatory Guide 1.23, Revision 1 (NRC 2007a), in which the potential release point level is
 22 assumed to be 60 m. The resulting temperature difference is used to define the Pasquill
 23 Stability Category, which becomes an input parameter into atmospheric dispersion calculations
 24 as part of the prediction of potential accident consequences. The results of the atmospheric
 25 dispersion calculations are presented in Section 2.9.3, and these calculations are used in the
 26 evaluation of potential accident consequences in Section 5.10.

27 At CPNPP, atmospheric stability is determined using the temperature measurements at the
 28 10- and 60-m levels at the onsite meteorological tower. Overall, the Pasquill Stability Class is
 29 neutral (Class D) or stable to extremely stable (Classes E, F, and G) 78.1 percent of the time.
 30 Neutral or stable classifications are most common in the fall and winter, with the greatest
 31 instability occurring during the months of May through August (Luminant 2009a).

32 **2.9.2 Air Quality**

33 The discussion on air quality includes the six common "criteria pollutants" for which the EPA has
 34 set national ambient air quality standards (ozone, particulate matter, carbon monoxide, nitrogen
 35 oxides, sulfur dioxide, and lead). The air quality discussion also covers heat-trapping

1 “greenhouse gases” (primarily carbon dioxide) which have been the principal factor causing
 2 climate change over the last 50 years (Karl et al. 2009).

3 The CPNPP site is located in Somervell County, which is in the Metropolitan Dallas-Fort Worth
 4 Intrastate Air Quality Control Region (40 CFR 81.39). Air quality in Somervell County is
 5 regulated by TCEQ Region 4, Dallas–Ft. Worth region. Somervell County, the location of
 6 CPNPP, is designated as unclassifiable/attainment for all criteria pollutants (40 CFR 81.344;
 7 TCEQ 2009a). Although there are no monitoring stations operated within the county, TCEQ
 8 monitors a station in Granbury, in Hood County, less than 10 mi from the CPNPP site, and the
 9 results from this site are considered to be applicable to Somervell County. In 2008, there were
 10 nine days on which the EPA’s Eight-Hour Ozone Standard of 0.075 parts per million (ppm) was
 11 exceeded for at least one 1-hour measurement period at the Granbury monitoring site.
 12 However, the Eight-Hour average standard was not exceeded at any point during 2008
 13 (TCEQ 2009b).

14 In the area near Somervell County, a nine-county area to the northeast is a nonattainment area
 15 for EPA’s 8-hr ozone standard (TCEQ 2009a). This area includes Johnson County, which
 16 borders Somervell County to the east, and the other counties within the Dallas and Fort Worth
 17 metropolitan area. In this area, the EPA’s Eight-Hour Ozone Standard was exceeded on 12
 18 days during 2008 (TCEQ 2009c). The prevailing wind direction in the region is from the south
 19 and southeast (from the CPNPP area towards the Dallas-Fort Worth area), and this pattern is
 20 even more prevalent in the summer months when air quality standards are exceeded.

21 CPNPP currently has a TCEQ air permit, Number 19225, to manage air quality associated with
 22 the operation of CPNPP Units 1 and 2. The sources of the emissions, and their associated
 23 emissions and operations limits as defined in the permit, are presented in Table 2-31. The
 24 permit, renewed in 2004 for a ten-year period, specifies emissions limits for volatile organic
 25 carbons (VOCs), total oxides of nitrogen (NO_x), sulfur dioxide (SO₂), particulate matter (PM),
 26 and carbon monoxide (CO) (TCEQ 2004).

Table 2-31. Emissions and operations limits associated with CPNPP Units 1 and 2

Source	VOC	NO _x	SO ₂	PM	CO	Hours/Year
Auxiliary Boiler	<1.0	3.7	12.8	2.1	3.7	500
Emergency Generator #1	<1.0	20.9	2.8	<1.0	1.8	600 (combined for generators 1 through 4)
Emergency Generator #2	<1.0	20.9	2.8	<1.0	1.8	600 (combined for generators 1 through 4)
Emergency Generator #3	<1.0	20.9	2.8	<1.0	1.8	600 (combined for generators 1 through 4)
Emergency Generator #4	<1.0	20.9	2.8	<1.0	1.8	600 (combined for generators 1 through 4)
Emergency Generator #5	<1.0	1.2	<1.0	<1.0	<1.0	250
Emergency Generator #6	<1.0	<1.0	<1.0	<1.0	<1.0	250
Diesel Fire Pump No.1	<1.0	1.0	<1.0	<1.0	<1.0	200 (combined for both fire pumps)
Diesel Fire Pump No.2	<1.0	1.0	<1.0	<1.0	<1.0	200 (combined for both fire pumps)
Total	<9.0	90.5	24	2.1	10.9	-

Source: TCEQ 2004.

1 Carbon dioxide has been building up in the Earth's atmosphere since the beginning of the
2 industrial era in the mid-1700s, primarily due to the burning of fossil fuels (coal, oil, and natural
3 gas) and the clearing of forests. Human activities have also increased the emissions of other
4 greenhouse gases such as methane, nitrous oxide, and halocarbons. These emissions are
5 increasing the optical thickness of heat-trapping gases in the Earth's atmosphere, causing
6 global surface temperatures to rise (Karl et al. 2009).

7 **2.9.3 Atmospheric Dispersion**

8 Atmospheric dispersion factors are used to evaluate the potential consequences resulting from
9 accidental and routine radiological releases from the CPNPP site. For accidental releases,
10 atmospheric relative air concentration values (χ/Q values) are used to estimate the dispersion of
11 released effluents that will occur through atmospheric transport and atmospheric diffusion
12 processes. Guidance for the calculation of atmospheric dispersion factors is presented in
13 NRC's Regulatory Guide 1.145 (NRC 1983). The atmospheric dispersion calculations are
14 presented in Section 2.9.3.1, and the results are used to estimate the consequences of potential
15 accidents in Section 5.10. For the evaluation of routine releases of gaseous effluents, χ/Q
16 values and atmospheric deposition (D/Q) values are used to estimate the dispersion of released
17 effluents and the rates of deposition and radioactive decay of released gaseous effluents.
18 Guidance for the calculation of χ/Q and D/Q values associated with routine releases is
19 presented in NRC's Regulatory Guide 1.111 (NRC 1977). The results of the routine release
20 calculations are presented in Section 2.9.3.2, and the results are used to estimate the
21 consequences of routine releases of gaseous effluents in Section 5.9.

22 The meteorological data used in the dispersion and deposition calculations include wind speed,
23 wind direction, and atmospheric stability. The data are to be collected and presented as hourly
24 averages, as defined in NRC's Regulatory Guide 1.23 (NRC 2007a). For CPNPP, the data
25 used in the calculations are the data collected from the onsite meteorological station for the
26 years 2001 through 2004, and 2006 (five total years of data). According to the ER, data
27 recovery for the year 2005 was below 90 percent, and therefore data from 2005 were not used
28 (Luminant 2009a). The data used included wind speed and direction at the height of 10 m and
29 atmospheric stability class based on temperature differential measurements at the 10- and 60-m
30 heights at the onsite meteorological station.

31 To confirm the applicability of the data, the review team viewed the meteorological station and
32 instrumentation, reviewed the available data from the station and compared data from the
33 station with data from other, nearby stations. In addition, the review team compared the data
34 from the 5-year period (2001 to 2004, and 2006) with that from other years to verify that it
35 results in representative or conservative calculations.

36 Based on these comparisons, the review team concludes that the data from the onsite
37 meteorological tower represent the affected environmental conditions as required by 10 CFR
38 100.20 and that the data are representative of longer-term meteorological conditions in the
39 region. Therefore, the data provide an acceptable basis for estimating atmospheric dispersion
40 for the evaluation of routine and accidental releases required by 10 CFR 50.34 and 10 CFR Part
41 50, Appendix I.

42 **2.9.3.1 Short-Term Atmospheric Dispersion Estimates for Accident Releases**

43 The purpose of the calculation of short-term atmospheric relative concentration values is to
44 estimate the dispersion that would occur in association with an accidental release of gaseous
45 effluent. As directed in Regulatory Guide 1.145 (NRC 1983), the calculations were done to
46 estimate the dispersion occurring at the EAB within a 2-hr time period immediately following an

1 accident. In addition, the calculations were done to estimate the dispersion occurring at the
 2 outer boundary of the Low Population Zone (LPZ) at time intervals of 0 to 8 hr, 8 to 24 hr, 1 to
 3 4 days (24 to 96 hr), and 4 to 30 days (96 to 720 hr) following an accident, as defined in Section
 4 2.3.4 of Regulatory Guide 1.70 (NRC 1978). The calculation was performed by developing
 5 hourly cumulative frequency distributions of the relative concentration (χ/Q) value at each
 6 location of interest. The χ/Q reported and used in the evaluation of consequences of a release
 7 is that which is exceeded 50 percent of the time during the time period evaluated (the median
 8 value).

9 Additional site-specific input parameters required for the dispersion calculations include the
 10 release height, cross-sectional area of the reactor building, and distances to the EAB and LPZ
 11 boundary. For the calculations associated with accidental releases, the release height was
 12 assumed to be at ground level. The cross-sectional area of the containment building is 2500
 13 m², and the height of the building is 69.9 m. The distance from the release boundary to the EAB
 14 is 600 m, and the distance to the LPZ boundary is 3,219 m.

15 Using the meteorological data discussed in Section 2.9.3, and the input parameters presented
 16 above, the Applicant used the PAVAN computer code to calculate the atmospheric dispersion
 17 estimates. The PAVAN computer code calculates χ/Q values using the equations and
 18 assumption provided in Section 1.3.1 of Regulatory Guide 1.145 (NRC 1983). The review team
 19 has reviewed the calculations presented in the ER (Luminant 2009a), evaluated the applicability
 20 of the input parameters and reasonableness of the results, and performed independent
 21 calculations to verify the calculations performed by the Applicant. The results of the calculations
 22 are provided in Table 2-32. The results are used in Section 5.10 to calculate potential
 23 exposures associated with accidental releases of gaseous effluents.

Table 2-32. CPNPP short-term atmospheric dispersion estimates for accident releases

	50% Probability Level χ/Q Values (sec/m ³)				
	0-2 hr	0-8 hr	8-24 hr	24-96 hr	96-720 hr
EAB	5.75E-05				
LPZ		3.32E-06	2.75E-06	1.83E-06	1.01E-06

24 **2.9.3.2 Long-Term Atmospheric Dispersion and Deposition Estimates for Routine**
 25 **Releases**

26 The purpose of the calculation of long-term atmospheric relative concentration values is to
 27 estimate the dispersion and deposition associated with routine releases of gaseous effluents.
 28 The estimates are expressed as annual average normalized χ/Q values, and as annual
 29 normalized total D/Q computed at selected downwind locations. These estimates are
 30 developed by considering the release characteristics, meteorological conditions, and the
 31 downwind travel distance.

32 To develop estimates of the long-term dose to the population in the region surrounding the site,
 33 the Applicant used the XOQDOQ computer program (NRC 1982). The estimates were
 34 calculated at the points of maximum potential concentration outside of the site boundary, at
 35 points of maximum individual exposure, and at points within a radial grid of sixteen 22.5-degree
 36 sectors extending to a distance of 80 km from the site. The calculations included consideration
 37 of the effects of radioactive decay and dry deposition.

38 The meteorological data used as input into the XOQDOQ program were taken from a table of
 39 joint frequency distribution of wind direction and wind speed by atmospheric stability class. The
 40 data were obtained from the onsite meteorological station during the period from 2001 to 2004,

1 and 2006. The assumed release point was located at the center of the containment, with the
2 release assumed to be at ground level in accordance with Regulatory Guide 1.111 (NRC
3 1977b). The cross-sectional area of the reactor building, and distances to the EAB and LPZ
4 boundary were the same as those used for the short-term exposure dispersion calculations.

5 Radioactive decay and deposition were incorporated into the calculations for radiological impact
6 evaluations. The evaluation used an overall half-life of 2.26 days for short-lived noble gases,
7 and a half-life of 8 days for iodines released to the atmosphere. Wet deposition is assumed to
8 not be important, and the dry deposition rate of noble gases is expected to be so slow that
9 depletion is not a factor.

10 Using the meteorological data discussed in Section 2.9.3, and the input parameters presented
11 above, the Applicant used the XOQDOQ computer program (NRC 1982) to develop relative χ/Q
12 and relative D/Q estimates. The XOQDOQ program performs the calculations using methods
13 and assumptions required in Regulatory Guide 1.111 (NRC 1977). The results were
14 developed with and without the consideration of dry deposition, and as depleted and undepleted
15 values. The review team has reviewed the calculations presented in the ER (Luminant 2009a),
16 evaluated the applicability of the input parameters and reasonableness of the results, and
17 performed independent calculations which have verified the calculations performed by the
18 Applicant. The results are used in Section 5.9.2.2 to calculate doses from potential exposures
19 to ionizing radiation associated with routine releases of gaseous effluents.

20 **2.9.4 Meteorological Monitoring**

21 The source of most of the meteorological data used to support the CPNPP Unit 3 and 4 COL
22 evaluation is the onsite meteorological monitoring station that is used to support operation of
23 CPNPP Units 1 and 2. The onsite station operated from 1972 to 1976 to collect data to support
24 the preoperational phase for Units 1 and 2. The system was then reestablished in 1988, prior to
25 the fuel load for Unit 1, and has operated continuously since that time (Luminant 2009a).

26 The meteorological station consists of a primary meteorological tower, a backup tower, and
27 associated computer systems for operation, data collection, and data analysis. The primary
28 tower has instruments, located on booms, at heights of 10 and 60 m. The following data are
29 collected: wind speed at 10 and 60 m; wind direction at 10 and 60 m; ambient temperature at
30 10 m; temperature difference between 10 and 60 m; sigma theta (standard deviation of the wind
31 vane position, a measure of turbulence) at 10 m; and precipitation near ground level (Luminant
32 2009c). The primary tower is located east of the reactor complex, and will continue to be used
33 during the construction and operation of Units 3 and 4. The length and orientation of the booms
34 and alignment of aspirator motors and shields are designed to comply with meteorological
35 monitoring requirements of Regulatory Guide 1.23 (NRC 2007a).

36 The backup tower is located approximately 25 m from the primary tower. Backup
37 measurements are made at a height of 10 m and include wind speed, wind direction, ambient
38 temperature, and sigma theta.

39 Humidity measurements are not currently made at the onsite station. Luminant collected onsite
40 humidity measurements during June through September of 2008 for the purpose of establishing
41 a correlation between onsite humidity measurements and humidity measurements from DFW
42 Airport and Mineral Wells. Based on this correlation, Luminant proposes to use the data from
43 Mineral Wells as the data of record to support calculations associated with cooling tower plume
44 analysis (Luminant 2009a).

2.10 Nonradiological Health

This section describes aspects of the environment at the CPNPP site and within the vicinity of the site associated with nonradiological human health impacts. The section provides the baseline for evaluation of impacts to human health from building and operation of the proposed Units 3 and 4. Building activities have the potential to affect public and occupational health, create impacts from noise, and impact health of the public and workers from transportation of construction materials and personnel to the building site. Operation of the proposed Units 3 and 4 has the potential to impact the public and workers at the CPNPP site from operation of the cooling system, noise generated by operations, electromagnetic fields (EMFs) generated by transmission systems, and transportation of operations and outage workers to and from the site.

2.10.1 Public and Occupational Health

This section describes public and occupational health at the CPNPP site and vicinity associated with air quality, occupational injuries and etiological agents (i.e., disease causing microorganisms).

2.10.1.1 Air Quality

Public and occupational health can be impacted by changes in air quality from activities that contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust from commuter traffic (NRC 1996). Air quality near the CPNPP site is discussed in Section 2.9.2. Fugitive dust and other particle material (including PM₁₀ and PM_{2.5}) can be released into the atmosphere during any site excavations and grading. Most of these activities that generate fugitive dust are short in duration, over a small area, and can be controlled using watering, application of soil adhesives, seeding, and other best management practices.

Exhaust emissions during normal plant operations associated with on-site vehicles and equipment as well as from commuter traffic can affect air quality and human health. Nonradiological supporting equipment (e.g., diesel generators, fire pump engines), and other nonradiological emission-generating sources (e.g., storage tanks) or activities at the existing CPNPP are not a significant source of criteria pollutant emissions. Diesel generators and supporting equipment would be in place for emergency-use only but would be started regularly to test that the systems are operational. Emissions from nonradiological air pollution sources are permitted by TCEQ.

2.10.1.2 Occupational Injuries

In general, occupational health risks to workers and onsite personnel engaged in activities such as building, maintenance, testing, excavation and modifications are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. The U.S. Bureau of Labor Statistics provides reports that account for occupational injuries and illnesses as total recordable cases, which includes those cases that result in death, loss of consciousness, days away from work, restricted work activity or job transfer, or medical treatment beyond first aid. The State of Texas also tracks the annual incidence rates of injuries and illnesses for electric power generation, transmission and distribution workers. These records of statistics are used to estimate the likely number of occupational injuries and illnesses for operation of Units 1 and 2 and predict the likely number of cases for the proposed new units.

1 The combined safety records for all Luminant's facilities reached 17 years without an
2 Occupational Safety and Health Administration (OSHA) recorded injury and 113 years without a
3 lost-time accident. In the first half of 2009, CPNPP reached 2 million safe work hours without a
4 lost time injury (Business Wire 2009).

5 **2.10.1.3 Etiological Agents**

6 Etiologic agents consist of all microorganisms that can cause infectious disease in humans.
7 One class of etiologic agents is thermophilic; these microorganisms thrive in hot water generally
8 well above 40°C. Thermal discharges have the potential to increase the growth of
9 microorganisms, including *Salmonella* species, *Shigella* species, and *Pseudomonas* species, as
10 well as thermophilic organisms, including fungi, bacteria such as *Legionella* species, and free-
11 living amoeba such *Naegleria fowleri* and *Acanthamoeba* species. These microorganisms could
12 result in potentially serious human health concerns, particularly at high exposure levels.

13 *Salmonella* and *Shigella* species are mostly associated with areas of poor sanitation, but they
14 can also be transmitted by the common house fly. Although the organisms can live for several
15 weeks in water, they do not multiply there. *Pseudomonas* can be found in soil, humidifiers, on
16 the skin of healthy individuals, and anywhere *Salmonella* and *Shigella* are found (NRC 1996,
17 Appendix D). While *Pseudomonas* could be found in Lake Granbury (and other water bodies),
18 there is no known sanitation pathway for large numbers of these organisms to enter the
19 reservoir.

20 Legionnaires' disease can be very serious and can cause death in up to 5 to 30 percent of
21 cases. One population-based study estimated that more than three-quarters of cases are
22 currently undiagnosed or unreported (CDC 2009). The incidence rate is less than 0.3 per
23 100,000 persons in Texas (Neil and Berkelman 2008).

24 Primary amebic meningoencephalitis (PAM) is a rare but nearly always fatal disease caused by
25 infection with *Naegleria fowleri*. In 2007, six cases of PAM in the United States were reported to
26 the Centers for Disease Control and Prevention (CDC); all six patients died (CDC 2008c). Two
27 of the six were in Texas. Exposure to PAM primarily occurred in untreated, warm, freshwater
28 lakes or rivers in 15 southern tier states, including Texas.

29 Temperatures above 38° C have been measured near the point where the once-through cooling
30 water from CPNPP Units 1 and 2 is discharged to a cove on the south end of Squaw Creek
31 Reservoir. Although this was a popular area for fishing when the reservoir was open, there
32 were no reports of illness associated with thermophilic bacteria (Luminant 2010b).

33 A review of the outbreaks of human water-borne diseases in Texas indicates that the incidence
34 of most of these diseases is not common. Outbreaks of Legionellosis, Salmonellosis, or
35 Shigellosis that occurred in Texas from 1996 to 2006 were within the range of national trends in
36 terms of cases per 100,000 population or total cases per year, and the outbreaks were
37 associated with pools, spas, or lakes (CDC 1997, 1998b, 1999, 2001, 2002b, 2003, 2004b,
38 2005, 2006b, 2007, and 2008d). Texas does have higher incidences of infection by *Naegleria*
39 *fowleri* compared to most other States in the country. Infection with *N. fowleri* causes the
40 disease primary amebic meningoencephalitis (PAM), a brain infection that leads to the
41 destruction of brain tissue and is fatal (CDC 2008c). From 1995 to 2007, there were three
42 waterborne disease outbreaks in Texas (one each in 1998, 1999, and 2002). None of the
43 outbreaks were from recreational exposure to untreated water, e.g., swimming or boating in a
44 river (CDC 1998a, 2000, 2002a, 2004a, 2006a, 2008a, b). From 1972 to 2007, there have been
45 36 occurrences of PAM in Texas, ranging from zero to five cases per year. All of these cases
46 were fatal, exposures occurred during the months of June through September, and four
47 exposures occurred in lakes and one occurred in a river.

1 **2.10.1.4 Noise**

2 The noise around the CPNPP site is typical of a commercial operation in a mostly rural area.
3 Operational noises mix with those from traffic, residential activities, and natural sources.

4 In 2007, Luminant conducted an ambient noise survey within 5 mi. of the site. The locations
5 chosen were near the site boundary or places where people might gather, such as churches.
6 The nearest residence to the southwest and the residences across SCR were also considered.
7 The locations of the sampling sites are shown in Figure 2.5-20 of the ER (Luminant 2009a).
8 While noise is diminished by distance, foliage, and geographic features, it will be attenuated
9 much less over water.

10 The area noise levels during the day were found to be between 35–70 (traffic) dBA, with 36–60
11 dBA at night. The average equivalent sound levels ranged between 36 and 55 dBA (daytime)
12 and 37–55 dBA (night time) (Luminant 2009a). For context, the sound intensity of a quiet office
13 is 50 dBA, normal conversation is 60 dBA, busy traffic is 70 dBA, and a noisy office with
14 machines or an average factory is 80 dBA.

15 Regulations governing noise associated with the activities at the CPNPP site are generally
16 limited to worker health. Federal regulations governing construction noise are found in 29 CFR
17 Part 1910, “Occupational Health and Safety Standards,” and 40 CFR Part 204, “Noise Emission
18 Standards for Construction Equipment.” The regulations in 29 CFR Part 1910 deal with noise
19 exposure in the construction environment, and the regulations in 40 CFR Part 204 generally
20 govern the noise levels of compressors. Although several Texas municipalities have noise
21 ordinances, the State of Texas does not have noise regulations covering rural areas that would
22 be applicable to the CPNPP site.

23 **2.10.2 Transportation**

24 The transportation network surrounding the CPNPP site consists of farm-to-market roads,
25 federal and state highways, and railway, as well as a public airport. Most traffic is personal
26 vehicle and over the road tractor/trailer transport. Plant workers from Hood County travel to
27 work on FM 56 or FM 51. FM 56 provides access from Somervell County. An additional
28 network of roads, such as US 377, are available for workers from other areas (Luminant 2009a).
29 A railway about 9.5 mi from the site serves an average of two trains a day, while the Granbury
30 Municipal Airport about 10 mi north of the site averages 73 aircraft operations a day (Luminant
31 2009a).

32 **2.10.3 Electromagnetic Fields**

33 Transmission lines generate both electric and magnetic fields, referred to collectively as EMF.
34 Public and worker health can be compromised by acute exposure to electrical sources
35 associated with the power transmission systems, including switching stations (or substations)
36 on-site and transmission lines connecting the plant to the regional electrical distribution grid.
37 Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is considered
38 to be extremely low frequency (ELF). In comparison, television transmitters have frequencies of
39 55 to 890 MHz and microwaves have frequencies of 1000 MHz and greater (NRC 1996).

40 The transmission corridors surrounding CPNPP are described in Section 2.2 of the ER
41 (Luminant 2009c). Three single-circuit transmission lines are located on existing right-of-ways
42 and use existing tower structures (Luminant 2009a, Figure 1.1-5).

43 Electric shock resulting from direct access to energized conductors or from induced charges in
44 metallic structures is an example of an acute effect from EMF associated with transmission lines
45 (NRC 1996). Objects near transmission lines can become electrically charged by close

1 proximity to the electric field of the line. An induced current can be generated in such cases,
2 where the current can flow from the line through the object into the ground. Capacitive charges
3 can occur in objects that are in the electric field of a line, storing the electric charge, but
4 insulated from the ground. A person standing on the ground can receive an electric shock from
5 coming into contact with such an object because of the sudden discharge of the capacitive
6 charge through the person's body to the ground. Such acute effects are controlled and
7 minimized by conformance with National Electrical Safety Code (NESC) criteria and adherence
8 to the standards for transmission systems regulated by the Public Utility Commission of Texas
9 (PUCT).

10 Long-term or chronic exposure to power transmission lines have been studied for a number of
11 years. These health effects were evaluated in NUREG-1437, which concluded:

12 The chronic effects of electromagnetic fields (EMFs) associated with nuclear
13 plants and associated transmission lines are uncertain. Studies of 60-Hz EMFs
14 have not uncovered consistent evidence linking harmful effects with field
15 exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic
16 chemicals and ionizing radiation) in that dramatic acute effects cannot be forced
17 and longer-term effects, if real, are subtle. Because the state of the science is
18 currently inadequate, no generic conclusion on human health impacts is possible
19 (NRC 1996).

20 **2.11 Radiological Environment or Monitoring**

21 A radiological environmental monitoring program (REMP) has been conducted around the
22 CPNPP site since operations began in 1990. This program measures radiation and radioactive
23 materials from all sources, including the CPNPP Units 1 and 2. The REMP includes the
24 following pathways: direct radiation; atmospheric, aquatic and terrestrial environments; and
25 groundwater and surface water. A preoperational environmental operating program was
26 conducted from 1981 to 1989 (Luminant 2009a) to establish a baseline to observe fluctuations
27 of radioactivity in the environment after operations began. After routine operation of Unit 1
28 started in 1990 and Unit 2 started in 1993, the monitoring program continued to assess the
29 radiological impacts to workers, the public, and the environment. The results of this monitoring
30 are documented in an annual environmental operating report for the CPNPP site.

31 The NRC staff reviewed historical data from the REMP reports for the 6-year period 2003
32 through 2008 (TXU 2004, TXU 2005, TXU 2006, TXU 2007, Luminant 2008, Luminant
33 2009c). These reports show that exposures or concentrations in air, water, and vegetation are
34 comparable to preoperational levels, with the exception of the levels of tritium in SCR. The
35 monitoring data for the waters of the SCR show tritium concentration ranging from 11,800 to
36 14,300 pCi/L. The trend in SCR tritium levels indicates that SCR may have reached equilibrium
37 with the tritium release rate of the existing CPNPP Units 1 and 2. The equilibrium value is less
38 than Luminant's administrative action level of 30,000 pCi/L.

39 The NRC's *Liquid Radioactive Release Lessons Learned Task Force Report* (NRC 2006) made
40 recommendations regarding potential unmonitored groundwater contamination at U.S. nuclear
41 plants. Groundwater is monitored at five onsite locations; the results of the groundwater
42 monitoring are included in the annual environmental operating report. In 2007 and 2008, all
43 radionuclides in the groundwater, including tritium, were below the detection limits (Luminant
44 2008c, Luminant 2009d).

2.12 Related Federal Projects and Consultations

The staff reviewed the possibility that activities of other Federal agencies (e.g., dam construction) might impact the issuance of COLs to Luminant for proposed Units 3 and 4. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS [10 CFR 51.10(b)(2)].

Federal lands within a 50-mi radius of the CPNPP site include the Naval Air Station Joint Reserve Base six miles west of central Fort Worth and four lakes managed by the USACE (Figure 2-9). State parks and other recreation facilities in the region are enumerated in Sections 2.5.1.2 and 2.5.2.4. There are no Native American tribal reservations within 50 mi of the CPNPP site.

The NRC is required under Section 102(2)(C) of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EIS. During the course of preparing this EIS, NRC consulted with the USFWS and National Marine Fisheries Service. A list of such correspondence is included in Appendix F.

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3 %20barren,%20exposed%20sites,%20most%20known%20sites%20are%20underlain%20by
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3.0 Site Layout and Plant Description

1 The Comanche Peak Nuclear Power Plant (CPNPP) site is located on the border of Hood and
2 Somervell Counties, Texas. Luminant applied to the U.S. Nuclear Regulatory Commission
3 (NRC) for combined construction permits and operating licenses (COLs) for proposed Units 3
4 and 4. In addition to the COL application, Luminant may need to apply for a permit from the
5 U.S. Army Corps of Engineers (Corps) to conduct activities that result in alteration of waters of
6 the United States. The proposed new units would be situated wholly within the existing CPNPP
7 site and adjacent to existing CPNPP Units 1 and 2. The site is situated approximately 40 mi
8 southwest of Fort Worth, Texas, and 5-mi north of Glen Rose, Texas.

9 This chapter describes the key plant characteristics that are used to assess the environmental
10 impacts of the proposed actions. The information is drawn from Luminant's Environmental
11 Report (ER) (Luminant 2009a), its Final Safety Analysis Report (FSAR) (Luminant 2009b), and
12 supplemental documentation from Luminant as referenced.

13 Whereas Chapter 2 of this environmental impact statement (EIS) describes the existing
14 environment of the proposed site and its vicinity, this chapter describes the physical layout of
15 the proposed plant. This chapter also describes the physical activities involved in building and
16 operating the plant and associated transmission lines. The environmental impacts of building
17 and operating the plant are discussed in Chapters 4 and 5, respectively. This chapter is divided
18 into four sections. Section 3.1 describes the external appearance and layout of the proposed
19 plant. Section 3.2 describes the proposed plant structures, systems and components, and it
20 provides an overview of the reactor power conversion system and overall plant design. Section
21 3.3 describes the activities involved in building or installing each of the plant structures. Section
22 3.4 describes the operational activities of the plant systems that interface with the environment.
23 References cited are listed in Section 3.5.

24 3.1 External Appearance and Plant Layout

25 The existing CPNPP site consists of two Westinghouse pressurized-water reactor units (i.e.,
26 CPNPP Units 1 and 2), a turbine building, a switchyard, water intake and discharge structures,
27 and support buildings. The CPNPP site is located in Hood and Somervell Counties,
28 approximately 5 mi north of Glen Rose, Texas. The site lies on a peninsula located next to
29 Squaw Creek Reservoir (SCR) (see Figures 2-2 and 2-3), which serves as the source of cooling
30 water for Units 1 and 2.

31 A radioactive waste disposal system, a fuel-handling system, the auxiliary structures, and other
32 onsite facilities required for a complete nuclear power station are located on the CPNPP site.
33 The existing site development is shown in the photograph in Figure 3-1, which also shows an
34 artist's conception of the proposed two new reactor units. The COL site is located in a
35 previously disturbed area approximately 0.5 mi northwest of Units 1 and 2. Units 1 and 2 would
36 not be changed under the proposed action.

37 For the Unit 3 and 4 cooling systems, Luminant proposes to use wet mechanical draft cooling
38 towers. Water for the new cooling towers would be supplied from a new intake structure on
39 Lake Granbury through two new pipelines (see Figure 2-5). A new blowdown water treatment
40 facility and evaporation pond would be constructed south of Units 1 and 2. Two new pipelines
41 would be built for discharge of treated blowdown water to Lake Granbury.

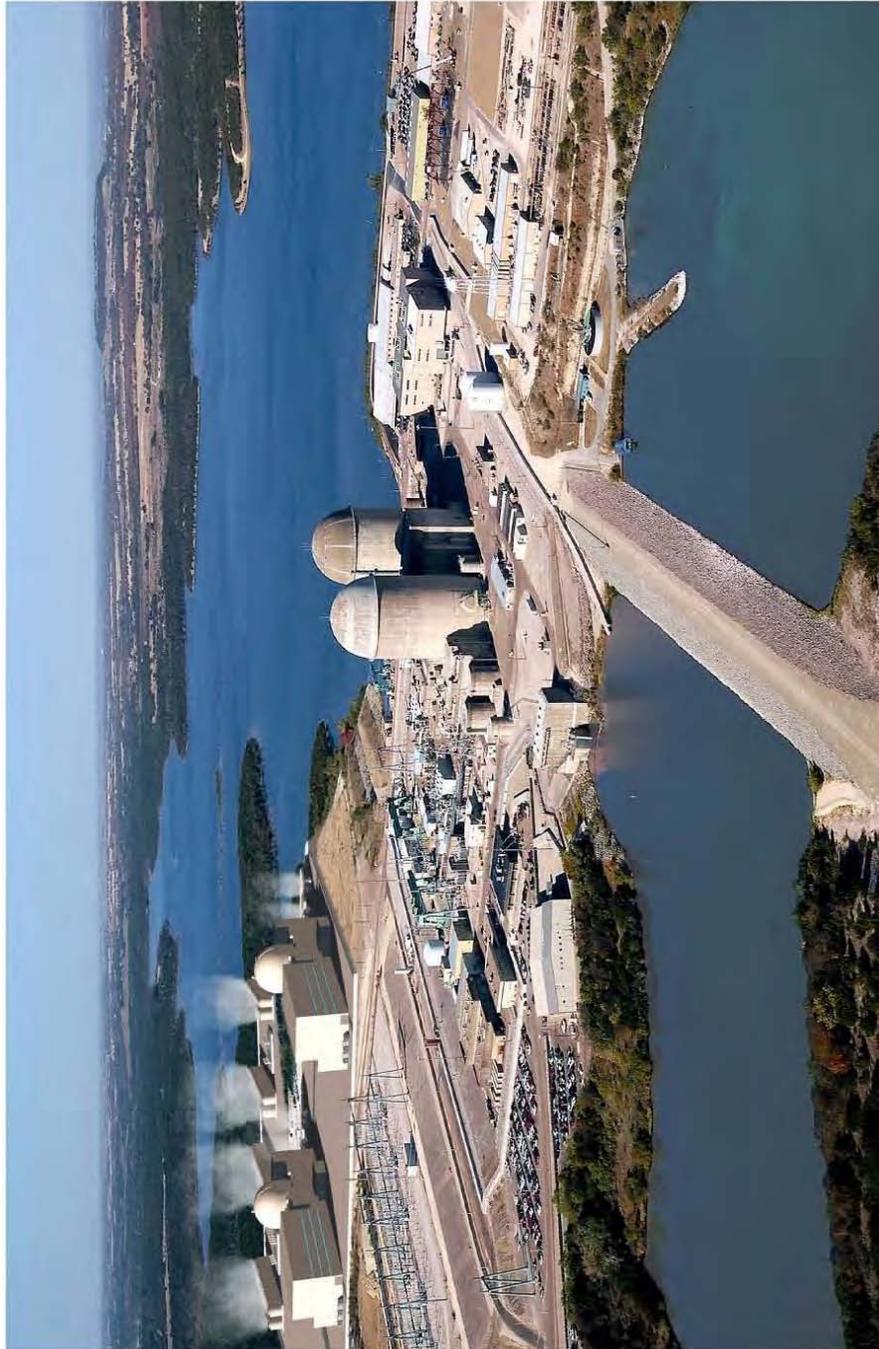


Figure 3-1. Photograph of existing CPNPP Units 1 and 2, with an artist's conception of the proposed Units 3 and 4 on the left-hand side of the photograph (Luminant 2009a).

1 Up to four new transmission lines would be built. Two would be added to existing towers and
2 two would be built on new towers in new rights-of-way. The transmission lines are described in
3 Section 3.2.2.3.

4 **3.2 Proposed Plant Structures, Systems, and Components**

5 This section describes each of the major plant structures: the reactor power system, structures
6 that would have a significant interface with the environment during operation, and the balance of
7 plant structures. All of these structures are relevant in the discussion of the impacts of building
8 the proposed Units 3 and 4 in Chapter 4. Only the structures that interface with the environment
9 are important to the operational impacts discussed in Chapter 5.

10 **3.2.1 Reactor Power Conversion System**

11 The proposed new CPNPP Units 3 and 4 would utilize Mitsubishi Heavy Industries (MHI) U.S.
12 Advanced Pressurized-Water Reactor (US-APWR) units (MHI 2009). Each US-APWR unit has
13 a reactor vessel, four steam generators (SGs), and four reactor coolant pumps. The thermal
14 energy produced by the new reactors is carried by the primary coolant to the SGs, where it is
15 transferred in a heat exchanger to the secondary-side cooling water to produce steam.

16 The steam from the SGs flows through steam turbines, creating rotational mechanical energy,
17 which in turn rotates an electric generator to produce electricity. Secondary-side steam from the
18 turbines is condensed and cooled by water from the new mechanical draft cooling towers. Then
19 the secondary-side coolant is pumped by a series of feedwater pumps back to the SGs.

20 Figure 3-2 is a simplified flow diagram of the reactor power conversion system. A more detailed
21 discussion using information from Luminant's ER (Luminant 2009a) is presented in the following
22 paragraphs.

23 Each US-APWR unit is connected to four SGs by means of four primary hot leg pipes and four
24 primary cold leg pipes. A reactor coolant pump is located in each of the four cold leg pipes to
25 circulate the pressurized reactor coolant through the reactor core. As the reactor coolant flows
26 through the reactor core, it makes contact with the fuel rods, which contain the enriched
27 uranium dioxide fuel. As the reactor coolant passes through the reactor core, heat from the
28 nuclear fission process is removed from the reactor. This heat is transported to the SGs by the
29 circulating reactor coolant and passes through the tubes of the SGs to heat the feedwater from
30 the secondary system. The reactor coolant is pumped back to the reactor by the reactor coolant
31 pumps, where it is reheated to start the heat transfer cycle over again (Luminant 2009a).

32 Inside the SGs, the reactor heat from the primary system is transferred through the walls of the
33 tubes to convert the incoming feedwater from the secondary system into steam. The steam is
34 transported from the SGs by main steam piping to drive the high-pressure and low-pressure
35 turbines connected to an electric generator to produce electricity. After passing through the
36 three low-pressure turbines, the steam is condensed back to water by cooled circulating water
37 inside titanium tubes located in the condenser. The cooled circulating water used to condense
38 the steam is provided by a separate water circuit that includes the mechanical draft cooling
39 towers. The heat from the condensed steam is rejected into the atmosphere at the mechanical
40 cooling towers. The condensate is then preheated and pumped back to the SGs as feedwater
41 to repeat the steam cycle (Luminant 2009a).

42 The primary reactor coolant circuit, the secondary-side coolant circuit, and the mechanical
43 cooling towers involve three separate systems, each having its own liquid coolant. The liquid
44 coolants are not allowed to mix or exchange between or among these three systems.

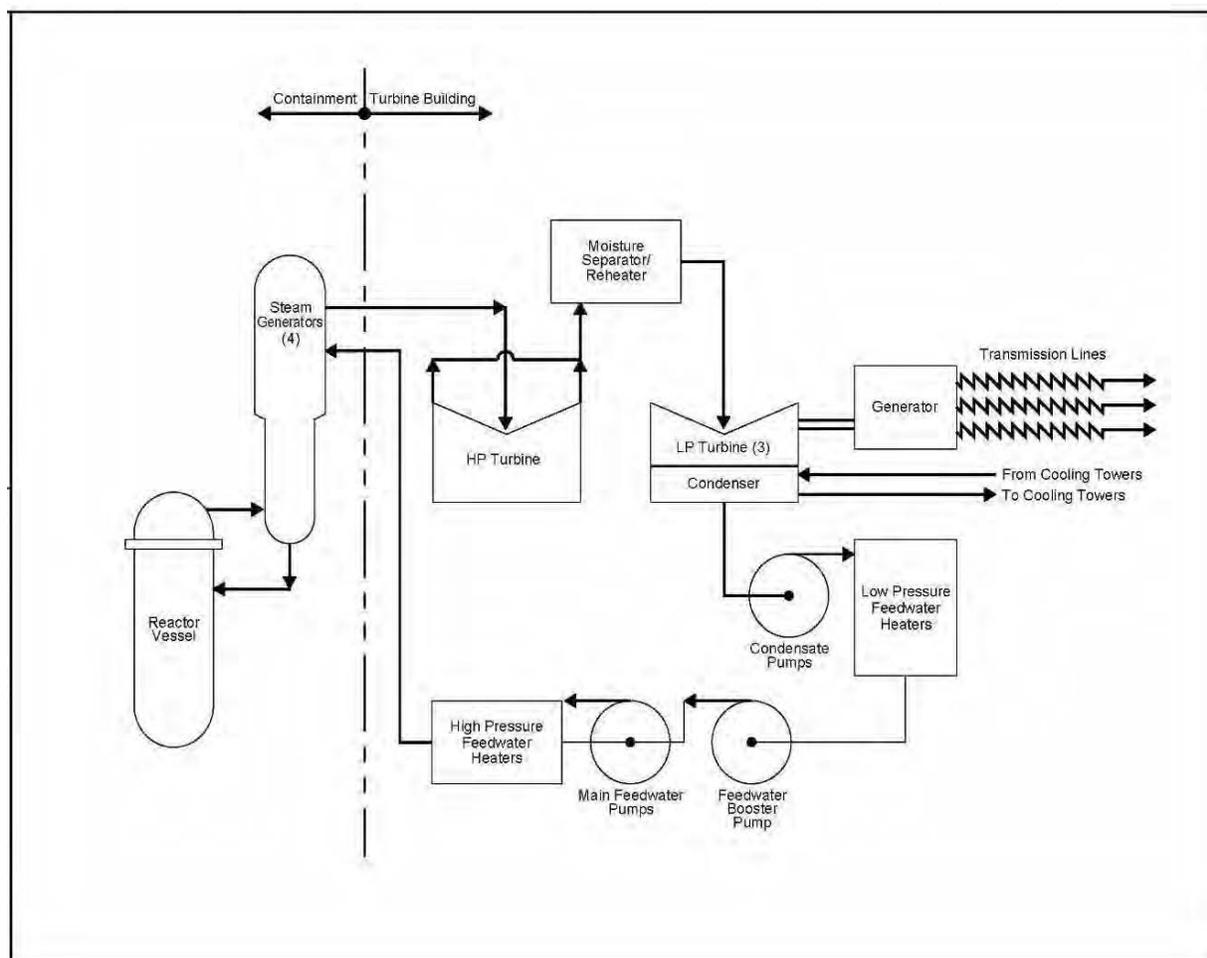


Figure 3-2. Simplified flow diagram for the CPNPP reactor power conversion system (Luminant 2009a).

1 **3.2.1.1 Plant Description**

2 Each of the two proposed Units 3 and 4 would have a rated and design core thermal power
 3 level of 4451 MW(t). The rated and design net output of each electric generator is
 4 approximately 1600 MW(e).

5 The US-APWR units would use uranium dioxide fuel, enriched to 4.55 weight percent uranium-
 6 235. Each US-APWR unit would contain 257 fuel assemblies, each containing 264 fuel rods.
 7 The total quantity of uranium dioxide is 305,830 lb (1190 lb per fuel assembly). The reactor
 8 core design is expected to operate for 24 months between refueling, with an average burnup of
 9 46,200 megawatt-days per metric ton uranium (MWd/MTU) and a maximum burnup of 54,200
 10 MWd/MTU.

11 For the cooling system, Luminant proposes to use wet mechanical draft cooling towers. Two
 12 such cooling towers would be constructed for each of the proposed units, for a total of four new
 13 cooling towers. Water for the new cooling towers would be supplied from Lake Granbury
 14 through two new pipelines. No water from the adjacent SCR would be used to cool the new
 15 CPNPP Units 3 and 4. A new blowdown water treatment facility (BDTF), including two large
 16 ponds, to reduce the total dissolved solids (TDS) of blowdown water would be built south of

1 Units 1 and 2. The BDTF would produce a clean permeate stream, which would then be
2 blended with the remaining untreated blowdown and routed to Lake Granbury via two new
3 pipelines and underwater diffusers in the lake.

4 Engineered safety features of the new construction protect the public in the event of an
5 accidental release of radioactive fission products from the reactor cooling system. The following
6 discussion summarizes these safety features using information taken from Luminant's ER
7 (Luminant 2009a). Additional detail is contained in the Design Control Document (DCD) for the
8 US-APWR (MHI 2009). The engineered safety features include the following.

- 9 • Containment System. The containment vessel is a cylindrical structure with a hemispherical
10 dome made of prestressed, post-tensioned concrete. The inside of the structure is lined
11 with carbon steel. The structure sits upon a flat, reinforced concrete foundation slab. The
12 containment vessel completely encloses the reactor and the reactor coolant system and is
13 designed to minimize any leakage.
- 14 • Containment Heat Removal System. This system consists of four independent trains with
15 four containment spray (CS)/residual heat removal (RHR) pumps and four CS/RHR heat
16 exchangers. The CS reduces temperature and pressure in containment to acceptable levels
17 and provides long-term containment cooling following a loss of coolant accident (LOCA).
18 This system automatically actuates following a CS signal and draws water from the refueling
19 water storage pit. The refueling water storage pit provides a continuous source of water for
20 the CS/RHR pumps. The RHR removes reactor core decay heat and other residual heat
21 from the reactor coolant. This system also transfers refueling water between the reactor
22 cavity and the refueling water storage pit at the beginning and end of refueling operations.
23 All pumps, motor-operated valves, and instruments have emergency power backups.
- 24 • Containment Isolation System. This system provides isolation of lines penetrating the
25 reactor containment to preserve the integrity of the containment boundary and to prevent the
26 release of radioactive products to the environment following a postulated accident.
- 27 • Emergency Core Cooling System. The primary function of this system is to provide
28 emergency reactor core cooling following a LOCA. The system also mitigates accidents and
29 ensures safe shutdown by performing emergency boration, letdown, and emergency
30 makeup.
- 31 • Control Room Habitability System. This system maintains habitable conditions in the main
32 control room envelope to protect the operators from airborne radioactivity, smoke, and toxic
33 gas. The habitability system has a heating, ventilating, and air-conditioning (HVAC) system
34 with dedicated redundant air-handling units, filters, fans, and airtight isolation dampers.
- 35 • Fission Product Removal and Control System. This system consists of the pH control
36 system and the annulus air cleanup system. To control pH, a buffer agent is added to
37 provide sump water pH adjustment following a LOCA. The annulus air cleanup system
38 prevents uncontrolled release of radioactivity to the environment from the containment
39 penetration area and the safeguards components area. These areas are maintained at
40 negative pressure during an accident. This system is also used for containment
41 depressurization during normal operations. The annulus air cleanup system initiates
42 automatically on a safety injection signal.
- 43 • Emergency Feedwater System. This system is automatically initiated during a significant
44 transient event. It provides makeup water to the steam generators to sustain their ability to

1 remove heat from the reactor coolant system by converting it to steam. The heat so
2 converted would be discharged to the condenser or to the atmosphere.

3 The turbine generator consists of the turbine, generator, moisture separator and reheaters,
4 steam valves, and their auxiliary systems. The turbine generator system is designed to change
5 the thermal energy of the steam flowing through the turbine into rotational mechanical energy,
6 which rotates an electric generator to provide electrical power. The turbine generator consists
7 of a double-flow, high-pressure turbine and three double-flow, low-pressure turbines. It is a
8 tandem compound type, 1800 rpm machine. The design details are provided in Section 10.2 of
9 the DCD (MHI 2009).

10 Each turbine generator has a rated and design net output of approximately 1600 MW(e) for
11 each reactor thermal output of 4451 MW(t). The generator rating is 1,900,000 kVA with a power
12 factor of 0.9. Plant electrical consumption is approximately 90 MW(e), or about 5.5 percent of
13 generator output at rated power.

14 Figure 3-2 shows a simplified flow diagram of the reactor power conversion system. The
15 significant design features and performance characteristics for the major power conversion
16 system components are listed in Table 10.1-1 of the DCD (MHI 2009). Turbine generator and
17 auxiliary design parameters are listed in Table 10.2-1 of the DCD (MHI 2009). The main
18 condenser is a single-pressure, surface cooling, radial flow type unit with a total heat transfer
19 surface area of 1.437×10^6 ft². The condenser-designed heat duty is 9.90×10^9 Btu/hr. The
20 condenser is equipped with titanium tubes (Luminant 2009a).

21 **3.2.2 Structures with a Major Environmental Interface**

22 The review team divided the plant structures into two primary groups: those that interface with
23 the environment and those that are internal to the reactor and associated facilities but without
24 direct interaction with the environment. Examples of interfaces with the environment are
25 withdrawal of water from the environment at the intake structures, release of water to the
26 environment at the discharge structure, and release of excess heat to the atmosphere. The
27 structures or locations with environmental interfaces are considered in the review team's
28 assessment of the environmental impacts of facility construction and preconstruction and facility
29 operation in Chapters 4 and 5, respectively. The power-production processes that would occur
30 within the plant itself and that do not affect the environment are not relevant to a National
31 Environmental Policy Act (NEPA) review and are not discussed further in this EIS. However,
32 such internal processes are considered by the NRC in the US-APWR design certification
33 documentation and in the NRC safety review of Luminant's COL application. This section
34 describes the structures with a significant plant-environment interface. The remaining structures
35 are discussed in Sections 3.3.1 and Section 3.4.2, inasmuch as they may be relevant in the
36 review team's consideration of impacts discussed in Chapters 4 and 5.

37 **3.2.2.1 Cooling Water System**

38 The detailed description of the cooling water systems and their anticipated modes of operation
39 for CPNPP Units 3 and 4, as provided in this section, is taken from Luminant's ER (Luminant
40 2009a). Design data and performance characteristics for the cooling system components are
41 presented in the next subsection. The parameters provided are used to evaluate the impacts to
42 the environment from cooling system operation in Chapter 5. The principal environmental
43 interfaces of these systems are the plant intake and discharge structures as well as the cooling
44 towers. The basic system configuration is illustrated in Figure 3-3.

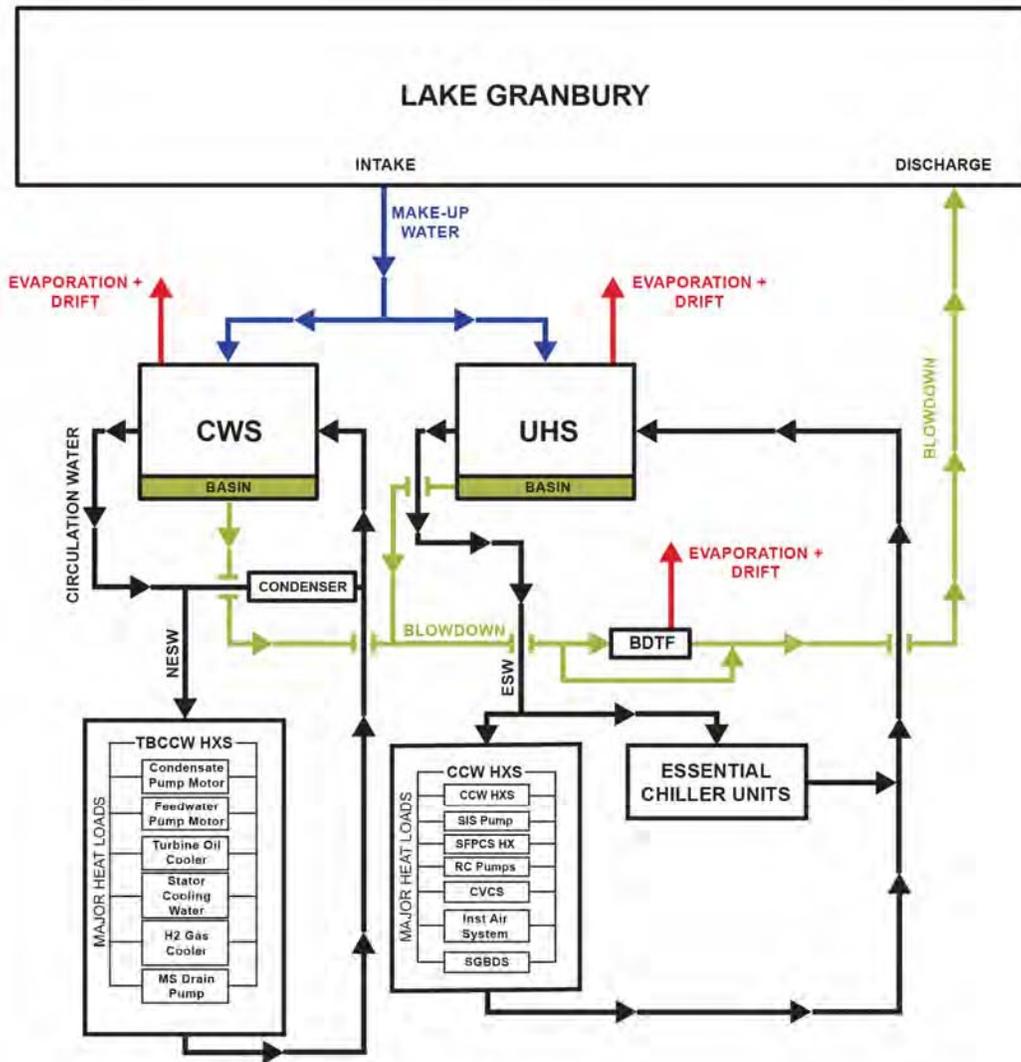


Figure 3-3. Simplified water use diagram for CPNPP Units 3 and 4 (Adapted from Luminant 2010b).

1 **Systems Description**

2 CPNPP Units 3 and 4 are provided with three cooling systems that transfer heat to the
 3 environment during normal modes of plant operation. These systems are the essential service
 4 water system (ESWS), the non-essential service water system (NESWS), and the circulating
 5 water system (CWS). There are six anticipated plant operational modes:

- 6 • power operation,
- 7 • startup,
- 8 • hot standby,
- 9 • hot shutdown,
- 10 • cold shutdown, and
- 11 • refueling.

Site Layout and Plant Description

- 1 Heat generated during each operational mode is released to the atmosphere and to Lake
 2 Granbury from the CWS, ESWS, and NESWS. The amount of heat released to the atmosphere
 3 and Lake Granbury during each mode of operation is provided in Table 3-1.

Table 3-1. Heat transfer to the environment for six operating modes (data values are in million Btu/hr)

Modes of operation	Total Heat Transferred ESWS and CWS	Heat Dissipated to Atmosphere by ESWS	Heat Released in Liquid Discharges by ESWS(a)	Heat Dissipated to Atmosphere by CWS	Heat Released in Liquid Discharges by CWS(b)
Power Operation	10,340.	100.0	2.62	9,970	267.6
Startup	659.7	144.1	3.71	498.5	13.38 ^(c)
Hot Standby	102.62	100.0	2.62	NA	0
Safe Shutdown Cooldown by CS/RHR(e)	390.6	390.6	0 ^(d)	NA	0
Refueling (Full Core Offload)	471.5	459.1	12.4	NA	0
	120.6	117.54	3.04	NA	0

(a) ESWS heat released in blowdown discharge is based on ESW blowdown water temperature of 95°F, and lake water temperature of 47°F.

(b) CWS heat released in blowdown discharge is based on CWS blowdown temperature of 88.5°F, and lake water temperature 47°F. Therefore, some heat would be dissipated in Lake Granbury. In addition, wastewater transferred from the BDTF to the storage pond would dissipate a fraction of the heat to the environment.

(c) The startup mode is based on 5% of rated power condition. The 5 percent heat value is prorated from the heat value of rated power operation (normal operation).

(d) ESW blowdown control valve is closed during safe shutdown.

(e) ESW cooldown by CS/RHRS operation is based on all four ESW trains operating for duration of 4 hr.

Source: Luminant 2009a

- 4 The CWS and ESWS are supplied with raw water from the intake structure on Lake Granbury to
 5 replace water which has been consumed and discharged as part of system operations. The
 6 makeup water system (MWS) supplies water to the CWS cooling towers to make up for water
 7 consumed as the result of evaporation, drift, and blowdown. The makeup water supply to the
 8 NESWS comes from the CWS. The quantities of water withdrawn, consumed, and discharged
 9 for the CWS and the ESWS are provided in Table 3-2. The chemicals to be added to the CWS
 10 and ESWS water are listed in Table 3-3.

Table 3-2. Water withdrawn and discharged per unit for six operating modes

Modes of Operation	Water Source	Quantity Withdrawn gpm	Quantity Consumed (CWS) gpm	Quantity Discharged (CWS) gpm	Quantity Consumed (ESWS) gpm	Quantity Discharged (ESWS), gpm	Quantity Discharged into Lake Granbury, gpm
Power Operation	Lake Granbury	31,615	18,412	12,929	165	109	13,038
Startup	Lake Granbury	2958	1506	1057	240	155	1212
Hot Standby	Lake Granbury	1178	531	373	165	109	482
Safe Shutdown	Lake Granbury	630(a)	0	0	630(a)	0(a)	0(a)
Cold Shutdown	Lake Granbury	1283	14	10	744	515	525
Refueling (Full Core Offload)	Lake Granbury	331	5	4	195	127	131

(a) During accident conditions, including loss-of-cooling accident and loss of off-site power, blowdown control valves close automatically upon receipt of low water level signal or emergency core cooling system actuation signal. Make-up water may be available, but the design basis of the ultimate heat sink does not require make-up water.

Source: Luminant 2009a

1 During normal operation, the Wheeler Branch Reservoir (WBR) supplies up to 300 gpm. This
 2 water supply includes up to 50 gpm for daily potable water use for the entire site and from 0 to
 3 250 gpm to the raw water storage tanks, which in turn supply water to the demineralized water
 4 system (DWS). The amount of water needed from WBR is bounded by the maximum delivery
 5 rate of 300 gpm, with the estimated monthly maximum being 1.3×10^7 gal.

6 **Makeup Water System**

7 The MWS supplies makeup water from Lake Granbury to the CWS and ESWS and consists of
 8 five 50 percent capacity pumps, two for each unit and one spare pump in standby, common for
 9 both units. The MWS supplies water to the ESWS cooling tower to make up for water
 10 consumed as the result of evaporation, drift, and blowdown.

11 During normal operation, Lake Granbury provides 31,341 gpm makeup to the CWS, and
 12 274 gpm as makeup for the ESWS, for a total of 31,615 gpm per unit, plus 320 gpm to the raw
 13 water storage tanks, or a total of 63,550 gpm for both units. The estimated monthly average
 14 water need from Lake Granbury is 2.73×10^9 gal to operate both CPNPP Units 3 and 4. Normal
 15 operation is at 100 percent power operation, which is at a maximum makeup demand; therefore,
 16 the maximum is approximated to be the same as the normal need. The minimum demand is
 17 during an outage when the only flow being pulled from Lake Granbury for that unit is the ESWS
 18 makeup (331 gpm per unit). The estimated monthly minimum water demand from Lake
 19 Granbury is 1.38×10^9 gal per unit. Therefore, the minimum demand occurs when one unit is in
 20 an outage and the other is in power operation.

Table 3-3. Chemicals that would be added to the essential service water system (ESWS) and circulating water system (CWS) of the CPNPP Units 3 and 4.^(a)

System	Chemicals	Amount used (gal/yr/unit)	Frequency of Use	Concentration in waste stream
ESWS	Biocide (sodium hypochlorite)	12,000	Continuous	0.2 ppm residual or free chlorine
ESWS	pH/LSI/adjustment (sulfuric acid)	12,000	Continuous	<2.2 ppm H ₂ SO ₄
ESWS	Corrosion inhibitor antiscalant (ortho-polyphosphate and phosphonate)	1200	Continuous	Permit limit
CWS	Biocide (sodium hypochlorite)	120,000	Continuous	0.2 ppm residual or free chlorine
CWS	pH/LSI/adjustment (sulfuric acid)	120,000	Continuous	<2.2 ppm H ₂ SO ₄
CWS	Corrosion inhibitor antiscalant (ortho-polyphosphate and phosphonate)	12,000	Continuous	Permit limit
CWS	Dechlorination of blowdown (sodium bisulfite)	1200	Intermittent	Sufficient to reduce residual chlorine to <0.2 ppm

(a) The CWS supplies water to the NESWS.

Source: Luminant 2009a

1 Circulating Water System

2 The CWS supplies cooling water to remove heat from the main condensers under varying
 3 conditions of power plant operation and site environmental conditions. The CWS is arranged
 4 into two cooling tower basins for each unit, each with four 12.5 percent capacity, vertical, wet pit
 5 type, single-stage mixed flow circulating water pumps located in each cooling tower basin. Two
 6 CWS cooling towers provide 100 percent cooling for normal power operation. Each pump
 7 provides a flow rate of 164,715 gpm into the main condensers removing heat by transferring
 8 heat to the CWS water, and then the heated CWS water is returned to the mechanical draft
 9 cooling tower. Once in the cooling tower, the water is cooled by the counterflow principle of
 10 heat transfer to the rising air and evaporative cooling. The heat removed is rejected to the
 11 atmosphere, and the cooled water returns to the cooling tower basin. The system is provided
 12 with a blowdown capability to maintain the system performance by elimination of contaminants
 13 that build up as a result of the evaporation process. The chemical concentration factor for the
 14 CWS cooling tower is 2.4 cycles of concentration. The Texas Commission on Environmental
 15 Quality (TCEQ) specifies 93°F as the thermal water quality discharge criterion, which is the
 16 maximum temperature at which water may be discharged, in Lake Granbury (Luminant 2009a).

17 Non-Essential Service Water System

18 The NESWS provides cooling water to remove heat from the turbine component cooling water
 19 system (TCS). The heat is removed via the TCS heat exchanger and discharged to the cooling
 20 towers via the CWS.

1 The NESWS consists of three 50 percent capacity pumps; three 50 percent capacity TCS heat
2 exchangers; two 100 percent capacity strainers; and associated piping, valves, instrumentation,
3 and controls. The NESWS pumps are single-stage horizontal, centrifugal, constant speed,
4 electric motor driven, and are located in the turbine building. Each pump is designed to provide
5 approximately 13,500 gpm, which meets the maximum flow requirements for normal power
6 operation (based on two pump operation); therefore, one pump can be out of service for
7 maintenance during power operation. The temperature rise across the heat exchangers varies
8 with each mode of operation. The NESWS is in operation during several modes of plant
9 operation, as described in the operational modes subsection. During normal operation with a
10 maximum heat load, the temperature rise is approximately 10°F–1°F during cold shutdown, safe
11 shutdown, and hot standby; 0.4°F during refueling; and 8°F during plant startup.

12 The NESWS is arranged in such a way that any two of the three pumps can operate in
13 conjunction with any two of three TCS heat exchangers to meet the system flow requirements.
14 One out of two 100 percent capacity strainers is used. Each NESWS pump takes suction from
15 a common header in the CWS piping and the discharge from the TCS heat exchangers
16 combines into a common header.

17 ***Essential Service Water System***

18 The ESWS provides cooling water to remove the heat from the component cooling water
19 system (CCWS) heat exchangers and the essential chiller units. The ESWS transfers the heat
20 from these components to the ultimate heat sink (UHS)¹.

21 The ESWS consists of four 50 percent capacity pumps. The ESWS is arranged into four
22 independent trains (A, B, C, and D). Each train consists of one ESWS pump, two 100 percent
23 strainers in the pump discharge line, one 100 percent strainer upstream of the CCWS heat
24 exchanger, one CCWS heat exchanger, one essential chiller unit, associated piping, valves,
25 instrumentation, and controls. Heat is dissipated via the UHS, which consists of four 50 percent
26 wet mechanical draft cooling towers. The ESWS pumps are vertical, wet-pit, centrifugal,
27 constant speed, electric motor driven, and are located at the essential service water intake
28 basin. Essential service water is pumped through the strainers to the CCWS heat exchangers
29 for heat removal. The temperature rise across the heat exchangers varies with each mode of
30 operation. For Trains A and B during normal operation with a maximum heat load, the
31 temperature rise is approximately 11.6°F–31.6°F during cool down, 11.0°F during refueling,
32 8.0°F during plant startup, and 31.6°F during safe shutdown. For Trains C and D during normal
33 operation with a maximum heat load, the temperature rise is approximately 5.6°F–31.6°F during
34 cool down, 6.7°F during refueling, 6.9°F during plant startup, and 31.6°F during safe shutdown.
35 The heated essential service water returns to the UHS, where the heat is then rejected to the
36 atmosphere.

37 The essential service water blowdown is diverted to Lake Granbury via the CWS blowdown
38 pipe. This blowdown is used to control levels of solids concentration in the ESWS. As water
39 cycles through the system, the chemicals become concentrated. The chemical concentration
40 factor for the ESWS cooling tower, which is the number of times the water is cycled through the
41 system to produce the chemical concentrations set forth in Table 3-3, is 2.4 cycles of
42 concentration.

¹ The UHS is comprised of a set of wet mechanical draft cooling towers located over the ESWS intake basin (also known as the cooling town basin). The cooling tower basin is also part of the UHS. The UHS provides the safety-related source of cooling for the normal essential components and removes reactor decay heat during and after an accident (Luminant 2009a)

1 **3.2.2.2 Other Permanent Plant-Environment Interfacing Structures, Systems, or**
2 **Components**

3 ***Blowdown Treatment Facility and Ponds***

4 Luminant describes the BDTF as a facility to control the concentration of TDS and chlorides in
5 the blowdown water, a stream of water that would be extracted from cooling tower water, before
6 being returned to Lake Granbury (Luminant 2009d). Luminant's conceptual design of the BDTF
7 is a 400-ac area consisting of reverse osmosis and ultrafiltration equipment buildings, a 47-ac
8 storage pond and a 128-ac evaporation pond.² The evaporation pond would be intended to
9 evaporate the wastewater from the BDTF to the point the salts could be disposed of at a landfill.
10 Luminant has not described how precipitated salts and/or bittern recovered from the evaporation
11 pond would be converted into a form that could be disposed of in a landfill. However, Luminant
12 has stated that the salts could be passed through a filter press to reduce their moisture content
13 (Luminant 2009c) or the wet salts could be packaged and shipped in water-tight containers to
14 be processed at the landfill facility to meet the landfill waste treatment requirements
15 (Luminant 2009e).

16 Although Luminant has not developed the following details, the BDTF would also include access
17 roads, power lines and pipelines that are required to get people, materials and electricity to the
18 site. The site would also have to have facilities for handling salt residues, preparing salt for
19 shipment, as well as appropriate vehicle access. As shown in Figure 3-4, the ultrafiltration and
20 reverse osmosis equipment would produce a product stream and two wastewater streams. The
21 product stream would be demineralized water with low TDS and chloride concentrations that
22 would be mixed with blowdown water from the cooling tower basins and piped to Lake
23 Granbury. In addition to the product stream, the reverse osmosis equipment would produce a
24 waste stream with high TDS and chloride concentration. The ultrafiltration equipment would
25 remove particles from the blowdown water stream routed to the BDTF that might foul the
26 reverse osmosis equipment. Part of the blowdown water stream is diverted and carries these
27 removed particles as an additional waste stream to the storage pond. Luminant plans to
28 combine the two waste streams in the storage pond. High-mineral-content water would be
29 pumped from the storage pond to the evaporation pond.

30 Because evaporation from pond surfaces is not sufficient to evaporate the quantity of
31 wastewater generated in the BDTF, Luminant plans to use 182 devices known as misters
32 arrayed over the evaporation pond. Luminant based its conceptual design on Turbo-Mist
33 evaporators sold by Slimline Manufacturing Ltd (Luminant 2010b). These evaporators consist
34 of a powerful blower in a housing that directs a strong stream of air upward at about a 45°
35 angle. Around the outlet of the blower housing are 30 nozzles that produce a fine spray. The
36 blower forces the spray about 60 ft high (McIntyre 2010). The manufacturer reports that an
37 individual evaporator produces a sound level of 95 db at 25 ft (Slimline Manufacturing 2010).
38 Luminant plans to surround the evaporation pond with a 16-ft tall fence with fabric in order to
39 mitigate salt drift from the misters that passes beyond the pond boundary.

² Luminant has only developed a conceptual design for the BDTF (Luminant 2009e). Therefore, the design parameters for the facility could change as Luminant pursues a permit from the State of Texas for discharging blowdown water into Lake Granbury.

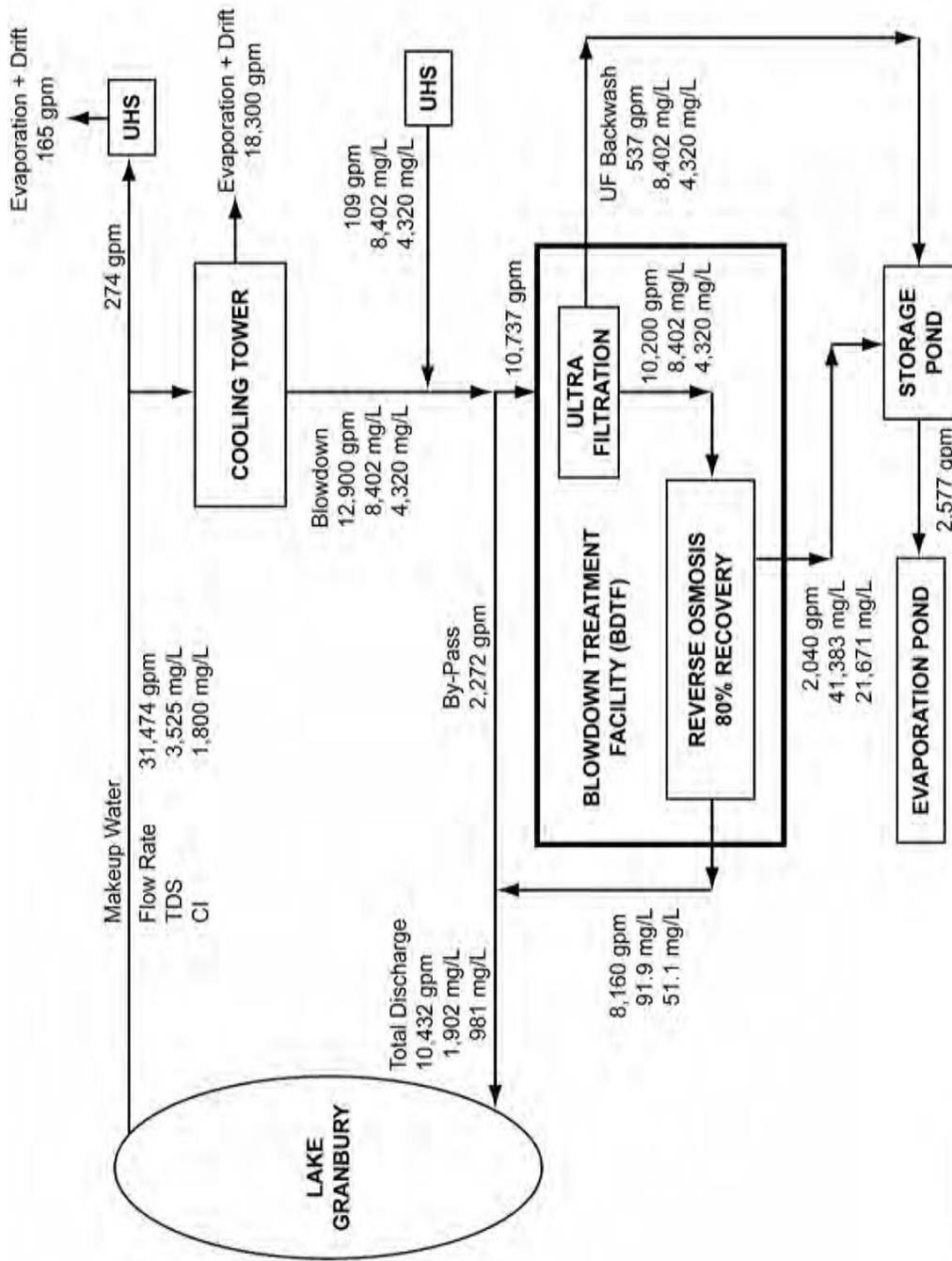


Figure 3-4. Mass balance for blowdown treatment facility (BDTF) when Lake Granbury total dissolved solids (TDS) and chloride concentrations are high. Flow rates are per unit (Adapted from Luminant 2009a).

1 **Sanitary Waste Treatment Plant**

2 A new sanitary waste treatment plant with a 100,000 gpd capacity would be installed as part of
3 the Unit 3 and 4 construction project. The proposed wastewater treatment system would be
4 composed on an equalization tank, aeration chamber, clarifier, sludge digester tank with post-
5 processing ultraviolet disinfection treatment, and associated pumps and blowers. The new
6 system would include a filter press for sludge dewatering. Unit 1 and 2 sludge is presently
7 dewatered using a bag filter system. The Unit 1 and 2 bag filter system would be
8 decommissioned and replaced by the new Unit 3 and 4 filter press, which would have sufficient
9 capacity to dewater sanitary waste sludge from all four Units. During construction of Units 3 and
10 4, the existing Unit 1 and 2 system would operate in parallel with the new treatment system
11 because neither system alone would have sufficient capacity to treat the waste generated
12 during construction. After construction of Units 3 and 4 is complete, the Unit 1 and 2 sanitary
13 waste treatment system would be decommissioned and the combined sanitary waste would be
14 treated in the new system.

15 **3.2.2.3 Power Transmission System**

16 Oncor Electric Delivery Company (Oncor) is the transmission service provider for CPNPP.
17 Oncor Electric Delivery is a regulated electric distribution and transmission business that
18 provides reliable electricity delivery to consumers. Oncor Electric Delivery is responsible for
19 operating, maintaining, building, dispatching, and marketing the electric transmission system
20 from the generator bus bars through the distribution substations. Oncor has an additional
21 responsibility to provide a transmission system that supplies offsite power for startup and normal
22 shutdown of nuclear reactors through the transmission switchyards.

23 Oncor is a member of the Electric Reliability Council of Texas (ERCOT). As the independent
24 system operator for the region, ERCOT schedules power on an electric grid that connects
25 40,000 mi of transmission lines and more than 550 generation units. ERCOT manages the flow
26 of electric power to 22 million Texas customers, representing 85 percent of the state's electric
27 load and 75 percent of the Texas land area. ERCOT also manages financial settlement for the
28 competitive wholesale bulk-power market and administers customer switching for 6.5 million
29 Texans in competitive choice areas.

30 ERCOT is an independent not-for-profit corporation, subject to oversight by the Public Utility
31 Commission of Texas (PUCT) and the Texas Legislature. The ERCOT region has an overall
32 generating capacity of approximately 78,000 MW (Luminant 2009a).

33 **Onsite Transmission System**

34 The onsite power transmission system consists of one switchyard-transformer yard (transformer
35 yard) for each of Units 3 and 4 at the turbine buildings and a combined switchyard (Units 3 and
36 4 Switching Station; U34SS) for the units where they connect to the transmission lines that
37 leave the site. In the unit transformer yards, power from the generators is increased in voltage
38 to 345 kV. U34SS connects and routes power from the unit transformer yards to the external
39 transmission systems.

40 Luminant's construction plans have the distance between the Units 3 and 4 transformer yards
41 and U34SS from about 0.3 to 0.66 mi (Luminant 2009a). After leaving the switchyard,
42 transmission lines would traverse a distance of about one mi before exiting the site boundaries.
43 These lines are described in the following subsection from U34SS to the points where they
44 connect with the regional transmission system, not distinguishing between onsite and offsite
45 lines.

1 **Offsite Transmission System**

2 Four new 345-kV circuits are planned to distribute the power that would be produced by Units 3
 3 and 4. Two circuits would use vacant circuit positions on existing 345-kV, double-circuit lattice,
 4 steel tower structures in existing rights-of-way. Figure 3-5 shows a 345-kV, double-circuit tower
 5 with vacant circuit positions.



6 **Figure 3-5.** Oncor transmission line towers with vacant circuit positions
 7 (NRC staff photograph).

8 The first line to occupy a vacant circuit in an existing right-of-way (ROW) is a 22.4-mi circuit
 9 utilizing a vacant circuit position on the existing 345-kV towers between U34SS and the
 10 Johnson Switch 345-kV Switching Station. The circuit would continue from Johnson Switch
 11 another 22.4 mi to the Everman 345/138-kV Switching Station. The other line to occupy a
 12 vacant circuit would be installed on the vacant position on the 41.6-mi 345-kV towers between
 13 U34SS and the Parker 345 kV Switching Station. See Figure 2-13.

14 Luminant reports that Oncor would build the two circuits in new ROWs. Oncor would build a
 15 new 45-mi circuit in a new ROW utilizing Oncor's standard 345-kV, double-circuit lattice, steel
 16 tower structure line between the U34SS and the Whitney 345-kV switching station. Oncor
 17 would also build a new 17-mi circuit in a new ROW utilizing Oncor's standard 345-kV, double-
 18 circuit lattice, steel tower structure line between U34SS and the DeCordova 345-kV Switching
 19 Station. There are already 345-kV and 183-kV circuits between CPNPP and DeCordova
 20 Switching Station on rights of way with a combined width of 230 ft.

21 The new ROW to DeCordova Switching Station would be adjacent to and parallel with the
 existing lines. The new ROW would be 160 ft wide, creating a combined ROW 390 ft wide. The
 new ROW would have standard Oncor 345-kV towers, with one of the two circuit positions filled.

1 The new 45-mile Whitney transmission line from the CPNPP Site to Whitney includes
2 approximately 18-miles of new ROW that does not parallel any existing ROW. This portion of
3 the new ROW would extend from the CPNPP site to a point near the town of Walnut Springs in
4 Bosque County. The remainder of the route would parallel existing transmission line ROW from
5 Walnut Springs to Whitney. The new ROW would be 160 ft wide. Where it runs adjacent to the
6 existing ROW between Walnut Springs and Whitney, the combined ROW would be 320 ft wide.
7 The new ROW would employ standard Oncor 345-kV towers, with one of the two circuit
8 positions filled.

9 Figure 2-13 shows the current concept for the proposed connections to the existing power grid
10 and the above discussion explains the anticipated routing for new transmission line rights of
11 way. However, changes may be made during a routing study process that will be conducted by
12 Oncor and reviewed by the PUCT. The PUCT considers several factors, including
13 environmental integrity, when reviewing each application for a certificate to construct a
14 transmission line (TUC 2003). The utility applicant must give notice of its intent to secure a
15 certificate to neighboring municipalities and affected property owners and may be required to
16 hold a public meeting (PUCT 2009). The utility applicant must also reasonably consider a route
17 for the proposed transmission line that would moderate the impact on the affected community
18 and landowners (PUCT 2003). Procedures for the route study process call for identifying areas
19 where transmission lines are excluded or should be avoided.

20 **3.3 Construction and Preconstruction Activities**

21 The NRC's authority is limited to construction activities that have a "reasonable nexus to
22 radiological health and safety or common defense and security" (72 FR 57416), and the NRC
23 has defined "construction" within the context of its regulatory authority. Examples of
24 construction [defined at Title 10 of the Code of Federal Regulations (CFR) 50.10(a)] activities for
25 safety-related structures, systems, or components include driving of piles; subsurface
26 preparation; placement of backfill, concrete, or permanent retaining walls within an excavation;
27 installation of foundations; or in place assembly, erection, fabrication, or testing.

28 Other activities related to building the plant that do not require NRC approval (but may require a
29 permit from the Corps) may occur before, during, or after NRC-authorized construction
30 activities. These activities are termed "preconstruction" in 10 CFR 51.45(c) and may be
31 regulated by other local, State, Tribal, or Federal agencies. Preconstruction includes activities
32 such as preparation of the site (e.g., site clearing and grading, erosion control and other
33 environmental mitigation measures), erection of fences, excavation, erection of support
34 buildings, building service facilities (e.g., roads, pipelines, transmission lines), and procurement
35 or fabrication of components occurring at other than the final, in-place location at the site.
36 Further information about the delineation of construction and preconstruction activities is
37 presented in Chapter 4.

38 This section describes the structures and activities associated with building the proposed
39 Units 3 and 4. This section also characterizes the major activities for the principal structures to
40 provide the requisite background for the assessment of environmental impacts. However, it
41 does not represent a discussion of every potential activity or a detailed engineering plan.

42 Table 3-4 provides general definitions and examples of construction and preconstruction
43 activities that would be performed in building the new units. Luminant anticipates that site
44 activities would be performed in the following sequence.

- 1 • Preconstruction planning and exploration activities would include such site activities as soil
2 boring, sampling, and monitoring wells, or additional geophysical borings as allowed by
3 10 CFR 50.10(a)(1) and the removal or relocation of existing facilities at the CPNPP site.
- 4 • Site preparation activities would include installation of temporary facilities, construction
5 support facilities, service facilities, utilities, docking and unloading facilities, excavations for
6 facility structures and foundations, and construction of structures, systems, and components
7 that do not constitute limited work authorization (LWA) activities as discussed in 10 CFR
8 50.10(a)(1).
- 9 • Subsurface preparation, placement of backfill and concrete within an excavation, and
10 installation of foundations would be performed under the COLs.
- 11 • Construction activities would include the major power plant construction activities under the
12 COLs.

13 For the purposes of analysis, Luminant assumed a construction schedule based on providing
14 additional commercial electric generation beginning in 2017 for CPNPP Unit 3 and in 2018 for
15 Unit 4. The description of site preparation and construction activities in this section assumes
16 that construction on CPNPP Unit 3 would begin following the site preparation for CPNPP Units 3
17 and 4 and that construction of CPNPP Unit 4 would begin 12 months following commencement
18 of CPNPP Unit 3 construction (Table 3-5).

19 Temporary construction facilities and laydown areas for staging of long-lead-time components
20 would be located on site (Figure 3-6). These components would be assembled on site into
21 modules as part of the preconstruction activities. The impacts of constructing these facilities are
22 described in Chapter 4.

23 **3.3.1 Site Preparation**

24 Site preparation includes installation of temporary facilities (e.g., storage warehouses, concrete
25 batch plant), relocation of facilities within the CPNPP site, staging equipment, module assembly,
26 and preparation activities to support power plant construction. Figure 3-6 depicts the
27 construction utilization plan, along with plant access roads, heavy haul roads, and other
28 construction planning features.

Table 3-4. Descriptions and examples of building activities for CPNPP Units 3 and 4

Activity	Description	Examples
Excavation dewatering	Pumping water from wells or pumping water directly to keep excavations from flooding with groundwater or surface runoff.	Pumping water from excavation of base for reactor building.
Grouting	Installation of low-permeability material in the subsurface around deep excavation to minimize movement of groundwater.	Slurry wall would be installed around excavation for the reactor building.
Deep excavation	Digging an open hole in the ground. Deep excavation requires equipment with greater vertical reach than a backhoe. Deep excavation generally requires dewatering systems to keep the hole from flooding.	Excavating to support fabrication of basement for the reactor.
Erection	Assembling of all modules into their final positions, including all connection between modules.	Using crane to assemble reactor modules.
Fabrication	Creating an engineered material from the assembly of a variety of standardized parts. Fabrication can include conforming native soils to some engineered specification (e.g., compacting soil to meet some engineered fill specification).	Preparing and pouring concrete; laying rebar for basement.
Grading	Reforming the elevation of the land surface to facilitate operation of the plant and drainage of precipitation.	Minor leveling of the site from its current relatively level terrain.
Hauling	Transporting material and workforce along established roadways.	Construction workers driving on new access road.
Paving	Laying impervious surfaces, such as asphalt and concrete, to provide roadways, walkways, parking areas, and site drainage.	Paving parking area.
Shallow excavation	Digging holes or trenches to depths reachable with a backhoe. Shallow excavation may not require dewatering.	Pipelines; foundations for small buildings.
Vegetation management	Thinning, planting, trimming, and clearing vegetation.	Maintaining switchyard free of vegetation.
Filling of aquatic resources	Discharging of dredge and/or fill material into waters of the United States, including wetlands.	Placement of a culvert for a roadway.

1

Table 3-5. Schedule for construction of CPNPP Units 3 and 4

Activity	Start Date	Finish Date	Duration
Unit 3			
Site preparations	4th qtr 2009	3rd qtr 2012	36 months
First concrete	4th qtr 2012		
Site construction to fuel load	4th qtr 2012	3rd qtr 2016	48 months
Fuel load to startup	4th qtr 2016	3rd qtr 2017	12 months
Commercial operation	4th qtr 2017		
Unit 4			
Site preparations	2nd qtr 2012	3rd qtr 2013	18 months
First concrete	4th qtr 2013		
Site construction to fuel load	4th qtr 2013	3rd qtr 2017	46 months
Fuel load, startup	3rd qtr 2017	2nd qtr 2018	10 months
Commercial operation	2nd qtr 2018		

Source: Luminant 2009a

2 3.3.1.1 Power Block Earthwork (Excavation)

3 The power block consists of an area encompassing the nuclear island and turbine building
 4 areas, which include the following buildings for each unit:

- 5 • reactor building, including the prestressed concrete containment vessel;
- 6 • power source buildings;
- 7 • power source fuel storage vaults;
- 8 • essential service water pipe tunnel;
- 9 • UHS-related structures;
- 10 • auxiliary building;
- 11 • access building; and
- 12 • turbine building.

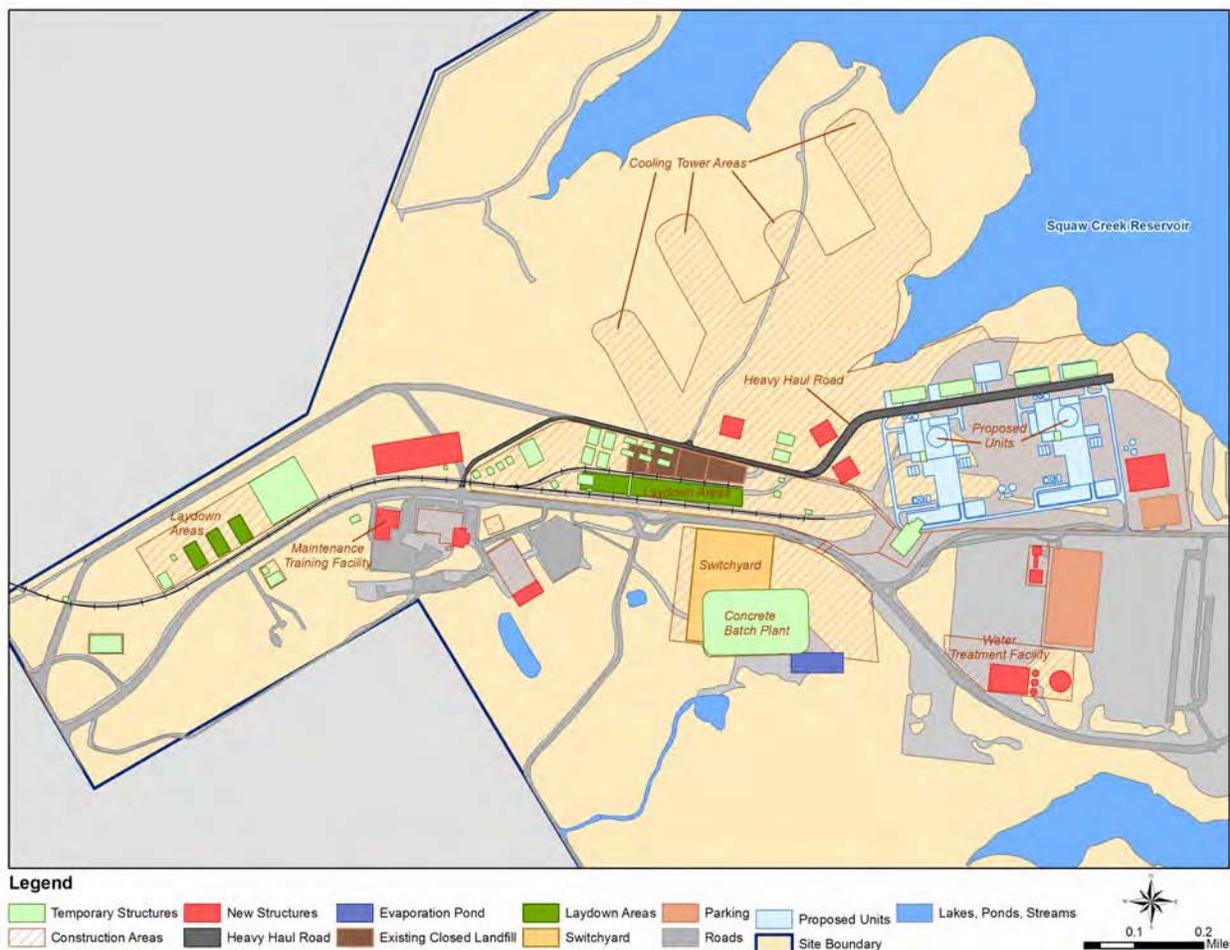


Figure 3-6. Detailed site plan showing construction laydown areas (Luminant 2009a).

1 In accordance with Regulatory Guide 1.165 (NRC 1997), the open excavations would be
 2 geologically mapped, and the NRC would be notified when the excavations are open for
 3 inspection.

4 **3.3.1.2 Power Block Earthwork (Backfill)**

5 The installation of safety-related Category 1 structural backfill material placed under safety-
 6 related structures or systems would occur as part of the site preparation activities. Backfill
 7 material would come from the concrete batch plant, qualified onsite borrow pits, or qualified
 8 offsite sources. The backfill would be installed up to the building's foundation grades in
 9 overexcavated areas and would continue around foundations upward as the buildings rise from
 10 the excavation up to plant grade.

11 **3.3.1.3 Reactor Building Base Mat Foundation**

12 After the subsurface preparations are completed, the next sequential work operation would be
 13 the installation of foundations. The reactor building basemat would be the first to be installed.
 14 The detailed steps include:

- 15 • installing the grounding grid;

- 1 • forming the mud-mat concrete work surface; and
- 2 • reinforcing steel and civil, electrical, mechanical/piping embedded items (basemat module)
- 3 and forming, concrete placement and curing.

4 **3.3.1.4 Blowdown Treatment Facility and Ponds**

5 The BDTF with its storage and evaporation ponds would be constructed on 400 ac of existing
6 site property along the blowdown return pipelines to Lake Granbury (see Figure 2-5). Luminant
7 estimates that the evaporation pond would occupy approximately 128 ac and would be
8 constructed to a depth of 4 ft plus 2 ft of freeboard which Luminant reports would protect from a
9 10-yr, 2-hr rainfall (Luminant 2009c, Luminant 2009d, Luminant 2009e). A storage pond of
10 approximately 47 ac with a depth of 32 ft plus 2 ft of freeboard would be constructed near the
11 evaporation ponds (Luminant 2009e). The design and construction of these ponds would be
12 required to comply with requirements of the TCEQ, including pond liner and size requirements,
13 operational freeboard requirements, permeability, soil compaction, and under-drain leak
14 detection requirements. The ponds would be lined with either high density polyethylene or
15 compacted clay. An under-drain system would be provided to collect and detect any seepage
16 from the pond.

17 All 400 acres of the BDTF are anticipated to be affected by the facility construction and
18 operation (Luminant 2010a). Excavation would be required for the construction of the ponds on
19 the order of 1.7 million yd³ of rock and soil for the evaporation ponds and 2.8 million yd³ for the
20 storage pond. Additional excavation would be required for construction of the water treatment
21 equipment and associated pumps and pipelines.

22 **3.3.1.5 Road and Rail Construction**

23 During construction, access to the CPNPP site would be via Farm-to-Market Road 56 (FM 56).
24 To the extent practical, Luminant would use the existing onsite road system and drainage
25 systems. A new switchyard for CPNPP Units 3 and 4 would be located south of the existing
26 access road from FM 56, and a road into the switchyard would be built. A heavy haul route
27 would be built on site to support the transport of heavy modules and components from the
28 existing heavy haul route. Temporary surfacing would be installed on the heavy haul route, as
29 needed. A temporary construction parking lot would be created. Construction laydown and
30 fabrication areas would be cleared, grubbed, graded, and graveled or paved with a road system
31 to accommodate the site construction traffic.

32 The existing onsite rail line would be upgraded. The upgrades would include the installation of
33 ballast or rail sections on the existing rail bed.

34 **3.3.1.6 Security Construction**

35 Security structures would include access control points, fencing, lighting, physical barriers, and
36 guardhouses. Security features would be installed during the early part of site preparation
37 activities.

38 **3.3.1.7 Temporary Utilities**

39 Temporary utilities would include aboveground and underground infrastructure for power,
40 communications, potable water, wastewater and waste treatment facilities, fire protection, and
41 construction gas and air systems. The temporary utilities would support the entire construction
42 site and associated activities, including construction offices, warehouses, storage and laydown

1 areas, fabrication and maintenance shops, the power block, the batch plant facility, measuring
2 and testing equipment, and intake and discharge areas.

3 The materials brought on site for temporary utilities may include but are not limited to wood
4 products for utility poles, concrete forms and crating; electrical cable to route temporary power;
5 temporary piping for potable and sanitary water facilities and to the concrete batch plant; paint
6 and spray cans for various construction and housekeeping services; plastics from containers
7 and protective coverings. Luminant has no estimate of the quantities of these materials but
8 estimates that an area of 5 to 10 ac may be needed for staging construction waste materials.
9 Luminant reports that materials collected in this area will be sorted for those that can be
10 reclaimed, either as recyclable material, reusable material or as investment recovery. The
11 remaining material will be shipped to appropriate landfills. Luminant expects 4 to 5 truckloads of
12 personal trash and packing wastes associated with construction to be shipped to landfills.
13 Luminant will not burn any waste.

14 **3.3.1.8 Temporary Construction Facilities**

15 Temporary construction facilities, including offices, warehouses for receiving and storage,
16 temporary workshops, toilets, training facilities, and personnel access facilities, would be built.
17 The site of the concrete batch plant would be prepared for aggregate unloading and storage,
18 and the cement storage silos and concrete batch plant would be erected.

19 **3.3.1.9 Laydown, Fabrication, Shop Area Preparation**

20 Activities to support preparation of the laydown, fabrication, and shop areas include:

- 21 • performing a construction survey to establish local coordinates and benchmarks for
22 horizontal and vertical control;
- 23 • grading, stabilizing, and preparing the laydown areas;
- 24 • installing construction fencing;
- 25 • installing shop and fabrication areas, including the concrete slabs for formwork laydown,
26 module assembly, equipment parking and maintenance, fuel and lubricant storage, and
27 rigging loft; and
- 28 • Installing concrete pads for cranes and crane assembly.

29 **3.3.1.10 Clearing, Grubbing, and Grading**

30 Clearing and grubbing of the site would begin with the removal of vegetation. In preparation for
31 excavation, topsoil would be moved to a storage area for later use. The general plant area,
32 including the switchyard and UHS areas would be brought to plant grade at an approximate
33 elevation of 822 ft above mean sea level in preparation for foundation excavation. Existing
34 underground utilities in the site area would be removed. The site utilization plans illustrate the
35 areas to be cleared and graded.

36 Luminant estimates that about 101 ac of Ashe juniper forest and 17 ac of mixed hardwoods
37 exist in the proposed construction area. In addition, Luminant estimates that in the area where
38 the BDTF would be built, 313 ac of Ashe juniper and 45 ac of mixed hardwoods would be
39 cleared. The vegetation would be disposed of by chipping/mulching to create mulch that would
40 be spread on the construction area to minimize erosion. No vegetation would be disposed of by
41 burning.

1 Luminant reports that it would use the wood chips as hydraulic mulch for erosion control per
 2 Luminant's BMP Guidance document, called "Temporary Best Management Practices"
 3 (Luminant 2010a). Hydraulic mulch uses wood fiber with or without other chemical binders in
 4 water that is applied to soil. The mixture requires 24 hours to dry after which it is effective. It
 5 may be necessary to reapply it to maintain erosion control. The wood fibers are applied at 2000
 6 to 4000 lb/ac. Luminant reports that the mulch would be reapplied every two to six months.

7 For the main construction area, Luminant reports that the 118 ac of juniper and hardwoods
 8 would generate 12 million dry pounds of wood fiber. Assuming that it treats the 193-ac onsite
 9 construction disturbed areas, excluding building footprints, at a 4000-lb/ac rate two to six times
 10 per year, Luminant estimates that the shredded wood would provide mulching for 30 to 90
 11 months. Luminant does not explain the disposition of approximately 36 million pounds of mulch
 12 that would result from chipping and shredding the 358-ac of woody vegetation on the BDTF site.

13 Approximately 5.3 million yd³ of soil and rock (cut material) would be excavated during
 14 construction of CPNPP Units 3 and 4. Cut material that cannot be reused in the footprint would
 15 be retained on site in two excavated soil retention areas located in the south portion of the site.
 16 One 30-ac area is near the west property line. It can accommodate approximately 367,000 yd³
 17 of material. East of this area is a 149-ac site, which can accommodate up to 3.3 million yd³ of
 18 material and includes the location of the BDTF.

19 Luminant reports that efforts would be taken to achieve beneficial reuse of the cut material. It is
 20 estimated that approximately 1 million yd³ of the cut material would be available for reuse as site
 21 excavation backfill material to help achieve final grade elevation of the footprint. Approximately
 22 3.3 million yd³ can be beneficially reused to prepare the BDTF area for development.

23 Approximately 367,000 yd³ can be beneficially reused in the expansion of the existing security
 24 training facility and gun range. In addition, suitable rock material would be used in swales and
 25 other applications. Any remaining soil that cannot be reused would be transported off site to a
 26 construction/demolition landfill or permitted landfill.

27 **3.3.1.11 Underground Installations**

28 Underground installations, such as non-safety-related underground fire protection, water supply
 29 piping, sanitary system, compressed air and gas piping, and electrical power and lighting duct
 30 bank would be installed and backfilled.

31 **3.3.1.12 Unloading Facilities Installation**

32 The existing rail line would be upgraded with adjacent construction laydown areas to support
 33 receipt of the bulk commodities. A spur into the batch plant area to support concrete materials
 34 would be built, and a heavy lift crane would be erected.

35 **3.3.1.13 Intake/Discharge Cofferdams and Piling Installation**

36 Installation of a raw water intake structure for CPNPP Units 3 and 4 is planned adjacent to and
 37 northwest of the existing intake structure on Lake Granbury that currently supplies water to
 38 SCR. The new intake structure would connect to two new 42-in. pipelines, each supplying
 39 water directly to the cooling towers for Units 3 and 4 and nearby to the existing intake structure.
 40 Two additional gravity-drain 42-in. blowdown discharge pipelines (one from Unit 3 and one from
 41 Unit 4) with multiport diffusers are to be located approximately 900 ft upstream from DeCordova
 42 Bend Dam, in the vicinity of the existing discharge pipe. The distance between the intake
 43 location and the proposed discharge location on Lake Granbury is approximately 1.2 mi.

1 Building the intake and blowdown discharge structures is expected to require 12 to 18 months.
2 The intake structure is expected to be approximately 80 feet long (east-west direction) and
3 40 feet wide (Figure 3-7). The foundation would be 3-ft diameter caissons drilled into the
4 limestone bedrock under Lake Granbury. Steel sheet piling would establish the underwater
5 perimeter of the intake structure. Luminant reports that neither coffer dams nor dredging would
6 be employed (Luminant 2010a). To minimize impingement mortality and entrainment of fish and
7 shellfish, Luminant would apply a passive screening system with the intake structure (Luminant
8 2009a). The system would consist of a traditional well-screen design which has spiral wound,
9 wedge shaped wire drum modules. Each module is 6 ft long and mounted in a tee arrangement
10 such that each tee has 12 ft of screen drum, and is 16.33 ft long, with a total screen area of
11 245ft² per tee. There are a total of four tees with a total screen area of 490 ft² per unit and the
12 mesh screens are sized for a maximum through screen velocity of less than 0.5 ft/s.

13 The blowdown diffusers would be established along the bottom of Lake Granbury at a depth
14 such that the discharge nozzles would be a minimum of 10 ft below the surface at low water
15 level (Figure 3-8). The discharge pipes would be approximately 4 ft in diameter. Each 82-ft-
16 long discharge diffuser would have eighteen 4-in diffuser nozzles aimed 30 degrees from
17 vertical in the downstream direction. The two diffusers would be parallel and approximately 12
18 ft apart, center to center. Luminant has not decided whether to bury the pipe in the lake bottom
19 or to locate it on the bottom and hold it in place with rip-rap or by strapping it to concrete
20 supports located on the lake bottom. Burying the diffuser in the lake bottom would require
21 excavation of trenches approximately 5 ft deep, 12 ft wide and 82 ft long for the pipes (Luminant
22 2010a) and the potential removal of some of the dredged material not used to refill the trenches.

23 The four pipelines associated with the proposed Units 3 and 4 are expected to be placed in the
24 existing 50-ft pipeline ROW. During construction, an area of up to 125 ft wide along the ROW
25 could be disturbed. The new pipelines are expected to be parallel to the existing makeup and
26 return water pipelines and are illustrated in Figure 2-5. The existing makeup pipelines are
27 presently used to maintain the level in SCR. The existing return line has never been used to
28 support operation of CPNPP Units 1 and 2 and is not expected to be used in the future. The
29 land to be disturbed along the pipeline corridor consists mainly of grassland and scrub brush.
30 While building the intake and discharge structures, an additional amount of land disturbance is
31 anticipated to occur.

32 **3.3.2 Power Block Construction**

33 The power block consists of the reactor building, the turbine building, and more than a dozen
34 smaller, but essential facilities.

35 The reactor building, which includes the reactor vessel, is an integrated steel and concrete
36 structure with three floor elevations below plant grade and five elevations above grade in an
37 area of approximately 304 by 210 ft. The major activities associated with the reactor building
38 construction following the basemat foundation placement include

- 39 • erecting the reactor concrete containment vessel shell modules;
- 40 • placing walls, slabs, and reactor pedestal;
- 41 • installing the reactor vessel and pool modules; and
- 42 • setting the polar crane and the upper reactor building roof structure.

43 The mechanical, piping, HVAC systems, and electrical installations would begin in the lower
44 elevations and would continue to the upper elevations.

45 The reactor building has the longest construction duration.

1 The turbine building is a concrete and steel structure with an area of approximately 167 by
2 321 ft. The turbine building has one floor below grade and three floor elevations above grade.
3 The turbine building construction would begin with the pedestal basement and buried circulating
4 water piping installation. Installation of the pedestal columns, condenser modules, and pedestal
5 deck would follow. The building exterior to the turbine pedestal would be erected; the turbine
6 building crane and the exterior walls and roof would then be installed. The mechanical, piping,
7 HVAC, and electrical installations would begin in the lower elevations and would continue to the
8 upper elevations. The turbine and generator would be assembled inside the building.

9 Support facilities to be constructed within the power block include

- 10 • the switchyard and installation of the main transformers,
- 11 • the administrative simulator and training facility buildings,
- 12 • the circulating water intake and discharge structures,
- 13 • circulating water cooling towers,
- 14 • safety-related tunnels,
- 15 • the UHS cooling tower,
- 16 • basin and pump houses,
- 17 • machine shop,
- 18 • sewage treatment facility,
- 19 • fire protection pump house,
- 20 • makeup water treatment building,
- 21 • various yard tanks, and
- 22 • laboratories for radiological and chemical analyses to support plant operations.

23 **3.3.3 Transmission Lines**

24 Luminant reports that Oncor's typical 345-kV ROW width is 160 ft, with the centerline typically in
25 the center of the ROW (Luminant 2009a). Some ROWs are wider to accommodate additional
26 facilities. Actual ROW widths and areas would not be known until the final ROWs are
27 determined.

28 **3.3.3.1 Construction of Transmission Line Corridors**

29 Luminant reports that new transmission lines are routed in accordance with the PUCT's "policy
30 of prudent avoidance," whereby Oncor is tasked with reasonably avoiding population centers
31 and other locations where people gather in order to limit exposure to electromagnetic fields
32 (EMFs) (Luminant 2009a).

Site Layout and Plant Description

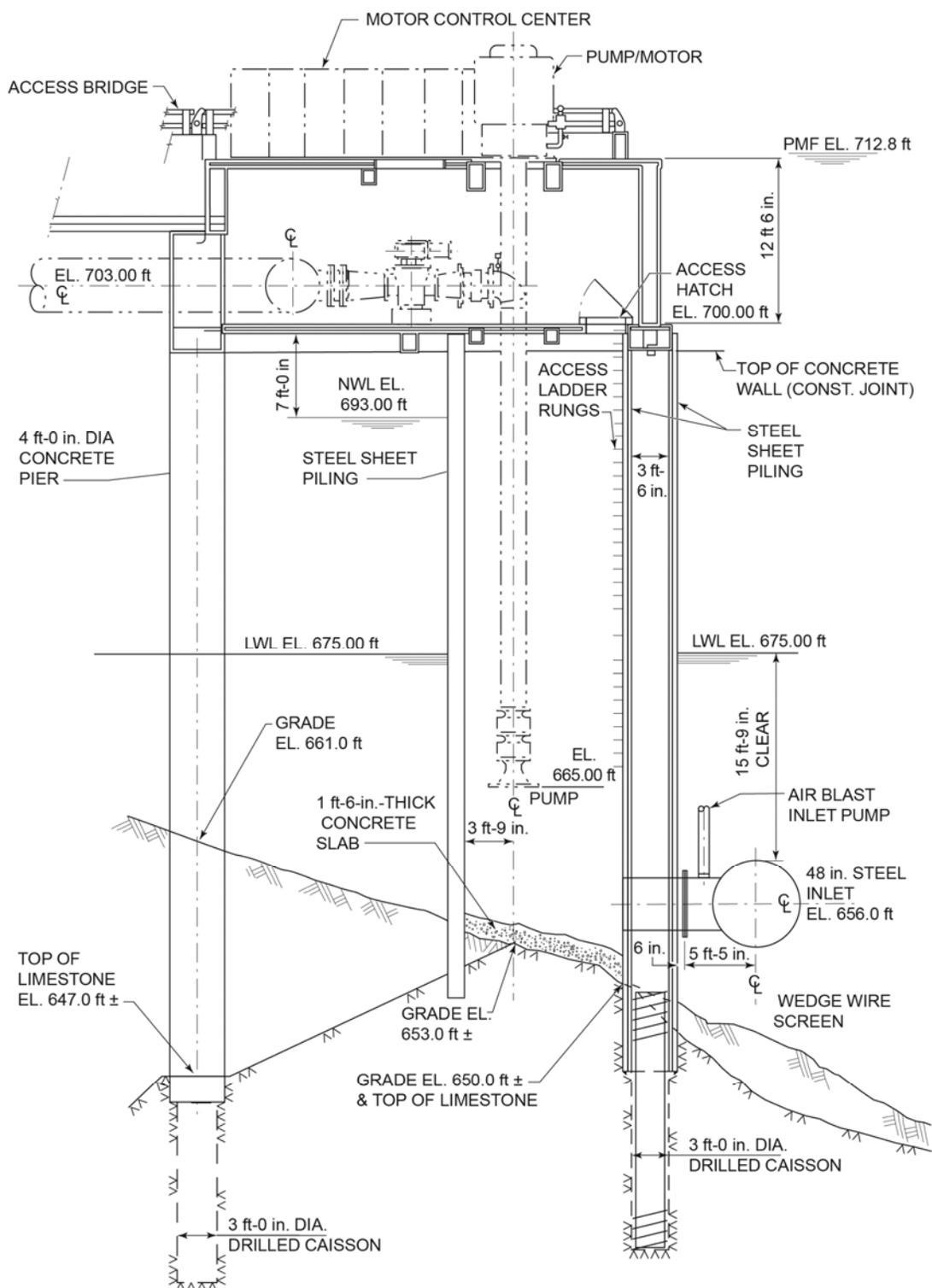


Figure 3-7. Proposed makeup water intake structure on Lake Granbury (cross section) (Adapted from Luminant 2010b).

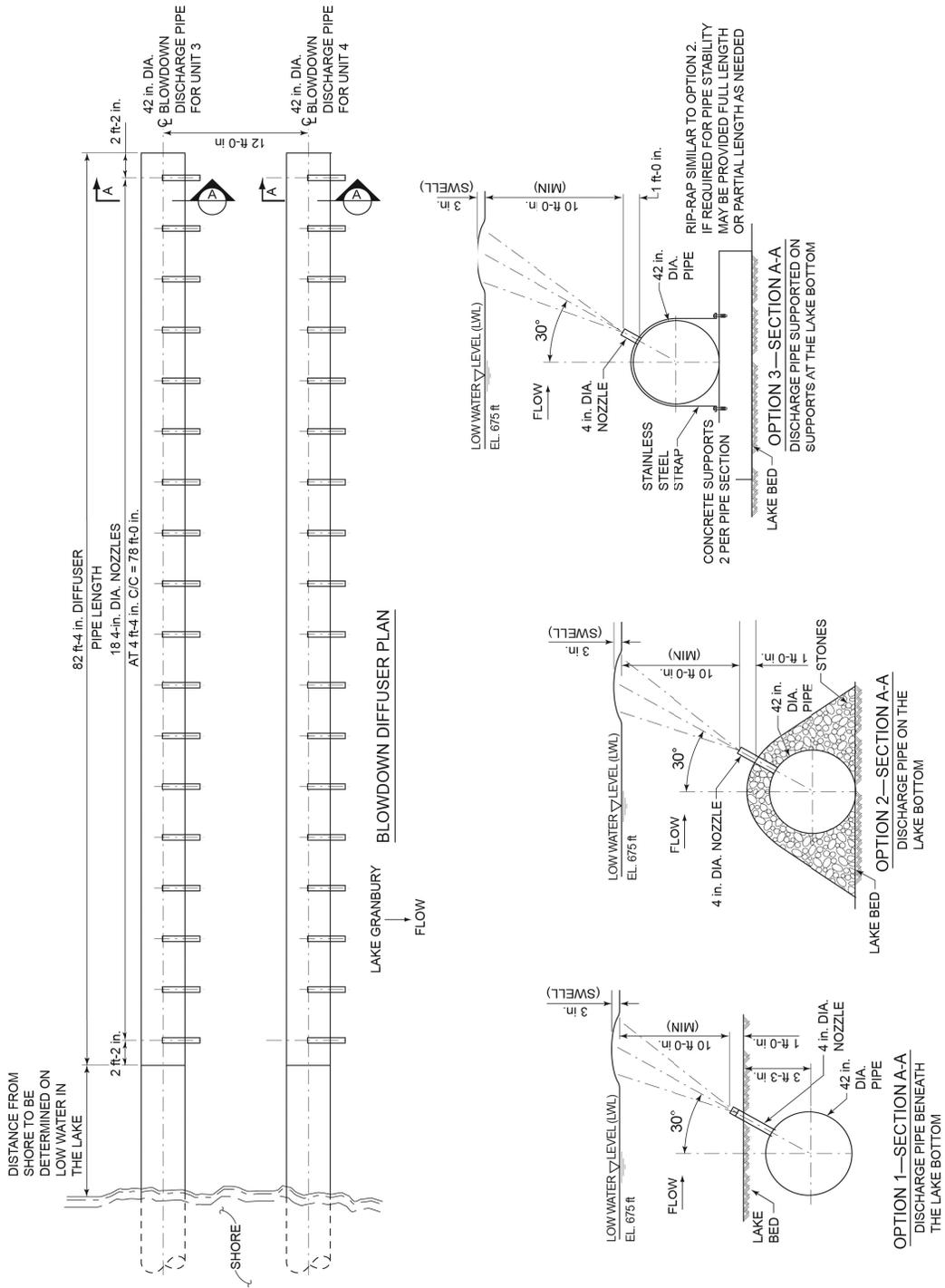


Figure 3-8. Blowdown water system discharge diffuser as proposed for construction in Lake Granbury (Adapted from Luminant 2010b).

1 The transmission line structures are self-supporting steel towers. The transmission line
2 structures are designed to withstand standard loading conditions for the specific site. Figure 3-5
3 depicts a typical 345 kV Oncor transmission tower. Towers for 345 kV transmission lines are
4 usually located at 1000 to 1100 ft intervals. The minimum ground clearance for maximum sag
5 condition is 45 ft. The maximum operating temperatures of the line are 100°C and 120°C under
6 emergency conditions. The tangent tower is designed for a 1200-ft wind span and a 1400-ft
7 weight span at a 0-degree angle. Wind span is determined by the wind loading on half of the
8 span leading into a tower plus the wind loading on half of the span leading away from a tower.
9 Weight span is determined by the total weight loading of wire measured between the low points
10 of the spans entering and leaving the tower.

11 The lines would be designed to meet or exceed the requirements of the National Electrical
12 Safety Code and the American National Standards Institute. The 345-kV line would be
13 designed to keep the electric field at the conductor surface significantly below corona inception
14 (Luminant 2009a).

15 **3.3.3.2 Clearing of Corridors**

16 Luminant reports that clearing of new corridors would be performed in accordance with *Oncor*
17 *Transmission Engineering Standard 720-003* (Oncor 2007). This standard specifies that the
18 construction of access roads shall be minimized and that necessary access roads shall be
19 constructed in a manner which prevents damage or erosion to the ROW and adjacent property.
20 The standard authorizes Oncor's authorized representative to supervise and approve most
21 aspects of the corridor work. No grading, dumping of excess dirt, clearing, or tree trimming is
22 allowed unless permission has been obtained from the property owner(s) by Oncor or its
23 contractor.

24 The standard describes full-cut clearing and selective-cut clearing, but does not indicate when
25 or where each would be used or how the decision to use one or the other would be made. For
26 full-cut clearing, all trees, brush and undergrowth within the ROW shall be cut level with the
27 ground. No stump is allowed to exceed 2 in. above the ground. Trees in a fence line over 4 in.
28 in diameter are to be cut to the top of the fence. Trees that overhang the ROW are to be
29 trimmed to eliminate the overhanging limbs.

30 For selective-cut clearing, two areas are defined, the primary cleared area and the variable
31 cleared area. The variable cleared area extends 50 ft on either side of the primary cleared area.
32 The allowable vegetation height in the variable cleared area ranges from 10 ft at the edge of the
33 primary cleared area to about 40 ft at 50 ft from the primary cleared area. However, the
34 contractor is to remove any tree that would exceed the allowable height at maturity. In the
35 primary cleared area, all trees, brush or undergrowth which exceeds 10 ft in height is to be cut,
36 and any other vegetation which would conflict with construction or maintenance of the
37 transmission line is to be removed. For a 345-kV steel tower line, the primary cleared area is
38 75 ft wide. Oncor's clearing contractors are required to treat all stumps with herbicide to prevent
39 re-sprouting and regrowth. Additionally, Oncor requires that their clearing contractors assure
40 strict compliance with Federal, State, and local regulations for the acquisition, storage, use, and
41 disposal of herbicides.

42 Oncor retains authority to decide how cut vegetation would be disposed of. Where burning is
43 used, Oncor and its contractors would comply with all applicable laws and regulations. Burying
44 timber or brush is forbidden without permission from Oncor. The standard describes method by
45 which cut vegetation may be disposed of piling it in the ROW (Oncor 2007, Luminant 2009a).

1 **3.3.3.3 Construction and Erection of Towers and Lines**

2 Transmission line towers are spaced 1000 to 1100 ft apart so most of the ground disturbance is
3 associated with building the towers and building the access roads to reach the tower locations.

4 Luminant reports that the installation of electrical conductor wires would be performed using the
5 tension method, as described in Institute of Electrical and Electronics Engineers (IEEE)
6 Standard 524 (Luminant 2009a). The tension method of stringing transmission lines involves
7 threading a light pilot pulling line through the travelers. The pilot line pulls a heavy pulling line
8 through the travelers. Then, the pulling line is used to pull the conductor through the travelers.
9 Once in place, the conductors are tensioned and fixed in place. IEEE Standard 524 notes that
10 the “tension method of stringing is applicable where it is desired to keep the conductor off the
11 ground to minimize surface damage or in areas where frequent crossings are encountered. The
12 amount of ROW travel by heavy equipment is also reduced” (IEEE 2003).

13 On average, one mile of 345kV transmission requires 3 days with a crew of 70 and
14 approximately 20 truckloads of material. Construction disturbance varies from less than 1 ac/mi
15 to as much as 10 ac/mi. Typically, 70 percent of vegetation is reestablished after construction.
16 At a 70-percent revegetation rate, between 0.5 and 7 ac would be restored after construction.

17 **3.3.4 Construction Workforce**

18 The construction workforce would consist of field craft labor and field supervisor labor.
19 Table 3-6 provides estimates of the percentage of the total workforce for craft and field
20 supervisor labor makeup that is anticipated during the construction of Units 3 and 4.
21 Approximately 70 percent of the total workforce is expected to come from outside the 50-mi
22 region. Field supervisor personnel are expected to come primarily from outside the 50-mi
23 region.

24 The construction of CPNPP Units 3 and 4 would incorporate a number of large prefabricated
25 modules. Modularization shifts some of the work to other locations that are outside the 50-mi
26 region and thus supports smaller numbers for the onsite construction workforce and duration.
27 The estimated construction onsite workforce present assumes a high degree of offsite
28 fabrication.

29 The schedule assumes approximately 36 months for site preparation, 51 months from COL
30 issuance to CPNPP Unit 3 fuel load, and 12 months for startup. Commercial operation of
31 CPNPP Unit 4 is scheduled to begin 8 months after that of CPNPP Unit 3. Based on this
32 schedule, the peak onsite construction workforce for CPNPP Units 3 and 4 is approximately
33 4300 people. Table 3-7 summarizes the onsite construction workforce by year of the project.

34 **3.3.5 Summary of Resource Commitments during Construction and** 35 **Preconstruction**

36 Table 3-8 provides a list of the significant resource commitments of construction and
37 preconstruction. The values in this table combined with the affected environment described in
38 Chapter 2 provide the basis for the impacts assessed in Chapter 4. These values were stated
39 in Luminant’s ER (Luminant 2009a), and the review team determined that the values are
40 reasonable.

41 **3.4 Operational Activities**

42 The operational activities considered in the review team’s environmental review are those
43 associated with structures that interface with the environment. Examples of operational

1 activities are withdrawing water for the cooling system, discharging blowdown water and
 2 sanitary effluent, and discharging waste heat to the atmosphere. Safety activities within the
 3 plant are discussed by the applicant in the FSAR portion of its application (Luminant 2009b) and
 4 are reviewed by the NRC in its safety evaluation report (in progress).

Table 3-6. Total workforce by craft for construction of CPNPP Units 3 and 4

Laborers	Percentage of total workforce for US-APWR construction ^(a)
Asbestos	2.7
Boilermakers	0.5
Carpenters	14.4
Cement masons	1.3
Electricians	10.6
Ironworker	19.2
Laborers	16.4
Millwrights	4.3
Operating engineers	7.7
Painters	0.9
Pipefitters	12.8
Roofers	0.3
Sheet metal workers	2.0
Steamfitters	4.3
Teamsters	2.9
TOTAL	100

(a) The total man-hours were converted to man-years by assuming a 50-hr work week and 52 weeks per year. The total man-years were used to derive the percentages.

Note: Additional non-manual labor equivalent to 12.6 of the construction labor noted above will also be required.

Source: Luminant 2009a

5 The following sections describe the operational activities, including the cooling system and its
 6 operational modes (Section 3.4.1), the plant-environmental interfaces of importance during
 7 operations (Section 3.4.2), the radioactive and nonradioactive waste management systems
 8 (Sections 3.4.4 and 3.4.5), and a summary of the values of parameters likely to be experienced
 9 during operations (Section 3.4.6).

10 **3.4.1 Description of Operational Modes**

11 The operational modes for proposed Units 3 and 4 considered in the assessment of operational
 12 impacts on the environment (Chapter 5 of this EIS) are normal operating conditions and
 13 emergency shutdown conditions. These are the nominal conditions under which maximum
 14 water withdrawal, heat dissipation, and effluent discharges occur. Cooldown, refueling, and
 15 accidents are alternative modes to normal plant operation during which water intake, cooling

1 tower evaporation water discharge, and radioactive releases may change from nominal
 2 conditions. The primary plant cooling shifts from the CWS to the ESWS during these alternate
 3 modes.

Table 3-7. Expected numbers of onsite workers by year for construction of CPNPP Units 3 and 4¹

Year	Total Workers
2008	22
2009	60
2010	195
2011	713
2012	1054
2013	2636
2014	5201
2015	4117
2016	1055
2017	494
2018	464
2019	412

1 Does not include existing operations workers or outage workers at CPNPP Units 1 and 2.

Source: Luminant 2009a

4 3.4.2 Plant-Environment Interfaces during Operation

5 When in operation, CPNPP Units 3 and 4 would produce electrical energy from nuclear fuel
 6 using a steam turbine system as described in Section 3.2.1. Waste heat is a by-product of
 7 normal power generation at a nuclear power plant. The excess heat that remains in the closed-
 8 loop steam system after it passes through the turbines would be transferred to the atmosphere
 9 using evaporative and conductive cooling in a set of wet mechanical-draft cooling towers (as
 10 described below). Water for the new cooling towers would be obtained from a new intake
 11 structure to be built at Lake Granbury, and the water would be carried to the CPNPP site by new
 12 pipelines. Additional details are provided in Section 3.4.2.1.

13 In addition to evaporative losses, a fraction of cooling water (0.0005 percent of CWS flow) would
 14 also be lost in the form of droplets (drift) from the cooling tower. The water that does not
 15 evaporate or drift from each tower would be routed back to the cooling tower's basin.
 16 Evaporation of water from the cooling water system in the cooling tower increases the
 17 concentration of TDS in that water collected in the cooling tower basin. To control the
 18 concentration of dissolved solids in the cooling tower water, a stream of water would be
 19 extracted and replaced with water from Lake Granbury; the water extracted from cooling tower
 20 water, called "blowdown," is anticipated to have a TDS concentration between about 2000 and
 21 8500 mg/L.

1 **Table 3-8.** Summary of Resource Commitments Associated with Building Proposed Units 3 and 4

Resource Area	Value	Description
All Resource Areas	7.25 years	Duration of preconstruction and construction activities (i.e., site preparation until time of fuel loading) for two proposed units
Land Use, Terrestrial Ecology, Cultural and Historic Resources (Site and Vicinity)	675 ac	Disturbed area footprint: <ul style="list-style-type: none"> • 123 ac for Units 3 and 4 • 152 ac for cooling towers • 400 ac for Blowdown Treatment Facility
Aquatic Ecology Structures	0.12 ac	Disturbed area footprint for intake and discharge in Lake Granbury: <ul style="list-style-type: none"> • 0.07 ac for intake structure • 0.05 ac total for discharge structures
Hydrology/Surface Water	200,560 gpd	Includes process water, potable water, and sanitary usage. Water would be provided by Somervell County Water District from surface water sources including the Wheeler Branch Reservoir
Socioeconomics, Transportation, Air Quality	4953 workers Up to an additional 1200 workers on site for Units 1 and 2	Peak construction workforce, in late 2014
Terrestrial Ecology, Nonradiological Health, Socioeconomics	93-108 dBA 60 dBA	Peak noise level on site Estimated noise level at exclusion area boundary

Source: Luminant 2009a and Luminant 2010a)

2 Luminant estimates that under conditions of very high Lake Granbury TDS concentrations,
 3 3525 mg/l, about 83 percent of the blowdown would be diverted to the BDTF; the remainder of
 4 the blowdown would be combined with demineralized water produced by the BDTF and
 5 discharged to Lake Granbury. Cooling water system blowdown is the only wastewater that
 6 would be treated by the BDTF.

7 Luminant expects the ultrafiltration and reverse osmosis equipment to generate about 5200 gpm
 8 of wastewater to be evaporated (for both units combined). Using the manufacturer guidance on
 9 evaporator performance and the local 10-yr average pan evaporation rate, Luminant concluded
 10 that 182 misters (evaporators) within the bounds of the 128-ac evaporation pond would be
 11 sufficient to reduce the wastewater to a dry salt that could be shipped to a landfill for disposal.

1 In addition to the salts from the BDTF, the operation of CPNPP Units 3 and 4 would generate
2 both radiological and nonradiological wastes of a solid, liquid, or gaseous nature. These wastes
3 and the systems by which they would be managed are described in Sections 3.4.4 and 3.4.5.

4 CPNPP Units 3 and 4 would be connected to the existing electrical power grid at a new
5 substation to be built at the CPNPP site. Both existing and new transmission lines would be
6 used to distribute this power from the CPNPP site to customers as described in Section 3.2.2.3.

7 **3.4.2.1 Plant Water Use and Treatment**

8 Water for the operation of CPNPP Units 3 and 4 would originate from two sources: Lake
9 Granbury and the WBR. During plant operation, raw water for cooling water and other in-plant
10 uses in CPNPP Units 3 and 4 would be withdrawn from Lake Granbury at a withdrawal rate of
11 up to 63,550 gpm (equivalent to 91.5 mgd). Annual withdrawals from Lake Granbury would total
12 about 100,500 ac-ft/yr. Up to 350 gpm of water in a new pipeline (Luminant 2010a) from WBR
13 (up to a maximum authorized withdrawal of 565 ac-ft/yr) would be acquired from the WBR
14 through the Somervell County Water District for specific uses.

15 Proposed CPNPP Units 3 and 4 would utilize Lake Granbury as the source of their cooling
16 water, so future withdrawals for that purpose would be in addition to the ongoing withdrawals of
17 makeup water for Units 1 and 2. Treated blowdown from the cooling towers would be
18 discharged back into Lake Granbury, and it is estimated that the consumptive water use from
19 the operation of Units 3 and 4 would be approximately 62,700 ac-ft/yr (Luminant 2009a). During
20 operation of all four reactors, Luminant would withdraw a total volume of approximately 137,800
21 ac-ft/yr from Lake Granbury, while approximately 42,100 ac-ft/yr would be returned to the lake
22 (Luminant 2009a), a net loss of 96,800 ac-ft/yr. (Approximately 34,100 ac-ft/yr of Lake
23 Granbury water is consumed maintaining SCR in support of Units 1 and 2.)

24 Most of the water withdrawn from Lake Granbury would be used as makeup water for the
25 circulating water systems. An additional volume averaging 548 gpm for two units combined
26 would be used for makeup water for the essential service water systems. Water for use in the
27 circulating water and essential service water systems would be treated through the addition of
28 chemicals, including chlorine, biocide, algaecide, pH adjuster, corrosion inhibitor, and silt
29 dispersant. The chemicals that would be added to the essential service water system and the
30 circulating water system, the amounts used annually, frequency of use, and the resulting
31 concentrations in the waste streams are discussed in Section 3.2.2.1.

32 For the 350 gpm of WBR water from the Somervell County Water District, up to 50 gpm would
33 be used for daily potable water use for the entire CPNPP site. From 0 to 350 gpm of WBR
34 water would go to the raw water storage tanks which is the supply source to the demineralized
35 water system (Luminant 2010a). All of the water from the WBR is treated at an off-site location
36 to applicable drinking water quality standards and would not require additional treatment prior to
37 use.

38 The fire protection system would be initially supplied with water from WBR. During subsequent
39 operations, raw water for demineralized water systems and fire protection could be obtained
40 from either or both WBR or Lake Granbury. Raw water requirements for these purposes would
41 total about 1100 gpm, including up to 250 gpm to supply the fire protection systems. WBR
42 water would be used in fire protection or sent to demineralization systems without pretreatment.
43 Before being used for those purposes, however, Lake Granbury water would be

- 44 • treated with biocide to remove algae, slime, and bacteria,
- 45 • filtered to remove suspended matter

- 1 • treated with sodium hypochlorite to eliminate additional biological impurities,
- 2 • treated with bisulfite and antiscalant to protect reverse osmosis units from residual chlorine
- 3 and scaling, and
- 4 • treated with two stages of reverse osmosis to remove dissolved solids.

5 Water for uses requiring demineralized water would be treated in mixed bed demineralizers to
6 remove remaining dissolved substances.

7 Cooling water blowdown would contain elevated concentrations of TDS and chloride, and would
8 be produced at an average rate of about 26,000 gpm. In order to meet anticipated discharge
9 limits, Luminant has proposed the BDTF (Section 3.2.2.2) to control the quality of blowdown
10 water discharged to Lake Granbury. A portion of this blowdown (approximately 21,500 gpm)
11 would be sent to the BDTF, where treatment would separate it into two fractions: (1) a
12 concentrated brine containing much of the dissolved salt load and (2) a demineralized fraction
13 with a TDS concentration of about 110 mg/L. The brine (about 5200 gpm) would be discharged
14 to the evaporation pond for evaporation and settling, while the demineralized water (about
15 16,300 gpm) would be combined with untreated blowdown (about 4500 gpm) and discharged to
16 Lake Granbury. Luminant reports that this system will assure that blowdown discharged to Lake
17 Granbury would have TDS and chloride concentrations below 2500 and 1000 mg/L,
18 respectively.

19 **3.4.2.2 The Cooling System's Operational Modes**

20 ***Circulating Water System***

21 In the power operation and startup modes, heat is generated, dissipated to the atmosphere, and
22 released in liquid discharges from the CWS. The CWS releases heat to the atmosphere via the
23 CWS cooling tower and to Lake Granbury liquid discharges via blowdown. The quantities of
24 heat released are summarized in Table 3-1.

25 The CWS provides cooling during the power operation mode. The power operation mode
26 rejects the most heat as the CWS removes heat rejected from the turbine by way of the
27 condenser. The CPNPP Units 3 and 4 are in power operation mode for an estimated
28 97 percent of the operating cycle. During startup and hot standby, a smaller amount of heat is
29 rejected by way of the condenser. The CPNPP Units 3 and 4 are estimated to be in the startup
30 mode for less than 1 percent of the operating cycle, in refueling for 2 percent of the operating
31 cycle, in the hot standby mode for less than 1 percent of the operating cycle, and in the safe
32 shutdown mode for less than 1 percent of the operating cycle. These estimates do not include
33 forced outages as they cannot be predicted. The power operating mode is paramount,
34 operating for over 23 months out of a 24-month cycle and consuming the most flow. Therefore,
35 all other modes are bounded by the power operation.

36 ***Non-Essential and Essential Service Water Systems***

37 The ESWS operates in all six modes of plant operation and releases heat to the atmosphere via
38 the UHS cooling towers, and in liquid discharges to Lake Granbury in the form of blowdown.
39 The amount of heat released during each of these modes of operation in the CWS and the
40 ESWS is shown in Table 3-1.

41 The NESWS provides heat removal from the TCS during power operation while the ESWS
42 provides cooling water for heat removal from the CCWS during all six modes of normal
43 operation. During refueling, the ESWS also supports a full core offload. CPNPP Units 3 and 4
44 are estimated to be in the power operation mode for 97 percent of the operating cycle.

1 3.4.2.3 Transmission Line Operation and Corridor Maintenance

2 Once placed into service, transmission lines are scheduled for inspection several times per year
3 following an inspection protocol developed on the basis of Oncor's operating experience with its
4 overall transmission system. The purpose of the inspections is to identify any deterioration or
5 damage to the transmission towers or power lines that require repair. The inspections also seek
6 to identify any man-made encroachment onto the ROW or the growth of woody vegetation that
7 might interfere with operation of the system. Inspections can be performed from the ground but
8 are most often performed using light aircraft or helicopters. Ground and aerial inspections
9 generate noise. Maintenance and repair also require persons on the ground to use trucks and
10 other vehicles in the ROW.

11 Vegetation management occurs on a maintenance cycle dictated by the vigor of local vegetation
12 and Oncor's local experience. This maintenance typically requires cutting herbaceous and low
13 woody growth on a relative short cycle and cutting saplings, larger shrubs, and small trees on a
14 longer cycle that varies within the service area from west to east. The cycle may also vary
15 depending on public concerns, local ordinances, line maintenance, and environmental
16 considerations. Right-of-way maintenance typically involves use of herbicides in addition to light
17 power equipment such as saws, mowers, and hand tools.

18 Application of herbicides is one of the primary methods used by Oncor for maintaining rights of
19 way once they have been cleared of woody vegetation or reclaimed. After initial clearing by
20 cutting, herbicides are often applied to stumps to limit resprouting of woody species. Foliar
21 application of herbicides is used afterwards if resprouting occurs or if the ROW is invaded by
22 noxious weeds or other undesirable species. Undesirable species are controlled as required by
23 local management plans usually established at the county level. Hand cutting and mowing are
24 used in areas where herbicides may not be effective, difficult to apply, or undesirable.
25 Herbicides are handled and applied only by qualified personnel in accordance with
26 manufacturer specifications and guidance from regulatory agencies that license appropriately
27 trained personnel to perform the work.

28 Access roads for construction and subsequent maintenance are stabilized wherever necessary
29 with gravel to prevent formation of ruts and gullies in the exposed soil. These road surfaces are
30 allowed to grass-over and are re-cut only as needed to permit occasional vehicular access
31 (Luminant 2009a).

32 Noise associated with 345-kV transmission systems may be attributed to corona discharge,
33 radio and television interference, and audible noise. Corona discharge is a luminous discharge
34 caused by the ionization of the air surrounding a conductor due to the existing surface voltage
35 gradient (electric field intensity) exceeding a certain critical level. Insulators and line hardware
36 energized to the same potential as the conductor would produce a similar corona discharge.
37 Corona discharge would appear as visible light and can cause an audible hiss or crackling
38 sound as well.

39 Audible noise from transmission lines primarily occurs during wet weather. In dry conditions,
40 the conductors usually operate below the corona inception level and few corona sources are
41 present. In wet conditions, however, water drops striking or collecting on the conductors may
42 produce corona discharge, causing audible noise (Luminant 2009a). Luminant reports that
43 corona noise along transmission lines is usually of low volume, about 10 dB or less. However,
44 when directly below power lines, one may perceive a "hum" of 50 to 60 dB on a quiet, humid
45 day (Luminant 2009a).

1 EMFs diminish rapidly with distance. Readings on the strength of magnetic field strength
2 directly under existing 230-kV and 525-kV lines typically range from 15 to 25 mG. At 75 ft from
3 the ROW fence, these levels decrease to a range of 3 to 7 mG (Luminant 2009a).

4 **3.4.3 Radioactive Waste Management System**

5 Liquid, gaseous, and solid radioactive waste management systems would be used to collect and
6 treat the radioactive materials produced as by-products from the operation of the proposed
7 CPNPP Units 3 and 4. These systems would process radioactive liquid, gaseous, and solid
8 effluents to maintain releases within regulatory limits and at levels as low as is reasonably
9 achievable before being released to the environment. Waste-processing systems would be
10 designed to meet the design objectives of 10 CFR Part 50, Appendix I (“Numerical Guides for
11 Design Objectives and Limiting Conditions for Operation to Meet the Criterion ‘As Low as is
12 Reasonably Achievable’ for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor
13 Effluents”).

14 Radioactive material in the reactor coolant would be the primary source of gaseous, liquid, and
15 solid radioactive wastes in light-water reactors. Radioactive fission products build up within the
16 fuel as a consequence of the fission process. The fission products would be contained in the
17 sealed fuel rods, but small quantities escape the fuel rods and contaminate the reactor coolant.
18 Neutron activation of the primary coolant system would also be responsible for coolant
19 contamination and for induced radioactivity in reactor components.

20 This section provides summary descriptions of the liquid, gaseous, and solid radioactive waste
21 management systems for CPNPP Units 3 and 4. These summary descriptions are based on
22 Chapter 11 of the US-APWR DCD (MHI 2009), Chapter 11 of the Luminant FSAR (Luminant
23 2009b), and Section 3.5 of the Luminant ER (Luminant 2009a).

24 The liquid and gaseous radioactive source terms for the US-APWR design were provided by
25 Luminant in ER Tables 5.4-6 and 5.4-7 (Luminant 2009a) and were based on its FSAR
26 (Luminant 2009b).

27 **3.4.3.1 Liquid Radioactive Waste-Management System**

28 The liquid waste management system (LWMS) is designed to safely monitor, control, collect,
29 process, handle, store, and dispose of liquid radioactive waste generated as a result of normal
30 operation, including anticipated operational occurrences. The LWMS would be located in the
31 auxiliary building (A/B) and includes the following:

- 32 • the equipment and floor drain processing subsystem,
- 33 • the detergent drain subsystem,
- 34 • the chemical drain subsystem, and
- 35 • the reactor coolant drain subsystem.

36 The LWMS is designed to provide sufficient capacity, redundancy, and flexibility to process
37 incoming waste streams such that discharged liquid effluents are below concentration levels
38 specified in 10 CFR Part 20, Appendix B, Table 2, during periods of equipment downtime,
39 normal operation, and operation at design basis fission product leakage levels. Segregated
40 systems are provided to collect water from floor drains and equipment, separately processing
41 streams that could interfere with other processes, such as flows containing detergents. Liquid
42 waste processing systems use filtration to remove suspended solids, activated charcoal to
43 remove organic contaminants, and ion exchange resin to remove dissolved solids and
44 radionuclides. Spent filtration media, such as filters, ion exchange media, and charcoal media,

1 are sent to the solid waste management system (SWMS) for further processing and packaging.
2 Dewatering of these solid wastes produces liquid waste streams that are returned to the LWMS.

3 Each system includes holding tanks used to accumulate liquid wastes prior to processing and
4 allow for sampling and analysis of liquid wastes prior to release. Radiation detection equipment
5 and sampling features would be provided at key locations. Protection against inadvertent
6 discharge of noncompliant waste is provided through the detection and alarm systems, and by
7 administrative controls. Waste monitoring tanks are provided with sample ports and with mixing
8 nozzles inside the tank to allow thorough mixing for representative samples. Analysis of
9 samples is used so that treated waste meets recycle and/or release limits. Once it is confirmed
10 that the treated effluent meets discharge requirements, the effluent is released into SCR via the
11 CPNPP Units 1 and 2 circulating water return line. The liquid effluent is released at ambient
12 temperature, as it would be stored inside the auxiliary building waste monitoring tanks during
13 analysis and prior to release.

14 All of the LWMS holdup, sampling and monitoring, and processing equipment would be located
15 within the auxiliary building (A/B), and served by the building drain system. No discharges other
16 than planned releases from the monitoring tanks are expected. Subsystems and components of
17 the LWMS are not shared between units. The LWMS is designed for individual unit operation;
18 the LWMS for CPNPP Unit 3 is separate from the system for CPNPP Unit 4.

19 The US Environmental Protection Agency (EPA) national drinking water standard for tritium is
20 20,000 pCi/L (40 CFR Part 141). Where no drinking water pathway exists, as in the SCR, a
21 value of 30,000 pCi/L may be used (Table 3.12-2 CPNPP Off-site Dose Calculation Manual,
22 Revision 26) (Luminant 2009b). The tritium concentration in SCR is controlled by additions of
23 water from Lake Granbury and from rainfall, and through evaporation of tritium from SCR and
24 release of tritium in water discharged to Squaw Creek at the SCR dam. Luminant reported that
25 releasing all liquid radioactive wastes to SCR during the maximum tritium generation condition
26 (that is, with all four units operating at full power) could lead to tritium concentration levels
27 approaching 30,000 pCi/l in SCR. To prevent exceeding a tritium concentration of 30,000 pCi/L
28 limit in SCR, Luminant plans to divert a portion of the liquid effluent from CPNPP Units 3 and 4
29 discharge header to an evaporation pond to be constructed within the site boundary. Under the
30 maximum tritium generation condition, up to half of liquid effluent would be diverted into the
31 evaporation pond.

32 The evaporation pond is designed to provide sufficient surface area for natural evaporation
33 based on the local area rainfall and evaporation rate and on long-term discharge of half the
34 liquid effluent to the pond. The evaporation pond is sized to prevent overflow due to the local
35 maximum rainfall condition. The pond design includes a transfer pump and discharge line that
36 connects into the CPNPP Units 1 and 2 circulating water return line to keep the pond from
37 overflowing during periods of extreme weather conditions. The airborne dose pathway resulting
38 from evaporation of tritium from the pond is evaluated in Section 5.9.

39 The CPNPP Units 3 and 4 normal effluent discharge header and the evaporation pond
40 discharge lines are connected to the circulating water return line for CPNPP Units 1 and 2 in two
41 locations before the circulating water is discharged into SCR. The locations of the connections
42 are selected to allow sufficient distance for thorough mixing before the liquid is released into
43 SCR.

44 In the event that both CPNPP Units 1 and 2 are temporarily not in operation, and there is no
45 dilution flow available, the waste holdup tanks and waste monitoring tanks are designed to
46 provide capacity to store at least one month of waste input. An evaluation of the need for
47 circulating water from CPNPP Units 1 and 2 as dilution water for liquid effluents from CPNPP
48 Units 3 and 4 is to be performed before Units 1 and 2 are shut down.

1 The steam generator blowdown (SGBD) monitor measures the radiation level in the SGBD
2 water after it is treated and before it is returned to the condenser. A sample from the SGBD
3 mixed-bed demineralizers is monitored for radiation. Normally, the treated SGBD water would
4 not contain radioactive material. In the event of significant primary-to-secondary system
5 leakage due to an SG tube leak, the SGBD liquid may become contaminated with radioactive
6 material. Detection of radiation above a predetermined setpoint automatically initiates an alarm
7 in the main control room for operator actions and automatically turns off the valve through which
8 treated liquid is sent to the condenser. Plant personnel are required to manually sample the
9 SGBD water for analysis. If it is confirmed that the liquid is contaminated, the liquid would be
10 routed to the LWMS for processing.

11 The calculated dose to a maximally exposed individual from liquid effluents is evaluated in
12 Section 5.9 of this EIS.

13 **3.4.3.2 Gaseous Radioactive Waste-Management System**

14 The gaseous waste management system (GWMS) is designed to monitor, control, collect,
15 process, handle, store, and dispose of gaseous radioactive waste generated as the result of
16 normal operation, including anticipated operational occurrences. The main sources of plant
17 radioactive gaseous inputs to the GWMS are the waste gases from the volume control tank
18 (VCT), the containment vessel reactor coolant volume drain tank, the boric acid evaporator, and
19 the chemical and volume control system holdup tanks (HTs). Because nitrogen is used as a
20 cover gas for the HTs, the gas is returned back to the HT for reuse. Otherwise, the nitrogen gas
21 is treated and discharged. Most of the waste gas entering the GWMS during normal operation
22 is composed of cover nitrogen gas, a small amount of radioactive gaseous isotopes of krypton
23 and xenon, and to a lesser extent hydrogen and oxygen.

24 The gaseous wastes from the above sources are processed to reduce the quantity of
25 radioactive material prior to release to the environment. During normal operation, radioactive
26 isotopes, including xenon, krypton, and iodine are generated as fission products. A portion of
27 these nuclides are present in the primary coolant due to fuel cladding defects. These nuclides
28 are to be stripped out of the coolant in the VCT and the HTs into the nitrogen cover gas and
29 carried to the GWMS. Charcoal bed adsorbers are designed to control and minimize the
30 release of radioactive nuclides into the environment by delaying the release of the radioactive
31 noble gases. The charcoal bed adsorbers also contain activated charcoal to remove radioactive
32 iodine.

33 The GWMSs for CPNPP Units 3 and 4 are independent of each other. Processed gaseous
34 waste is further diluted by HVAC ventilation flow before the gases are released from the plant
35 stack for each unit. The plant stack is the only GWMS release point for both the gaseous waste
36 system and the HVAC systems associated with the reactor building (R/B), A/B, power source
37 building, and the access building. The plant stack runs alongside the containment vessel (C/V)
38 with the release point at the same elevation as the top of the containment vessel (Luminant
39 2009b). Radiation monitors are provided upstream of the discharge valve on the GWMS. The
40 discharge valves would be closed if the radiation set point is exceeded.

41 Potential dose to a maximally exposed individual from gaseous effluents is evaluated in
42 Section 5.9 of this EIS.

43 **3.4.3.3 Solid Radioactive Waste-Management System**

44 The SWMS for CPNPP Units 3 and 4 are designed to process, package, and temporarily store
45 solid radioactive waste prior to shipment. This system is located in the auxiliary building and is
46 designed to handle spent resin, sludge, oily waste, spent filters, and dry active waste, including

1 contaminated clothing, broken equipment, and maintenance items that cannot be easily
2 decontaminated and reused.

3 Normally, no effluent would be released from the SWMS. Water removed from the spent resin
4 is transferred via the vacuum pump back to the waste HTs for further processing in the LWMS.
5 Plant makeup water is used for spent resin sluicing. The water extracted from the spent resin
6 dewatering operation does not contain any chemical impurities. It is contaminated with resin
7 fines and also some dissolved nuclides due to the liquid-solid equilibrium phenomenon. The
8 dewatering area is designed with area drainage collection of decontamination water. In the
9 event that spillage occurs or that the waste container drops and spills, decontamination water is
10 available to clean the area. The drainage would be directed to the waste HTs for processing.

11 The SWMS for CPNPP Unit 3 is completely independent of the SWMS for CPNPP Unit 4.
12 Estimates of expected waste volume generated annually by each wet and dry waste source are
13 given in the Tables 11.4-1 and 11.4-2 in the US-APWR DCD (MHI 2009). Estimates of the
14 volume and classification of packaged solid wastes shipped by each unit are given in
15 Table 11.4-3 in the US-APWR DCD (MHI 2009). Approximately 30,000 ft³ would be shipped
16 annually from the two units combined.

17 A common radioactive waste interim storage facility is provided between Units 3 and 4 and is
18 designed to store classes A, B, and C wastes from all four CPNPP units for up to 10 years. The
19 interim storage facility also includes a separate storage area for mixed waste and temporary
20 staging of large equipment items for maintenance.

21 **3.4.4 Nonradioactive Waste Systems**

22 The following sections provide descriptions of the nonradioactive waste systems proposed for
23 the CPNPP site, including systems for chemical, biocide, sanitary, and other effluents.

24 **3.4.4.1 Effluents Containing Chemicals or Biocides**

25 This section describes the nonradioactive waste systems and the chemical and biocidal
26 characteristics of each nonradioactive waste stream discharged from the plant. It identifies and
27 quantifies each chemical or biocide added to the receiving water by any discharge stream as
28 well as substances added by corrosion and erosion. It compares the discharged quantities and
29 concentrations with applicable effluent limitations and standards. It also describes naturally
30 occurring substances changed in form or concentrated by plant operations with sufficient detail
31 to enable subsequent evaluation of environmental impacts and compliance with applicable
32 water-quality standards.

33 Luminant plans to use chemicals to treat water in the circulating water system and the essential
34 service water system as described in Table 3-3. Luminant specifies the effluent concentrations
35 in waste water as (a) less than "0.2 ppm residual sodium hypochlorite (NaOCl) or free chlorine,"
36 (b) less than 2.2 ppm sulfuric acid (H₂SO₄), (c) "PO₄ or proprietary [ortho-polyphosphate and
37 phosphonate] agent to permit limit, and (d) sodium bisulfite (NaHSO₃) "sufficient to reduce
38 residual chlorine to less than 0.2 ppm" (Luminant 2009a).

39 Luminant reports that total suspended solids (TSS) in the vicinity of DeCordova Bend Dam near
40 the south end of Lake Granbury average 11 mg/L with a range of results from 2 to 120 mg/L.
41 Luminant does not report discharge of TSS. Luminant reports that TDS in blowdown
42 discharged to Lake Granbury would be limited to 2500 mg/L "assuming the inlet TDS
43 concentration is 1680 mg/L" (Luminant 2009a).

1 **3.4.4.2 Sanitary System Effluents**

2 This section briefly describes the anticipated volumes generated during construction or
3 operation and the method for ultimate disposal of treated wastes.

4 Luminant reports sanitary wastewater generation of about 50 gal per person per 24-hr shift from
5 operations at Units 1 and 2. Overall, they estimate generation of 25,000 to 50,000 gal per day
6 from current operations. During construction of Units 3 and 4, Luminant expects sanitary
7 wastewater generation of up to 100,000 gal per day by construction personnel. Added to the
8 amounts from current operations they estimate a site total of 125,000 to 150,000 gpd. Because
9 the current sanitary wastewater system has a maximum capacity of 90,000 to 100,000 gpd, the
10 Units 3 and 4 sanitary wastewater system would need to be operational before the construction
11 workforce reaches its higher levels. Until the second sanitary wastewater system is operational,
12 portable toilets would be provided for construction workers (Luminant 2009a).

13 The treated effluent would be discharged directly to SCR without further treatment. The
14 discharged effluent would meet the following effluent limits: (a) pH between 6 and 9; (b)
15 monthly average TSS no more than 20 ppm, daily maximum no higher than 45 ppm; (c) monthly
16 biological oxygen demand no higher than 20 ppm, daily maximum no higher than 45 ppm; and
17 (d) monthly average coliform bacteria count no higher than 200 per 100 mL, daily maximum no
18 higher than 400 per 100 mL.

19 Digested sludge would be treated with a few pounds per day of lime and ferric chloride before
20 dewatering. The current sanitary wastewater system produces dewatered sludge at a rate of
21 about 90 lb/day (17 ton/year), except during refueling outages when the rate increases to about
22 330 lb/day. During construction, sludge generation is expected to average 370 lb/day
23 (67 ton/year); 660 lb/day during refueling outages. After the end of construction, sludge
24 generation will average 180 lb/day (33 ton/year); 500 lb/day during refueling outages
25 (Luminant 2010a).

26 **3.4.4.3 Other Nonradioactive Waste Effluents**

27 ***Gaseous emissions***

28 Luminant reports that each unit would have four emergency gas turbine generators (GTG) and
29 two GTGs for nonemergency situations for alternating current (AC) power sources when power
30 to the site has been lost, two auxiliary boilers, and one internal combustion engine-driven fire
31 pump. All these systems are diesel fueled. During normal operation of the plant, this
32 equipment is primarily used during periodic testing. There would be no treatment of the
33 gaseous emissions from the GTGs or the fire pump.

34 Six onsite GTG units, each furnished with its own support subsystems, would provide power to
35 the selected plant AC loads. The GTG units would be housed in the emergency power supply
36 building. Each engine's exhaust gas circuit would consist of the engine exhaust gas discharge
37 pipes from the turbocharger outlets to a single vertically mounted outdoor silencer that
38 discharges to the atmosphere at an approximate elevation of 855 ft above mean sea level.

39 The primary fuel storage for each GTG and its associated transfer pumps would be located in
40 the yard area, below grade within a concrete vault confinement.

41 The auxiliary boilers would be used to provide auxiliary steam during plant startup and
42 shutdown. The auxiliary steam boilers would be diesel-fired package boilers with storage tanks
43 capable of storing 300,000 gal of oil and day tanks storing 12,000 gal of oil. The auxiliary boiler
44 and associated equipment would be located outside in the yard. The steam converter and
45 associated equipment would be located in the turbine building, and the common equipment

1 would be located in the auxiliary building. The exhaust for the auxiliary boiler and the vent(s) for
2 the auxiliary boiler oil storage tank have not been located at this time.

3 Two 2500-gpm capacity fire pumps would be provided for each unit. The lead pump would be
4 electric motor driven, and the second pump would be diesel engine driven. The exhaust for the
5 diesel-driven pump and the vent(s) for the diesel storage tank have not been located at this
6 time. The fuel tank for the diesel-driven fire pump would hold enough fuel to operate the pump
7 for at least 2 hr.

8 Table 3-9 summarizes pollutant emissions from the gas turbine generators, the diesel-driven fire
9 pump, the auxiliary boilers, and the fuel storage tanks that support them.

Table 3-9. Average annual pollutant emissions from Unit 3 and 4 stationary fuel burning equipment
(data values are in pounds per year)

Equipment	Hydrocarbons	Carbon monoxide	Nitrogen oxides	Sulfur dioxide	Particulate matter
Gas turbine generators	87	1719	24,283	1095	260
GTG fuel storage	433	–	–	–	–
Auxiliary boilers	148	2288	3564	9208	1486
Boiler fuel storage	67	–	–	–	–
Fire pumps	–	16	88	–	4
Fire pump fuel storage	0.3	–	–	–	–
Total	735	4023	27,935	10,303	1750

Source: Luminant 2009a and Luminant 2010a.

10 **Solid wastes**

11 Nonradioactive solid wastes would include typical industrial wastes such as metal, wood, and
12 paper as well as process wastes such as nonradioactive resins, filters, and sludge. These
13 nonradioactive wastes would be disposed of in a permitted offsite landfill. The proposed project
14 is classified as a small quantity generator of hazardous waste. Solid wastes would be disposed
15 of offsite by contract at a licensed permitted facility. CPNPP Units 3 and 4 are expected to
16 produce similar amounts of waste per year as CPNPP Units 1 and 2. For 2007, Luminant
17 reports nonhazardous waste production for CPNPP Units 1 and 2 of 2.2 million lb; however, the
18 wastes do not include resins, filters, or sludges (Luminant 2009a).

19 Periodically, the BDTF evaporation ponds would be drained for solids removal. BDTF solids
20 would be disposed of at an offsite nonhazardous landfill. Luminant presents two estimates of
21 the mass of salts that would be produced by BDTF operations—both nuclear units operating—
22 that would need disposal. Luminant's expected case has 391 million pounds (195,500 tons) of
23 dry salt per year. Luminant's maximum case has 831 million pounds (415,500 tons) of dry salt
24 per year. The maximum case is based on the assumption that the water in Lake Granbury has
25 a TDS of 3525 mg/l all year. While the TDS of Lake Granbury occasionally reaches 3525 mg/l,
26 assuming that the TDS would be that high for an entire year is extremely conservative.
27 Luminant's expected case is an appropriate estimate of the dry mass of salt that could be
28 reasonably expected. However, drying salt to a moisture-free condition would require long
29 periods of warm, dry weather or a device in which the brine would be dried by addition of heat.

1 The first would not occur reliably at the CPNPP site, and the second is not part of Luminant’s
 2 design. For its estimate of solid waste quantities, Luminant provided zero and 20% moisture
 3 estimates. At 20% moisture, Luminant’s expected case estimate becomes 244,000 tons of salt
 4 per year. Luminant reports that no hazardous wastes would be stored on site and that no
 5 hazardous wastes would be discharged from the site (Luminant 2009a).

6 **3.4.5 Summary of Resource Parameters during Operation**

7 Table 3-10 provides a list of the significant resource commitments involved in operating Units 3
 8 and 4 that are relevant to more than one resource evaluation. The values in this table,
 9 combined with the affected environment described in Chapter 2, provide a part of the basis for
 10 the operational impacts assessed in Chapter 5. These values were stated in Luminant’s ER
 11 (Luminant 2009a) and in its supplemental RAI responses, and the review team has determined
 12 that the values are reasonable.

13 **Table 3-10.** Parameters Associated with Operation of Proposed CPNPP Units 3 and 4

Resource Area	Normal Operating Condition	Maximum Condition	Description
Socioeconomics	1494 workers	2694 workers	Normal condition is for four operating plants, with Units 3 and 4 under start-up testing;; Maximum occurs during refueling outages that will require up to 1200 additional workers on site
Terrestrial Ecology, Radiological Health, Socioeconomics	229 ft	229 ft	Height of tallest structure on site (containment building)
Hydrology – Surface Water	300 gpm	300 ac-ft/yr	Potable and sanitary requirements
	63,550 gpm	137,800 ac-ft/yr	Withdrawal from Lake Granbury; Normal condition is for Units 3 and 4; Maximum is for all four units
	26,076 gpm	42,100 gpm	Blowdown return to Lake Granbury; Normal condition is for Units 3 and 4; Maximum is for all four units
Aquatic Ecology	<0.5 fps	0.5 fps	Intake screen approach velocity

Table 3-10. (contd)

Resource Area	Normal Operating Condition	Maximum Condition	Description
Terrestrial Ecology, Socioeconomics, Nonradiological Health	55 dBA	85 dBA	Cooling tower sound level; Normal value is at 1000 ft; Maximum value is at close proximity
Radiological Health, Transportation, Need for Power	4451 MW(t)		Rated and design core thermal power of each UP-APWR unit
	1600 MW(e)		Rated and design net output of turbine-electric generator
	100 MW(e)		Station load per unit
Radiological Health	95 percent		Expected annual capacity factor
Meteorology/Air Quality	55.4 ft	55.4 ft	Height of mechanical draft cooling towers
	9.90×10^9 Btu/hr	9.90×10^9 Btu/hr	Waste heat to atmosphere

Sources: Luminant 2009a and Luminant 2009b

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4.0 Construction Impacts at the Proposed Site

1 This chapter examines the environmental issues associated with building the proposed Units 3
2 and 4 at the Comanche Peak Nuclear Power Plant (CPNPP) site as described in the application
3 for combined licenses (COLs) submitted by Luminant Generation Company LLC (Luminant) to
4 the U.S. Nuclear Regulatory Commission (NRC). As part of its application, Luminant submitted
5 (1) an Environmental Report (ER) (Luminant 2009a), which discusses the environmental
6 impacts of building, operating, and decommissioning the proposed new nuclear units, and (2) a
7 Final Safety Analysis Report (FSAR) (Luminant 2009b), which addresses safety aspects of
8 construction and operation.

9 As discussed in Section 3.3 of this environmental impact statement (EIS), the NRC's authority
10 related to building new nuclear units is limited to construction "activities that have a reasonable
11 nexus to radiological health and safety and/or common defense and security" (72 FR 57416).
12 The NRC has defined "construction" according to the bounds of its regulatory authority. Many of
13 the activities required to build a nuclear power plant do not fall within the NRC's regulatory
14 authority and, therefore, are not "construction" as defined by the NRC. Such activities are
15 referred to as "preconstruction" activities in Title 10 of the Code of Federal Regulations (CFR)
16 Part 51.45(c). The NRC staff evaluates the direct, indirect, and cumulative impacts of the
17 construction activities that would be authorized with the issuance of a COL. The environmental
18 effects of preconstruction activities (e.g., clearing and grading, excavation, and erection of
19 support buildings) are included as part of this EIS in the evaluation of cumulative impacts.

20 As described in Section 1.1.3, the U.S. Army Corps of Engineers (Corps or USACE) is a
21 cooperating agency on this EIS consistent with the updated Memorandum of Understanding
22 (MOU) signed with the NRC (Corps and NRC 2008). The NRC and the Corps established this
23 cooperative agreement because both agencies have concluded it is the most effective and
24 efficient use of Federal resources in the environmental review of a proposed new nuclear power
25 plant. The goal of this cooperative agreement is the development of one EIS that provides all
26 the environmental information and analyses needed by the NRC to make a license/permit
27 decision and all the information needed by the Corps to perform analyses, draw conclusions,
28 and make a permit decision in the Corps' Record of Decision (ROD) documentation. To
29 accomplish this goal, the environmental review described in this EIS was conducted by a joint
30 NRC and Corps team (review team). The review team was composed of NRC staff and its
31 contractors and staff from the Corps.

32 The information needed by the Corps includes information to perform (1) analyses to determine
33 that the proposed action is the least environmentally damaging practicable alternative (LEDPA),
34 and (2) its public interest assessment. To perform the public interest assessment, the Corps
35 considers the following public interest factors: conservation, economics, aesthetics, general
36 environmental concerns, wetlands, historic and cultural resources, fish and wildlife values, flood
37 hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water
38 supply, water quality, energy needs, safety, food and fiber production, and mineral needs.

39 Many of the impacts the Corps must address in its LEDPA analysis are the result of
40 preconstruction activities. Also, most of the activities conducted by a COL applicant that would
41 require a permit from the Corps would be preconstruction activities. Luminant has not submitted
42 an application for a permit from the Corps. However, based on the information it has provided
43 to the NRC and the Corps, Luminant is expected to request a permit from the Corps to conduct
44 the following activities: filling, dredging, excavating, grading, removing or destroying vegetation,
45 and building structures.

1 While both NRC and the Corps must meet the requirements of the National Environmental
2 Policy Act of 1969, as amended (42 USC 4321, et seq.) (NEPA 1969), both agencies also have
3 mission requirements that must be met in addition to the NEPA requirements. The NRC's
4 regulatory authority is based on the Atomic Energy Act of 1954, as amended (42 USC 2011,
5 et seq.). The Corps' regulatory authority related to the proposed action is based on Section 10
6 of the Rivers and Harbors Appropriation Act of 1899 (Rivers and Harbors Act) (33 USC 403, et
7 seq.), which prohibits the obstruction or alteration of navigable waters of the United States
8 without a permit from the Corps, and Section 404 of the Clean Water Act (CWA) (33 USC 1344,
9 et seq.), which prohibits the discharge of dredged or fill material into waters of the United States
10 without a permit from the Corps. Therefore, the applicant may not commence preconstruction
11 or construction activities in jurisdictional waters, including wetlands, without a Corps permit.
12 The permit would typically be issued following the Corps' evaluation and public feedback in the
13 form of public comments on its draft environmental review. Because the Corps is a cooperating
14 agency under the MOU for this EIS, the Corps' ROD of whether to issue a permit will not be
15 made until after public comment has been received on this NRC/Corps draft EIS and the final
16 EIS is issued.

17 The collaborative effort between the NRC and the Corps in presenting their discussion of the
18 environmental effects of building the proposed project, in this chapter and elsewhere, must
19 serve the needs of both agencies. Consistent with the MOU, the staffs of the NRC and the
20 Corps collaborated in the (1) review of the COL application and information provided in
21 response to requests for additional information (developed by the NRC and the Corps) and
22 (2) development of the EIS. NRC regulations (10 CFR 51.45(c)) require that the impacts of
23 preconstruction activities be addressed by the applicant as cumulative impacts in its ER.
24 Similarly, the NRC's analysis of the environmental effects of preconstruction activities on each
25 resource area would be addressed as cumulative impacts, normally presented in Chapter 7.
26 However, because of the collaborative effort between the NRC and the Corps in the
27 environmental review, the combined impacts of construction activities that would be authorized
28 by the NRC with its issuance of COLs and preconstruction activities are presented in this
29 chapter. For each resource area, the NRC also provides an impact characterization solely for
30 construction activities that meet the NRC's definition of construction at 10 CFR 50.10(a).
31 Thereafter, both the assessment of the impacts of 10 CFR 50.10(a) construction activities and
32 the assessment of the combined impacts of construction and preconstruction are used in the
33 description and assessment of cumulative impacts in Chapter 7 of this EIS.

34 For most environmental resource areas (e.g., terrestrial ecology), the impacts are not the result
35 of either solely preconstruction or solely construction activities. Rather, the impacts are
36 attributable to a combination of preconstruction and construction activities. For most resource
37 areas, the majority of the impacts would occur as a result of preconstruction activities.

38 This chapter is divided into 13 sections. In Sections 4.1 through 4.11, the review team
39 evaluates the potential impacts on land use, water use and quality, terrestrial and aquatic
40 ecosystems, socioeconomics, environmental justice, historic and cultural resources,
41 meteorology and air quality, nonradiological health effects, radiological exposures to
42 construction workers, nonradioactive waste, and applicable measures and controls that would
43 limit the adverse impacts of building the new units. An impact category level—SMALL,
44 MODERATE, or LARGE—of potential adverse impacts has been assigned by the review team
45 for each resource area using the definitions for these terms established in Chapter 1. In some
46 resource areas, for example, in the socioeconomic area where the impacts of taxes are
47 analyzed, the impacts may be considered beneficial and would be stated as such. The review
48 team's determination of the impact category levels is based on the assumption that the
49 mitigation measures identified in the ER or activities planned by various State and county

1 governments, such as infrastructure upgrades (discussed throughout this chapter), are
 2 implemented. Failure to implement these upgrades might result in a change in the impact
 3 category level. Possible mitigation of adverse impacts, where appropriate, is presented in
 4 Section 4.11. A summary of the construction impacts is presented in Section 4.12. Citations for
 5 the references cited in this chapter are listed in Section 4.13. The technical analyses provided
 6 in this chapter support the results, conclusions, and recommendations presented in Chapters 7,
 7 9, and 10 of this EIS.

8 The review team's evaluation of the impacts of building CPNPP Units 3 and 4 draws on
 9 information presented in Luminant's ER and supplemental documents, the Corps' permitting
 10 documentation, and other government and independent sources.

11 **4.1 Land-Use Impacts**

12 This section provides information on land-use impacts associated with site-preparation activities
 13 (preconstruction) and construction of the proposed Units 3 and 4 at the CPNPP site. The
 14 breakdown of activities into construction and preconstruction categories and their associated
 15 impacts are provided in Section 4.12 of this EIS. Topics discussed in this section include land-
 16 use impacts at the site and in the vicinity of the site and in transmission line right(s)-of-way
 17 (ROWs) and offsite areas.

18 **4.1.1 The Site and Vicinity**

19 Proposed Units 3 and 4 would be located northwest of existing Units 1 and 2. The proposed
 20 locations for Units 3 and 4 and all supporting facilities are entirely within the existing CPNPP
 21 site. As described by the Applicant, erection of the new units would disturb approximately 675
 22 ac of land on the site for permanent structures and temporary laydown areas, including
 23 approximately 123 ac for Units 3 and 4, 152 ac for the proposed cooling towers, and about 400
 24 ac for a Blowdown Treatment Facility (BDTF) and associated evaporation ponds (Luminant
 25 2009a). Of the 675 ac disturbed in building the project, about 125 ac would be landscaped or
 26 revegetated once the construction and preconstruction activities are complete, leaving
 27 approximately 550 ac occupied by permanent structures or supporting facilities (Luminant
 28 2009a).

29 Approximately 7 ac of prime farmland at the CPNPP site would be permanently converted to
 30 industrial use to accommodate new Units 3 and 4, mostly in previously disturbed areas
 31 (Luminant 2009a). Approximately 154 ac of prime farmland would be converted to industrial
 32 use in the area of the BDTF (Shumpert 2010). No agricultural activities currently take place in
 33 either area. The total of 161 ac of prime farmland that would be affected represents
 34 approximately 15.1 percent of the 1064 ac of prime farmland on the CPNPP site and
 35 approximately 0.1 percent of the 144,425 ac of prime farmland in the project vicinity (Luminant
 36 2009a). Most of the 152-acre area affected by the proposed cooling towers is covered by
 37 evergreen forest that would require clearing. As discussed in more detail in Section 4.3.2.1 of
 38 this EIS, site disturbance activities would permanently fill approximately one-half of a small
 39 littoral wetland area covering approximately 0.78 ac. Land use on the CPNPP site is not subject
 40 to any municipal, county, or state land use plans or zoning ordinances. No construction and
 41 preconstruction activities would take place within a 100-yr or 500-yr floodplain.

42 Construction equipment and reactor components would be transported to the CPNPP site using
 43 Farm-to-Market (FM) Road 56 and an existing railroad spur. Existing roadways onsite would be
 44 improved to support the delivery of fabrication materials, and a new heavy haul road would be
 45 built to link the railroad spur to the construction site for Units 3 and 4, a distance of
 46 approximately 1.1 mi (Luminant 2009a). Section 4.4.1.3 of this EIS states that the increased

1 traffic could have noticeable physical impacts on roads, especially on FM Road 56, and Section
2 4.4.4.1 concludes that traffic flow on FM Road 56 would be noticeably affected by traffic
3 associated with building the proposed Units 3 and 4. Development of Units 3 and 4 would be
4 expected to produce limited offsite land-use changes in the vicinity, primarily as a result of the
5 need to provide additional short-term housing to accommodate construction workers. Impacts
6 on roads, housing, and infrastructure are described in Section 4.4 of this EIS. While most of the
7 material excavated in building Units 3 and 4 will be used as fill material on-site, some material
8 may be transported off-site for disposal in a construction/demolition landfill or in a state-
9 permitted landfill. Conversely, some fill material for the project may be brought onto the site
10 from off-site locations (Luminant 2009a). It is not expected that the demands for fill or for fill
11 disposal capacity will substantially add to the cumulative demands for these resources in the
12 region. Noise and dust generated by construction and preconstruction activities would have
13 minor effects on the residential area adjacent to the western boundary of the CPNPP site;
14 however, these effects are not expected to be sufficient to lead to changes in the land use of the
15 area.

16 The impacts of the proposed activities on land use would be limited to the clearing and
17 occupation of forested and other naturally vegetated areas and lands designated as prime
18 farmland, as well as impacts to a small area (0.78 ac) of wetlands (discussed further in Section
19 4.3.2.1). The forested areas affected are typical of the vicinity and the region. The designated
20 prime farmland is not currently used for agriculture and, due to its situation within the current
21 site boundaries of the CPNPP, has low potential for future agricultural use. Thus, no mitigation
22 for impacts to onsite forested areas or prime farmlands would be warranted. Measures to
23 mitigate impacts to onsite wetlands are discussed in Section 4.3.2.5 of this EIS.

24 Based on information provided by Luminant and the review team's independent review, the
25 review team concludes that the combined land use impacts of construction and preconstruction
26 activities on the CPNPP site would be SMALL, and no further mitigation would be warranted.
27 Based on the above analysis, and because the NRC-authorized construction activities represent
28 only a portion of the analyzed activities, the NRC staff concludes that the land-use impacts of
29 NRC-authorized construction would also be SMALL.

30 **4.1.2 Transmission Line and Pipeline Right(s)-of-Way and Offsite Areas**

31 Texas law (Texas Statutes, Utility Code, Section 39.051) requires that entities that transmit and
32 distribute electrical power be legally separate from those responsible for generating the power.
33 Power generated by CPNPP Units 3 and 4 would be transmitted along transmission lines
34 owned, operated, and maintained by Oncor Electric Delivery System LLC (Oncor). As depicted
35 on Figure 2-13, the proposed new transmission lines include five 345-kV circuits. Three of the
36 proposed new transmission lines would use vacant circuit positions on tower structures of
37 existing transmission lines and would require no additional ROWs (or widening of ROWs):

- 38 • a 22-mi circuit between the onsite switching station and the Johnson Switch 345-kV
39 switching station in Johnson County,
- 40 • a 22-mi circuit between the Johnson Switch switching station and the Everman 345/138-kV
41 switching station in Tarrant County, and
- 42 • a 42-mi circuit between the onsite switching station and the Parker 345-kV switching station
43 in Parker County.

44 The remaining two new transmission lines would follow new routes that would require acquiring
45 and clearing a new ROW and erection of new towers. These lines include

- 1 • a 45-mi circuit from the onsite switching station to the Whitney 345-kV switching station in
2 Bosque County and
- 3 • a 17-mi circuit from the onsite switching station to the DeCordova 345-kV switching station
4 in Hood County.

5 Figure 2-13 indicates general corridors for the two proposed transmission lines on a new ROW.
6 Specific locations for these transmission circuits would be determined through a Routing Study
7 Process conducted by Oncor and reviewed by the Public Utility Commission of Texas (PUCT).
8 The PUCT considers several factors, including environmental integrity, when reviewing each
9 application for a certificate to construct a transmission line (Texas Statutes, Utilities Code, Sect.
10 37.056, 2003, 2007). The utility applicant (which for the transmission lines would be Oncor)
11 must give notice of its intent to secure a certificate to neighboring municipalities and affected
12 property owners and may be required to hold a public meeting (Public Utilities Commission of
13 Texas (PUCT), Procedural Rule, Sect. 22.52(a), 2003, 2009). The utility applicant must also
14 reasonably consider a route for the proposed transmission line that would moderate the impact
15 on the affected community and landowners (PUCT, Substantive Rule, Sect. 25.101(b)(3)(B),
16 2003, 2009). Procedures for this Routing Study Process call for identifying areas from which
17 transmission lines are excluded or where they should be avoided.

18 While Oncor has not yet determined the exact routes for the proposed new transmission lines,
19 land use in and around the corridor locations shown on Figure 2-13 is typical of the affected
20 region. The typical ROW width for Oncor's 345-kV transmission lines is 160 ft; hence it is
21 reasonable to assume that the width for the routes ultimately selected for the two new ROWs
22 would be 160 ft.

23 A representative transmission line route within the proposed DeCordova corridor would require
24 approximately 149 ac of new ROW, of which approximately 72 percent would be grassland, 7
25 percent would be water, 7 percent would be open developed land, and 7 percent would be
26 deciduous forest (Luminant 2009a). The line would pass near the AES Corporation's Wolf
27 Hollow natural-gas-fired, combined-cycle power plant and three residential subdivisions off
28 Mitchell Bend Court in Hood County, but would not interfere with these land uses.
29 Approximately 82 to 90 new steel lattice tower structures would be required for this line, each
30 requiring foundation excavations (Luminant 2009a).

31 A representative transmission line route within the proposed Whitney corridor would occupy
32 approximately 954 ac, including approximately 58 percent grassland, 19 percent deciduous
33 forest, and 14 percent evergreen forest (Luminant 2009a). The corridor location as currently
34 shown would pass very close to Dinosaur Valley State Park, possibly encroaching on its
35 western boundary. The corridor location as currently shown would also cross the Fossil Rim
36 Wildlife Center. The introduction of a large transmission line supported by steel lattice towers
37 could noticeably reduce the suitability of the state park and wildlife center for their current
38 recreational uses. The proposed Whitney transmission circuit would require approximately 216
39 to 238 steel lattice tower structures. Each structure would require foundation excavations
40 (Luminant 2009a).

41 In addition to transmission line impacts, offsite land use in the vicinity would be affected by
42 installation of proposed water intake and discharge structures on Lake Granbury and new
43 pipelines connecting these structures to the CPNPP (see Figure 2-5). The new water intake
44 structure would be built adjacent to the existing intake point. The surrounding residential area
45 could experience some noise and dust during installation, but this effect would be minimized
46 because most disturbances would take place at the base of a steep embankment, whereas the
47 residences are situated atop the embankment. The proposed discharge point would be built at
48 the edge of a low-density residential area adjacent to an existing switchyard. The process of

1 building the proposed water intake and discharge structures would not produce impacts
2 sufficient to result in changes in the use of nearby lands.

3 Two 42-in. water intake pipelines would carry water from Lake Granbury to CPNPP Units 3 and
4 4, and two 42-in. (one for each unit) discharge pipelines would return water to the lake. The
5 water intake pipelines are currently under review by NRC staff in the U.S. Advanced
6 Pressurized Water Reactor design control documents and are not considered part of the NRC-
7 authorized activities in this EIS. The total length of the pipelines would be approximately 13 mi,
8 with approximately 7.5 mi being outside the CPNPP site. Outside the CPNPP site the intake
9 pipelines would parallel existing pipelines that support CPNPP Units 1 and 2. The discharge
10 pipelines would follow the same route for most of its length but would diverge onto a new
11 location for approximately 1.4 mi to connect to the proposed discharge structure in Lake
12 Granbury. All the new pipelines would be located within the existing 50-ft ROW, which
13 encompasses 49.7 ac, including approximately 63 percent grassland, 13 percent deciduous
14 forest, and 12 percent open developed land. Building activities in this corridor would be
15 expected to disturb another 64-ac area of approximately the same land use types.
16 Approximately 0.1 ac of woody wetlands would be affected (Luminant 2009a); however, since
17 the pipelines would be installed underground and backfilled to natural grade, disturbance to the
18 wetland would be expected to be temporary.

19 The pipeline route would transect two low-density residential areas, in one case cutting through
20 lawn area and in the other following an existing street. In addition, the route would cut through
21 the parking area of a convenience store/gasoline station, possibly disrupting access to the
22 business.

23 Based on information provided by Luminant and Oncor and the review team's independent
24 review, the review team concludes that land-use impacts of construction and preconstruction
25 activities associated with transmission lines and offsite pipelines would be MODERATE. This
26 conclusion is based primarily on the fact that one of the proposed transmission line corridors
27 may pass on or close to the edge of Dinosaur Valley State Park and because development of
28 pipelines and transmission lines could sever tracts of public and private property and
29 permanently interfere with land uses on some of those tracts. Potential mitigation measures to
30 reduce these impacts could include designating Dinosaur Valley State Park and all areas visible
31 from the park along with the Fossil Rim Wildlife Center property as exclusion areas for the
32 routing study that will be conducted for the proposed Whitney circuit. In addition, temporary
33 impacts to the convenience store/gasoline station affected by installation of the proposed water
34 intake and discharge pipelines could be minimized through mitigation measures such as
35 construction practices and scheduling. With application of the mitigation measures outlined
36 above, the land use impacts would be much less noticeable.

37 NRC's 2007 Limited Work Authorization (LWA) rule (10 CFR 50.10 (a)(2)) specifically states
38 that transmission lines are not NRC-authorized construction activities. Additionally, the pipeline
39 that supplies makeup water to the proposed new units would be preconstruction and therefore
40 not part of the NRC-authorized activities. The NRC staff therefore concludes that land-use
41 impacts from NRC-authorized activities would be SMALL and no mitigation would be warranted.

42 **4.2 Water-Related Impacts**

43 Water-related impacts involved in building a nuclear power plant are similar to impacts that
44 would be associated with any large industrial construction project, and not much different than
45 those seen during the building of CPNPP Units 1 and 2. Prior to initiating site preparation or
46 other site work, Luminant would be required to obtain the appropriate authorizations regulating

1 alterations to the hydrological environment. These authorizations would likely include the
2 following:

- 3 • CWA Section 404 Permit. This permit would be issued by the USACE, which governs
4 impacts of construction activities on wetlands or waters of the United States and
5 management of dredged material.
- 6 • CWA Section 401 Certification. This certification would be issued by the Texas Commission
7 on Environmental Quality (TCEQ) and ensure that the project does not conflict with State
8 water-quality management programs.
- 9 • CWA Section 402(p) National Pollutant Discharge Elimination System (NPDES) construction
10 and industrial stormwater permits. These permits would regulate point-source stormwater
11 discharges. The U.S. Environmental Protection Agency's (EPA's) stormwater regulations
12 have established requirements for stormwater discharges from various activities including
13 construction activities. The EPA has delegated the authority for administering the NPDES
14 program in the state of Texas to the TCEQ, which issues Texas Pollutant Discharge
15 Elimination System (TPDES) permits. The stormwater management system would be
16 required to comply with TPDES General Permit TXR150000 (Luminant 2009a).

17 In addition to the above permit requirements, the Applicant has committed to design the
18 stormwater management system in accordance with *Edwards Aquifer Technical Guidance on*
19 *Best Management Practices* (TCEQ 2009), the Texas Department of Transportation *Hydraulic*
20 *Design Manual*, (TxDOT 2004).

21 **4.2.1 Hydrological Alterations**

22 This section (1) identifies and describes proposed preconstruction and construction activities,
23 including site preparation, plant construction, clearing transmission corridors and building
24 transmission lines, and offsite building activities that could result in hydrologic alterations;
25 (2) describes and analyzes the resulting hydrologic alterations and the physical effects of these
26 alterations on other water users; (3) analyzes the practices proposed to minimize hydrologic
27 alterations having adverse impacts; and (4) assesses compliance with applicable Federal,
28 State, regional, local, and affected Native American tribal standards and regulations.

29 Building of Units 3 and 4 would result in permanent structures occupying about 275 ac on the
30 7950-ac CPNPP site to the west and northwest of Units 1 and 2. This includes approximately
31 123 ac of disturbance for the power plant and approximately 152 ac for the cooling towers. An
32 additional 400 ac would be disturbed for a cooling tower BDTF to the southwest of the Squaw
33 Creek Reservoir (SCR) Dam. Additional areas would be disturbed to build pipelines from the
34 proposed intake structure on Lake Granbury to the proposed Units 3 and 4, pipelines proposed
35 for discharge of treated blowdown water and cooling water to underwater diffusers on Lake
36 Granbury, and pipelines from the cooling towers to the power block area. Building of
37 infrastructure such as roads and stormwater drainage systems, and a potable water supply line
38 from the CPNPP property boundary to the plant site is also expected to result in additional
39 disturbance. Larger areas of the site would be subject to temporary disturbance for laydown
40 yards, temporary buildings, parking areas, and other temporary uses. Much of the building
41 activity for CPNPP Units 3 and 4 would occur in areas in which building activity has previously
42 occurred and stormwater drainage systems and roadways already exist.

43 Site preparation and the building of the power plant would require the removal and redistribution
44 of several hundred cubic yards of rock and overburden soil material, including the removal of an

1 existing structure, an existing Class II landfill, a foundation, and paved areas and the relocation
2 of an onsite rail line.

3 Potential erosion and sedimentation from these activities would be controlled using appropriate
4 best management practices (BMPs), as specified by Luminant (2009a) to be included in its
5 Stormwater Pollution Prevention Plan (SWPPP). These controls may include vegetative buffer
6 zones, silt fencing, straw bales, slope breakers, and other soil-erosion-prevention measures, as
7 well as diversionary channels to sedimentation basins. Stormwater retention ponds, which
8 would be designed to accommodate the larger of either the surface water runoff from a 2-year,
9 24-hr storm or a minimum of 3600 ft³ per acre drained, would be designed and built to allow
10 sediment-laden water from dewatering activities to pass through ponds prior to discharge. Any
11 effects to SCR and other receiving waters that might occur from site-disturbing activities would
12 be temporary and minor due to the implementation of appropriate stormwater BMPs.

13 As a result of grading, soil compaction, and creation of impervious surfaces (such as paved
14 areas and roofs), the building of the new units is likely to increase the volume of site stormwater
15 runoff compared with pre-existing conditions. Final site grading would be designed to ensure
16 that runoff would drain away from safety-related structures via drainage channels or sheet flow
17 and subsequently to SCR through catch basins or as unobstructed overland flow.
18 Sedimentation basins would be designed to accommodate flow from a 100-year, 24-hr storm
19 event during facility operations (URS 2008). Any effects to SCR or other receiving waters
20 resulting from increased runoff would be minor, due in part to the implementation of these
21 measures.

22 Installation of a raw water intake structure for CPNPP Units 3 and 4 adjacent to the existing
23 intake structure on Lake Granbury would require dredging that could lead to a temporary
24 increase in turbidity in the lake. No riprap installation or other measures are expected to be
25 required to stabilize the banks of the lake during and following installation of the new intake.
26 Activities directly affecting Lake Granbury would be subject to regulation by the TCEQ and the
27 USACE, and impacts would be minor and temporary.

28 The two wetland areas near the proposed site of the cooling towers would not be directly
29 disturbed but could possibly be affected by sediment runoff. Sedimentation basins and other
30 engineering controls would be used to limit any adverse effects to the wetlands, so any impacts
31 to wetlands would be minimal. There would be no direct impact on floodplains, as no portions of
32 the proposed CPNPP Units 3 and 4 site and the pipeline corridor between Lake Granbury and
33 the CPNPP site are within 100- or 500-year floodplains (Luminant 2009a).

34 No new offsite roads would be required to support the building of CPNPP Units 3 and 4, so
35 there would be no hydrologic alterations for offsite road construction.

36 The building of CPNPP Units 3 and 4 would not affect the availability or quality of groundwater
37 beyond the site. Undifferentiated fill material, regolith, and bedrock beneath the CPNPP Units 3
38 and 4 site would be removed and replaced with engineered fill material (Luminant 2009b). At
39 the nuclear island, excavations would extend below the perched water table, but experience
40 during the building of CPNPP Units 1 and 2 indicates there would be minimal need to pump
41 groundwater to dewater excavation areas in order to build Units 3 and 4 (Luminant 2009a).
42 Standard sump pumps would be used for excavation dewatering, as needed, and, but collected
43 water would periodically be removed from excavations and directed to a stormwater retention
44 basis to remove sediment before discharging the water to SCR (Luminant 2009a and Luminant
45 2009b). Final site grading and drainage would be designed to minimize infiltration and avoid the
46 development of perched groundwater conditions.

1 Based on these factors, hydrological alterations from construction and preconstruction activities
2 would have only minor impacts on water resources.

3 **4.2.2 Water Use Impacts**

4 This section describes, analyzes, and assesses the proposed project construction and
5 preconstruction activity impacts on water use. It includes identification of the proposed
6 construction and preconstruction activities that could have impacts on water use and analysis
7 and evaluation of proposed practices to minimize adverse impacts on water use.

8 **4.2.2.1 Surface Water Use Impacts**

9 Surface water for use in building CPNPP Units 3 and 4 would be obtained from the Somervell
10 County Water District (SCWD) via a pipeline from Wheeler Branch Reservoir. Water would be
11 used for activities such as fire protection and concrete batch plant operation. Building activities
12 for the proposed project's facilities are estimated to require an average of 300 gpm and a
13 maximum of 1,300 gpm (Luminant 2009a) during working hours. Additional water would be
14 supplied from SCWD for potable water for domestic and sanitary needs. Potable and sanitary
15 water requirements are estimated to total 12,900 gpd. A total volume of 200,560 gpd (225 ac-
16 ft/yr) would be obtained from Wheeler Branch Reservoir. This is 11.3 percent of this reservoir's
17 available annual supply and less than the 300 ac-ft/yr volume allocated to Luminant (Section
18 2.3.2.1), so the impacts to other SCWD water users would be minimal. Impacts of the
19 withdrawal on stream flow in the Paluxy River (which supplies Wheeler Branch Reservoir) would
20 also be minimal, as the withdrawal volume would be equivalent to just 0.3 percent of the mean
21 annual flow and 5 percent of lowest recorded annual flow in the Paluxy River at Glen Rose.
22 Water for dust suppression and general cleanup would be withdrawn from SCR, with average
23 and maximum requirements estimated at 22 and 44 gpm, respectively. At an average
24 withdrawal rate of 22 gpm, withdrawals from SCR would total 35 ac-ft/yr, which would result in a
25 minimal impact compared with the consumptive use of nearly 20,000 ac-ft/yr of SCR water by
26 Units 1 and 2 in 2006 and the discharge of more than 21,000 ac-ft/yr from SCR dam that same
27 year (Section 2.3.2.1). CPNPP is the only consumptive user of water from SCR. There are no
28 other users that depend upon water availability from SCR.

29 Based on these factors and on information provided by Luminant and the review team's
30 independent evaluation, the review team concludes that the surface water use impacts of
31 construction and preconstruction activities would be SMALL, and no further mitigation would be
32 warranted. In addition, the NRC staff concludes the surface water use impacts of NRC-
33 authorized construction activities would be SMALL, and no further mitigation would be
34 warranted.

35 **4.2.2.2 Groundwater Use Impacts**

36 There would be no groundwater use during construction of CPNPP Units 3 and 4 beyond
37 current limited onsite withdrawals (Luminant 2009a). As a result, there would be no impacts
38 from groundwater use. Based on this information and on information provided by Luminant and
39 the review team's independent evaluation, the review team concludes that the groundwater use
40 impacts of construction and preconstruction activities would be SMALL, and no further
41 mitigation would be warranted. Therefore, in addition, the NRC staff concludes the groundwater
42 use impacts of NRC-authorized construction activities would be SMALL, and no further
43 mitigation would be warranted.

1 **4.2.3 Water Quality Impacts**

2 Water quality impacts for construction and preconstruction activities would be similar to those
3 for other large industrial construction projects. Soil erosion and disturbance of sediments could
4 result in increased turbidity in surface waters. Spills of fuels and lubricants from construction
5 equipment could contaminate surface water and groundwater.

6 **4.2.3.1 Surface Water Quality Impacts**

7 Activities that could impact surface water quality include site clearing for buildings, roads, and
8 drainage systems and construction of water supply lines, buildings, parking lots, roads, cooling
9 water intake and discharge structures, the BDTF, retention and evaporation ponds, and
10 temporary construction laydown areas. Some excavations are expected to extend below
11 shallow/perched groundwater by 5 to 15 ft; dewatering effluents from these areas would be
12 directed to a stormwater retention (sedimentation) basin. The sedimentation basin that would
13 be used for stormwater drainage during the building process would be designed to
14 accommodate runoff from a 2-year, 24-hr storm or would provide 3600 ft³ of storage per acre
15 drained, whichever is greater.

16 A circulating water blowdown evaporation pond would be built onsite to receive effluent from
17 operation of the BDTF. It would have a surface area of approximately 130 ac and a depth of
18 4 ft. In addition, a 3-mo storage pond measuring 48 ac by 20 ft deep would be built adjacent to
19 the evaporation pond to maintain an acceptable water level in the evaporation pond. Both
20 ponds would be constructed with geomembrane liners and clay soils and would contain drain
21 systems to detect and collect potential seepage.

22 Building of the power plant is expected to affect 123 ac of a previously disturbed area of the
23 7950-ac site. In addition, site preparation for the cooling towers would entail the stripping of
24 vegetation and earthmoving activities on about 152 ac of previously undisturbed land. The
25 BDTF would be built on 384 ac of largely undisturbed land. Because most permanent
26 structures associated with CPNPP Units 3 and 4 would be located on a peninsula extending into
27 SCR, runoff from the disturbed areas would have the potential of impacting water quality in that
28 reservoir. In addition, increased turbidity and sedimentation would occur in Lake Granbury from
29 dredging and installation of intake and discharge structures for the cooling water system.

30 Vegetation removal and site grading would lead to soil erosion by wind and rainstorms. Unless
31 intercepted and treated, stormwater runoff would increase turbidity and sedimentation to SCR
32 and Lake Granbury. To reduce the amounts of suspended sediments entering these water
33 bodies, stormwater flows would be directed to settling ponds. The ponds would be designed to
34 accommodate runoff from a 2-year, 24-hr storm or provide 3600 ft³ of storage per acre drained,
35 whichever is greater. Discharge from the settling ponds would be directed to SCR.

36 Impacts would be controlled by implementation of a construction SWPPP as required by the
37 TPDES General Permit Relating to Construction Activities (General Permit). BMPs to control
38 runoff may include vegetative buffers, silt fencing, and sedimentation basins.

39 Because hydrological alterations resulting from site preparation and building activities would be
40 localized and temporary; disturbed land would be stabilized to prevent erosion; and permits,
41 certifications, and the SWPPP require the implementation of BMPs to minimize impacts, the
42 review team concludes that the surface water quality impacts of construction and
43 preconstruction activities would be SMALL, and no mitigation beyond the BMPs would be
44 warranted. In addition, the NRC staff concludes the surface water quality impacts of NRC-
45 authorized construction activities would be SMALL, and no mitigation beyond the BMPs would
46 be warranted.

1 **4.2.3.2 Groundwater Quality Impacts**

2 The SWPPP will include provisions for spill prevention, as well as detection and cleanup of
3 leaks and spills. Therefore, its implementation would reduce the potential for leaks and spills.
4 Shallow groundwater flow within the site is towards SCR (see Figure 4-1), such that any
5 contamination entering shallow groundwater in the onsite fill or Glen Rose Formation due to
6 leaks and spills would migrate toward SCR. Contamination reaching SCR through shallow
7 groundwater would combine with surface water contamination and would be similarly diluted.
8 Any shallow contamination of the perched Glen Rose Formation would not adversely affect
9 groundwater users because this groundwater is not used for water supply. The review team
10 concludes that the groundwater quality impacts of construction and preconstruction activities
11 would be SMALL, and no further mitigation beyond the BMPs for spills would be warranted.
12 The NRC staff also concludes that the impacts of NRC-authorized construction would be
13 SMALL, and no further mitigation would be warranted.

14 **4.2.4 Hydrological Monitoring**

15 Luminant states in the ER that it would incorporate BMPs into a site-specific SWPPP and
16 monitor stormwater discharges associated with the construction and preconstruction activities
17 according to TPDES requirements and state water quality standards (Luminant 2009a). The
18 SWPPP is required to be implemented before starting construction and pre-construction
19 activities (TCEQ 2008).

20 **4.3 Ecological Impacts**

21 This section describes the potential impacts to ecological resources from building and
22 preconstruction activities related to CPNPP Units 3 and 4. The section is divided into two
23 subsections: terrestrial impacts and aquatic and wetlands impacts.

24 **4.3.1 Terrestrial Impacts**

25 This section provides information on the potential impacts to terrestrial ecological resources
26 from preconstruction and construction of proposed Units 3 and 4 at CPNPP. The discussion in
27 Section 4.3.1.1 addresses the CPNPP site and vicinity. Section 4.3.1.2 discusses terrestrial
28 ecosystem impacts associated with the expansion of the transmission system to include a new
29 385-kV transmission line ROW as well as installation of new water intake and discharge
30 pipelines within the existing and new ROWs. Topics discussed include erosion and
31 sedimentation control, sensitive resources, spill prevention and response, and construction-
32 related noise.

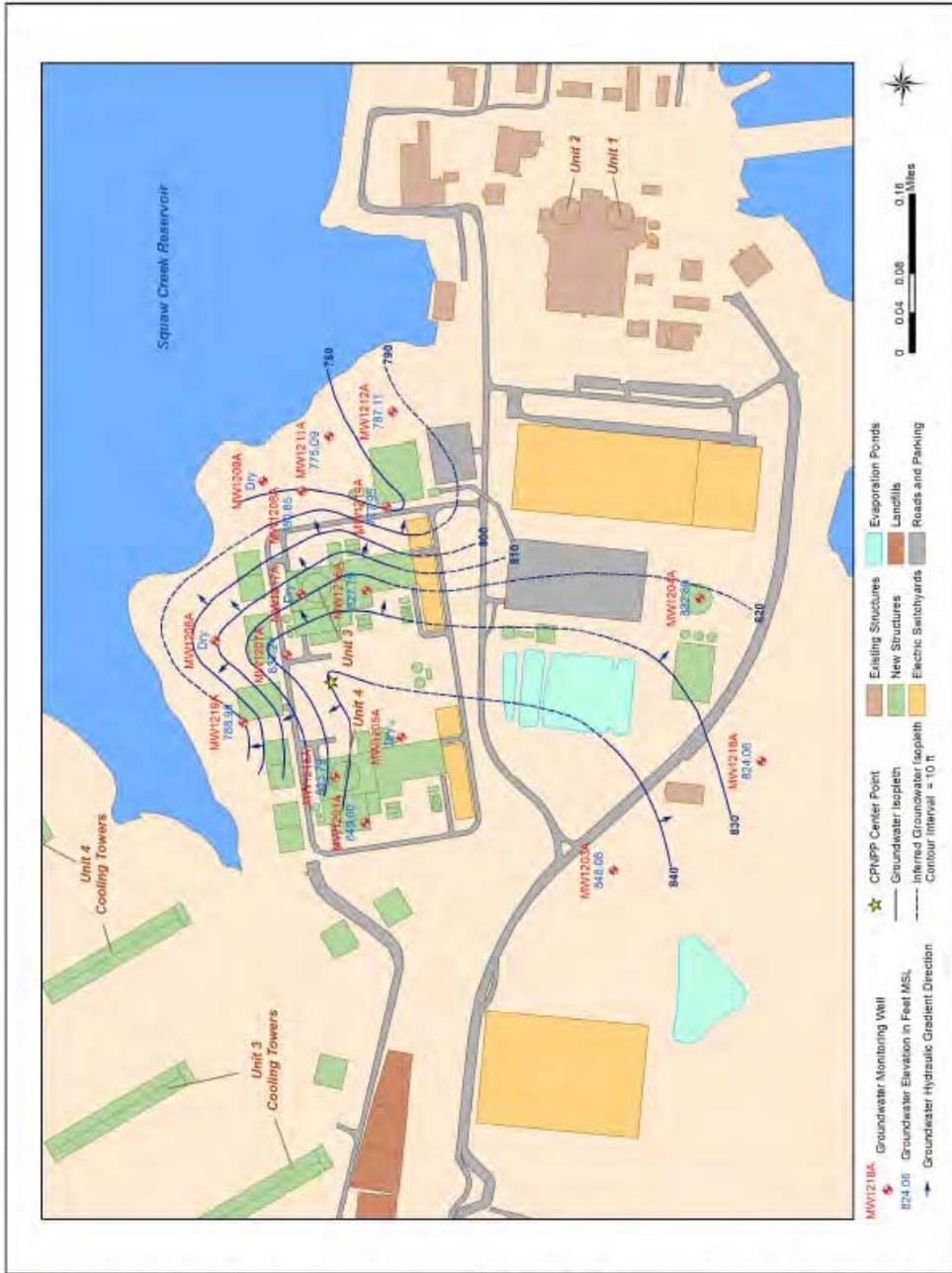


Figure 4-1. Potentiometric map showing groundwater isopleths and flow directions beneath the CPNPP site. Source: Luminant 2009a.

1 **4.3.1.1 Terrestrial Resources – Site and Vicinity**

2 ***Wildlife Habitat***

3 **Overview**

4 Approximately 675 ac on the CPNPP site would be physically disturbed by construction and
5 preconstruction activities associated with Units 3 and 4. Approximately 275 ac of the
6 disturbance would be to accommodate the proposed reactors units, switchyard, cooling towers,
7 and other centralized facilities (Central Project Area, see Figure 4-1 and Table 4-1); and
8 approximately 400 ac of the disturbance would be to accommodate the BDTF (BDTF Area, see
9 Figure 2-5). After the proposed facilities are built, approximately 125 of the disturbed acres
10 would be revegetated; and the remaining 550 ac would be permanently occupied by various
11 project structures and pavement (Table 4-1). However, approximately 105 ac of the 550 ac of
12 permanent impacts constitute former laydown areas from development of Units 1 and 2 that
13 currently provide little ecologically valuable habitat.

14 The net permanent loss of 445 ac of natural terrestrial habitat would affect only about 10
15 percent of the natural habitat available on the site. The maximum area of soil that would be
16 disturbed at any time would be 675 ac. Most habitat losses would take place during
17 preconstruction activities, that is, after the land was cleared but before construction of safety-
18 related facilities was initiated.

19 ***Minimizing Impacts***

20 BMPs would be employed to minimize impacts from erosion, sedimentation, and fugitive dust to
21 areas surrounding the building activities zone. A site-specific SWPPP would be developed and
22 followed to minimize areas to be disturbed by phasing land clearing, protecting vegetated
23 buffers, and employing temporary and permanent seeding to promote soil stabilization. Design
24 construction, and preconstruction mitigation measures to avoid impacts to stream and riparian
25 areas, where possible, would be described in the SWPPP (Luminant 2009a).

26 Native grasses would be reintroduced in disturbed areas through seed broadcasting as allowed
27 in accordance with required security measures for the site. Native grasses are the preferred
28 cover for most disturbed areas and promote biodiversity. However, in some situations native
29 grasses are not the optimal choice for revegetation due to high erosion probability and/or
30 seasonal conditions or along fence lines for reasons of security due to blocking view of possible
31 intruders. In these areas improved grasses [i.e., buffalo (*Bouteloua dactyloides*) and rye grass
32 (*Lolium* spp.)] would be used to quickly establish cover of disturbed areas. Where practical,
33 natural regeneration of native grasses would be allowed in areas where improved grasses were
34 used to control erosion. In some places native shrubs and trees would be replanted according
35 to a revegetation and/or landscaping plan for the facility (Luminant 2009a). Undesirable and/or
36 invasive species would be controlled through measures identified in a Wildlife Management
37 Plan currently under review by the Texas Parks and Wildlife Department (TPWD) as part of the
38 Clean Texas Program (Luminant 2009a).

Construction Impacts at the Proposed Site

Table 4-1. Acres of habitat types before and after construction and preconstruction at the CPNPP site that would be affected by development of Units 3 and 4

	CPNPP Site	Entire project	Central area only	BDTF only	CPNPP Site after Development
Before development					
Ashe juniper forest	3071	413	100	313	2658
Mixed hardwood forest	528	63	18	45	465
Grassland	698	94	60	34	729 ^(a)
Wetland	53	0.4	0.4	0	52.6
Developed and Previously Disturbed	499	105	97	9	394
Open Water	3125	0	0	0	3125
TOTAL	4849	675	275	400	4174
After development					
Revegetated	N/A	125	125	0	N/A
Developed	N/A	550	150	400	N/A
TOTAL	N/A	675	275	400	N/A

(a) This number assumes that the 125 ac of temporary impacts are restored to grassland following development.

Source: Luminant 2009a

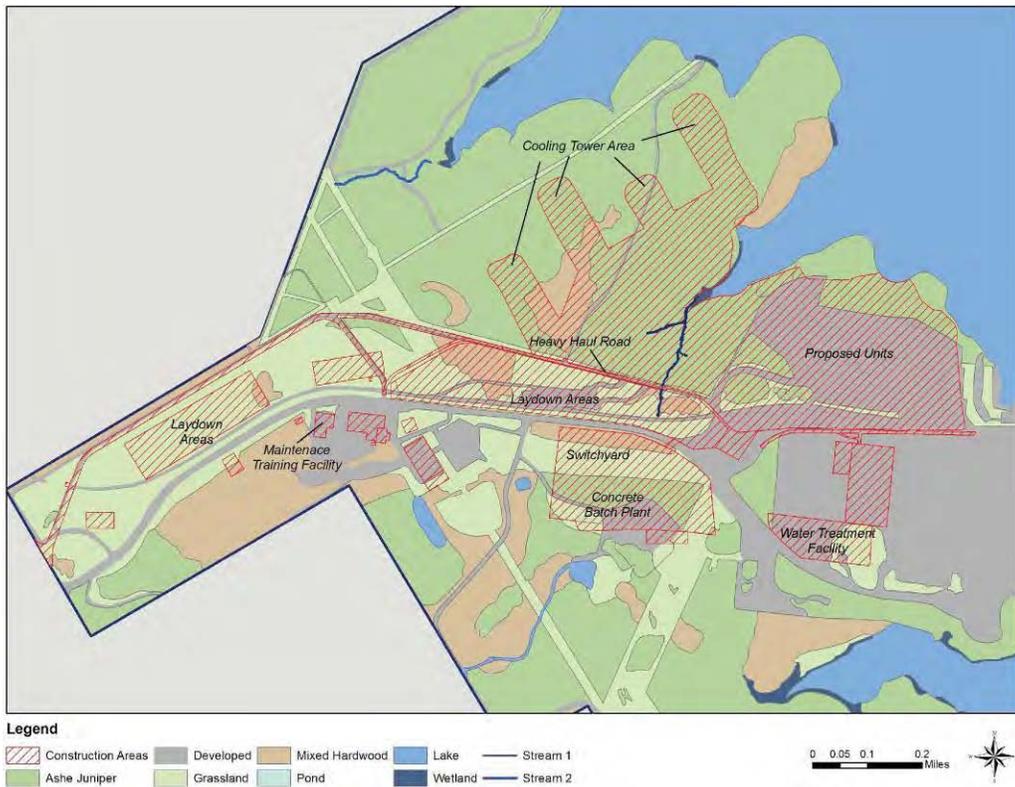


Figure 4-2. Ecological cover types within development footprint (Luminant 2009a)

1 **Types of Habitat Affected**

2 **Central Project Area.**

3 Expected effects from preconstruction and construction activities in the central project area
 4 would include temporary and long-term alteration and loss of vegetative cover, loss of wildlife
 5 habitat, increased erosion, and increased interaction between humans and wildlife. As
 6 indicated in Table 4-1, approximately 100 ac of Ashe juniper woodland - savanna (about 3
 7 percent of that presently onsite), 18 ac of mixed hardwood forest (about 4 percent of that
 8 onsite), and 60 ac of grassland (about 9 percent of that onsite) are located within the central
 9 project area (Table 4-1) (Luminant 2009a). Approximately 0.4 ac of wetlands are located within
 10 the central project area; wetland impacts are described in Section 4.3.2.1. The remaining
 11 acreages of all cover types are in areas previously disturbed by development of CPNPP Units 1
 12 and 2 (Luminant 2009a).

13 Much of the central project area was once used as a large parking lot during construction of the
 14 existing CPNPP Units 1 and 2. The area of the former parking lot is a relatively low-quality
 15 wildlife habitat lacking the vertical layering of vegetation that favors wildlife diversity. It is
 16 occupied primarily by small mammals, ground-nesting birds, and common reptiles (Luminant
 17 2009a). The cooling towers that would support proposed CPNPP Units 3 and 4 would be
 18 located on a largely undeveloped peninsula that extends into SCR immediately northwest of the
 19 core area of the site. About 152 ac would be disturbed. The peninsula is presently covered
 20 primarily by Ashe juniper woodland - savanna and to a lesser extent by mixed hardwood forest.
 21 Ashe juniper (*Juniperus ashei*) is an aggressive native woody species that has expanded its
 22 range since European settlement due to overgrazing of livestock and fire suppression (Sullivan

1 1993). Ashe juniper stands lack vertical structure and have low species diversity, making them
 2 less valuable habitats than other types of woody vegetation; the mixed hardwood forest in the
 3 central project area is more valuable as wildlife habitat (Luminant 2009a).

4 **BDTF Area.** Developing the BDTF would permanently affect approximately 400 ac (Table 4-1)
 5 (Luminant 2009a). Approximately 313 ac of Ashe juniper woodland - savanna (about 10
 6 percent of that presently onsite), 34 ac of grassland (about 5 percent of that onsite), 45 ac of
 7 mixed hardwood (about 9 percent of that onsite), and 7 ac of developed area have been
 8 identified within the 400-ac BDTF area that would be affected by development (Luminant
 9 2009a).

10 **Wildlife Habitat Summary**

11 Development areas shown on Figure 4-2 contain no old growth timber, unique or sensitive
 12 plants, or unique or sensitive plant communities. Because the vegetation communities within
 13 the CPNPP boundary are common throughout Somervell and Hood counties, the affected
 14 terrestrial habitats would be a small percentage of the total acreage of these cover types in the
 15 vicinity (Table 4-2). Onsite building activities would not noticeably reduce the local diversity of
 16 plants or plant communities or associated wildlife.

Table 4-2. Terrestrial habitat acreages on CPNPP site and vicinity (6- mi radius).

USGS Description	Site	Vicinity
Open Water	3328	6959
Developed Areas	846	11,747
Mixed Hardwood Forest	732	18,465
Evergreen Forest ¹	1870	26,085
Grassland/Herbaceous	1101	73,292
Agricultural Lands	35	7311
Wetlands	100	2702
TOTAL	8012¹	146,561

¹ Ashe juniper woodland savannah would be included as part of the Evergreen Forest designation used in this table.

17 Construction and preconstruction of CPNPP Units 3 and 4 would comply with Federal and State
 18 regulations, permit conditions, existing procedures, and established BMPs. Development and
 19 support areas shown on Figures 4-1 and 2-5 contain no unique or sensitive plants or unique or
 20 sensitive plant communities. Plants and wildlife found in less disturbed habitats on or near the
 21 CPNPP site commonly occur throughout north-central Texas. Because the vegetation
 22 communities within the CPNPP boundary are common throughout Somervell and Hood
 23 Counties, the wildlife habitat to be disturbed during preconstruction and construction, which
 24 would total about 10 to 15 percent of that available onsite, would be a small percentage of the
 25 total acreage of these cover types in the general area. Building and operating the new facilities
 26 at the CPNPP site are not expected to noticeably impact local movement patterns of wildlife.
 27 Development activities onsite would not noticeably reduce the local diversity of plants, plant
 28 communities, or wildlife species that inhabit them. Therefore, the review team concludes that
 29 impacts to wildlife habitat on the CPNPP site (both in the central project area and BDTF area)
 30 would be minimal.

1 **Flora and Fauna**

2 Removal of woody vegetation can result in increased ecosystem fragmentation that can affect
 3 the movement of wildlife. Figures 2-5, 2-13, and 4-1 indicate that the affected Ashe juniper
 4 woodland - savanna and mixed hardwood forest are already partially isolated from adjacent
 5 forested areas as a result of previous development and transmission line maintenance activities.
 6 Construction and preconstruction activities that would affect small stands of woody vegetation
 7 are not expected to result in additional habitat fragmentation or removal of potential travel
 8 corridors available to terrestrial wildlife.

9 Species with onsite habitats likely to be affected by development activities at the CPNPP would
 10 include mammals [e.g., raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), eastern
 11 cottontail (*Sylvilagus floridanus*), deer mouse (*Peromyscus* spp.), and cotton rat (*Sigmodon*
 12 ssp.)], birds [e.g., American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius*
 13 *phoeniceus*), savanna sparrow (*Passerculus sandwichensis*), and northern flicker (*Colaptes*
 14 *auratus*)], reptiles [e.g., western diamond-backed rattlesnake (*Crotalus atrox*) and slider
 15 (*Trachemys scripta*)], and amphibians [e.g., bullfrog (*Rana catesbeiana*), leopard frog (*Rana*
 16 *berlandieri*), and Woodhouse's toad (*Bufo woodhousii*)] (see Section 2.4.1.1).

17 During building of CPNPP Units 3 and 4 and associated power transmission lines and water
 18 pipeline rights-of-ways, wildlife might be destroyed or displaced, primarily as a result of
 19 operating heavy equipment (e.g., during land clearing). Less mobile animals, such as reptiles,
 20 amphibians, and small mammals, are expected to incur greater mortality than more mobile
 21 animals, such as birds. Although undisturbed habitat would be available nearby for displaced
 22 animals during construction and preconstruction, increased competition for available space
 23 could result in increased predation and decreased fecundity, ultimately leading to a temporary
 24 reduction in population size. Species that can adapt to disturbed or developed areas might
 25 readily recolonize portions of the disturbed area where suitable habitat remains or is replanted
 26 or restored. The destruction, temporary displacement and reduced productivity, and
 27 recolonization of wildlife also apply to offsite disturbances in forest habitat that would result as
 28 land was cleared for the new transmission line and pipeline rights-of-way (see Section 4.3.1.2).
 29 As construction and preconstruction activity ends and some habitats are restored naturally or
 30 through mitigation activities, habitats would again become available to some wildlife species that
 31 previously occupied these spaces.

32 Noise from building can affect wildlife by inducing physiological changes, nest or habitat
 33 abandonment, or behavioral modifications, or it may disrupt communications required for
 34 breeding or defense (Larkin 1996). However, wildlife often habituates to such noise (Larkin
 35 1996). Construction and preconstruction activities that would generate noise include operation
 36 of equipment such as jackhammers, pile drivers, and heavy construction vehicles. In addition,
 37 construction noise results from the movement of workers, materials, and equipment. Heavy
 38 equipment, such as scrapers and bulldozers, typically emit noise at levels within the 70 to
 39 90 dBA range at distances of 100 ft, although short-term noise levels from construction activities
 40 can be as high as 110 dBA. These noise levels would not extend far beyond the boundaries of
 41 project activities. The threshold at which birds and small mammals are startled or frightened is
 42 80 to 85 dBA (Golden et al. 1980). The review team expects that noise levels associated with
 43 establishment of the transmission line ROW would be similar to those associated with
 44 construction and preconstruction at the CPNPP site and would be below threshold levels for
 45 wildlife at 400 ft. Thus, impacts on wildlife from construction and preconstruction noise would
 46 be negligible.

47 Avian collisions with fabricated structures such as cooling towers, and other structures,
 48 including large cranes and other construction equipment, are a result of numerous factors

1 related to species characteristics. These factors include flight behavior, age, habitat use,
2 seasonal habits, and diurnal habitats. Also, weather, topography, land use, and orientation of
3 the structures are factors in avian collisions. Most authors on the subject of avian collisions with
4 utility structures agree that collisions are not a biologically significant source of mortality for
5 thriving populations of birds with good reproductive potential (EPRI 1993). The NRC (1996)
6 reviewed monitoring data concerning avian collisions at nuclear power plants with large cooling
7 towers and determined that the overall avian mortality is low. Cooling towers at the CPNPP site
8 would be low in profile, 60 ft or less in height (Luminant 2009a), and although located within the
9 central migratory flyway, avian collisions are not expected to be substantial.

10 Increased traffic due to the large construction force would likely increase traffic-related wildlife
11 mortalities. Local wildlife populations could suffer declines if roadkill rates were to exceed the
12 rates of reproduction and immigration. However, while roadkill is an obvious source of wildlife
13 mortality, except for special situations not applicable to the CPNPP site (e.g., ponds and
14 wetlands crossed by roads where large numbers of migrating amphibians and reptiles would be
15 susceptible), traffic mortality rates rarely limit population size (Forman and Alexander 1998).
16 Consequently, the overall impact on local wildlife populations from increased vehicular traffic on
17 the CPNPP site during building is expected to be negligible.

18 The review team determined that the development-related impacts of habitat loss, noise,
19 collisions with elevated structures, and increased traffic may adversely affect onsite wildlife.
20 The project could potentially result in some destruction of habitat and disruption or loss of some
21 individuals in the areas of disturbance. The project would include permanent alteration of some
22 habitat areas, potentially resulting in the loss or relocation of biota over the operational lifespan.
23 However, in light of the availability of similar habitat throughout the region, the impacts would be
24 temporary, minor, and mitigable.

25 **4.3.1.2 Terrestrial Resources – Transmission Lines and Cooling Water Pipelines**

26 ***Transmission Lines***

27 The transmission system addition for CPNPP Units 3 and 4 is being developed as required by
28 ERCOT and the PUCT. ERCOT and the PUCT follow a legal and regulatory process necessary
29 to allow building of additions to the existing transmission system; this includes preparation of a
30 separate Environmental Analysis (CPSES 2007).

31 Three single-circuit transmission lines would be located on existing ROWs and use existing
32 tower structures. No land-use or land management changes, and hence no substantial
33 increases in terrestrial resource impacts are expected from transmission line alterations existing
34 ROWs. Vegetation maintenance is already performed, and wires could be strung with little
35 disturbance to the ROWs (Luminant 2009a).

36 Two double circuit expansions would require the establishment of new towers on a new or
37 expanded 160-ft-wide ROW. The first is the 45-mi line to Whitney, and the second is the 17-mi
38 line to DeCordova. Figure 2-14 illustrates the probable location of the transmission lines.

39 The impacts of land clearing, grading, and levelling to construct transmission lines on the new or
40 expanded ROWs would generally be similar to those experienced onsite with two major
41 exceptions. First, grading would occur at only the locations of the additional transmission
42 towers, where the activity would be limited to that needed to provide a level foundation for the
43 individual towers. Second, the ability to relocate proposed tower sites laterally along the ROW
44 allows avoidance of grading in most environmentally sensitive areas such as those that might
45 contain small populations of special interest plants, water bodies and waterways, and wetlands.

1 Land along the DeCordova ROW consists mainly of grassland, while the land along the Whitney
2 ROW primarily consists of grassland with some deciduous and evergreen forest. Table 2-11
3 shows existing land cover within the proposed transmission line corridors. The new Whitney
4 ROW would occupy approximately 954 ac, and the new DeCordova ROW would occupy
5 approximately 149 ac. It is expected that little of these areas would be disturbed. Grassland
6 would be only minimally disturbed; it is likely that some forest clearing would be required but the
7 extent cannot be determined until actual ROW locations have been determined.

8 Types of impacts that could occur in areas to be disturbed would include direct injury or
9 mortality to wildlife. Nests and burrows could be destroyed during clearing and grading
10 activities. Thus, species with the highest likelihood to be affected would include those with
11 limited mobility, species that burrow, and birds. Building-related disturbances would be short
12 term and confined to the site or adjacent storage areas. Noise, fugitive dust, and activities
13 associated with site clearing and grading, where necessary, and installation of support
14 structures could disturb and displace wildlife within and adjacent to impact areas. These
15 disturbances would be short term and concentrated within the activity area. Depending on the
16 final routing of the transmission ROWs small forest clearings created could contribute to forest
17 fragmentation.

18 ***Cooling Water Pipelines***

19 Additional water intake and discharge pipelines are expected to be installed for CPNPP
20 extending from the plant to Lake Granbury. The pipelines are expected to follow an existing 50-
21 ft ROW. The disturbed land along the existing pipeline corridor is about 50 ac consisting mainly
22 of grassland and low deciduous and evergreen forest (Table 2-12). During building and
23 development a 150-ft-wide corridor would be established down the centerline of the existing
24 ROW. Building activities in this corridor would be expected to disturb another 64-ac area
25 consisting of mostly grassland with some low deciduous and evergreen forest. The new
26 pipelines would largely parallel the existing makeup and return water pipelines. They are
27 illustrated in Figure 2-5. Additional intake and discharge structures would be established on
28 Lake Granbury. The impacts of land clearing, grading, trenching, and levelling to place the
29 water pipeline between the site and Lake Granbury would generally be the same as those
30 experienced onsite. Following pipeline installation, the approximately 114-ac area disturbed for
31 the pipeline would probably be seeded with annual grasses or other species that would not
32 require periodic fertilizing or application of other amendments. Following initial seeding, the
33 disturbed area would be allowed to revegetate naturally with native herbaceous and small shrub
34 species, largely approximating the cover types established on the existing ROW. Preventing
35 the future growth and development of large shrubs and trees would establish a permanent
36 corridor that would be maintained as grassland to ensure safety and facilitate visual inspection
37 of the ROW (Luminant 2009a).

38 The largely grassland types that would be affected contain no wetlands or habitat for threatened
39 or endangered species (Luminant 2009a). Field reconnaissance along the ROW in April and
40 July of 2007 failed to reveal any important species or habitats, including wetlands
41 (Luminant 2009a).

42 ***Minimizing Impacts***

43 Transmission line and water pipeline development would be addressed in an SWPPP and a spill
44 prevention plan as well as in the BMPs that are would be incorporated into those plans.
45 Measures used to maintain the transmission line ROWs after installation are discussed in
46 Section 5.3.1.2. The cooling water pipeline is not expected to require much vegetation
47 maintenance beyond occasional control of large trees and shrubs (Luminant 2009a). The new

1 ROWs would be subject to pre-disturbance investigations, possibly including, but not limited to,
2 reconnaissance to ascertain the presence or absence of plant species of special concern and
3 other important species and habitats defined in NUREG-1555 (NRC 2000) or as required by
4 Federal or State agency regulatory requirements (Luminant 2009a).

5 TPWD stated that it understands that the proposed transmission line ROW routes are
6 preliminary and subject to change. Therefore, the information TPWD has provided regarding
7 resources within the vicinity of the proposed new ROWs as discussed below would need to be
8 updated for the USACE permit action and State permit actions. TPWD and the USACE would
9 re-evaluate the assessment of potential impacts to rare resources and waters of the United
10 States (US) after specific routes are identified (TPWD 2009b).

11 Given the relatively small acreage that would actually be affected by construction and
12 preconstruction and the nature of the land that would be committed, impacts on terrestrial
13 resources from the expansion of the Whitney and DeCordova ROWs would be minor. Because
14 the cooling water pipelines would be installed in a previously disturbed area, most of which is
15 grassland, and the additional area that would be required for pipeline placement would be
16 disturbed only temporarily, impacts on terrestrial resources from placement of the cooling water
17 pipeline would be minimal.

18 **4.3.1.3 Important Terrestrial Species and Habitats**

19 ***Important Terrestrial Species – Site and Vicinity***

20 This section describes the potential construction and preconstruction related impacts to
21 important species, including commercially and recreationally valuable species, Federally
22 proposed, threatened, or endangered terrestrial species and State-listed species as well as
23 other ecologically important species resulting from building Units 3 and 4 at the CPNPP site and
24 the associated transmission line and cooling water pipeline ROWs. The potential impacts of
25 and preconstruction activities on these species are described in the following sections. There
26 are no areas designated as critical habitat in the vicinity of the CPNPP site.

27 Recreational hunting on the CPNPP property is not presently permitted. Any loss of
28 recreationally valuable species or their continuing unavailability to local hunters would have no
29 impact on opportunities for recreational hunting in the area. Thus, the impact to commercially
30 and recreationally valuable species would be negligible. Most species at the CPNPP are
31 common to the region; those rare species potentially present are more abundant elsewhere in
32 the region. There is no evidence suggesting that any species present is critical to the structure
33 or function at the ecosystem level or that any species might function as a true biological
34 indicator. Thus, there would be no impacts to critical and indicator species. With the exception
35 of the recreation areas, campgrounds, boating areas, and wildlife viewing sites in the vicinity of
36 the CPNPP listed in Table 2-8 and the wetlands discussed in Section 4.3.2, there are no
37 important terrestrial habitats on or in the immediate area of the site. Of these areas, Dinosaur
38 Valley State Park and Fossil Rim Wildlife Center are close enough to project activities that they
39 could potentially be affected by creation of a new ROW.

40 The Whitney ROW might pass very close to, or possibly through, a small portion of the
41 northwest corner of Dinosaur Valley State Park. Potential impacts of transmission line
42 establishment on a new ROW are discussed in Section 4.3.1.2. Recorded occurrences of two
43 Federally and State-listed endangered species—black-capped vireo and golden-cheeked
44 warbler—have been documented in Dinosaur Valley State Park (TPWD 2009b). Once the exact
45 location of the new right-of-way was determined, Oncor would coordinate with TPWD and U.S.
46 Fish and Wildlife Service (USFWS) to determine the potential for impacts to these species

1 would be undertaken as part of the environmental review process of ERCOT and the PUCT. It
 2 is likely that with adjustment of the ROW location, and tower placement and timing of project
 3 activities to avoid the breeding season of these species, impacts to them could be minimized
 4 (See Biological Assessment in Appendix F). The corridor location for the Whitney ROW as
 5 currently shown would also cross the Fossil Rim Wildlife Center. Examination of a map
 6 provided by TPWD suggests that there are no recorded occurrences in the Texas Natural
 7 Diversity Database (TXNDD) in the Fossil Rim Wildlife Center (TPWD 2009b).

8 Thus, other than for Dinosaur Valley State Park, construction and preconstruction at the CPNPP
 9 site and vicinity would have minimal impact on important habitat. Distance from the site to the
 10 other areas listed in Table 2-8 would provide a suitable buffer to any construction noise
 11 originating from the CPNPP site. The building of the Whitney transmission line near the
 12 Dinosaur Valley State Park could have noticeable effect on Federal and State-listed species and
 13 habitat. Oncor could adjust the timing of building and the location of the transmission lines
 14 within the proposed corridors to avoid adverse impacts to Federal and State-listed endangered
 15 species.

16 ***Federally Listed Species***

17 The only Federally listed terrestrial species with recorded occurrences within 10 mi of the
 18 CPNPP site and proposed new power transmission and cooling water pipeline ROWs are the
 19 endangered black-capped vireo and endangered golden-cheeked warbler (see Biological
 20 Assessment in Appendix F). Both of these species are also State listed as endangered
 21 (TPWD 2009b). These two species are the only Federally listed species that have been
 22 documented or are known to occur in Somervell County (USFWS 2006). They are discussed
 23 below.

24 **Black-capped vireo (*Vireo atricapillus*) (Federally and State-listed as endangered).**

25 Due to the absence of the black-capped vireo and suitable habitat on the CPNPP site, the
 26 potential for impacts to black-capped vireos due to project construction and preconstruction at
 27 the site would be negligible. However, the black-capped vireo is known to occur in Dinosaur
 28 Valley State Park, which lies within the corridor that would be used by Oncor to select a route
 29 for the Whitney transmission line, one of the transmission lines needed to serve the proposed
 30 new CPNPP units. The building of the Whitney transmission line near the Dinosaur Valley State
 31 Park could have a noticeable effect on the black-capped vireo. Oncor could adjust the timing of
 32 building and the location of the transmission lines within the proposed corridors to avoid any
 33 adverse impacts on the black-capped vireo.

34 **Golden-cheeked warbler (*Dendroica chrysoparia*) (Federally and State-listed as 35 endangered).**

36 This species is typically dependent on mature Ashe juniper habitat and various species of oak.
 37 Pair territory size is about 16.5 ac (Pulich 1976).

38 A survey conducted following USFWS protocol during breeding season in April and May 2008 to
 39 determine the presence or absence of golden-cheeked warblers in the peninsula area proposed
 40 for placement of the new cooling towers found neither golden-cheeked warblers nor habitat
 41 considered suitable (PBS&J 2008). The only patch of Ashe juniper forest with maturity and
 42 adequate hardwoods suitable to provide favorable golden-cheeked warbler habitat was 3.7 ac,
 43 which was considered by the investigators to be too small to support a breeding pair (PBS&J
 44 2008). In the BDTF area a habitat survey was performed in November 2007 and compared to a
 45 reference site where known golden-cheeked warbler populations exist. Additional site
 46 reconnaissance was performed on February 4, 2009. Both surveys indicated that favorable

1 golden-cheeked warbler habitat is absent from the area of the BDTF (Luminant 2009a). See the
2 Biological Assessment in Appendix F for further details.

3 Due to the absence of the golden-cheeked warbler and its favored habitat on the CPNPP site,
4 the potential for impacts to golden-cheeked warblers due to project development at the CPNPP
5 site would be minimal. However, the golden-cheeked warbler is known to occur in Dinosaur
6 Valley State Park, which lies within the corridor that would be used by Oncor to select a route
7 for the Whitney transmission line, one of the transmission lines needed to serve the proposed
8 new CPNPP units. The building of the Whitney transmission line near the Dinosaur Valley State
9 Park could have a noticeable effect on the golden-cheeked warbler. Oncor could adjust the
10 timing of building and the location of the transmission lines within the proposed corridors to
11 avoid any adverse impacts on the golden-cheeked warbler.

12 **State-Listed Species**

13 As explained in Section 2.4.1.3, State-listed and rare species potentially in the vicinity of the
14 CPNPP site, including the pipeline ROW and the proposed new power transmission ROWs,
15 include three bird, three reptile, and two plant species. Potential construction and
16 preconstruction impacts to these species, with the exception of black-capped vireo and golden-
17 cheeked warbler which are also Federally endangered and were discussed above, are
18 described below. Species considered are those with known occurrences in one or more of the
19 three counties potentially affected by the proposed CPNPP Units 3 and 4 project, including the
20 two proposed new transmission line ROWs (Somervell, Hood, and Bosque Counties). Also
21 considered are species without recorded occurrences, but that TPWD considers could be
22 present and impacted by the project when suitable habitat is present (TPWD 2007).

23 Site-specific information is not available for all of these species, and TPWD has commented that
24 absence of information about a species in an area of potentially suitable habitat does not mean
25 that the species is absent from the area (TPWD 2009b). Thus, TPWD recommends performing
26 onsite habitat surveys for the species, avoiding suitable habitat if found, developing minimization
27 and compensatory measures to reduce impacts when habitat cannot be avoided, and informing
28 construction crews to avoid disturbance of such species when found (TPWD 2009b).

29 Luminant has stated that in rare instances development activities might inadvertently encounter
30 special status wildlife species, their habitat, and vegetation, in which case work in the immediate
31 area would be halted and appropriate State agency officials and environmental consultants
32 would be contacted to determine proper mitigation measures so that work could resume.

33 **Fauna**

34 **Bald eagle (*Haliaeetus leucocephalus*) (State-listed as Threatened).** No large, deciduous
35 trees such as mature cottonwoods that might be capable of supporting a large eagle nest are
36 expected to be removed by development activities in either the Ashe juniper or mixed hardwood
37 woodlands at SCR or Lake Granbury. Locations for project activities away from SCR and Lake
38 Granbury are unlikely to provide favourable nesting habitat for bald eagles. Bald eagles
39 transiently visiting these locations would likely disperse to other locations while work activities
40 take place. Therefore, the proposed development activities are not expected to adversely affect
41 bald eagles.

42 **Texas garter snake (*Thamnophis sirtalis annectens*) (considered Rare by TPWD, but with
43 no regulatory listing).** According to NatureServe, there are no existing natural heritage
44 records of Texas garter snake occurrences for Hood, Somervell, or Bosque Counties
45 (NatureServe 2009). TPWD lists one occurrence within 10 mi of the proposed Whitney
46 transmission line ROW (TPWD 2009b). Because of the paucity of recorded sightings in the

1 project area and because disturbance could possibly be avoided by adjusting locations of power
 2 transmission line towers if the Texas garter snake was encountered during building, potential for
 3 impacts to this species would be minimal.

4 **Texas horned lizard (*Phrynosoma cornutum*) (State-listed as Threatened).** There are no
 5 recorded occurrences of Texas horned lizard within 10 mi of the CPNPP site or proposed new
 6 power transmission or pipeline ROWs (TPWD 2009b). The Texas horned lizard is typically
 7 associated with sandy and rocky soils and short or sparse vegetation. While its preferred food
 8 source, the harvester ant, was identified on the CPNPP site during directed field surveys, the
 9 ants were found in an area dominated by tall grass and forbs rather than the sparser habitat
 10 used by the horned lizard. No Texas horned lizards were found (Luminant 2009a). The
 11 potential for impacts to this species due to construction and preconstruction at the CPNPP or
 12 proposed power transmission or pipeline ROWs would be minimal.

13 **Timber (canebreak) rattlesnake (*Crotalus horridus*) (State-listed as Threatened).** There
 14 are no recorded occurrences of timber rattlesnakes within 10 mi of the CPNPP site or proposed
 15 new power transmission or pipeline ROWs (TPWD 2009b). This species was not observed on
 16 the site during field visits in 2007 (Luminant 2009a).

17 Timber rattlesnakes are most frequently associated with riparian and bottomland forest or
 18 partially wooded hillsides. Although no timber rattlesnakes were observed at the CNPP site,
 19 proposed building activities could potentially affect them in mixed hardwood habitat at the
 20 proposed locations of the new cooling towers and BDTF, and in such habitats along the
 21 transmission and pipeline ROWs.

22 Mechanical clearing in these areas may adversely affect small numbers of timber rattlesnakes
 23 through (1) direct mortality of those who fail to flee or are torpid when equipment is in use or (2)
 24 loss of habitat and food resources. Given the amount of similar habitat elsewhere at the
 25 CPNPP, this impact would be expected to be negligible, with little to no impact on populations of
 26 the rattlesnake elsewhere in the area.

27 **Comanche Peak prairie clover (*Dalea reverchonii*) (Considered Rare by TPWD, but with
 28 no regulatory listing).** This prairie clover is only known from about 20 occurrences within a
 29 very small geographic area in north-central Texas and is considered extirpated from the
 30 Comanche Peak area (NatureServe 2009). The single recorded occurrence of Comanche Peak
 31 prairie clover within 10 mi of the CPNPP site and proposed new power transmission or pipeline
 32 ROWs is more than 3 mi to the north of areas to be affected by project activities based on the
 33 map provided by TPWD (TPWD 2009f). There should therefore be no impacts to Comanche
 34 Peak prairie clover from project activities.

35 **Glen Rose yucca (*Yucca necopina*) (Considered Rare by TPWD, but with no regulatory
 36 listing).** Only one known occurrence of Glenn Rose yucca occurs on or near the CPNPP plant
 37 or associated transmission and cooling water pipelines. This occurrence is near the intake area
 38 of the proposed water pipeline (TPWD 2009b). If this Glen Rose yucca is encountered during
 39 pipeline placement, work in the immediate area would be halted and appropriate TPWD officials
 40 and environmental consultants would be contacted to determine proper mitigation measures so
 41 that work could resume (Luminant 2009a). With development of suitable mitigation, impacts to
 42 Glenn Rose yucca due to project activities, if any, would be minimal.

43 **Summary**

44 Based on threatened and endangered species surveys, historical records, life history
 45 information, known threatened and endangered species locations, and information provided by
 46 Luminant in the ER (Luminant 2009a) and in its RAI responses, the review team concludes that

1 the impacts on terrestrial Federally and State-listed threatened, endangered, and rare species
2 from construction and preconstruction activities on the CPNPP site and associated new power
3 transmission and cooling water pipeline ROWs would be negligible, and additional mitigation
4 beyond that stated above would not be warranted. However, the black-capped vireo and
5 golden-cheeked warbler are known to occur in Dinosaur Valley State Park, which lies within the
6 corridor that would be used by Oncor to select a route for the Whitney transmission line, one of
7 the transmission lines needed to serve the proposed new CPNPP units. The building of the
8 new transmission line near Dinosaur Valley State Park would have a noticeable effect on these
9 species or their habitat. Coordination with TPWD and U.S. Fish and Wildlife Service (USFWS)
10 to determine the potential for impacts to these species could be undertaken, and it is likely that
11 with adjustment of the ROW location, and tower placement and timing of project activities to
12 avoid the breeding season of these species, impacts to them could be minimized.

13 **4.3.1.4 Terrestrial Monitoring during Construction and Preconstruction**

14 During construction and preconstruction activities at the CPNPP site and along the expanded
15 power transmission and water pipeline ROW, monitoring would take place for the presence of
16 special-status wildlife habitats or vegetation (i.e., for areas used by USFWS- and TPWD-
17 protected species. In the event that any were located, work in the immediate area would be
18 halted, and appropriate Federal and State agency officials and environmental consultants would
19 be contacted to determine proper mitigation measures so that work could resume
20 (Luminant 2009a).

21 **4.3.1.5 Potential Mitigation Measures for Construction- and Preconstruction- Related** 22 **Terrestrial Impacts**

23 The existing CPNPP site environmental procedures and BMPs address regulatory and permit
24 requirements. Additional permit requirements might be developed by the USACE and/or State
25 agencies that address specific measures for mitigation of environmental impacts during the
26 building. Various types of environmental protection procedures for the construction and
27 preconstruction of CPNPP Units 3 and 4 were discussed in general in Section 4.3.1.1.

28 **4.3.1.6 Summary of Impacts to Terrestrial Resources during Construction and** 29 **Preconstruction Activities**

30 The impact of construction and preconstruction on wildlife habitat within the CPNPP site
31 (including permanent and temporary losses of Ashe juniper, mixed hardwood, and grassland
32 habitat) when compared with the total acreage of these cover types in the general area would
33 be minimal. Luminant would be required to comply with conditions of any permits, such as
34 Section 404 permits from the USACE, including any wetland mitigation discussed in Section
35 4.3.2.3. The potential onsite impact on wildlife populations would be minimal, and Luminant
36 would implement mitigation measures at the CPNPP site and within the transmission line and
37 cooling water pipeline ROWs, including BMPs for erosion and dust control, proper equipment
38 maintenance, and adherence to all applicable permit conditions. The review team reviewed the
39 potential impacts of developing Units 3 and 4 on terrestrial ecological resources on the CPNPP
40 site, including loss of habitat and wetlands, noise, traffic mortality, and avian collisions. Based
41 on information provided by Luminant, including the BMPs identified in the ER, and the review
42 team's independent evaluation, it concludes that the combined impacts of construction and
43 preconstruction activities for the proposed CPNPP Units 3 and 4 upon terrestrial ecosystems
44 would be SMALL to MODERATE, depending on the exact route ultimately selected for the
45 Whitney power transmission line. The potential for MODERATE impacts is due primarily to the
46 possibility of impacts to black-capped vireo and golden-cheeked warbler habitat from building of

1 that segment of the Whitney transmission line traversing Dinosaur Valley State Park. Further
 2 avoidance, minimization, and other mitigation measures might be required by other State or
 3 Federal agencies. For example, the Corps may require wetland mitigation as a stipulation for
 4 issuing the required Corps permit.

5 The Limited Work Authorization (LWA) rule (72 FR 57416) specifically states that transmission
 6 lines are not included in the definition of construction. Since onsite terrestrial resource impacts
 7 would be SMALL, and the MODERATE impacts are attributable only to transmission line
 8 development with respect to habitat for black-capped vireos and golden-cheeked warblers, NRC
 9 staff concludes that the impacts to terrestrial ecosystems from NRC authorized construction
 10 activities would be SMALL, and no further mitigation would be required.

11 **4.3.2 Aquatic Ecology and Wetlands Impacts Related to Construction and** 12 **Preconstruction**

13 Impacts to aquatic and wetlands resources, from construction and preconstruction activities for
 14 CPNPP Units 3 and 4 would mainly be associated with impacts to SCR from activities at the
 15 proposed site of Units 3 and 4 and to Lake Granbury from activities associated with installation
 16 of the makeup water intake and blowdown discharge structures. There also is a potential for
 17 aquatic impacts from the installation of new transmission line and pipeline ROWs across
 18 waterbodies. As discussed in Section 4.2.2.1, water withdrawals for CPNPP from the Wheeler
 19 Branch Reservoir and the Paluxy River during construction and preconstruction would result in
 20 only a very small reduction in flow in the Paluxy River at Glen Rose (0.3 percent of mean annual
 21 flow, 5 percent of the lowest recorded annual flow). Also, the installation of a pipeline to carry
 22 water from Wheeler Branch Reservoir to CPNPP would not cross or affect water resources.
 23 Thus, impacts on Wheeler Branch Reservoir and the Paluxy River from construction and
 24 preconstruction activities for CPNPP Units 3 and 4 would be negligible and are not further
 25 evaluated below. All work would be conducted in accordance with applicable regulatory
 26 permits, including Section 10 of the Rivers and Harbors Act and Section 404 of the CWA.

27 **4.3.2.1 Aquatic Resources and Wetlands – Site and Vicinity**

28 ***Impacts of Construction and Preconstruction on Squaw Creek Reservoir***

29 The construction and preconstruction activities associated with CPNPP Units 3 and 4 and
 30 related facilities are described in detail in Section 3.3.1. Building of the power plant facilities
 31 would not result in the loss of aquatic habitat in SCR, though impacts on the aquatic resources
 32 of SCR could potentially result from soil erosion and other runoff from building activities. If
 33 stormwater erodes exposed soil from the areas being developed and runoff carries it into the
 34 lake, the resulting sedimentation and turbidity could adversely affect the aquatic community in
 35 the adjacent area of the reservoir. However, an SWPPP would be developed and implemented
 36 prior to site clearing and other construction and preconstruction activities to substantially reduce
 37 or eliminate such erosion-related impacts. In accordance with the SWPPP, BMPs would be
 38 implemented, including the installation and maintenance of silt fencing, the maintenance of
 39 vegetated buffer zones between SCR and areas undergoing development, and the diversion of
 40 runoff to sediment retention basins (Luminant 2009a).

41 There would be no modifications to the existing intake and discharge structures on SCR,
 42 development related to the proposed Units 3 and 4 would not occur in the water, and a
 43 vegetated buffer zone would be maintained between the shoreline and areas undergoing
 44 development. As a result, noise from development activities would not be expected to affect
 45 aquatic biota in SCR. Any noise transmitted through the water would likely be attenuated
 46 sufficiently to prevent physiological damage to aquatic biota, and if noise was to reach stressful

1 levels near the site, fish and other motile species would be able to leave the area and avoid its
2 effects.

3 As a result of the management practices and development plans described above, the building
4 of the proposed CPNPP Units 3 and 4 facilities would be unlikely to adversely affect the aquatic
5 ecosystem of SCR. The review team concludes that the impacts of construction and
6 preconstruction activities on aquatic resources in SCR would be minimal and that additional
7 mitigation beyond the practices described above would not be warranted.

8 ***Impacts of Construction and Preconstruction on Streams, Ponds, and Wetlands at the***
9 ***Site***

10 No perennial streams that flow into SCR are located in the vicinity of the CPNPP site. Only a
11 small, intermittent stream located between the power plant area and the cooling tower area
12 would be affected (Figure 2-13). Except during wet periods, the rocky bed of this stream is
13 almost completely dry, with only a few small pools retaining water. The stream originates near
14 the main road through the existing facility and flows approximately 1600 ft down a forested
15 hillside before entering a small (0.78 ac), littoral, wetland community that has developed at the
16 mouth of the stream where it joins SCR. This stream would be considered subject to USACE
17 Section 404 jurisdiction (Enercon 2009). Based on current site plans, this stream would be
18 entirely within the footprint of the proposed facility (Enercon 2009). As a result, the stream
19 channel would be filled by development of the site. Current plans indicate that about 0.3 mi of
20 the intermittent stream would be replaced with a pipe and covered with fill (Enercon 2009).
21 However, given its small size, intermittent flow, and minimal aquatic community, development of
22 this stream drainage would not result in a substantial ecological impact and would not noticeably
23 affect the aquatic community of SCR.

24 As described in Section 2.4.3.1, only two of the 48 wetlands delineated on the CPNPP site lie
25 within construction and preconstruction areas and, thus, would be directly affected by the
26 addition of Units 3 and 4 at CPNPP (Figure 2-13) (Enercon 2009). These two wetlands together
27 constitute less than 2 percent of the wetland area at the CPNPP site. One of these wetlands is
28 the 0.78-ac littoral wetland at the mouth of the intermittent stream described above
29 (Figure 2-17). This wetland would be subject to the jurisdiction of the USACE (Enercon 2009).
30 Given its location along the shoreline of the lake, the hydrology of this wetland is likely
31 determined mainly by SCR water levels. However, increases in impervious surfaces associated
32 with development in the watershed of the intermittent stream may increase the magnitude of
33 storm flows and increase erosion of the stream's banks as it passes through the wetland, which
34 could further reduce its area and functionality. In addition, current plans show about half of the
35 area of this wetland being graded and filled (Enercon 2009). USFWS requested that this
36 wetland area be isolated from the development area by surrounding it with a 100-ft buffer to (1)
37 protect potential golden-cheeked warbler habitat in the area, (2) provide a wildlife corridor, and
38 (3) provide an additional vegetative filter to minimize the effects of runoff on existing water
39 quality (USFWS 2009). The plans as drawn do not provide sufficient area for the establishment
40 of the buffer. If these plans become final, mitigation measures (such as onsite or offsite
41 compensation through creation of additional wetland area), which would be considered by
42 USACE as part of the Section 404 permitting process necessary for building activities, may be
43 required.

44 Within the area where the BDTF would be built immediately south of SCR (Figure 2-13), there
45 are two streams that drain northeast to enter Squaw Creek below the reservoir dam. Some
46 portions of these streams have defined banks and a high-water mark and appear to be
47 intermittent, but in other portions these characteristics are undefined. Based on interpretation of
48 information reported in Enercon (2009), the current conceptual design for the BDTF indicates

1 that approximately 1.5 mi of these drainages may be within the footprint of the BDTF facility.
2 USACE jurisdiction concerning these streams has not been determined. Also within the BDTF
3 footprint and upgradient of these drainages is an old livestock pond that is isolated
4 (Enercon 2009), very small (less than 1 ac), and essentially unvegetated. Given the intermittent
5 flow of these streams, the small size of the streams and pond, and their minimal aquatic
6 communities, development of this area would not result in a substantial ecological impact.
7 Impacts to these aquatic features would not noticeably affect the downstream aquatic
8 community of Squaw Creek.

9 Building of the proposed CPNPP Units 3 and 4 facilities would be likely to result in the filling of
10 several small aquatic resources within the footprint of the proposed facility adjacent to SCR.
11 However, based on the small sizes of the potentially affected intermittent streams, wetlands,
12 and stock pond and the minimal aquatic communities they support, the review team concludes
13 that the impacts of construction and preconstruction activities on these aquatic resources would
14 be minimal. Additional mitigation beyond the BMPs in the SWPPP likely would be required by
15 the USACE in conjunction with permitting under CWA Section 404 of the development activities
16 affecting these streams and wetlands. The overall cumulative impacts to waters of the United
17 States from these activities would be considered by USACE as part of the permitting process.

18 ***Impacts of Construction and Preconstruction on Lake Granbury***

19 The installation of the intake and discharge structures would result in the loss of aquatic habitat
20 in Lake Granbury. The construction and preconstruction activities associated with the intake
21 and discharge structures are described in detail in Section 3.3.1. These activities would affect
22 limited areas and sediment volumes and would be conducted in accordance with USACE permit
23 requirements.

24 The proposed location of the intake structure is on the southwest bank of Lake Granbury
25 approximately 75 ft upstream of the existing intake and pumping station for CPNPP Units 1 and
26 2 makeup water (Luminant 2010) and approximately 7200 ft (1.3 mi) upstream of the
27 DeCordova Bend Dam. The intake screens would be located approximately 110 ft from shore
28 at a depth of approximately 34 ft at a location where the depth of the lake is approximately 40 ft
29 (Luminant 2009a). The intake structure (Figure 3-4) is expected to be approximately 80 ft long
30 by 40 ft wide, resulting in a footprint of about 3200 sq ft (0.07 ac) (Luminant 2010). The design
31 of the discharge structure is expected to include two multiport diffuser pipes, each 82 ft long with
32 18 diffuser nozzles angled at 30 degrees from vertical in the downstream direction (Luminant
33 2010). The discharge structure would be installed on the bottom of the reservoir approximately
34 900 ft upstream of the dam (Luminant 2009a). The pipes would be installed using one of three
35 options: buried beneath the lake bottom, resting on the lake bottom and covered by riprap, or
36 strapped to concrete supports placed on the lake bottom (Figure 3-5). Each option would affect
37 the same area of lake bottom, which would have a width approximately three times the diameter
38 of each pipe, resulting in a footprint for each pipe about 12 ft wide by 82 ft long (Luminant 2010)
39 and covering 984 sq ft. The total area covered by both discharge pipelines would be
40 approximately 0.05 ac (Luminant 2010).

41 The benthic habitat within the footprints of the intake and discharge structures would be
42 permanently lost. However, these areas would be very small in comparison to the large area of
43 the lower portion of the reservoir. In addition, the benthic community in this area is limited in
44 abundance and diversity, and the fish community of the reservoir is not dependent on this area
45 for spawning or other needs. Increases in turbidity and settling/deposition of suspended
46 sediment are expected to occur during development in the immediate vicinity of the proposed
47 intake and discharge structures. These impacts would be temporary and localized, affecting a
48 relatively very small area of Lake Granbury only during the period of construction and

1 preconstruction. Cofferdams would be installed around the in-water work areas, further limiting
2 the potential for sediment disturbance and impacts beyond the footprint areas. Given the close
3 proximity of the existing CPNPP Units 1 and 2 makeup water intake downstream of the
4 proposed intake for Units 3 and 4, there is a potential for benthic invertebrates that may be
5 suspended with the disturbed sediments to be transported to the existing intake and entrained
6 or impinged on the screens during the temporary period of disturbance. However, the benthic
7 macroinvertebrate community in this area consists predominantly of small, common species of
8 insect larvae (flies and midges), and the occurrence of such entrainment/impingement effects
9 would not substantially reduce their populations.

10 Building of the onshore components of the intake and discharge structures would not result in
11 the loss of aquatic habitat in Lake Granbury. Development-related impacts on the aquatic
12 resources of the reservoir could potentially result from soil erosion and other runoff during
13 building activities. If stormwater erodes exposed soil from the areas being developed and runoff
14 carries it into the lake, the resulting sedimentation and turbidity could adversely affect the
15 aquatic community in the adjacent area of the lake. However, an SWPPP would be developed
16 and implemented prior to site clearing and other construction and preconstruction activities to
17 substantially reduce or eliminate such erosion-related impacts. In accordance with the SWPPP,
18 BMPs would be implemented, including the installation and maintenance of silt fencing, the
19 maintenance of vegetated buffer zones between the lake shore and development areas where
20 possible, and the possible diversion of runoff to sedimentation basins.

21 Because facilities would be installed within Lake Granbury and on the shoreline, there would be
22 the potential for aquatic organisms to be adversely affected by related noise. Hearing
23 impairments caused by loud activities, such as pile driving, have been shown to reduce some
24 fishes' abilities to locate prey, increase their risk of predation, and possibly reduce their
25 reproductive success (Hastings and Popper 2005). However, activities generating loud
26 underwater noise would be very localized and temporary, and fish could readily avoid proximity
27 to the source. Information on the effects of noise on aquatic invertebrates is extremely limited,
28 and the invertebrate community of the lake in this area is characterized by a limited diversity
29 and abundance of species, most of which are common insects. Although some individual fish or
30 aquatic invertebrates could suffer injury or mortality due to development-related activities and
31 noise, the number of individuals affected would likely be very small, and populations would be
32 essentially unaffected because most species could quickly move away from the area to suitable
33 habitat elsewhere in the reservoir. Thus, noise resulting from the installation of these facilities
34 would not be expected to have a substantial impact on aquatic biota in Lake Granbury.

35 As a result of these management practices, the installation of the proposed intake and
36 discharge structures would be unlikely to adversely affect aquatic ecosystems. The review
37 team concludes that the impacts of construction and preconstruction activities on aquatic
38 resources in Lake Granbury would be minimal and that additional mitigation may be required by
39 the USACE permit.

40 **4.3.2.2 Aquatic Resources and Wetlands – Transmission Lines and Cooling Water** 41 **Pipelines**

42 The proposed new transmission lines and potentially affected aquatic resources, including
43 wetlands, are described in Section 2.4.2.2. Of the five new transmission lines proposed, three
44 would be added to vacant positions on existing towers within existing ROWs and would not
45 require new tower installation or ROW clearing that could impact aquatic resources. The other
46 two lines would require the clearing of new ROWs and the installation of new towers. The
47 DeCordova line would extend approximately 17 mi northeast to the DeCordova switching station

1 on the west bank of Lake Granbury, and the Whitney line would extend approximately 45 mi
2 southeast to the Whitney switching station below the Lake Whitney dam (Figure 2-14).

3 The DeCordova transmission line would likely cross Squaw Creek and several inlets along the
4 shoreline of SCR, the Brazos River, and Lake Granbury (Figure 2-14). The entire length of the
5 DeCordova ROW would parallel an existing ROW, so existing culverts or other infrastructure at
6 stream crossings within that ROW could be used during installation and long-term maintenance
7 of the new, parallel ROW (Luminant 2010). The Whitney transmission line would likely cross
8 only one major waterbody, the Paluxy River, and several small tributaries of the Brazos River
9 and Lake Whitney (Figure 2-14). The initial 18-mi segment of the Whitney line, from CPNPP
10 south to where the line turns east near the town of Walnut Springs in northern Bosque County,
11 would require the clearing and preparation of new ROW. This segment of ROW would cross
12 approximately nine intermittent streams at 23 locations and the Paluxy River at one location
13 (Table 4-3). In order to facilitate access for installation and long-term maintenance, culverts
14 likely would be installed at the stream crossings. At the Paluxy River, however, existing bridges
15 and crossings could be used and no additional culverts or bridges would be needed. The
16 remaining 27 mi of the Whitney line would parallel an existing transmission line ROW from
17 Walnut Springs to Whitney. Where the widened ROW crosses streams in this 27 mi segment,
18 existing stream crossings within the existing ROW would be used and no new bridges or
19 culverts would be required (Luminant 2010). The total area of intermittent stream channel that
20 may be affected by culvert installation along the Whitney line is estimated at approximately 0.5
21 ac (Table 4-3). This estimate is expected to be conservative because it is unlikely that a culvert
22 would be needed at every stream crossing.

23 The wetland areas that may be crossed by these two lines are relatively small, about 23 ac for
24 Whitney and 1.6 ac for DeCordova, together composing less than 2.5 percent of the vegetated
25 acreage crossed (Table 2-11). Because tower locations can be adjusted based on terrain, it is
26 likely that towers could be located entirely outside the limited wetland areas that may be
27 included within the ROWs. However, there is the possibility that limited areas of wetland within
28 the ROWs could be affected by the installation and use of access roads.

29 The potential for installation of these transmission lines to affect aquatic resources would be
30 principally associated with the potential for soil erosion and stormwater runoff to cause
31 sedimentation impacts in adjacent waterbodies and wetlands. However, an SWPPP would be
32 implemented prior to construction to substantially reduce or eliminate such erosion-related
33 impacts. In accordance with the SWPPP, BMPs would be implemented, including the
34 installation and maintenance of silt fencing and the maintenance of vegetative buffer zones
35 between areas being cleared and potentially affected waterbodies and wetlands. As a result of
36 these management practices, the installation of the proposed transmission lines would be
37 unlikely to adversely affect aquatic ecosystems and wetlands. If it is determined that impacts on
38 wetlands or streams potentially would result from proposed transmission line installation
39 activities, USACE would be consulted in advance. If any USACE jurisdictional waters would be
40 affected, mitigation may be required.

41 The cooling water intake and blowdown discharge pipelines for the proposed CPNPP Units 3
42 and 4 mainly would follow an existing ROW containing the 48-in. water pipeline for Units 1 and 2
43 that connects Lake Granbury to SCR (Figure 2-5). Although the new pipelines would be
44 installed within the existing 50-ft-wide pipeline ROW, a corridor up to 125 ft wide may be
45 disturbed during installation (Luminant 2009a). ROWs for the new pipelines would diverge from
46 the existing ROW at each end: where they would extend around the south side of SCR, and
47 where the discharge pipeline would extend southeast from the intake location on Lake Granbury
48 to the discharge location near the dam. Aquatic resources within the ROW areas where the
49 pipelines potentially would be installed include stock ponds, several small tributaries of the

1 Brazos River and Squaw Creek. A field survey of the pipeline ROW found no wetlands present
2 (Luminant 2009a). The stock ponds are small, isolated, man-made impoundments that provide
3 minimal habitat for aquatic species.

4 The pipeline ROW would cross approximately seven intermittent streams at ten locations and
5 Squaw Creek, which flows continually below the SCR dam, at one location (Table 4-4). In order
6 to prevent or minimize disturbance of stream beds and riparian zones, tunneling would be used
7 to install the pipelines at all stream crossings. In addition, infrastructure currently present to
8 allow vehicles to cross streams in the existing pipeline ROW would be used during new pipeline
9 installation and long-term maintenance (Luminant 2010). The tributaries are intermittent
10 streams (HDR 2008), which typically lack surface flow during dry periods and support minimal
11 aquatic communities. Squaw Creek immediately below the dam is a small stream in which a
12 minimum flow of 1.5 cfs is maintained by routine discharges from the dam (Luminant 2009a).
13 Assuming the methods described above are used and that BMPs would be employed to
14 minimize impacts from sediment transport into the waterbodies, there would be minimal adverse
15 impacts on aquatic resources from pipeline installation.

16 The review team concludes that the impacts of transmission line, pipeline, and ROW
17 preconstruction activities on aquatic resources and wetlands would be minimal and that
18 additional mitigation beyond the practices described may be required in the USACE permit.

19 **4.3.2.3 Important Aquatic and Wetlands Species and Habitats**

20 This section describes the potential effects on important aquatic and wetlands species and their
21 habitats, including recreationally important fishes and the forage fishes on which they feed, and
22 Federally or State listed threatened or endangered aquatic species that may result from building
23 the proposed CPNPP Units 3 and 4 and associated new transmission line and pipeline ROWs.
24 The biology and life histories of important species are presented in Section 2.4.2.4. The
25 nonnative and nuisance species discussed in Section 2.4.2.4 can have important ecological
26 effects, which are predominantly adverse, but these species would not be affected by
27 construction and preconstruction activities. The potentially affected wetland habitats are small,
28 of limited value, and are not critical to important aquatic species. The potential impacts of
29 construction and preconstruction activities on important aquatic species of the potentially
30 affected water bodies are described in the following sections.

1

Table 4-3. Stream crossings within the 18-mi segment of new ROW for the Whitney transmission line

Stream Crossing ID	Stream Name	Stream Type	Estimated Stream Width (ft)	Affected Area (ac) ⁽¹⁾
TSC-1	Panther Branch	intermittent	40	0.02
TSC-2	unnamed	intermittent	40	0.02
TSC-3	Opossum Branch	intermittent	40	0.02
TSC-4	Opossum Branch	intermittent	40	0.02
TSC-5	Opossum Branch	intermittent	40	0.02
TSC-6	Opossum Branch	intermittent	40	0.02
TSC-7	Opossum Branch	intermittent	40	0.02
TSC-8	Opossum Branch	intermittent	40	0.02
TSC-9	Paluxy River	river	⁽²⁾	⁽²⁾
TSC-10	unnamed	intermittent	40	0.02
TSC-11	Bowden Branch	intermittent	40	0.02
TSC-12	Bowden Branch	intermittent	40	0.02
TSC-13	Bowden Branch	intermittent	40	0.02
TSC-14	Barker Branch	intermittent	40	0.02
TSC-15	Barker Branch	intermittent	40	0.02
TSC-16	Barker Branch	intermittent	50	0.02
TSC-17	Barker Branch	intermittent	40	0.02
TSC-18	Barker Branch	intermittent	40	0.02
TSC-19	South Fork Hill Creek	intermittent	40	0.02
TSC-20	South Fork Hill Creek	intermittent	50	0.02
TSC-21	Mustang Creek	intermittent	40	0.02
TSC-22	Mustang Creek	intermittent	40	0.02
TSC-23	Steele Creek	intermittent	90	0.04
TSC-24	Steele Creek	intermittent	110	0.05
Total Affected Acreage from Culvert Installation at Stream Crossings				0.51

(1) Based on assumption that a culvert of length 20 ft would be installed at each stream crossing: affected area = stream width x culvert length. Stream widths were estimated using topographic maps and aerial photographs. The actual affected area of streambeds may be lower than the estimate because a culvert is unlikely to be needed at every stream.

(2) Existing bridges and crossings will be utilized at the Paluxy River crossing, so a culvert is not expected to be needed.

Source: Luminant 2010

Table 4-4. Stream crossings for the new pipelines to be installed in the existing ROW between CPNPP and Lake Granbury

Stream Crossing ID	Stream Name	Stream Type	Estimated Stream Width (ft)	ROW Area at Stream Crossing (ac) ⁽¹⁾
PSC-1	unnamed	intermittent	40	0.05
PSC-2	unnamed	intermittent	40	0.05
PSC-3	unnamed	intermittent	40	0.05
PSC-4	unnamed	intermittent	40	0.05
PSC-5	unnamed	intermittent	40	0.05
PSC-6	unnamed	intermittent	40	0.05
PSC-7	Squaw Creek	intermittent ⁽²⁾	50	0.06
PSC-8	Panther Branch	intermittent	40	0.05
PSC-9	Panther Branch	intermittent	40	0.05
PSC-10	Panther Branch	intermittent	40	0.02
PSC-11	Panther Branch	intermittent	40	0.02
Total Pipeline ROW Acreage at Stream Crossings				0.56

(1) ROW area at each stream crossing = estimated stream width x ROW width. Width of existing ROW is 50 ft.

(2) Squaw Creek is depicted as an intermittent stream on the topographic map; however, its flow is perennial downstream of the SCR dam in the area of the proposed pipeline crossing.

Source: Luminant 2010

1 Recreational Fishery and Forage Species

2 Although SCR was stocked with fish and opened for public fishing soon after its completion,
 3 fishing by the public was banned in SCR for security reasons in September 2001. CPNPP
 4 employees and certain invited groups were allowed to fish from the banks of SCR, but boats
 5 were not permitted (Luminant 2009a). SCR has been reopened to the public for full recreational
 6 uses, including fishing and boating, but access will be controlled. There would be no in-water
 7 facilities installed on SCR in conjunction with CPNPP Units 3 and 4, so the recreational fishery
 8 and forage fish populations of the reservoir would not be affected.

9 Water-based recreation is among the uses for which Lake Granbury is operated by the Brazos
 10 River Authority. The overall fishing opportunities provided by Lake Granbury are rated by
 11 TPWD as good for largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*),
 12 white bass (*M. chrysops*), channel catfish (*Ictalurus punctatus*), and sunfish (*Lepomis* spp.) and

1 fair for white crappie (*Pomoxis annularis*) (TPWD 2009a). Lake Granbury populations of game
 2 fish and forage fish, such as threadfin shad (*Dorosoma petenense*) and gizzard shad
 3 (*D. cepedianum*), have been reduced annually since 2001 by toxic blooms of golden alga
 4 (*Prymnesium parvum*). Stocking has been used to mitigate the losses of striped bass and
 5 largemouth bass (Baird and Tibbs 2006). Relatively small areas of habitat potentially used by
 6 these or other fishery and forage species in Lake Granbury would be lost due to installation of
 7 the proposed intake and discharge structures upstream from the dam. These species are
 8 mobile and could avoid areas where construction and preconstruction activities and associated
 9 effects, including noise, are occurring. Use of erosion prevention and stormwater management
 10 practices in areas adjacent to SCR and Lake Granbury would prevent or minimize the potential
 11 for sediment-related effects on fishes. Accordingly, the review team concludes that impacts on
 12 important fishery and forage species from construction activities associated with CPNPP Units 3
 13 and 4 would be minimal.

14 ***Aquatic and Wetlands Threatened and Endangered Species***

15 As discussed in Section 2.4.2.4, Federally listed aquatic species are not known or likely to occur
 16 in SCR or Lake Granbury or in the stream segments or wetlands that would be crossed by the
 17 proposed new transmission lines. Consequently, the potential for Federally listed aquatic
 18 species to be affected by activities related to facility development would be negligible. The
 19 Brazos water snake (*Nerodia harteri*) is the only State-listed aquatic species with recorded
 20 occurrences in the counties potentially affected by the proposed CPNPP Units 3 and 4 facilities
 21 (Somervell and Hood Counties) or the two proposed new transmission line ROWs (Somervell,
 22 Hood, and Bosque Counties).

23 The Brazos water snake has a State listing status of threatened. This status has been
 24 attributed to its limited range and specific habitat requirements (McAllister and Bursey 2008).
 25 Threats to the species' range and distribution include dams, which can inundate streams and
 26 reduce available riverine habitat. However, the standing waterbodies that result from such
 27 barriers may also provide suitable habitat for this snake. According to the Rare Resource
 28 Occurrences database maintained by the TPWD (TPWD 2009c), three Brazos water snakes
 29 were sighted within 10 mi of the proposed CPNPP Units 3 and 4 site between 1984 and 1989.
 30 In addition, a study by McAllister and Bursey (2008) reported that a total of seven individuals of
 31 this species (juveniles and adults) were collected in Somervell County in July 1987 and between
 32 May and July 1988. Although the Brazos water snake has historically occurred in Somervell,
 33 Hood, and Bosque Counties, review of available data from the Texas Natural Diversity
 34 Database indicated that there have been no reported observations of this species in the vicinity
 35 of the proposed CPNPP Units 3 and 4 in more than 20 years.

36 The shoreline of SCR would not be substantially affected by the proposed development
 37 associated with Units 3 and 4, and the area of shoreline on Lake Granbury that would be
 38 affected by installation of the intake structure and discharge pipeline would be very small
 39 compared to the available shoreline of the reservoir. The BMPs that would be employed to
 40 minimize or prevent sediment-related impacts on water quality would prevent impacts on the
 41 populations of small forage fishes on which the Brazos water snake would potentially feed. In
 42 addition, snakes are highly mobile and able to avoid areas of activity related to the building of
 43 facilities. Therefore, it is unlikely that this snake currently inhabits the area of Lake Granbury
 44 where these activities would occur, and if present, it is unlikely that the snake would be
 45 adversely affected during the development period.

46 Three species of freshwater mussels that are State-listed as threatened are designated by
 47 TPWD as potentially occurring or having been recorded in at least one of the three counties in
 48 which proposed facilities would be located: the Texas fawnsfoot (*Truncilla macrodon*) in Hood,

1 Somervell, and Bosque Counties; and the false spike mussel (*Quincuncina mitchelli*) and
2 smooth pimpleback (*Quadrula houstonensis*) in Bosque County. Two other mussels, the
3 pistolgrip (*Tritogonia verrucosa*) and rock pocketbook (*Arcidens confragosus*), are State species
4 of concern designated by TPWD as potentially occurring or having been recorded in all three of
5 the counties in which proposed facilities would be located (TPWD 2010a, 2010b, and 2010c).

6 The Texas Natural Diversity Database includes no reported observations of any of these
7 mussels within 10 mi of the proposed CPNPP Units 3 and 4 or the proposed new transmission
8 line ROWs (TPWD 2009c). The false spike mussel possibly has been extirpated in Texas
9 (TPWD 2010b). Although habitats supportive of all five species potentially could be present in
10 the Brazos River between Lake Granbury and Lake Whitney, these mussels are not known to
11 occur in this river segment and were not found in recent biological surveys at a location
12 downstream of the DeCordova Bend Dam (Bio-West 2008). Although the smooth pimpleback
13 and rock pocketbook may occur in reservoirs, they have not been reported in recent surveys of
14 invertebrate organisms in Lake Granbury and SCR. Thus, none of the five species of mussels
15 is likely to occur in Lake Granbury or SCR, which is where construction or preconstruction
16 activities potentially could affect benthic invertebrates, and these activities would not occur in
17 the river.

18 An additional species designated as a State species of concern with the potential to occur in
19 Bosque County is the Guadalupe bass (*Micropterus treculii*) (TPWD 2010a). The Guadalupe
20 bass utilizes habitats with flowing water, preferring downstream segments of small streams, and
21 it would not occur in reservoirs such as Lake Granbury or SCR. The range of the Guadalupe
22 bass is limited to the northern and eastern parts of the Edwards Plateau region of south-central
23 Texas, including portions of the Brazos River drainage well downstream of Lake Whitney, such
24 as the Lampasas, Leon, and Little Rivers (Lee et al. 1980). Thus, the Guadalupe bass does not
25 occur in the Brazos River drainage in Hood or Somervell Counties, and review of available
26 records in the Texas Natural Diversity Database indicates that its last reported observation
27 within 10 mi of the proposed new CPNPP Units 3 and 4 transmission line ROWs in Bosque
28 County was in 1979 (TPWD 2009c). Consequently, the Guadalupe bass would not be likely to
29 occur in these reservoirs or the Brazos River above Lake Whitney and would not be affected by
30 construction or preconstruction activities on the reservoirs. Based on threatened and
31 endangered species surveys, historical records, life history information, known species
32 occurrence locations, and information provided by Luminant (Luminant 2009a) and responses to
33 request for additional information (RAI) responses, the review team concludes that the impacts
34 on aquatic Federally or State-listed threatened and endangered species from construction and
35 preconstruction activities associated with CPNPP Units 3 and 4 would be minimal.

36 **4.3.2.4 Monitoring of Aquatic Ecosystems and Wetlands during Development**

37 Luminant does not plan to conduct formal development-related monitoring of aquatic and
38 wetlands ecosystems due to the small potential for adverse impacts. The potential presence of
39 protected species in aquatic/wetland habitats affected by development would be monitored. In
40 the event that such a species was found to be present, work in the immediate area would be
41 halted, and appropriate Federal and State agency officials and environmental consultants would
42 be contacted to determine proper mitigation measures so that work could resume
43 (Luminant 2009a). In addition, monitoring and reporting requirements as specified in USACE
44 permits would be applicable.

1 **4.3.2.5 Potential Mitigation Measures for Development-Related Aquatic Ecology and**
 2 **Wetlands Impacts**

3 Upon completion of the final design for CPNPP Units 3 and 4, associated impacts to aquatic
 4 and wetlands resources would be evaluated, and appropriate permitting would be obtained from
 5 the USACE prior to construction or preconstruction activities. USACE coordination would
 6 include analysis of the identified impacts and a functional assessment of the proposed
 7 mitigation plan to ensure in-kind replacement of lost resources according to each design
 8 alternative (Luminant 2009a). The analysis would include how each project alternative was
 9 designed to avoid, minimize, and compensate for impacts to the aquatic resources. Impacts
 10 would be offset through the development of a USACE approved compensatory mitigation plan
 11 for the final design as part of the Section 404 permitting process.

12 **4.3.2.6 Summary of Impacts to Aquatic and Wetlands Resources during Construction**
 13 **and Preconstruction**

14 The review team reviewed the proposed construction and preconstruction activities for CPNPP
 15 Units 3 and 4 and the potential impacts to aquatic biota in the affected waterbodies and
 16 wetlands. Any impacts that would occur would be temporary and largely mitigable;
 17 compensatory mitigation may be required by the USACE permit. Based on this information,
 18 information provided by Luminant, and the review team's independent evaluation, the review
 19 team concludes that the impacts of construction and preconstruction activities for the proposed
 20 CPNPP Units 3 and 4 upon aquatic resources would be SMALL and that further mitigation
 21 beyond the actions stated above and arising from USACE permits would not be warranted.

22 The NRC staff concludes that essentially all impacts to aquatic resources would be from
 23 preconstruction activities. Therefore, the NRC staff concludes that the impacts to aquatic
 24 ecosystems from NRC-authorized construction activities would be SMALL, and no further
 25 mitigation would be warranted.

26 **4.4 Socioeconomic Impacts**

27 Building activities at CPNPP Units 3 and 4 could affect individual residents and communities in
 28 the surrounding region. Although the review team considered the entire 50-mi CPNPP region
 29 when assessing socioeconomic impacts, as described in Section 2.5, the primary Economic
 30 Impact Area (EIA) would be the six-counties in which more than 96 percent of the current
 31 CPNPP workforce resides: Somervell, Hood, Bosque, Erath, Johnson, and Tarrant Counties.

32 The review team reviewed the ER prepared by Luminant and verified the data sources used in
 33 its preparation by examining cited references. The review team requested clarifications and
 34 additional information from Luminant where needed to verify data in the ER. Unless otherwise
 35 specified in the following sections, the review team has drawn upon verified data from
 36 Luminant's ER and responses to requests for additional information. Where the review team
 37 used different analytical methods or additional information for its own analysis, the following
 38 sections include explanatory discussions and citations for additional sources.

39 **4.4.1 Physical Impacts**

40 Building activities at CPNPP Units 3 and 4 would cause temporary and localized physical
 41 impacts such as noise, odors, vehicle exhaust, and dust. Vibration and shock impacts are not
 42 expected because of the strict control of blasting and other shock-producing activities. This
 43 section addresses the physical impacts that could affect people, buildings, and roads. Section

1 4.4.2 addresses the potential impacts of building-related population growth, jobs, incomes, and
2 taxes on the EIA.

3 **4.4.1.1 Workers and the Local Public**

4 As discussed in Section 2.5.1.1, the area near the CPNPP site is rural, with a relatively low
5 population density. The 2007 estimated population within 5 mi of the CPNPP site was only
6 3530 individuals, with a population density of 45 people per square mile.

7 People in the project area who could be vulnerable to noise, fugitive dust, and gaseous
8 emissions resulting from building activities at CPNPP Units 3 and 4 are listed below in order of
9 most vulnerable to least vulnerable.

- 10 • Workers on the site.
- 11 • People working or living immediately adjacent to the CPNPP site.
- 12 • Transient populations such as temporary employees, recreational visitors, and tourists.

13 Workers within the CPNPP site boundary would experience the most direct physical impact
14 related to building activities. However, the workers would have adequate training and personal
15 protective equipment to minimize the risk of potentially harmful exposures. Emergency first-aid
16 care would be available at the site, and regular health and safety monitoring would be
17 conducted. These activities would be performed in compliance with local, State, and Federal
18 regulations and site-specific permit conditions. Reasonable efforts would be taken to make
19 transient populations aware of the potential impacts of building activities.

20 Approximately 675 ac of the CPNPP site would be disturbed to build Units 3 and 4. Most of the
21 disturbance would occur on previously disturbed areas or ones that are currently forested.
22 Offsite work would include developing the transmission line ROWs and of the water pipeline
23 from Lake Granbury. Building activities would result in elevated noise and dust levels and traffic
24 on roads. In addition to dust, construction equipment would increase local air pollution
25 emissions. Blasting to remove native rock could result in both noise and shock impacts.
26 Erection of cranes and buildings might affect the aesthetic qualities of the community.

27 **4.4.1.2 Buildings**

28 Building activities would not be likely to affect any offsite buildings, primarily due to distance.
29 The nearest residence is 0.8 mi southwest of the CPNPP Units 3 and 4 center point, to the east
30 of FM 56 and adjacent to the CPNPP site boundary. Because of their distance from the CPNPP
31 site, no offsite industrial or commercial facilities would be affected by building activities.

32 Many existing onsite buildings related to the safety of CPNPP Units 1 and 2 were constructed to
33 meet seismic qualification criteria, which makes them resistant to the effects of vibration and
34 shock similar to that which could occur during onsite building. Other onsite facilities were
35 constructed to the appropriate building codes and standards, which included consideration of
36 seismic loads. Regardless of the applicable design standard, building activities would be
37 planned, reviewed, and conducted in a manner that would ensure no adverse effect on CPNPP
38 Units 1 and 2 and the other buildings onsite.

39 Historically significant buildings or recognized cultural resources within the CPNPP site
40 boundary are discussed in Section 2.7, and impacts on historically significant buildings are
41 discussed in Section 4.6.

42 The distance of the nearest offsite structures would minimize the interaction of the buildings with
43 development activities, while the design of onsite buildings would ensure no adverse effects on

1 CPNPP Units 1 and 2. Thus, the impact of plant development on buildings would be minimal,
2 and no mitigation would be warranted.

3 **4.4.1.3 Roads**

4 Building activities at CPNPP Units 3 and 4 would increase vehicular traffic on local roads and
5 highways because additional workers and delivery trucks would drive to and from the CPNPP
6 site each day and in-migrating workers and their families would drive on local roads and
7 highways for personal travel. Section 2.5.2.3 describes the local transportation network around
8 the CPNPP site, and Figure 2-21 illustrates the road and highway systems in Somervell and
9 Hood counties.

10 Given the size of the traffic increases that would occur due to worker trips to and from the
11 CPNPP site and to personal trips by workers and their families (Section 4.4.4.1), it is likely that
12 building activities at Units 3 and 4 would have noticeable physical impacts on some roads in the
13 EIA, especially FM 56 north of the CPNPP entrance. This is would be most evident when the
14 physical impacts of traffic generated at the CPNPP site are combined with the existing physical
15 impacts of the large trucks used for gas exploration and drilling in the project area. These
16 impacts could warrant increased road repairs and maintenance (especially on FM 56) and
17 additional mitigation measures from Luminant and the Texas Department of Transportation
18 (TxDOT). Section 4.4.4.1 discusses the socioeconomic impacts of the additional vehicular
19 traffic on local roads and highways in the context of existing traffic volumes, road capacities,
20 and level of service (LOS).

21 **4.4.1.4 Aesthetics**

22 Building activities at CPNPP Units 3 and 4 would be visible primarily to workers onsite and
23 nearby residents because visibility from other areas offsite would be obstructed by the hilly
24 topography of the area. Luminant has committed to using materials and lighting that would
25 reduce visual impacts, as described in Section 3.1 of its ER.

26 Federal regulations require that any temporary or permanent structure, including all
27 accompaniments, that exceeds an overall height of 200 ft above ground level be appropriately
28 marked with lighting. The tallest structures onsite during the building period are expected to be
29 the cranes used for building facilities. Because these cranes primarily consist of iron
30 framework, they tend to be less visible from a distance than solid structures such as the Units 1
31 and 2 reactor domes, which are the tallest and most visible structures on the site. Therefore,
32 the cranes and other tall equipment would be outfitted with lights, which would create an
33 additional visual impact.

34 The CPNPP Units 1 and 2 reactor domes are 266 ft tall and would be taller than any permanent
35 structures associated with Units 3 and 4. Thus, because CPNPP Units 1 and 2 have been in
36 operation since 1990 and 1993, respectively, it is likely that the most severe visual impacts have
37 already occurred. The Units 1 and 2 reactor domes are visible from Dinosaur Valley State Park
38 and Oakdale Park. Because visual effects are inversely related to distance, the effects of the
39 CPNPP reactor domes on most other parks in the region are minimal. ER Section 2.2.1
40 discusses the visual effect of the reactor domes as a function of distance and angle of vision
41 occupied by the domes; as distance from the domes increases, the angle of vision occupied by
42 the domes decreases. Most of the parks in the region are located more than 14 mi from the
43 CPNPP site. Although the Units 1 and 2 reactor domes may be visible at that distance, they
44 occupy less than 1 degree of vision. Thus, the visual impact of building Units 3 and 4 at the
45 CPNPP site would be minimal and would warrant no mitigation beyond the measures proposed
46 by Luminant in its ER.

1 **4.4.1.5 Noise**

2 Building activities at CPNPP Units 3 and 4 would create noise primarily associated with heavy
3 equipment and vehicular traffic. Noise levels diminish with distance from the source due to
4 geometric attenuation, sound absorption in air, and sound absorption by barriers (walls, trees,
5 hills, etc.). Higher frequencies are absorbed more easily, and those frequencies are more
6 attenuated at a distance. While the attenuation of the power density in the sound is proportional
7 to the inverse of the distance squared, the loudness is determined by the sound pressure level,
8 measured in decibels. There is an approximately 3 decibels (acoustic) (dBA) decrease in sound
9 volume for a doubling in distance from a line source and an approximately 6 dBA decrease in
10 volume when the distance from a point source is doubled.

11 Neither the State of Texas nor Hood and Somervell counties has developed a noise regulation
12 that specifies the community noise levels that are acceptable. Luminant's ER identifies
13 locations near the CPNPP site with potential sensitivity to noise, such as residences, churches,
14 and the Happy Hill Children's Home. The distances to these locations ranged from 4193 ft (a
15 road intersection within the CPNPP site) to 18,725 ft (a highway east of the CPNPP site). The
16 nearest residence is 0.9 mi southwest of the site, just outside the site boundary.

17 Heavy equipment, such as scrapers and bulldozers, typically produces noise levels in the range
18 of 70 to 90 dBA at distances of 100 ft. Noise at the nearest residence should be comparable to
19 background levels (50 to 55 dBA). The development area nearest the CPNPP site boundary, a
20 transmission line location, would be about 264 feet within the site boundary. Even there, a 90-
21 dBA equipment noise level would be reduced to less than 80 dBA, exclusive of topography and
22 vegetation effects. This activity would also be brief compared to the main building work at
23 Units 3 and 4.

24 Overall, the impacts of noise from building activities at the CPNPP site would be minimal and
25 would not warrant mitigation. However, Luminant has stated that specific measures may be
26 used to reduce noise impacts as much as possible, including the use of quieter, newer
27 equipment and mufflers, limiting noisy work to the daylight hours, and notifying the affected
28 areas before unusual noise events (Luminant 2009a).

29 **4.4.1.6 Air Quality**

30 Building activities at CPNPP Units 3 and 4 would result in temporary impacts to local air quality
31 as a result of emissions associated with building activities. Similar to any large-scale building
32 project, dust particle emissions would be generated during ground-clearing, grading, and
33 excavation activities. Fugitive dust particles would be generated from the movement of
34 machinery and materials as well as during windy periods over recently disturbed or cleared
35 areas. There would also be emissions of particulate matter, volatile organic compounds
36 (VOCs), nitrogen oxides, sulfur dioxides, and carbon monoxide associated with the fueling and
37 combustion of fuels in heavy equipment and off-road vehicles and the operation of a concrete
38 batch plant. These emissions would be of similar type and magnitude to those associated with
39 the building of any other facility of a similar size.

40 To minimize air quality impacts associated with these emissions, Luminant would need to
41 modify the current air permit for the CPNPP facility, as well as the air permit for the concrete
42 batch plant. These permits prescribe emissions limits and a variety of mitigation measures that
43 would be implemented during building activities. Prior to site development, Luminant would
44 develop a Dust Control Plan (or equivalent) describing the specific actions to be taken to
45 mitigate the magnitude, duration, and timing of emissions to avoid releasing them during periods
46 of high winds or poor air quality. These actions would include managing the use of unpaved
47 roads (setting speed limits, using dust suppression, and minimizing dirt tracking onto paved

1 roads); covering haul trucks; phasing grading activities to minimize the exposed amount of
 2 disturbed soils; stabilizing onsite roads and excavated areas with coarse material covers or
 3 vegetation; and performing proper maintenance of vehicles, generators, and other equipment.

4 As discussed in Section 2.9, Somervell County is in attainment or unclassified for all criteria
 5 pollutants for which National Ambient Air Quality Standards have been established
 6 (40 FR 81.344). As a result, a conformity analysis on direct and indirect emissions would not be
 7 required (58 FR 63214).

8 **4.4.1.7 Summary of Physical Impacts**

9 Based on the information provided by Luminant and the review team's independent evaluation,
 10 the review team concludes that for workers and the local public, buildings, aesthetics, noise,
 11 and air quality, the physical socioeconomic impacts of construction and preconstruction
 12 activities for the CPNPP Units 3 and 4 would be SMALL and temporary, and no mitigation
 13 beyond that proposed by Luminant would be warranted. Therefore, NRC staff concludes that
 14 the physical socioeconomic impacts from NRC-authorized construction activities would also be
 15 SMALL, and no mitigation beyond that proposed by Luminant would be warranted.

16 Based on the size of the traffic increases that would occur due to construction and
 17 preconstruction activities at CPNPP Units 3 and 4, the review team concludes that the physical
 18 impacts on most roads in the EIA would be SMALL, but that the physical impacts on FM 56
 19 (particularly north of the CPNPP entrance) would be MODERATE. Luminant estimates that the
 20 labor hours associated with NRC-authorized construction would be approximately 98 percent of
 21 the total labor hours required to develop CPNPP Units 3 and 4, such that 98 percent of
 22 socioeconomic impacts would be attributable to NRC-authorized construction (Luminant 2009a).
 23 Based on this estimate, NRC staff also concludes that the physical impacts from NRC-
 24 authorized construction on most roads in the EIA would be SMALL, but that the physical
 25 impacts on FM 56 (particularly north of the CPNPP entrance) would be MODERATE. Thus,
 26 NRC staff concludes that NRC-authorized construction could warrant increased road repairs,
 27 maintenance, and additional mitigation measures on FM 56 from Luminant or TxDOT.

28 **4.4.2 Demography**

29 Section 2.5.1 provides population estimates and projections for the region and the EIA. Section
 30 2.5.2.1 provides data on the labor force, employment, and unemployment in the EIA.

31 The expansion of drilling operations in the Barnett Shale area has increased the demand for
 32 skilled workers substantially in the region, with unemployment levels in 2008 below 5 percent.
 33 Luminant's ER shows the number of workers in the North Central Workforce Development Area
 34 (WDA) and the Tarrant WDA who are skilled in the various types of craft labor that would be
 35 required to build Units 3 and 4. The crafts with the most plentiful workers in the two WDAs are
 36 laborers, carpenters, and electricians. The crafts with the least numbers of workers are
 37 millwrights, structural ironworkers, and boilermakers. Luminant expects a shortage of skilled
 38 workers, with very high shortages of boilermakers, carpenters, cement masons, and pipefitters
 39 and high shortages of ironworkers, electricians, and sheet metal workers.

40 Using Luminant's projection of the peak construction workforce (4953 workers), building Units 3
 41 and 4 would require almost 10 percent of the boilermakers, 43 percent of the millwrights, and 62
 42 percent of the structural ironworkers in the North Central and Tarrant WDAs (Luminant 2009a).
 43 Luminant states that it is very unlikely that such high percentages of skilled craftsmen would be
 44 available to work on Units 3 and 4. Also, many types of craft labor are location-dependent, and
 45 the workers must travel from site to site, sometimes across the country. Thus, Luminant

1 expects that a large number of the workers needed to build Units 3 and 4 would come from
2 outside the region and perhaps even outside the state of Texas (Luminant 2009a).

3 A 1983 study of nuclear power plant construction found that up to 30 percent of the construction
4 workforce came from the local area (Pijawka and Chalmers 1983). The cases with the largest
5 percentages of local workers occurred when there was rapid population growth in the area and
6 a large indigenous workforce. Somervell and Hood counties are experiencing rapid population
7 growth along with the Fort Worth metropolitan area. In addition, the North Central and Tarrant
8 WDAs are forecast to have more than 17,000 laborers by 2014 (Luminant 2009a). Thus, the
9 review team expects that the CPNPP region would provide a similarly large percentage of local
10 workers to develop CPNPP Units 3 and 4. For this analysis, the review team assumes that 30
11 percent of the construction workers would come from inside the region and 70 percent from
12 outside the region.

13 As indicated in Tables 4-5 and 4-6, Luminant estimates that there would be 4953 construction
14 workers onsite during the peak building period in late 2014. For most socioeconomic resources,
15 the review team analyzed only the impacts of the peak building period as an upper bound to
16 potential impacts, recognizing that impacts would likely be smaller during the rest of the building
17 period. From Luminant's estimate, the review team assumes that 30 percent of the construction
18 workers (1486 workers) would come from inside the region, and that 70 percent (3467 workers)
19 would in-migrate from outside the region. Because jobs such as those developing CPNPP Units
20 3 and 4 provide employment for only a few years, most of the in-migrating construction workers
21 would choose not to relocate their families to the region. Thus, this analysis assumes that only
22 25 percent of the in-migrating construction workers (867 workers) would bring a family and that
23 75 percent (2600 workers) would not bring a family.

24 In 2000, the average household size in Texas was 2.74 persons (USCB 2009a). However, the
25 state average includes households that do not typically have children (e.g., elderly people).
26 This analysis assumes an average household size of 3.0 as a more reasonable estimate of the
27 family size that would be associated with the construction workforce. Consequently, the
28 expected increase in population in the region due to in-migrating workers with families can be
29 determined by multiplying the average household size (3.0) by the number of construction
30 workers expected to in-migrate with their families (867 workers), for a total of 2601 new people
31 in the region. When added to the 2600 in-migrating construction workers without families, the
32 total population increase due to the in-migrating workforce would be 5201 people (Table 4-5).

33 Luminant also estimates that there would be 248 operations workers for Units 3 and 4 onsite
34 during the peak building period in 2014. Luminant expects that 50 percent of these operations
35 workers (124 workers) would come from inside the region and that 50 percent (124 workers)
36 would in-migrate from outside the region. Luminant also expects that all the in-migrating
37 operations workers would bring a family. Using an average household size of 3.0 persons, the
38 in-migration of 124 operations workers would result in an additional 372 people in the region.

Table 4-5. Total number of Unit 3 and 4 construction and operations workers onsite each year during building¹

Year	Construction	Operations	Total
2008	0	22	22
2009	0	60	60
2010	119	76	195
2011	621	92	713
2012	886	168	1054
2013	2423	213	2636
2014	4953	248	5201
2015	3739	378	4117
2016	598	457	1055
2017	0	494	494
2018	0	464	464
2019	0	412	412

1 Does not include existing operations workers or outage workers at CPNPP Units 1 and 2.

Source: Luminant 2009a

1 Thus, the combined in-migration of construction and operations workers and their families
 2 during the peak building period for Units 3 and 4 would result in a total population increase of
 3 5573 in the region. There would also be about 800 - 1200 additional workers onsite in 2014 for
 4 a scheduled outage at CPNPP Unit 1. This analysis of population growth does not include
 5 these outage workers because they are part of the existing baseline. This analysis also does
 6 not include any population growth related to the creation of indirect jobs during the building
 7 period because the review team expects that all the indirect jobs would be filled by existing
 8 residents of the EIA (Section 4.4.3.1).

9 Based on the residential pattern of current CPNPP workers (Table 2-19), the review team
 10 assumes that 23 percent of the total in-migrants (1282 persons) would reside in Somervell
 11 County and that 44 percent (2452 persons) would reside in Hood County. The review team
 12 further assumes that 11 percent (613 persons) would reside in Johnson County, 9 percent (501)
 13 in Tarrant County, 5 percent (279) in Erath County, and 4 percent (223) in Bosque County. The
 14 remaining 4 percent (223) would reside in Hamilton and Parker counties. Table 4-6 presents
 15 the calculations behind these assumptions.

Table 4-6. Potential population growth in the EIA due to peak building year (2014) employment at CPNPP Units 3 and 4

	Total	Somervell County	Hood County	Bosque County	Erath County	Johnson County	Tarrant County	Other counties
Construction workers	4953							
In-migrants (70% of total)	3467	797	1525	139	173	381	312	139
With family (25%) Avg. household size = 3.0	867	199	381	35	43	95	78	35
Total including family	2601	598	1144	104	130	286	234	104
Without family (75%)	2600	598	1144	104	130	286	234	104
Total building-related in- migrants	5201	1196	2288	208	260	572	468	208
Operations workers¹	248							
In-migrants (50% of total)	124	29	55	5	6	14	11	5
With family (100%) Avg. household size = 3.0	124	29	55	5	6	14	11	5
Total including family	372	86	164	15	19	41	33	15
Without family (0%)	0	0	0	0	0	0	0	0
Total operations-related in- migrants	372	86	164	15	19	41	33	15
Total in-migrants	5573	1282	2452	223	279	613	501	223

¹ Includes only the Unit 3 and 4 operations workers who would be on-site during building; does not include existing operations workers at CPNPP Units 1 and 2 or outage workers.

Source: The review team, based on Luminant 2009a.

1 This influx of construction and operations workers and their families during the peak building
 2 period would represent 16.7- and 5.0-percent increases in the projected 2010 populations
 3 (Table 2-19) of Somervell and Hood counties, respectively. The percentage increases in the
 4 projected 2010 populations for the other study area counties would be much smaller, as follows:
 5 Johnson County (0.4 percent), Tarrant County (0.03 percent), Erath County (0.7 percent), and
 6 Bosque County (1.2 percent).

7 Based on these factors and information provided by Luminant and the review team's
 8 independent evaluation, the review team concludes that the number of in-migrating construction
 9 workers and their families would represent a MODERATE population increase for Somervell
 10 and Hood counties, but only a SMALL population increase for the four other counties in the EIA.
 11 Luminant estimates that the labor hours associated with NRC-authorized construction would be
 12 approximately 98 percent of the total labor hours required to develop CPNPP Units 3 and 4,
 13 such that 98 percent of socioeconomic impacts would be attributable to NRC-authorized
 14 construction (Luminant 2009a). Based on this estimate, NRC staff also concludes that the
 15 number of workers and their families in-migrating because of NRC-authorized construction
 16 would represent a MODERATE population increase for Somervell and Hood counties, but only a
 17 SMALL population increase for the four other counties in the EIA. The impacts of this
 18 population growth on transportation, recreation, housing, public services, and education in the
 19 EIA are discussed in Sections 4.4.4.1 through 4.4.4.5.

20 **4.4.3 Economic Impacts to the Community**

21 This section evaluates the economic and social impacts on the region during the building of
 22 CPNPP Units 3 and 4. The evaluation focuses on the impacts that would occur because of the
 23 presence of the large workforce during the peak building period.

24 **4.4.3.1 Economy**

25 The impacts of developing Units 3 and 4 on the local and regional economy would depend on
 26 the region's current and projected population and economy. Section 2.5.1 provides population
 27 estimates and projections for the region and the EIA. Section 2.5.2.1 describes the economic
 28 characteristics of the EIA, including the labor force, employment by industry type,
 29 unemployment, total personal income, and per capita income.

30 Building CPNPP Units 3 and 4 would have economic impacts in the EIA by creating direct and
 31 indirect jobs and incomes, increasing purchases of goods and services, and generating tax
 32 revenues (tax revenues are discussed separately in Section 4.4.3.2.) As indicated in Tables 4-3
 33 and 4-4, the peak number of workers (construction and operations) onsite during the building
 34 period would be 5201, with 70 percent of the construction workers (3467 workers) and 50
 35 percent of the operations workers (124 workers) in-migrating from outside the region or the
 36 state. Thus, the project would provide 1486 construction jobs and 124 operations jobs for
 37 workers who already reside in the EIA. These direct jobs would help reduce unemployment in
 38 the study area, which had a total of 49,062 unemployed workers in 2008 (Table 2-19).

39 In addition, the 3591 in-migrating construction and operations workers would create new indirect
 40 jobs in the EIA through a process referred to as the multiplier effect. The U.S. Department of
 41 Commerce Bureau of Economic Analysis provides regional multipliers (RIMS II Multipliers) for
 42 industry jobs and earnings. Luminant used RIMS II multipliers to estimate the number of
 43 indirect jobs and expenditures that would result from developing CPNPP Units 3 and 4. For the
 44 construction workforce, Luminant used the construction industry from the RIMS II Multipliers,
 45 resulting in a multiplier value of 1.48. This means that for every new construction worker in the
 46 project area, 0.48 indirect jobs would be created. Thus, the 3467 in-migrating construction

1 workers would result in 1664 indirect jobs. For the 124 in-migrating operations workers,
2 Luminant used the power generation and supply multiplier from the RIMS II Multipliers, resulting
3 in a multiplier value of 2.1. This means that for every new operations worker in the project area,
4 1.1 indirect jobs would be created. Thus, the 124 in-migrating operations workers would result
5 in 136 indirect jobs. Together, the in-migrating construction and operations workers would
6 create a total of 1800 indirect jobs during the peak building period. Because most of these
7 indirect jobs would be service-related and not highly specialized, the review team assumes that
8 all of the indirect jobs would be filled by existing residents of the EIA. Therefore, these indirect
9 jobs would help reduce unemployment in the EIA, which had a total of 49,062 unemployed
10 workers in 2008 (Table 2-19).

11 The employment of a large construction workforce and a growing operations workforce at
12 CPNPP Units 3 and 4 over the 7-year building period would also have positive effects on
13 income in the EIA. Luminant estimated that the average annual salary for a construction worker
14 at CPNPP would be about \$30,000. However, based on experience in Texas, the review team
15 estimates that the average annual salary would be closer to \$54,000. Thus, assuming a peak
16 construction workforce of 4953, the CPNPP construction workforce could earn a total of about
17 \$268 million at peak. Over the course of the 7-year building period, the workforce would earn
18 over \$1.2 billion in wages. Earnings of this magnitude would have a positive effect on the total
19 and per capita income of the EIA (Table 2-22), which would be enhanced by the earnings of the
20 248 Units 3 and 4 operations workers who would be onsite during the building period and the
21 1800 indirect workers who would be employed during the building period.

22 Luminant estimates that, when combined, direct annual expenditures for labor and materials
23 over the 7-year building period would average \$240 million per year, with a peak of
24 approximately \$516 million in 2014. Most of the labor expenditures would occur in the EIA, but
25 most of the materials expenditures would occur outside the area. Based on the construction
26 multiplier of 1.58 from the RIMS II Multipliers, every dollar spent for direct expenditures would
27 add an additional 0.58 dollar in indirect expenditures to the area. This would result in the
28 generation of approximately \$139 million per year in indirect expenditures over the 7-year
29 building period, with a peak of approximately \$299 million in 2014.

30 Building CPNPP Units 3 and 4 would have a beneficial effect on the economy of the EIA, and to
31 a lesser extent the entire region, by creating direct jobs, incomes, and expenditures that would
32 generate indirect jobs, incomes, and expenditures. The review team expects that labor
33 expenditures would follow the residential pattern of CPNPP Unit 3 and 4 workers (Table 4-6), so
34 about two-thirds of the labor expenditures (\$177 million at peak; \$800 million in total) would
35 occur in Somervell and Hood counties and about one-third (\$91 million at peak; \$400 million in
36 total) would be distributed among the other four counties.

37 Based on these factors and on information provided by Luminant and the review team's
38 independent evaluation, the review team concludes that the economic impacts of construction
39 and preconstruction activities in Somervell County, and to a lesser extent in Hood County and
40 the rest of the EIA, would be LARGE and beneficial. However, the review team concludes that
41 the beneficial economic effects of construction and preconstruction activities in the rest of the
42 region would be relatively SMALL. Based on Luminant's estimate that 98 percent of
43 socioeconomic impacts would be attributable to NRC-authorized construction (Luminant 2009a),
44 NRC staff also concludes that the economic impacts of NRC-authorized construction in
45 Somervell County, and to a lesser extent in Hood County and the rest of the EIA, would be
46 LARGE and beneficial. NRC staff also concludes that the beneficial economic effects of NRC-
47 authorized construction in the rest of the region would be SMALL.

1 4.4.3.2 Taxes

2 Section 2.5.2.2 discusses current tax revenues within the EIA. Building activities and purchases
3 at CPNPP Units 3 and 4 and personal expenditures made by construction and operations
4 workers would generate several types of taxes, including income taxes on corporate profits,
5 wages, and salaries; sales and use taxes on corporate and employee purchases; real property
6 ad valorem taxes related to the CPNPP facilities; and personal property taxes associated with
7 employees.

8 While the State of Texas has no personal income tax, the wages paid to the construction and
9 operations workers during the building period would generate Federal income tax revenue. The
10 review team estimates that over the course of the 7-year building period the potential workforce
11 income for Federal tax purposes could total over \$1.2 billion.

12 As discussed in Section 2.5.2.2, the sales and use tax rate in populated areas in the EIA is 8.25
13 percent including local and State taxes. The review team's experience is that applicants
14 purchase approximately 10 percent of their construction materials locally. Assuming the same
15 percentage for CPNPP, the review team estimates that sales and use tax revenues on
16 Luminant's local expenditures for materials would average \$13 to \$15 million per year during the
17 7-year building period. Of this tax revenue, 73 percent would go to the state of Texas, with the
18 remaining revenue going to counties, cities, and local districts within the region.

19 Luminant currently pays ad valorem taxes on CPNPP Units 1 and 2 to Somervell and Hood
20 counties and to several taxing jurisdictions within those counties (Section 2.5.2.2), and it is
21 expected that Luminant would pay ad valorem taxes on Units 3 and 4 to the same jurisdictions.
22 Although the tax rates for Units 3 and 4 have not been finalized, Table 4-7 provides an estimate
23 of the potential tax revenues for affected jurisdictions assuming that Luminant pays the same ad
24 valorem taxes on Units 3 and 4 as on Units 1 and 2. The review team expects that the amount
25 of ad valorem taxes paid would increase each year as building progresses and property
26 improvements are completed. For Units 1 and 2, Luminant paid ad valorem taxes on the
27 partially completed units throughout the building period. If the same tax payment schedule is
28 established for Units 3 and 4, and assuming a 7-year building period, the review team estimates
29 that Luminant would pay approximately 1/7 of the full ad valorem tax the first year of building,
30 2/7 the second year, and so on until the end of the sixth year, when Luminant would pay 6/7 of
31 the full ad valorem tax. In the next year, building would be completed and the full ad valorem
32 tax would be considered part of operations, which is discussed in detail in Section 5.4. Given
33 this estimated payment schedule, the review team anticipates that the total ad valorem taxes
34 paid during the building period would be \$52 million for the Glen Rose Independent School
35 District (ISD) and \$15 million for Somervell County (Table 4-7). These ad valorem tax revenues
36 would surpass the current property tax revenues for both the Glen Rose ISD (\$24.8 million) and
37 Somervell County (\$8.5 million) (Table 2-23).

38 Local tax revenues, especially from ad valorem taxes and sales and use taxes, would increase
39 in the EIA during the building period. These increased tax revenues would be particularly
40 beneficial for the local jurisdictions in Somervell and Hood counties.

41 Based on these factors and on information provided by Luminant and the review team's
42 independent evaluation, the review team concludes that the tax revenue impacts of construction
43 and preconstruction activities in Somervell County, and to a lesser extent in Hood County,
44 would be LARGE and beneficial. However, the review team expects that the beneficial effects
45 of construction and preconstruction activities on tax revenues in the rest of the EIA and the rest
46 of the region would be relatively SMALL. Based on Luminant's estimate that 98 percent of
47 socioeconomic impacts would be attributable to NRC-authorized construction (Luminant 2009a),
48 NRC staff also concludes that the tax revenue impacts of NRC-authorized construction activities

1 in Somervell County, and to a lesser extent in Hood County, would be LARGE and beneficial.
 2 However, NRC staff expects that the beneficial effects of NRC-authorized construction on tax
 3 revenues in the rest of the EIA and the rest of the region would be SMALL.

Table 4-7. Potential total ad valorem taxes paid on CPNPP Units 3 and 4

Somervell County	\$15,370,812
Glen Rose	\$105
Somervell County Water District	\$5,646,612
Glen Rose ISD	\$52,065,513
Hood County	\$25,785
Tolar	\$111
Granbury ISD	\$56,202
Tolar ISD	\$45,219
Hood County Library District	\$765

ISD = Independent School District

Source: The review team, based on Luminant 2009a

4 **4.4.4 Infrastructure and Community Service Impacts**

5 The local infrastructure and community services that would be affected by building activities at
 6 CPNPP Units 3 and 4 include transportation, recreation, housing, public services (including
 7 water and wastewater, solid waste, police, fire, medical, and social services), and education.

8 **4.4.4.1 Transportation**

9 Building activities at CPNPP Units 3 and 4 would increase vehicular traffic on local roads and
 10 highways because additional workers and delivery trucks would drive to and from the CPNPP
 11 site each day and in-migrating workers and their families would drive for personal travel.
 12 Section 2.5.2.3 describes the local transportation network around the CPNPP site and
 13 Figure 2-21 illustrates the road and highway systems in Somervell and Hood counties.

14 This section discusses the impacts of the additional vehicular traffic on local roads and
 15 highways in the context of existing traffic volumes, road capacities, and LOS. The review
 16 team's bounding analysis focuses on the two times each day when building would generate the
 17 most additional traffic—the morning and afternoon peak traffic hours when construction workers
 18 would enter and exit the CPNPP site from FM 56.

19 Luminant has stated that building would take place during a single shift each day and that all
 20 traffic would access the CPNPP site via the existing entrance from FM 56 (Luminant 2009a).
 21 The review team's traffic analysis does not include the 248 Units 3 and 4 operations workers
 22 who would be on-site during building (because they could arrive during off-peak hours) or the
 23 daily deliveries (because they would arrive at various hours throughout the day). Also, the
 24 review team does not include the current Units 1 and 2 operations and outage workers because
 25 their trips are already included in TxDOT traffic counts. To estimate the number of construction
 26 worker vehicles that would travel to and from the CPNPP site each day, the review team used
 27 the average worker vehicle occupancy recorded during development of CPNPP Units 1 and 2 in
 28 1987 (2.34 workers per vehicle) (DeShazo, Starek & Tang, Inc. 1987). Based on this average
 29 occupancy, the 4953 construction workers would generate about 2117 vehicle trips to and from
 30 the CPNPP site each day.

31 As discussed in Section 2.5.2.3, TxDOT's 2007 traffic data indicate that FM 56 has an Annual
 32 Average Daily Traffic (AADT) count (bidirectionally) of 3500 vehicles just south of the CPNPP

1 entrance and 8500 vehicles just north of it. Luminant states that FM 56 currently has a LOS of
 2 “A,” meaning that there are no traffic delays on the road (Luminant 2009a). However, Luminant
 3 has not conducted a transportation study for building Units 3 and 4 and has provided no data on
 4 peak daily traffic counts on FM 56 or other roads.

5 Assuming the current percentages of average daily traffic south (30 percent) and north (70
 6 percent) of the CPNPP entrance on FM 56, the addition of 2117 trips each day during the
 7 building peak would add 635 trips south of the entrance and 1482 trips north of it. This would
 8 increase the AADT bidirectional count on FM 56 south of the CPNPP entrance to 4135 and
 9 north of the CPNPP to 9982. However, because AADT counts represent only the average daily
 10 flow of traffic in two directions (rather than the peak hourly flow in one direction), the review
 11 team believes that they do not accurately represent the traffic that would be added to FM 56.
 12 Because of the limitations in using an annual average, TxDOT adjusts AADT counts by using
 13 design hourly volume (DHV), which is usually “the 30th highest hourly volume for the design
 14 year” (TxDOT 2009). However, DHV also assumes a bi-directional flow of traffic. Therefore,
 15 the review team uses the DHV methodology to determine design hour maximum traffic counts
 16 on FM 56, but applies only half of the DHV to reduce the existing traffic count from bidirectional
 17 to unidirectional.

18 To calculate DHV, TxDOT uses the “K Factor,” which is the percentage of the peak AADT that
 19 represents the 30th highest hourly traffic volume. For typical main rural highways such as FM
 20 56, K Factors generally range from 12 to 18 percent (TxDOT 2009). DHV can be calculated by
 21 multiplying AADT by the K Factor, where K is the percentage of AADT occurring in the design
 22 hour:

23
$$\text{DHV} = (\text{AADT})(K).$$

24 Applying this formula to the existing AADT on FM 56 (i.e., 3500 vehicles south of the CPNPP
 25 entrance and 8500 additional vehicles north of it) and using a K Factor of 18 percent, the review
 26 team derives the following:

- 27 • estimated DHV on FM 56 south of CPNPP is $3500 \times 0.18 = 630$ trips (315 trips in each
 28 direction) during the daily peak traffic hour and
- 29 • estimated DHV on FM 56 north of CPNPP is $8500 \times 0.18 = 1530$ trips (765 trips in each
 30 direction) during the daily peak traffic hour.

31 For an analysis of the impacts of building CPNPP Units 3 and 4, the review team believes that a
 32 K Factor of 18 percent is too low because most of the additional traffic generated on FM 56
 33 would occur during 1-hr morning and afternoon traffic peaks as workers travel to and from the
 34 CPNPP site. To provide a more reasonable estimate of potential impacts, the review team
 35 assumes a K Factor of 75 percent for additional traffic during the building period (i.e., 75 percent
 36 of the additional trips on FM 56 would occur twice daily during 1-hr peaks, one in the morning
 37 and one in the afternoon).

38 Applying this formula to the projected increase in traffic on FM 56 due to building CPNPP Units
 39 3 and 4 (i.e., 635 additional vehicles south of the CPNPP entrance and 1482 additional vehicles
 40 north of it) and using a K Factor of 75 percent, the review team derives the following:

Construction Impacts at the Proposed Site

- 1 • the increase in traffic on FM 56 south of CPNPP would be $635 \times 0.75 = 476$ trips during
2 daily peak traffic hours and
- 3 • the increase in traffic on FM 56 north of CPNPP would be $1482 \times 0.75 = 1112$ trips during
4 daily peak traffic hours.

5 As indicated in Table 4-8, the total traffic expected on FM 56 during peak morning and afternoon
6 traffic hours would be 2668 vehicles, with 791 vehicles (315 existing + 476 new) south of the
7 CPNPP entrance and 1877 vehicles (765 existing + 1112 new) north of it. According to the
8 Transportation Research Board's 2000 *Highway Capacity Manual* (TRB 2000), the capacity of a
9 two-lane highway such as FM 56 is 1700 vehicles per hour for each direction of travel (Luminant
10 2009a).

11 Thus, the total number of peak hour trips south of the CPNPP entrance (791 trips) would be less
12 than half the design capacity of FM 56 (1700 trips), but the total number north of the CPNPP
13 entrance (1877 trips) would exceed the design capacity of FM 56 by about 10 percent during the
14 morning and afternoon peaks. An hourly traffic volume of this magnitude would have noticeable
15 impacts on traffic flow and LOS on FM 56, primarily for workers traveling to and from the site
16 from Granbury or Tolar. The review team believes that this impact would occur only during the
17 peak traffic hours each day, and would be most severe during the morning peak for workers
18 traveling south from Granbury or Tolar who would have to make a left turn (crossing north-
19 bound traffic) to enter the CPNPP site.

20 Traffic increases associated with a total of 2117 worker trips to and from the CPNPP site each
21 day during the building period would also affect other roads in the EIA, but the impacts would
22 likely be less severe than on FM 56. Based on the residential pattern of current CPNPP
23 workers (Table 2-21), the review team assumes that:

- 24 • 23 percent of the total increase in traffic (487 round trips) would originate in Somervell
25 County
- 26 • 44 percent (931 round trips) in Hood County
- 27 • 11 percent (233 round trips) in Johnson County
- 28 • 9 percent (190 round trips) in Tarrant County
- 29 • 5 percent (106 round trips) in Erath County, and
- 30 • 4 percent (85 round trips) in Bosque County.
- 31 • 4 percent (85 round trips) in Hamilton and Parker counties.

32 Building CPNPP Units 3 and 4 would also affect roads and highways throughout the EIA
33 because the in-migrating workers and their families would drive for personal travel (i.e., in
34 addition to daily trips to and from CPNPP). As discussed in Section 4.4.2, the combined in-
35 migration of construction and operations workers and their families during the peak building
36 period would result in a total population increase of 5573 people in the region.

Table 4-8. Peak hour¹ traffic impacts on FM 56 during the peak building year at CPNPP Units 3 and 4

Current peak hour traffic volume ²	FM 56 south of the CPNPP entrance				FM 56 north of the CPNPP entrance					
	Projected peak hour traffic from CPNPP construction workers ^{2,3}	Projected total peak hour traffic volume ²	Current peak hour traffic volume ²	Projected peak hour traffic from CPNPP construction workers ²	Projected total peak hour traffic volume	Existing capacity ⁵	Current peak hour traffic volume ²	Projected peak hour traffic from CPNPP construction workers ²	Projected total peak hour traffic volume	Existing capacity ⁵
1080	1588	2668	315	476	791	1700	765	1112	1877	1700

1 The review team assumes two daily peak traffic hours (i.e., morning and afternoon shift changes).

2 Calculated using TxDOT 2007 AADT data and K Factors of 18 percent (existing traffic) and 75 percent (CPNPP building-related traffic) based on TxDOT's *Roadway Design Manual* (TxDOT 2009).

3 Does not include deliveries (which are assumed to occur throughout the day) or current CPNPP Units 1 and 2 operations or outage workers because their trips are already included in TxDOT traffic counts.

4 Assumes 2.34 workers per vehicle based on DeShazo, Starek & Tang, Inc. 1987.

5 Based on Transportation Research Board's 2000 *Highway Capacity Manual* (TRB 2000, as cited in Luminant 2009a).

Source: The review team, based on Luminant 2009a

1 Assuming one household for each of the 991 in-migrating construction and operations workers
 2 with families, and one-half household for each of the 2600 in-migrating workers without families
 3 (for 1300 households, because many workers without families would tend to share housing as
 4 discussed in Section 4.4.4.3), the review team estimates that there would be 2291 new
 5 households in the EIA. According to the *Transportation Energy Data Book* (DOE 2008), the
 6 average U.S. household generates 3.4 vehicle round trips per day. Thus, subtracting the round
 7 trip to and from the CPNPP site each day, each of these 2291 new households could generate
 8 2.4 additional vehicle round trips per day, for a total of about 5498 additional vehicle round trips
 9 each day. Based on the residential pattern of current CPNPP workers (Table 2-21), the review
 10 team assumes that the distribution of personal trips would be the same as that discussed above
 11 for worker trips (Table 4-9). The extent to which these additional personal trips would affect
 12 each county would depend on the existing traffic volume, capacity, and LOS of each county's
 13 roads.

Table 4-9. Expected daily traffic distribution during the peak building period at CPNPP Units 3 and 4

County	Percent of total increase in traffic	Worker trips to and from CPNPP	Personal trips by CPNPP workers and family
Somervell	23	487	1265
Hood	44	931	2419
Johnson	11	233	605
Tarrant	9	190	494
Erath	5	106	275
Bosque	4	85	220
Hamilton and Parker	4	85	220
TOTAL	100	2117	5498

Source: The review team, based on Luminant 2009a.

14 Based on the size of the traffic increases that would occur due to construction and
 15 preconstruction activities at CPNPP Units 3 and 4, the review team concludes that impacts on
 16 traffic flow and LOS on most roads in the EIA would be SMALL, but that impacts on FM 56
 17 (particularly north of the CPNPP entrance) would be MODERATE. Based on the estimate that
 18 98 percent of socioeconomic impacts would be attributable to NRC-authorized construction
 19 (Luminant 2009a), NRC staff also concludes that the impacts of NRC-authorized construction
 20 on traffic flow and LOS would be SMALL on most roads in the EIA, but MODERATE on FM 56
 21 (particularly north of the CPNPP entrance). This is especially true when the additional traffic is
 22 combined with the existing traffic impacts of the large trucks used for gas exploration and drilling
 23 in the project area. These impacts to traffic flow and safety on FM 56 could warrant additional
 24 mitigation measures from Luminant (such as two shifts each day, staggered shift change times,
 25 and mandatory carpooling for workers) and TxDOT (such as improvements to traffic signals,
 26 lane width, turn lanes, and signage in the immediate area of the CPNPP site).

27 Figure 2-21 shows the railways in the immediate vicinity of the CPNPP site. The Ft. Worth
 28 Western Railroad Company owns and operates the railroad line that runs through Tolar
 29 approximately 10 mi northwest of the CPNPP site. The spur line that provides rail access to the
 30 CPNPP site connects with this main line in Tolar. Although Luminant would use the existing
 31 CPNPP rail spur for the delivery of materials, the additional rail traffic generated by building

1 Units 3 and 4 is not expected to adversely affect rail service on the Ft. Worth Western Railroad
2 main line through Tolar.

3 **4.4.4.2 Recreation**

4 Building activities at CPNPP Units 3 and 4 could affect recreation in the region by creating
5 visual impacts near of the site and increasing the residential population (which would increase
6 the use of existing and planned recreational facilities), traffic on local roads and highways, and
7 competition for hotel and motel rooms and spots in recreational vehicle (RV) parks.

8 Section 4.4.1 discusses the potential visual impacts of building at CPNPP Units 3 and 4. As of
9 June 2010, Luminant began allowing controlled access for the public to the SCR for fishing and
10 boating activities. Since the access is limited by Luminant, few individuals from the public would
11 be affected by the building of the new reactors and thus the visual impacts would be minimal.
12 The public recreational or tourist attraction closest to the CPNPP site other than the SCR is
13 Dinosaur Valley State Park, located 3.3 mi to the southwest. The Units 1 and 2 reactor domes
14 are visible from the park; therefore, building CPNPP Units 3 and 4 is expected to have a small,
15 incremental visual impact. The Texas Amphitheater, located on a hill overlooking SCR 3.7 mi
16 southeast of the CPNPP, hosts outdoor events, so building could result in a slight, temporary
17 visual impact. Although the new recreational facilities at the Wheeler Branch Reservoir would
18 be located only 1 mi south of the CPNPP site, it is likely that activities at the CPNPP site would
19 not be visible because of the topography surrounding the reservoir. Other outdoor attractions
20 are more than 5 mi away and probably would not be affected by the visual impacts of
21 construction and pre-construction activities. Because of the distance of area attractions from
22 the CPNPP site, the visual impacts on recreation would be minimal, and temporary and would
23 warrant no mitigation.

24 Section 4.4.2 discusses the population growth that could occur in the EIA as a result of
25 developing CPNPP Units 3 and 4. The review team expects that population growth of the
26 magnitude projected for the peak building period (i.e., 5573 new residents) would increase the
27 use of existing recreational facilities and the demand for additional ones. However, it is also
28 likely that the potential effects of this increased use and demand, such as the cost to repair or
29 replace existing recreational facilities or provide new ones, could be offset by increased funding
30 related to user fees and local tax revenues. Thus, the impacts of population growth would be
31 minimal and would warrant no mitigation.

32 Section 4.4.4.1 assesses the potential impacts of developing CPNPP Units 3 and 4 on
33 transportation in the EIA. The increases in vehicular traffic that would occur on local roads and
34 highways (particularly FM 56) could adversely affect traffic flow and safety, which could affect
35 the ability of tourists and recreational transients to travel near the CPNPP site. These impacts
36 would be temporary, however, and would decrease with distance from the CPNPP site. Overall,
37 the potential impacts of the increased traffic on FM 56 are likely to be noticeable (especially
38 during the morning and afternoon peak traffic hours), but the impacts on other roads in the
39 project area are likely to be minimal and would warrant no mitigation.

40 As discussed in Section 4.4.4.3, the short-term nature of many of the CPNPP construction jobs
41 makes it likely that a large percentage of these in-migrating workers would opt for short-term
42 housing in hotels, motels, or RV parks. It is likely that the presence of these workers during the
43 peak building period would make it more difficult for recreational transients to find hotel or motel
44 rooms or spots in RV parks, which might displace some of the transients to other housing in the
45 region, such as cabins, bed and breakfasts, and lodges. However, as discussed in Section
46 4.4.4.3, the impacts on short-term housing availability and price for recreational transients would
47 be minimal and would warrant no mitigation.

1 Based on these factors and on information provided by Luminant and the review team's
2 independent evaluation, the review team concludes that the impacts of construction and
3 preconstruction activities at CPNPP Units 3 and 4 on recreation would be SMALL and would
4 warrant no mitigation. Based on Luminant's estimate that 98 percent of socioeconomic impacts
5 would be attributable to NRC-authorized construction (Luminant 2009a), NRC staff also
6 concludes that the impacts of NRC-authorized construction activities on recreation would be
7 SMALL and would warrant no mitigation.

8 **4.4.4.3 Housing**

9 Building CPNPP Units 3 and 4 would increase the demand for both short- and long-term
10 housing in the EIA due to the in-migration of construction and operations workers and their
11 families. Section 2.5.2.5 provides data on existing housing in the EIA, including the total
12 number of units, total number and types of occupied units, total number of vacant units, and
13 vacancy rates. As discussed in Section 2.5.2.5, most of the current CPNPP employees (more
14 than 66 percent) live in Hood and Somervell counties, and more than 96 percent live in the EIA.
15 This analysis assumes that most of the construction workers and almost all of the operations
16 workers for Units 3 and 4 would follow this same residential pattern.

17 The combined in-migration of construction and operations workers and their families during the
18 peak building period would result in a population increase of 5573 people in the region (Section
19 4.4.2). The review team's analysis assumes that each of the 991 in-migrating construction and
20 operations workers with families would represent one household. However, the review team
21 also assumes that each of the 2600 workers in-migrating without families would each represent
22 one-half of a household (i.e., 1300 households) because many of these workers would tend to
23 share housing. Given these assumptions, the peak building period at CPNPP Units 3 and 4
24 would create 2291 new households in the EIA. Thus, the total demand for short- and long-term
25 housing units for the in-migrating construction and operations workers would be 2291 units.

26 There would be several refueling outages at CPNPP Units 1 and 2 during building at Units 3
27 and 4. Each of these outages would bring 800-1200 additional workers to the CPNPP site,
28 including an outage scheduled for Unit 1 during the peak building year. However, these
29 additional outage workers are already included in the baseline of existing housing demand, so
30 the review team does not include them in the discussion of impacts to long-term housing.

31 Based on the residential pattern of current CPNPP workers (Table 2-21), the review team
32 assumes that 23 percent of the additional housing units (527 units) would be needed in
33 Somervell County and that 44 percent (1008 units) would be needed in Hood County. The
34 review team further assumes that 11 percent (252 units) would be needed in Johnson County, 9
35 percent (206 units) in Tarrant County, 5 percent (115 units) in Erath County, and 4 percent (92
36 units) in Bosque County. The remaining 4 percent (92 units) would be needed in Hamilton and
37 Parker counties. The data in Table 4-10 indicate that each of the counties in the EIA has an
38 adequate number of existing vacant housing units to accommodate projected worker demand.

39 As indicated in Table 4-10, there are numerous hotels and motels in the EIA. When combined
40 with houses and apartments for rent, these hotels and motels would help meet the increased
41 demand for short-term housing. However, there would be competing demands for these short-
42 term housing units from recreational transients as well as workers involved in Barnett Shale
43 mining. It is likely that the number of construction and outage workers during the peak building
44 period would make it difficult for recreational transients to find hotel rooms, which might displace
45 some of the transients to other housing in the region, such as cabins, bed and breakfasts, RV
46 parks, and lodges.

Table 4-10. Vacant permanent and temporary housing units¹ and projected housing demand from in-migrating CPNPP workers² (2014) in the EIA

	Vacant permanent units	Temporary units	Projected demand	Surplus (or shortage)
Somervell County	312	471	527	256
Hood County	2880	834	1008	2706
Bosque County	1918	NA ²	92	1826
Erath County	2473	363	115	2721
Johnson County	4708	260	252	4716
Tarrant County	65,514 ³	NA ³	206	65,308

1 Data are for 2007, except for 2000 data used for Somervell and Bosque counties.

2 Data not available for Bosque County.

3 Tarrant County includes the southwestern portion of the city of Forth Worth; data for Tarrant County include the entire county and the city of Forth Worth, so the number of temporary units is not included.

Sources: The review team, based on USCB 2007; USCB 2009b; Luminant 2009a

1 Another alternative for short-term worker housing would be the 11 RV parks located in
2 Somervell and Hood counties (Section 2.5.2.5). These RV parks have a combined total of 619
3 spots, with possible expansion at two parks for a total of 90 additional spots. Almost all of the
4 RV parks are frequented by CPNPP Units 1 and 2 outage workers, so the review team expects
5 that some construction workers would also find lodging at these locations. As with hotels and
6 motels, the construction workers would likely displace some recreational transients at these RV
7 parks. However, there are numerous RV parks in the other cities in the region, including
8 Cleburne, Stephenville, Joshua, and Alvarado. These cities are located approximately 30
9 minutes from the CPNPP site, so it is likely that some of the construction and outage workers
10 would commute from these locations and the adverse impacts in terms of displaced
11 recreationists would be minimal and would warrant no mitigation.

12 Given the number of short-term and long-term housing units available in the EIA, the review
13 team expects that the in-migrating workers would be able to find sufficient housing within a
14 relatively short commuting distance. Based on these factors and on information provided by
15 Luminant and the review team's independent evaluation, the review team concludes that the
16 impacts of construction and preconstruction activities at CPNPP Units 3 and 4 on housing
17 availability and price would be SMALL and would warrant no mitigation. Based on Luminant's
18 estimate that 98 percent of socioeconomic impacts would be attributable to NRC-authorized
19 construction (Luminant 2009a), NRC staff also concludes that the impacts of NRC-authorized
20 construction activities on housing availability and price would be SMALL and would warrant no
21 mitigation.

22 4.4.4.4 Public Services

23 Building activities at CPNPP Units 3 and 4 would increase the demand for a variety of public
24 services in the EIA due to the in-migration of construction and operations workers and their
25 families. Section 2.5.2.6 provides data on existing public services in the study area, including
26 water and wastewater; solid waste; police, fire, and medical services; and social services.
27 (Educational services are discussed separately in Sections 2.5.2.7 and 4.4.4.5.) This analysis
28 of public service impacts assumes that more than 66 percent of the onsite workers during the

1 building of CPNPP Units 3 and 4 would live in Hood and Somervell counties and more than 96
2 percent would live in the EIA (Section 2.5.2).

3 As discussed in Section 4.4.2, the combined in-migration of construction and operations
4 workers and their families during the peak building period would result in a population increase
5 of 5573 people in the region. Given the assumptions described in Sections 4.4.2 and 4.4.4.1,
6 the peak building period would create 2291 new households in the EIA. Thus, the total demand
7 for public services would increase by 5573 people or 2291 housing units.

8 Based on the residential pattern of current CPNPP workers (Table 2-21), the review team
9 assumes a similar residential pattern for in-migrating construction and operations workers at
10 Units 3 and 4 (Section 4.4.2). The following subsections discuss the impacts of this population
11 growth on existing and planned public services.

12 ***Water and Wastewater***

13 Building CPNPP Units 3 and 4 would increase the demand for water and wastewater services in
14 the EIA due to the projected in-migration of 5573 new residents during the peak building period.
15 (Sections 3.3.1 and 4.2 discuss the increased demand for water and wastewater due to onsite
16 building activities.) In 2006, municipal water use [defined as “city-owned, districts, water supply
17 corporations, or private utilities supplying residential, commercial (non-goods-producing
18 businesses), and institutional (schools, governmental operations)”] in the EIA averaged 148 gal
19 per person per day (TWDB 2009).

20 Based on the population growth patterns discussed in Section 4.4.2 and the Texas Water
21 Development Board’s (TWDB) estimated demand of 148 gal of water per person per day, the
22 review team estimates that 189,736 additional gallons per day would be used in Somervell
23 County and that 362,896 additional gallons per day would be used in Hood County. The review
24 team also estimates that the four other counties in this analysis would require additional water
25 per day as follows: Johnson County (90,724 gal), Tarrant County (74,148 gal), Erath County
26 (41,292 gal), and Bosque County (33,004 gal).

27 The data in Table 4-11 indicate that, with the exception of Bosque County, all of the counties in
28 the EIA have adequate water treatment capacity to accommodate the additional demand that
29 would result from population growth during the peak building period. Moreover, Somervell,
30 Hood, and Johnson counties are planning expansions of their existing water supply and
31 treatment systems (Section 2.5.2.6), so the available capacity in those counties should be even
32 larger in 2014.

Table 4-11. Existing excess water and wastewater treatment capacity and projected water demand from in-migrating CPNPP workers (2014) in the EIA

	Existing excess water treatment capacity (MGD)	Existing excess wastewater treatment capacity (MGD)	Projected additional water demand (MGD)	Projected surplus (or shortage) water treatment capacity (MGD)	Projected surplus (or shortage) wastewater treatment capacity (MGD)
Somervell County	0.91	0.28	0.19	0.72	0.09
Hood County	7.10	0.99	0.36	6.74	0.63
Bosque County	0.03	0.06	0.03	0.0	0.03
Erath County	3.20	7.60	0.04	3.16	7.56
Johnson County	7.70	0.9	0.09	7.61	0.81
Tarrant County	320.02	57.5	0.07	319.95	57.43

Sources: The review team, based on Luminant 2009a.

1 In Bosque County, the city of Walnut Springs has a current daily water usage of 6000 gpd
2 serving 315 connections. However, maximum capacity data for the city's water treatment plant
3 are not available. Assuming the same usage for additional connections, the approximate
4 maximum capacity of the Walnut Springs water treatment plant is 38,100 gpd. The in-migrating
5 residents could increase water usage by 33,004 gpd, bringing the total demand to more than 86
6 percent of existing facility capacity. Walnut Springs relies solely on groundwater, so it is likely
7 that additional public or private wells would be needed to meet demand (Luminant 2009a).

8 Based on these factors and on information provided by Luminant and the review team's
9 independent evaluation, the review team concludes that the increased demand for water
10 associated with population growth from construction and pre-construction activities would have
11 a SMALL impact. However, the city of Walnut Springs has an existing water treatment capacity
12 problem that could be exacerbated by the in-migrating CPNPP construction workers. Based on
13 Luminant's estimate that 98 percent of socioeconomic impacts would be attributable to NRC-
14 authorized construction (Luminant 2009a), NRC staff also concludes that the increased demand
15 for water associated with NRC-authorized construction-related population growth would have
16 only a SMALL impact. However, NRC staff concludes that the city of Walnut Springs has an
17 existing water treatment capacity problem that could be exacerbated by the in-migrating workers
18 associated with NRC-authorized construction.

19 Conventional wastewater planning assumes that all of the water consumed by residents is
20 disposed of through wastewater treatment facilities. The data in Table 4-11 indicate that all of
21 the counties in the EIA have adequate wastewater treatment capacity to accommodate the
22 additional demand during the peak building period. However, some of the existing systems
23 would be approaching their capacities, especially in Somervell, Hood, Bosque, and Johnson
24 counties. Hood and Johnson counties are planning expansions of their existing wastewater
25 treatment systems independent of the decision to construct CPNPP Units 3 and 4 (Section
26 2.5.2.6), so the available capacity in those counties should be sufficient. There are no current
27 plans to expand the existing wastewater treatment systems in Somervell and Bosque counties,
28 which have existing wastewater treatment capacity problems that would be exacerbated by the
29 in-migrating construction workers.

30 Based on these factors and on information provided by Luminant and the review team's
31 independent evaluation, the review team concludes that the increased demand for wastewater
32 treatment associated with population growth from construction and pre-construction activities
33 would have a SMALL impact in most of the EIA, but could have a SMALL to MODERATE
34 impact in Somervell and Bosque counties. Based on Luminant's estimate that 98 percent of
35 socioeconomic impacts would be attributable to NRC-authorized construction (Luminant 2009a),
36 NRC staff also concludes that the increased demand for wastewater treatment associated with
37 NRC-authorized construction-related population growth would have a SMALL impact in most of
38 the EIA, but could have a SMALL to MODERATE impact in Somervell and Bosque counties.

39 **Solid Waste**

40 Building CPNPP Units 3 and 4 would increase the generation of solid waste in the EIA due to
41 the projected in-migration of 5573 new residents during the peak building period. (Section 3.3.1
42 discusses the increased generation of solid waste due to onsite building activities.) In 2007, per
43 capita solid waste generation in the United States was more than 4.6 lb/day (or 1679 lb/yr) (EPA
44 2008).

45 Based on the population growth patterns discussed in Section 4.4.2 and a per capita generation
46 rate of 1679 lb of solid waste per year, the review team estimates that 1076 additional tons of
47 solid waste per year would be generated in Somervell County, 2058 additional tpy in Hood

1 County, 515 tpy in Johnson County, 421 tpy in Tarrant County, 234 tpy in Erath County, and
2 187 tpy in Bosque County.

3 As discussed in Section 2.5.2.6, there are no active landfills in Somervell or Hood counties. In
4 2005 the IESI, Inc., Somervell County Transfer Station handled 14,284 tons of waste, and the
5 IESI, Inc., Granbury Transfer Station handled 16,153 tons. Thus, the additional solid waste
6 generated by the in-migrating residents of Somervell and Hood counties during the building
7 peak would represent a 7.5 percent increase for the IESI, Inc., Somervell County Transfer
8 Station and a 12.7 percent increase for the IESI, Inc., Granbury Transfer Station.

9 The total amount of additional solid waste from these two stations (3134 tons) would be
10 transported to the IESI, Inc., Weatherford Landfill in Parker County. The Weatherford Landfill
11 has an estimated 1.1 million tons of space remaining, so the total amount of solid waste
12 generated by the new residents of Somervell and Hood counties during the building peak would
13 represent only 0.3 percent of that excess capacity. Even considering the combined 1357 tons
14 of additional solid waste that would be generated in Bosque, Erath, Johnson, and Tarrant
15 counties, the review team expects that solid waste management and landfill capacity in the EIA
16 would be adequate.

17 Based on these factors and on information provided by Luminant and the review team's
18 independent evaluation, the review team concludes that the impacts of increased solid waste
19 associated with population growth from construction and pre-construction would be SMALL and
20 would warrant no mitigation. Based on Luminant's estimate that 98 percent of socioeconomic
21 impacts would be attributable to NRC-authorized construction (Luminant 2009a), NRC staff also
22 concludes that the impacts of increased solid waste associated with NRC-authorized
23 construction-related population growth would be SMALL and would require no mitigation.

24 ***Police, Fire, and Medical Services***

25 A temporary increase in population associated with the onsite workforce for a new nuclear
26 facility can increase the burdens on local police and fire departments and medical services.
27 Once building is completed, however, many of the onsite workers would leave, relieving the
28 burden on public services.

29 Building CPNPP Units 3 and 4 would increase the need for services in the EIA due to the
30 projected in-migration of 5573 new residents during the peak building period, 1196 into
31 Somervell and 2288 into Hood Counties. (Section 3.3.1 discusses CPNPP onsite security, fire,
32 and medical services during project building). The projected population of Somervell County in
33 2010 is 7693 (TSDC 2009a); given the county's current number of full-time police officers (19), it
34 would have 2.5 officers per 1000 residents without the CPNPP in-migrating workers. With the
35 CPNPP in-migrating workers during the peak building period, the number of police officers per
36 1000 residents in Somervell County would drop to 2.1. To maintain the current ratio of officers
37 per 1000 residents, Somervell County would need to add about three police officers during the
38 building peak employment period (2014).

39 Based on a projected 2010 population for Hood County of 48,396 (TSDC 2009a); the county's
40 67 full-time police officers represents 1.4 police officers per 1000 residents without the CPNPP
41 in-migrating workers. With the CPNPP in-migrating workers during the peak building
42 employment period, the number of police officers per 1000 residents in Hood County would drop
43 to 1.3. To maintain the current ratio of officers per 1,000 residents, Hood County would need to
44 add about three police officers during peak employment.

45 Local police officials have stated that they already have plans to expand services due to
46 population growth in Somervell and Hood counties independent of developing CPNPP Units 3

1 and 4 (Luminant 2009a). However, local police officials indicate that the planned building of
2 CPNPP Units 3 and 4 would hasten the intended expansions of staffing and infrastructure.
3 Based on these factors and on information provided by Luminant and the review team's
4 independent evaluation, the review team concludes that the impacts of construction and pre-
5 construction on local police resources would be SMALL and would warrant no mitigation.
6 Based on Luminant's estimate that 98 percent of socioeconomic impacts would be attributable
7 to NRC-authorized construction (Luminant 2009a), NRC staff also concludes that the impacts of
8 NRC-authorized construction activities on local police resources would be SMALL and would
9 warrant no mitigation.

10 The projected population of Somervell County in 2010 is 7693 (TSDC 2009a); given the
11 county's current number of paid and volunteer firefighters (40), it would have 5.2 firefighters per
12 1000 residents without the CPNPP in-migrating workers. With the CPNPP in-migrating workers
13 during the peak building period, the number of firefighters per 1000 residents in Somervell
14 County would drop to 4.5. To maintain the current ratio of firefighters per 1,000 residents,
15 Somervell County would need to add about six firefighters during peak employment.

16 The projected population of Hood County in 2010 is 48,396 (TSDC 2009a); given the county's
17 current number of volunteer firefighters (250), it would have 5.2 firefighters per 1000 residents
18 without the CPNPP in-migrating workers. With the CPNPP in-migrating workers during the peak
19 building period, the number of firefighters per 1000 residents in Hood County would drop to 4.9.
20 To maintain the current ratio of firefighters per 1,000 residents, Hood County would need to add
21 about 12 firefighters during peak employment.

22 CPNPP employs its own fire brigade to respond to all onsite emergencies; however, CPNPP
23 uses local firefighters when necessary in such situations. Local fire officials have stated that
24 they already have plans to expand services due to population growth in Somervell and Hood
25 counties independent of developing CPNPP Units 3 and 4 (Luminant 2009a). However, local
26 fire officials indicate that the planned building of CPNPP Units 3 and 4 would hasten the
27 intended expansions of staffing and infrastructure. Based on these factors and on information
28 provided by Luminant and the review team's independent evaluation, the review team
29 concludes that the impacts of construction and pre-construction on local firefighting capabilities
30 would be SMALL and would warrant no mitigation. Based on Luminant's estimate that 98
31 percent of socioeconomic impacts would be attributable to NRC-authorized construction
32 (Luminant 2009a), NRC staff also concludes that the impacts of NRC-authorized construction
33 activities on local firefighting capabilities would be SMALL and would warrant no mitigation.

34 Currently, the combined daily load at Glen Rose Medical Center and Lake Granbury Medical
35 Center is 23 beds. When planned expansions are complete, the two medical centers will have a
36 combined capacity of 142 beds, well above the current demand. The population growth
37 associated with onsite workers during the building peak would increase the populations of
38 Somervell and Hood counties by 16.7 percent and 5.0 percent, respectively (Section 4.4.2).
39 However, these increases would be temporary, and the review team expects that the existing
40 medical facilities would be more than adequate to accommodate the demands of this in-
41 migrating population. Based on these factors and on information provided by Luminant and the
42 review team's independent evaluation, the review team concludes that the impacts of
43 construction and pre-construction on local medical services would be SMALL and would warrant
44 no mitigation. Based on Luminant's estimate that 98 percent of socioeconomic impacts would
45 be attributable to NRC-authorized construction (Luminant 2009a), NRC staff also concludes that
46 the impacts of NRC-authorized construction activities on local medical services would be
47 SMALL and would warrant no mitigation.

1 **Social Services**

2 Social services in the EIA are provided by the Texas Department of Family and Protective
3 Services, nongovernmental organizations (NGOs), and religious groups. To the extent that
4 Luminant and its contractors would hire individuals who would otherwise rely on these social
5 services, building CPNPP Units 3 and 4 would help reduce demands on the service providers.
6 In addition, the beneficial economic effects of building CPNPP in terms of direct and indirect
7 jobs and incomes (Section 4.4.3.1) and State and local tax revenues (Section 4.4.3.2) would
8 enhance residents' and governments' ability to provide financial support for social services.
9 However, some of the new residents in-migrating to the area because of CPNPP construction
10 jobs would increase the demand for social services. Based on these factors and on information
11 provided by Luminant and the review team's independent evaluation, the review team
12 concludes that the impacts of construction and pre-construction on social services would be
13 SMALL and would warrant no mitigation. Based on Luminant's estimate that 98 percent of
14 socioeconomic impacts would be attributable to NRC-authorized construction (Luminant 2009a),
15 NRC staff also concludes that the impacts of NRC-authorized construction activities on social
16 services would be SMALL and would warrant no mitigation.

17 **4.4.4.5 Education**

18 Section 2.5.2.7 contains information about current enrollments and capacities of the school
19 districts most likely to be affected by CPNPP worker in-migration in Somervell and Hood
20 counties. For the peak building period, the review team estimates that 867 construction workers
21 and 124 operations workers would in-migrate with families to the EIA (Section 4.4.2). As
22 discussed in Section 4.4.2, the review team's analysis assumes an average household size of
23 3.0 persons. With respect to CPNPP worker households, the review team further assumes that
24 a family would average one child (aged between 0 and 18 year) per household, for a total of 991
25 new children in the EIA. Of these 991 new children, the review team assumes that 73.5 percent
26 (728 children) would be school-aged (i.e., 5 to 18 year old) based on an even distribution of
27 children aged 0 to 18 year. Thus, the review team's analysis assumes that the in-migrating
28 workers would bring 728 new K–12 students to the study area during the peak building period.

29 Based on the residential pattern of current CPNPP workers (Table 2-21), the review team
30 estimates that 167 new K-12 students would reside in Somervell County, 320 in Hood County,
31 80 in Johnson County, 66 in Tarrant County, 37 in Erath County, and 29 in Bosque County. The
32 remaining 29 students would reside in Hamilton and Parker counties.

33 In Somervell County, Glen Rose ISD has a maximum capacity of 2862 students, with enrollment
34 for the 2007–2008 school year at 1657 students. Thus, the addition of 167 new students would
35 not put Glen Rose ISD at capacity. Officials with Glen Rose ISD have indicated that the school
36 system would be capable of handling the influx of students generated by the anticipated
37 construction workforce (Luminant 2009a).

38 In Hood County, Granbury ISD has a maximum capacity of 8556 students and a September
39 2007 enrollment of 6882 students. Thus, the addition of 320 new students would not put
40 Granbury ISD at capacity.

41 Based on these factors and on information provided by Luminant and the review team's
42 independent evaluation, the review team concludes that the adverse impacts of construction
43 and preconstruction activities on local school districts would be SMALL. Based on Luminant's
44 estimate that 98 percent of socioeconomic impacts would be attributable to NRC-authorized
45 construction (Luminant 2009a), NRC staff also concludes that the adverse impacts of NRC-
46 authorized construction on local school districts would be SMALL. One possible exception is
47 Walnut Springs ISD in Bosque County, where enrollment could increase by 29 students (14

1 percent of current enrollment). However, during the building of CPNPP Units 1 and 2, the
2 district accommodated an influx of approximately 140 students. Local officials have stated that
3 the Walnut Springs ISD would be able to accommodate the additional students and would make
4 any necessary expansions (Luminant 2009a).

5 **4.4.4.6 Summary of Infrastructure and Community Service Impacts**

6 In Sections 4.4.4.4 and 4.4.4.5, the review team evaluated the potential impacts to infrastructure
7 and community services in the areas of public services (water and wastewater; solid waste;
8 police, fire, and medical services; and social services) and education. Based on the information
9 presented in those sections and on information provided by Luminant and the review team's
10 independent evaluation, the review team concludes that the infrastructure and community
11 services impacts of construction and preconstruction activities would be SMALL, with the
12 exception of potential MODERATE impacts to wastewater treatment facilities in Somervell and
13 Bosque counties. Based on Luminant's estimate that 98 percent of socioeconomic impacts
14 would be attributable to NRC-authorized construction (Luminant 2009a), NRC staff also
15 concludes that the impacts of NRC-authorized construction on infrastructure and community
16 services would be SMALL, with the exception of potential MODERATE impacts to wastewater
17 treatment facilities in Somervell and Bosque counties.

18 **4.4.5 Potential Mitigation Measures for Socioeconomic Impacts**

19 Most of the adverse socioeconomic impacts of developing CPNPP Units 3 and 4 would be
20 SMALL and temporary and would not warrant additional mitigation. However, as discussed in
21 Section 4.4.4.1, the traffic increases that would occur due to worker trips to and from the
22 CPNPP site would have MODERATE impacts on traffic flow and LOS on FM 56 (particularly
23 during the morning and afternoon peak traffic hours north of the CPNPP entrance). This is
24 especially true when this additional traffic is combined with the traffic impacts of the large trucks
25 used for gas exploration and drilling in the project area, which may not be fully characterized by
26 the 2007 AADT data. These impacts could warrant increased road maintenance and repairs or
27 additional mitigation measures from Luminant (such as two shifts each day, staggered shift
28 change times, and mandatory carpooling for workers) and TxDOT (such as improvements to
29 traffic signals, lane width, turn lanes, and signage in the immediate area of the CPNPP site).
30 Prior to commencing project building, Luminant should coordinate with TxDOT and the
31 governments of Somervell and Hood counties to plan for and implement appropriate mitigation.

32 **4.4.6 Summary of Socioeconomic Impacts**

33 The review team has assessed the proposed construction and preconstruction activities related
34 to building CPNPP Units 3 and 4 and the potential socioeconomic impacts in the region.
35 Physical impacts on workers and the general public include impacts on existing buildings,
36 transportation, aesthetics, noise levels, and air quality. Social and economic impacts span
37 issues of demographics, economy, taxes, infrastructure, and community services. Overall,
38 construction and preconstruction activities at CPNPP Units 3 and 4 would have both adverse
39 and beneficial impacts on socioeconomic resources in the EIA as explained below.

40 Based on information supplied by Luminant, the current availability of services, and additional
41 taxes that would likely compensate the need for additional services, the review team concludes
42 the impacts from construction and preconstruction activities on the affected local economies
43 would be beneficial and SMALL in the EIA. The effect on tax revenues would be beneficial and
44 SMALL, except for tax revenues in Somervell County (and to a lesser extent, Hood County),
45 which would be beneficial and LARGE. The site is relatively isolated, so aesthetic and
46 recreational impacts near the site would be SMALL.

1 The impacts on public services would be SMALL throughout the region. The review team
2 expects the overall impact on infrastructure and community services would be SMALL with the
3 exception of transportation. Increased vehicular traffic would occur, especially on FM 56, during
4 the peak building period. Given the size of the traffic increases that would occur due to worker
5 trips to and from the CPNPP site and to personal trips by workers and their families, it is likely
6 that building would have SMALL impacts on traffic flow and LOS on most roads in the EIA, and
7 but MODERATE impacts on traffic flow and LOS on FM 56 (particularly during the morning and
8 afternoon peak traffic hours north of the CPNPP entrance). These traffic impacts could warrant
9 mitigation, as discussed in Section 4.4.5.

10 Population growth resulting from the in-migration of CPNPP construction and preconstruction
11 workers during the peak periods would create additional demand for recreation, housing, public
12 services (water and wastewater; solid waste; police, fire, and medical services; and social
13 services), and education. However, the review team concludes that the impacts of this
14 increased demand would be SMALL given existing and planned resources and facilities.

15 **4.5 Environmental Justice Impacts**

16 The review team evaluated whether building CPNPP Units 3 and 4 would have
17 disproportionately high and adverse human health or environmental effects (Executive Order
18 12898) on minority or low-income populations in the region. To conduct this assessment, the
19 review team: (1) identified all potentially significant pathways for human health and
20 environmental effects, (2) determined the impact of each pathway for potentially affected
21 minority and low-income populations identified in Section 2.6, and (3) determined whether the
22 unique characteristics or practices of the populations would result in disproportionately high and
23 adverse effects on the minority or low-income populations.

24 The closest census block group cluster that contains a minority population of interest shares a
25 boundary with the CPNPP site to the south and west. Two small Census block group clusters lie
26 about six mi from the CPNPP. At much greater distances (more than ten miles from the site)
27 clusters of Census block groups can be found scattered throughout the southwest and the
28 northeast of the site, with the largest concentrations of minority populations of interest near Fort
29 Worth. Of these Census blocks, about 1.3 percent had an Aggregate Minority population that
30 exceeded one of the above criteria, and about 5.1 percent had an Aggregate Minority plus
31 Hispanic population that exceeded one of the above criteria. The closest Census block group
32 cluster with a low-income population of interest lies between 30 and 35 mi of the CPNPP to the
33 southwest, near Dublin in Erath County.

34 **4.5.1 Health and Environmental Impacts**

35 The review team evaluated whether the health or welfare of minority and low-income
36 populations in those Census blocks identified in Section 2.6 of this EIS could experience
37 disproportionately high and adverse affects by the impacts of building the proposed Units 3 and
38 4 at the CPNPP site. To perform this assessment, the review team followed the methodology
39 described in Section 2.6.1. In the context of construction and pre-construction activities at the
40 CPNPP site, the review team considered the questions outlined in Section 2.6.1.

41 As discussed in Section 2.6.3, the review team did not find any evidence of unique
42 characteristics or practices in the region that could lead to a disproportionately high and adverse
43 impact on any minority or low-income population.

44 For all three health-related considerations described in Section 2.6.1, the review team
45 determined through consultations with NRC staff health physics experts that the expected

1 building-related level of environmental emissions is well below the protection levels established
2 by NRC and EPA regulations and cannot impose a disproportionately high and adverse
3 radiological health effect on any identified minority or low-income populations.

4 The health and environmental effects of developing a nuclear power plant are very similar to
5 those of constructing any large-scale industrial project. There are three primary exposure
6 media in the environment: soil, water, and air. The following subsections discuss the potential
7 impacts of project development through each of these pathways.

8 **4.5.1.1 Soil Pathway**

9 Building activities on the CPNPP site would represent the largest potential source of soil-related
10 environmental impacts. However, soil-disturbing activities would be temporary, localized to the
11 CPNPP site, and at least 0.9 mi from the nearest surrounding populations. Further, soil
12 migration is not likely to occur due to adherence to regulations and permits and the use of
13 BMPs. In addition, the building site would be well-defined, access would be restricted, and no
14 minority or low-income populations or individuals would be relocated from the site. Therefore,
15 the review team concludes that soil-related environmental impacts during the building of CPNPP
16 Units 3 and 4 would not have disproportionately high and adverse human health or
17 environmental effects on minority or low-income populations.

18 **4.5.1.2 Water Pathway**

19 **Water Quality:** As discussed in Section 4.2.3, water quality impacts from building CPNPP Units
20 3 and 4 would be similar to those for other large industrial construction projects. Hydrological
21 alterations resulting from site preparation and building activities would be localized and
22 temporary, disturbed land would be stabilized to prevent erosion, and permits, certifications and
23 the SWPPP would warrant the implementation of BMPs to minimize impacts. Therefore, in
24 Section 4.2.3.1 the review team concludes that the surface water quality impacts of construction
25 and preconstruction activities would be minimal. Similarly, in Section 4.2.3.2 the review team
26 concludes that the groundwater quality impacts of construction and preconstruction activities
27 would be minimal. Given these conclusions regarding surface water and groundwater, the
28 review team concludes that the water-related environmental impacts of building CPNPP Units 3
29 and 4 would not have disproportionately high and adverse human health or environmental
30 effects on minority or low-income populations.

31 **Water Quantity:** As discussed in Section 4.2.2.1, CPNPP is the only consumptive user of
32 water from SCR and there are no other users that depend upon water availability from SCR.
33 Therefore, the review team determined there is no potential surface water pathway from building
34 activities by which a disproportionately high and adverse impact could be imposed upon any
35 minority or low-income population. In addition, as discussed in Section 4.2.2.2, there would be
36 no groundwater use during construction of CPNPP Units 3 and 4 beyond current limited onsite
37 withdrawals and there would be no impacts from groundwater use that could lead to a water
38 quantity pathway to a disproportionately high and adverse impact from building activities.

39 **4.5.1.3 Air Pathway**

40 During the building of CPNPP Units 3 and 4, air emissions would be expected from increased
41 vehicle traffic, construction equipment, and fugitive dust from building activities. Emissions from
42 vehicles and construction equipment would be unavoidable, but they would be localized and
43 small. Criteria pollutant emissions from fugitive dust would be localized, and particulate matter
44 (primarily dust and diesel carbon exhaust) control measures would be implemented to maintain
45 compliance with National Ambient Air Quality Standards (NAAQS). Because Somervell and
46 Hood counties are currently in attainment of all of the NAAQS air pollutants, the marginal

1 degradation of air quality that can be associated with the building activities of CPNPP Units 3
2 and 4 would impose negligible impacts on all populations. Therefore, the review team
3 concludes that air-quality-related impacts during project building would not have
4 disproportionately high and adverse human health or environmental effects on minority or low-
5 income populations.

6 **4.5.1.4 Noise**

7 Building activities at CPNPP Units 3 and 4 would create noise primarily associated with heavy
8 construction equipment and vehicular traffic. As discussed in Section 4.4.1.5, Luminant has
9 stated that it would use specific measures to reduce noise impacts as much as possible,
10 including using quieter newer equipment, using mufflers, limiting noisy work to daylight hours,
11 and notifying the affected areas before unusual noise events (Luminant 2009a). Because any
12 noise impacts would be temporary and localized to the CPNPP site, the review team concludes
13 that noise-related impacts during the building of CPNPP Units 3 and 4 would not have
14 disproportionately high and adverse human health or environmental effects on minority or low-
15 income populations.

16 **4.5.2 Socioeconomic Impacts**

17 The review team reviewed the socioeconomic impacts of building CPNPP Units 3 and 4
18 (Section 4.4) to evaluate if there would be any disproportionately high and adverse human
19 health or environmental effects on minority or low-income populations. Based on those
20 evaluations, the socioeconomic areas in which disproportionately high and adverse effects are
21 most likely would be in transportation and housing.

22 For transportation, increases in vehicular traffic during the peak building period would impede
23 traffic flow and reduce LOS on area roads, especially FM 56 (Section 4.4.4.1). However, the
24 review team concludes that these impacts would not have any disproportionately high and
25 adverse effects on minority or low-income populations because the severity of the impacts on
26 individual drivers would depend on where and when they drove rather than on their race,
27 ethnicity, or income. Further, the area where local roads would be most affected (i.e., within 10-
28 mi of the CPNPP) has much lower percentages of minority and low-income populations than the
29 region and the state of Texas (Section 2.6). Therefore, in terms of transportation, the adverse
30 impacts of building CPNPP Units 3 and 4 would not disproportionately affect minority and low-
31 income populations.

32 The increased demand for short-term housing during the peak building period at CPNPP could
33 decrease the availability and increase the price of short-term housing in the EIA (Section
34 4.4.4.3). Although increases in housing prices could have a noticeable effect on low-income
35 populations because their ability to afford short-term housing would be reduced relative to that
36 of higher-income populations the review team believes the impact would still be minimal, given
37 the temporary nature of any potential price increase and the fact that low income housing prices
38 are often subsidized or otherwise controlled, and that the amenities found in low income
39 housing are not a good match with the factors driving the demand for construction worker
40 housing.

41 **4.5.3 Subsistence and Special Conditions**

42 As discussed in Section 2.6.3, the review team's scoping and outreach did not identify any
43 special socioeconomic or health circumstances or potential pathways that could lead to
44 disproportionately high and adverse health and environmental impacts. Regarding subsistence
45 populations, the review team did not identify any unique resource dependencies or practices or

1 other circumstances that could result in disproportionately high and adverse impacts to minority
2 or low-income populations. Specifically, based on U.S. Census data, the review team identified
3 no low-income populations near the CPNPP site, where potential power plant related impacts
4 would be expected to be most significant. Moreover, the low-income populations identified in
5 the larger region are principally located within urban areas near the city of Forth Worth where
6 subsistence-type dependence on natural resources (e.g., fish, game, agricultural products, and
7 natural water sources) is less likely.

8 **4.5.4 Summary of Environmental Justice Impacts**

9 The review team found no evidence that the construction and preconstruction activities for
10 CPNPP Units 3 and 4 would have any disproportionately high and adverse human health or
11 environmental effects on minority or low-income populations through the pathways of soil,
12 water, and air. Similarly, the impacts of construction and preconstruction activities on most
13 socioeconomic resources would not have disproportionately high and adverse effects on
14 minority or low-income populations.

15 Based on the information presented in this section and on information provided by Luminant and
16 the review team's independent evaluation, the review team concludes that the environmental
17 justice impacts of construction and preconstruction activities would be SMALL, and no further
18 mitigation would be warranted.

19 **4.6 Historic and Cultural Resources**

20 The National Environmental Policy Act of 1969 (NEPA 1969), as amended, requires Federal
21 agencies to take into account the potential effects of their undertakings on the cultural
22 environment, which includes archaeological sites, historic buildings, and traditional places
23 important to local populations. The National Historic Preservation Act of 1966 (NHPA 1966), as
24 amended through 2000, also requires Federal agencies to consider impacts to those resources
25 if they are eligible for listing on the *National Register of Historic Places* (NRHP) (such resources
26 are referred to as "historic properties" in NHPA). As outlined in 36 CFR 800.8, "Coordination
27 with the National Environmental Policy Act of 1969," the NRC coordinated compliance with
28 Section 106 of NHPA in meeting the requirements of NEPA.

29 Construction and preconstruction of new nuclear power plants can affect either known or
30 undiscovered cultural resources. The NRC has determined that evaluating the suitability of the
31 existing CPNPP site for building, operating, and decommissioning a new nuclear unit is an
32 undertaking that could possibly affect either known or potential historic properties that may be
33 located at the site. Therefore, in accordance with the provisions of NHPA and NEPA, the NRC
34 is required to make a reasonable and good-faith effort to identify historic properties in the Area
35 of Potential Effect (APE) and, if present, determine if any significant impacts are likely to occur.
36 Identification is to occur in consultation with the State Historic Preservation Officer (SHPO),
37 American Indian Tribes, interested parties, and the public. If significant impacts are possible,
38 efforts should be made to mitigate them. As part of the NEPA/NHPA integration, if no historic
39 properties (i.e., places eligible for listing in the NRHP) are present or affected, the NRC is
40 required to notify the SHPO before proceeding. If it is determined that historic properties are
41 present, the NRC is required to assess and resolve any adverse effects of the undertaking.

42 For specific historic and cultural information on the CPNPP site, see Section 2.7 of this EIS. As
43 explained in Section 2.7, previous cultural resource identification efforts indicated the presence
44 of several archaeological sites, one of which is eligible for listing in the NRHP. The NRHP-
45 eligible site, 41SV30, lies outside of the APE for building impacts and was found to no longer

1 retain its archaeological integrity (Luminant 2009a). Luminant reports that in February 2007 the
2 SHPO concurred that no historic properties would be affected (Luminant 2009a).

3 Luminant plans to monitor land disturbing activities during the building of CPNPP Units 3 and 4
4 and associated transmission lines to identify potential cultural resources that may not have been
5 identified during the Section 106 review process (Luminant 2009a). In the event of an
6 inadvertent find, Luminant plans to stop work and notify the appropriate county authority, State
7 Historic Preservation Office (SHPO), and Tribal Historic Preservation Office (THPO).

8 Transmission service for the CPNPP site is provided by Oncor, an independent system operator
9 for the region. Oncor is responsible for operating, maintaining, building, dispatching, and
10 marketing the electric transmission system from the generator bus bars on the CPNPP site
11 through the distribution substations. Section 3.2.2.3 provides more details regarding Oncor's
12 responsibilities.

13 Oncor has not finalized the routes and designs of the proposed transmission lines ROWs.
14 Oncor has established procedures for identifying historic and cultural resources when siting and
15 building new transmission line ROWs (Oncor 2008). The full extent of potential historic and
16 cultural resource impacts in the transmission line ROWs would be estimated only after following
17 the PUCT process for routing and alignment of such transmission lines (Luminant 2009a).
18 Once this process is completed, Oncor would undertake the appropriate cultural resource
19 studies to ensure that resources were identified and addressed before the transmission lines
20 are built (Oncor 2008). In addition, consultation by Oncor with the Texas Historical Commission
21 would establish requirements to follow should archaeological, historical, or other cultural
22 resources be uncovered during building of the transmission lines (Oncor 2008). According to 10
23 CFR 50.10 (a)(2)(vii), transmission lines are not included in the definition of construction and are
24 not an NRC-authorized activity.

25 Based on (1) the construction and preconstruction measures that Luminant would take to avoid
26 adverse impacts to significant cultural resources, (2) the measures that Oncor would be
27 expected to take to avoid adverse impacts to significant cultural resources, and (3) the review
28 team's cultural resource analysis and consultation, it is the review team's conclusion that the
29 potential impacts on historic and cultural resources would be SMALL. Mitigation might be
30 warranted in the event of an inadvertent discovery.

31 The NRC staff believes that most of the impacts on cultural resources would be the result of
32 preconstruction activities. Based on this information, the NRC staff concludes that the cultural
33 resource impacts of NRC-authorized construction activities would be SMALL, and no further
34 mitigation would be warranted.

35 **4.7 Meteorological and Air Quality Impacts**

36 Sections 2.9.1 and 2.9.2 describe the meteorological characteristics and air quality of the
37 CPNPP site. The primary impacts of building CPNPP Units 3 and 4 on local meteorology and
38 air quality would be from dust from land clearing and building activities, open burning of debris,
39 emissions from equipment and machinery, concrete batch plant operations, and emissions from
40 vehicles used to transport workers and deliver materials to and from the plant site.

41 The ER (Luminant 2009a) describes the activities that would be conducted at the CPNPP site
42 in Section 3.9. Sections 3.9.3 and 3.9.4 of the ER specifically address air quality impacts
43 associated with land clearing and building activities. Air quality impacts directly associated with
44 these activities are described in the next section (4.7.1); air quality impacts associated with
45 transportation of construction workers are addressed in Section 4.7.2.

1 **4.7.1 Construction and Preconstruction Activities**

2 Preconstruction and construction activities at the CPNPP site would result in temporary impacts
3 to local air quality. Fugitive dust particle emissions would be generated during earthmoving,
4 concrete batch plant operation, and movement of vehicular traffic. Fugitive dust particles would
5 be generated from the movement of machinery and materials as well as during windy periods
6 over recently disturbed or cleared areas. There would also be emissions of particulate matter,
7 VOCs, nitrogen oxides, sulfur dioxides, and carbon monoxide associated with the fueling and
8 combustion of fuels in equipment, off-road vehicles, and the operation of a concrete batch plant.
9 Because Somervell County is in attainment or unclassified for all criteria pollutants for which
10 National Ambient Air Quality Standards have been established (40 CFR 81.344), a conformity
11 analysis on direct and indirect emissions is not required (58 FR 63214).

12 To minimize impacts associated with these emissions, the facility would require a concrete
13 batch plant air permit and a State Construction Air Permit. The concrete batch plant process
14 would generate particulates during the loading of dry concrete and aggregate. Based on the
15 estimated volume of concrete required, the total amount of particulates that would be generated
16 is estimated to be less than 53 tons, which would qualify the concrete batch plant as a minor
17 source of emissions. Both the concrete batch plant permit and State Construction Air Permit
18 would prescribe emissions limits and a variety of mitigation measures that would be
19 implemented.

20 In the ER (Luminant 2009a) Luminant has committed to the development and use of a
21 Construction Environmental Controls Plan prior to beginning construction and preconstruction
22 activities. The Construction Environmental Controls Plan would include air quality protection
23 procedures to be used to minimize the generation of fugitive dust and the release of emissions
24 from equipment and vehicles. These actions would include managing the use of unpaved roads
25 (speed limits, use of dust suppression, and minimization of dirt tracking onto paved roads);
26 covering haul trucks; phasing grading activities to minimize the exposed amount of disturbed
27 soils; stabilizing roads and excavated areas with coarse material covers or vegetation; and
28 performing proper maintenance of vehicles, generators, and other equipment.

29 Construction activities would also result in greenhouse gas emissions, principally carbon dioxide
30 (CO₂). Assuming a 7-yr construction period and typical construction practices, the review team
31 estimates that the total construction equipment CO₂ emission footprint for building two nuclear
32 power plants at the CPNPP site would be of the order of 70,000 metric tons, as compared to a
33 total United States annual CO₂ emission rate of 6,000,000,000 metric tons (EPA 2010).
34 Appendix J provides the details of the review team estimate for a reference 1000 MW(e) nuclear
35 power plant. Based on its assessment of the relatively small construction equipment carbon
36 footprint as compared to the United States annual CO₂ emissions, the review team concludes
37 that the atmospheric impacts of greenhouse gases from construction and preconstruction
38 activities would not be noticeable and additional mitigation would not be warranted.

39 In general, emissions from construction and preconstruction activities (including greenhouse
40 gas emissions) would vary based on the level and duration of a specific activity, but the overall
41 impact is expected to be temporary and limited in magnitude. Considering the information
42 provided by Luminant and its commitment to comply with all federal, state, and local regulations
43 that govern emissions, the review team concludes that the impacts from CPNPP Units 3 and 4
44 construction and preconstruction activities on air quality would not be noticeable because
45 appropriate mitigation measures would be adopted.

1 **4.7.2 Transportation**

2 The maximum number of site workers for proposed CPNPP Units 3 and 4 would be 4953
3 construction workers and 258 operations workers, but this number would be maintained for less
4 than 1 year. During the 5-year period from 2013 through 2017, the number of onsite workers
5 would be an average of 2927 (Luminant 2009a). As discussed in Section 4.4.4.1, Luminant
6 estimated, based on prior experience on Units 1 and 2, that carpooling for the workers would
7 occur at an average rate of 2.340 workers per car, resulting in 2117 added vehicle trips each
8 morning and each afternoon, compared to a current level of 12,000 trips per day. Air quality
9 impacts associated with these trips would include exhaust emissions from the vehicles.
10 Assuming that the length of each trip and types of vehicles would be approximately the same as
11 current vehicle traffic, exhaust emissions within the local area would increase, at peak
12 construction, by about 18 percent over current levels.

13 Construction workforce transportation would also result in greenhouse gas emissions,
14 principally carbon dioxide (CO₂). Assuming a 7-yr construction period and a typical workforce,
15 the review team estimates that the total construction workforce CO₂ emission footprint for
16 building two nuclear power plants at the CPNPP site would be of the order of 300,000 metric
17 tons; again, this is compared to a total United States annual CO₂ emission rate of
18 6,000,000,000 metric tons (EPA 2010). Appendix J provides the details of the review team
19 estimate for a reference 1000 MW(e) nuclear power plant. Based on its assessment of the
20 relatively small construction workforce carbon footprint as compared to the United States annual
21 CO₂ emissions, the review team concludes that the atmospheric impacts of greenhouse gases
22 from construction workforce transportation would not be noticeable and additional mitigation
23 would not be warranted.

24 Based on the limited increase in local vehicle traffic and the potential mitigation measures listed
25 in the ER, the review team concludes that the impact on the local air quality (including the effect
26 of greenhouse gas emissions) related to construction and preconstruction activities would be
27 temporary and would not be noticeable because appropriate mitigation measures would be
28 adopted.

29 **4.7.3 Summary**

30 The review team evaluated potential impacts on air quality associated with criteria pollutants
31 and greenhouse gas emissions during CPNPP site development activities. The review team
32 determined that the impacts would be minimal. On this basis, the review team concludes that
33 the impacts of CPNPP site development on air quality from emissions of criteria pollutants and
34 CO₂ emissions are SMALL and that no further mitigation is warranted. Because NRC-
35 authorized construction activities represent only a portion of the analyzed activities, the NRC
36 staff concludes that the air quality impacts of NRC-authorized construction activities would also
37 be SMALL, and no further mitigation beyond those the applicant has committed to implement
38 would be warranted.

39 **4.8 Nonradiological Health Impacts**

40 Luminant indicated that the physical impacts of building activities, including public health,
41 occupational health, noise, and transportation, would be minimal. Luminant qualitatively
42 discussed them in the ER (Luminant 2009a).

43 The area around the CPNPP site is a mixture of farmland and residential properties. The site
44 follows the shore of SCR on the north, east, and south (Luminant 2009a). The 2007 population
45 within 10 mi of the site, based on the 2000 U.S. Census, was about 32,500 (Luminant 2009a).

1 In addition to nine major pipelines, there are three other major industrial sites in the vicinity: the
2 DeCordova Compressor Station, Wolf Hollow gas-fired power plant, and the DeCordova Steam
3 Electric Station (Luminant 2009a). The following sections discuss the results of the staff's
4 assessment of nonradiological health impacts for the CPNPP site.

5 **4.8.1 Public and Occupational Health**

6 **4.8.1.1 Public Health**

7 Luminant stated in its ER that the physical impacts to the public from construction and
8 preconstruction activities at the CPNPP site might include inhalation of dust and vehicle exhaust
9 as sources of air pollution during site preparation and redress (Luminant 2009a). Luminant
10 stated that operational controls would be imposed to mitigate dust emissions, employing such
11 methods as stabilizing construction roads and spoils piles, periodically watering unpaved roads,
12 limiting vehicle speeds, covering haul trucks, phased grading, and revegetating road medians
13 and slopes (Luminant 2009a).

14 Engine exhaust would be minimized by maintaining fuel-burning equipment in good mechanical
15 order (Luminant 2009a). Luminant (Luminant 2009a) stated that applicable Federal, State, and
16 local emission requirements would be adhered to as they relate to open burning or the operation
17 of fuel-burning equipment.

18 The public would not be close to the construction site. The nearest accessible area is about
19 0.8 mi from the construction site for CPNPP Units 3 and 4, and the nearest residence is
20 approximately 0.9 mi from the construction site (Luminant 2009a). Luminant has opened SCR
21 for public use with controlled access; therefore, boaters and fisherman might be able to get
22 closer than 0.8 mi for limited periods of time.

23 **4.8.1.2 Construction Worker Health**

24 In general, human health risks for construction workers and other personnel working onsite
25 would be expected to be dominated by occupational injuries (e.g., falls, electrocution,
26 asphyxiation) to workers engaged in activities such as construction, maintenance, and
27 excavation. Historically, actual injury and fatality rates at nuclear reactor facilities have been
28 lower than the average U.S. industrial rates. According to the U.S. Bureau of Labor Statistics
29 (BLS) (BLS 2009), the fatal work injury rate has continued a gradual drop from 5.8 to 3.8 per
30 100,000 workers from 1992 through 2007. Luminant (Luminant 2009a) expects that the
31 construction workforce for proposed Units 3 and 4 would range from 119 in 2010 to more than
32 4953 (2014) over the 7 years of expected construction. The total workforce for the construction
33 of Units 3 and 4, varies over 12 years, beginning at 22 in 2008, increasing to a maximum of
34 5201 in 2014, and back down to 412 in 2019.

35 While statistical rates show some variation, they can be used to get a rough idea of health
36 impacts on the construction workers. The total labor force involved in the expansion of CPNPP
37 (Luminant 2009a) was multiplied by 2007 rates and totaled over the years of construction. (If
38 the current trend of declining deaths continues, these numbers should be bounding.) Using the
39 BLS fatal injury rate for the workforce overall and for construction (BLS 2009), one would not
40 expect a fatality (0.06–0.17 expected fatalities) during the expansion. With slightly older (and
41 higher) risk factors from the Center for Construction Research and Training (CPWR 2008a,
42 2008b), one might project one to two fatal accidents during this time.

43 The BLS also tracks different kinds of nonfatal work injuries (BLS 2008a, 2008b, 2008c, 2008d).
44 Applying the 2007 rates to the same work force over the years of work produced the projected
45 occupational illnesses and injuries in Table 4-12. The total number of reportable injuries and

1 occupational illnesses could range from 558 to 887 over the length of the project. The smallest
 2 number used the 2007 rate for utility construction in Texas. Projected nonfatal accidents and
 3 occupational illnesses severe enough to cause days away from work would be much smaller,
 4 ranging from 197 to 361, with Texas utility construction again at the lower end.

Table 4-12. Projected total nonfatal occupational illnesses and injuries to construction force using 2007 rates for various groups

	Total reportable occupational illnesses and injuries				Occupational illnesses and injuries with days away from work			
	All Private Industry	All Construction	Texas Construction	Texas Utility Construction	All Private Industry	All Construction	Texas Construction	Texas Utility Construction
Rate per 100 full-time workers per year	4.2 ^(a)	5.4 ^(b)	3.8 ^(c)	3.4 ^(c)	1.2 ^(a)	1.9 ^(d)	2.2 ^(c)	1.2 ^(c)
Illnesses and injuries	690	887	624	558	197	312	361	197

- (a) BLS 2008a
- (b) BLS 2008b
- (c) BLS 2008c
- (d) BLS 2008d

5 Occupational injury and fatality risks are reduced by strict adherence to NRC and Occupational
 6 Safety and Health Administration (OSHA) safety standards, practices, and procedures.
 7 Appropriate State and local statutes must also be considered when assessing the occupational
 8 hazards and health risks associated with construction. The staff assumes that Luminant would
 9 adhere to NRC, OSHA, and State safety standards, practices, and procedures during
 10 construction activities. Luminant states that workers would have adequate training and personal
 11 protective equipment to reduce the possibility of harmful exposures. A safety and medical
 12 program will be provided for construction workers, and all construction contractors and site staff
 13 would be required to comply with site safety, fire, radiation, and security policies, procedures,
 14 and safe work practices; State and Federal regulations; and site-specific permit conditions.
 15 Emergency first aid would be available at the construction site (Luminant 2009a). These actions
 16 would help minimize or prevent injury, illness, and death.

17 Other nonradiological impacts to construction workers discussed in this section include noise,
 18 fugitive dust, and gaseous emissions resulting from construction activities. Mitigation measures
 19 discussed in this section for the public also would help limit exposure to construction workers.
 20 Onsite impacts to construction workers would also be mitigated through training and use of
 21 personal protective equipment to minimize the risk of potentially harmful exposures. In addition
 22 to emergency first-aid care, regular health and safety monitoring of construction personnel could
 23 be undertaken.

1 **4.8.1.3 Summary of Public and Construction Worker Health Impacts**

2 Based on mitigation measures identified by Luminant in its ER (Luminant 2009a), permits and
3 authorizations required by State and local agencies, and the review team's independent review,
4 the review team concludes that the nonradiological health impacts to the public and workers
5 from construction and preconstruction activities would be SMALL, and additional mitigation
6 beyond the actions stated above would not be warranted.

7 **4.8.2 Noise Impacts**

8 Preconstruction and construction actions for a nuclear power plant are similar to those for other
9 large projects. They involve many noise-generating activities. Regulations governing noise
10 from construction-type activities are generally limited to protecting workers' hearing. Federal
11 regulations governing construction noise are found in 29 CFR 1910 and 40 CFR 204. The
12 regulations in 29 CFR 1910 deal with noise exposure in the construction environment, and the
13 regulations in 40 CFR 204 generally govern the noise levels of compressors. Neither the state
14 of Texas nor Hood or Somervell counties have specific noise regulations that specify acceptable
15 community noise levels (Luminant 2009a).

16 The ER (Luminant 2009a) indicates that activities associated with new construction at the
17 CPNPP site would have equipment producing peak noise levels in the 93- to 108-dBA range.
18 As illustrated in Table 4-13, noise strongly attenuates with distance. A 10-dBA decrease in
19 noise level is generally perceived as cutting the loudness in half. At a distance of 50 ft from the
20 point source, these peak noise levels would generally decrease to the 73- to 102-dBA range,
21 and at distance of 400 ft, the noise levels would generally be in the 58- to 84-dBA range,
22 depending on the source of the construction equipment. For context, Tipler (1982) lists the
23 sound intensity of a quiet office as 50 dBA, normal conversation as 60 dBA, busy traffic as 70
24 dBA, and a noisy office with machines or an average factory as 80 dBA. Construction noise (at
25 10 ft) is listed as 110 dBA, and the pain threshold is 120 dBA.

26 The ER (Luminant 2009a) states that the exclusion area boundary of the CPNPP site would be
27 greater than 0.8 mi from construction activities for new units. A 100-dBA noise level at 50 ft
28 from an activity would be expected to decrease to about 60 dBA at the exclusion area boundary.
29 There are no major roads, public buildings, or residences within the exclusion area. Similarly, a
30 100-dBA noise level would be expected to decrease to about 60 dBA (TRs 2009) at the nearest
31 residence, which is approximately 0.9 mi from the construction area. These estimates do not
32 include the noise attenuation associated with vegetation and topography. The use of several
33 noise-producing machines at one time could result in higher noise levels than a single-point
34 noise source.

35 Noise is more intrusive during sleeping hours than during work hours. For that reason
36 construction at night would be limited to essential operations. Most construction activities are
37 expected to occur between 0700 and 1700, although there would be some occasions when
38 construction had to continue at night, such as during continuous concrete pours. Unusual
39 construction noise, such as steam blows or blasting, could produce temporary excessive noise
40 levels (Luminant 2009a). Noise mitigation could be accomplished by maintenance of
41 equipment, verifying that noise control equipment on vehicles and equipment is in proper
42 working order, restriction of noise- and vibration-generating activities to daylight hours,
43 prohibiting construction activities from specific roads and neighborhood, and notifying people in
44 surrounding areas before periods of higher noise (Luminant 2009a). Occupational exposure
45 would be monitored, and construction personnel would be provided with hearing protection
46 when appropriate.

1

Table 4-13. Construction noise sources and attenuation with distance

Source	Noise Level (dBa) (peak)	Noise Level (dBa) Distance from Source			
		50 ft	100 ft	200 ft	400 ft
Heavy trucks	95	84–89	78–83	72–77	66–71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80–89	74–82	68–77	60–71
Dozer	107	87–102	81–96	75–90	69–84
Generator	96	76	70	64	58
Crane	104	75–88	69–82	63–76	55–70
Loader	104	73–86	67–80	61–74	55–68
Grader	108	88–91	82–85	76–79	70–73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Forklift	100	95	89	83	77

Source: Golden et al., 1980.

2 According to NUREG-1437 (NRC 1996), noise levels below 60 to 65 dBA are considered to be
 3 of small significance. More recently, the impacts of noise were considered in NUREG-0586,
 4 Supplement 1 (NRC 2002). The criterion for assessing the level of significance was not
 5 expressed in terms of sound levels but based on the effect of noise on human activities. The
 6 criterion in NUREG-0586, Supplement 1, is stated as follows:

7 The noise impacts...are considered detectable if sound levels are sufficiently
 8 high to disrupt normal human activities on a regular basis. The noise
 9 impacts...are considered destabilizing if sound levels are sufficiently high that
 10 the affected area is essentially unsuitable for normal human activities, or if the
 11 behavior or breeding of a threatened and endangered species is affected.

12 Considering the temporary nature of construction activities and the location and characteristics
 13 of the CPNPP site, the review team concludes that noise impacts from construction and
 14 preconstruction activities would be SMALL, and no further mitigation beyond the actions
 15 identified above would be warranted.

16 **4.8.3 Transporting Construction Materials and Personnel to the CPNPP Site**

17 In 1987 during the construction of Units 1 and 2, a traffic study was commissioned to improve
 18 traffic flow on FM 56 at the CPNPP entrance. During that time approximately 8694 people were
 19 employed onsite. The study identified 3710 vehicles entering the site per day, or approximately
 20 2.34 persons per vehicle. After the completion of the study, improvements in the form of traffic
 21 signals, widened lanes, turn lanes, and additional signage were made in the immediate area to
 22 handle the volume of traffic (Luminant 2009a).

23 Luminant estimates the peak construction workforce at 4953 (in late 2014), with 248 additional
 24 operations workers onsite. Assuming a conservative 1.8 people per vehicle, the onsite

1 workforce of 5201 (Luminant 2009a) results in about 2900 vehicles. Approximately 100 truck
2 deliveries per day would add little to the traffic volume. This number of vehicles would be less
3 than the 3710 vehicles experienced during construction of Units 1 and 2. (There was an
4 average of 2.34 people per vehicle at that time [Luminant 2009a.]) Units 1 and 2 need refueling
5 every 18 months, which requires 800 to 1200 additional workers. Unit 1 is scheduled to be
6 refueled during the peak construction period, which would bring the total number of workers
7 onsite to 6401 for less than a month (Luminant 2009a), or about 3556 vehicles under the same
8 occupancy assumptions. Even with the 100 trucks per day, the traffic would still be less than
9 that during the construction of Units 1 and 2. Not all daily traffic would be traveling the same
10 direction or on the road at the same time, and there have been many improvements in the roads
11 since the construction of the previous units. On the basis of the manageable increase in traffic
12 volume, little change is expected in the potential for vehicular accidents.

13 About 30% of the workforce is expected to come from the existing Granbury micropolitan area
14 (composed of Hood and Somervell Counties) (OMB 2005), which has an estimated 2010
15 population of 56,089 (TSDC 2009b). The other 70% of the peak construction force (3467
16 persons) are assumed to move into the area from outside. Given these assumptions, traffic
17 fatalities associated with the increase in population would be expected to rise by about 6%.
18 Given a national fatality rate of 13.6 per 100,000 population per year in 2007(NHTSA 2009),
19 approximately 8 fatalities per year would be anticipated in the Granbury micropolitan area and
20 less than 0.5 additional deaths due to the additional construction workers who moved into the
21 area (NHTSA 2009). These numbers were essentially unchanged when the 2007 Texas fatality
22 rate of 14.1 per 100,000 people was used. (NHTSA 2009)

23 The review team concludes that approximately 2900 additional vehicles might be required to
24 transport workers to and from Units 3 and 4 construction sites on FM 56 plus 100 truck
25 shipments per day. This volume would be substantially less than the volume during
26 construction of Units 1 and 2. Because improvements have been made in the roads since that
27 time, the impact to the construction workers would be typical for vehicular traffic and expected to
28 be SMALL. Based on these factors, on the information provided by Luminant, and on the
29 review team's independent evaluation, the review team concludes that impacts of transporting
30 building materials and personnel to the proposed CPNPP Units 3 and 4 site during construction
31 and preconstruction activities would be SMALL, and no further mitigation would be warranted.

32 **4.8.4 Summary of Nonradiological Health Impacts**

33 Based on the mitigation measures identified by Luminant in the ER (Luminant 2009a), the
34 permits and authorizations required by State and local agencies, and the review team's
35 independent evaluation, the review team concludes that nonradiological health impacts to the
36 local population and construction workers at the CPNPP site from fugitive dust, occupational
37 injuries, noise, and transport of materials and personnel would be SMALL and that additional
38 mitigation beyond the actions identified above would not be warranted. In addition, the NRC
39 staff concludes that because construction and preconstruction impacts would be SMALL, the
40 nonradiological health impacts of NRC-authorized construction would be SMALL, and no further
41 mitigation beyond the actions identified above would be warranted.

42 **4.9 Radiological Exposure to Construction Workers**

43 The sources of radiation exposure for construction workers would include direct radiation
44 exposure, exposure from liquid radioactive effluents, and exposure from gaseous radioactive
45 effluents from the existing CPNPP Units 1 and 2 during the site-preparation and construction
46 phase. Doses from operation of Unit 3 to workers constructing Unit 4 were not considered

1 because the construction and fueling of Unit 4 would be completed before Unit 3 began
2 operation. For the purposes of this discussion, construction workers were assumed to be
3 members of the public, not radiation workers; therefore, the dose estimates were compared to
4 the dose limits for the public, pursuant to 10 CFR 20, Subpart D. Luminant noted that the
5 construction activities for Units 3 and 4 would occur outside the protected area for CPNPP
6 Units 1 and 2 but inside the restricted area boundary (Luminant 2009a).

7 **4.9.1 Direct Radiation Exposures**

8 In the ER (Luminant 2009a) Luminant identified the refueling water storage tanks (RWSTs) as
9 the principal contained source of direct exposure at the construction site. The contribution from
10 this source is significantly reduced at CPNPP because the RWSTs have 2 1/2-ft, -thick concrete
11 walls. Luminant plans to build an Independent Spent Fuel Storage Installation (ISFSI) and
12 states that, in general, the dose rate at the ISFSI protected area fence (1000 ft from the source)
13 would be below 5.0×10^{-6} mrem/hr (Luminant 2009a). Assuming a 2500 hr/yr exposure period,
14 the annual dose to a construction worker 1000 ft from the ISFSI would be 1.25×10^{-2} mrem/yr
15 (Luminant 2009a). The NRC staff did not identify any additional sources of direct radiation
16 during the site visit or document reviews.

17 The Comanche Peak general area monitoring program uses thermoluminescent dosimeters
18 (TLDs) at defined points within the protected area to monitor direct radiation (Luminant 2009a).
19 Dosimeter readings at the protected area fence were equal to or less than 0.001 mr/hr in 2006
20 (Luminant 2009a). These TLDs are read quarterly and measure the contribution to dose from
21 all sources, including natural background and the current reactor operations. The TLD dose
22 should provide an upper-bound dose to construction workers because the protected area fence
23 is closer to Units 1 and 2 than the construction area for Units 3 and 4 (Luminant 2009a). Using
24 the same assumption of a 2500 hr/yr exposure, the direct radiation dose from the existing
25 nuclear operations would be much less than 2.5 mrem/yr because much of the TLD readings
26 would come from natural background.

27 The annual direct dose to a construction worker at least 1000 ft from the ISFSI and outside the
28 protected area for Units 1 and 2 would still be much less than 2.5 mrem/yr. This dose rate
29 conservatively assumes that the construction worker is always at this location.

30 **4.9.2 Radiation Exposures from Gaseous Effluents**

31 Some radioactive gaseous effluents are released during the operation of Units 1 and 2.
32 Potentially radioactive gases are continuously discharged from the fuel building, safeguards
33 building, auxiliary building ventilation exhaust system, and condenser off-gas system. There are
34 occasionally intentional discharges through the vent stacks from the containment purge exhaust
35 and waste gas decay tanks (Luminant 2009a).

36 Gaseous effluent releases are reported to the NRC annually for Units 1 and 2. Luminant used
37 the 2007 gaseous effluent data (Luminant 2008) to estimate the dose by submersion in cloud,
38 inhalation, and deposition as 0.004 mrem/yr total body.

39 **4.9.3 Radiation Exposures from Liquid Effluents**

40 Luminant estimated radiological dose to construction worker from liquid effluents to be small.
41 Although construction workers are not expected to be exposed to water pathways at the
42 construction site, Luminant assumed that construction workers receive the same dose as the
43 maximally exposed individual for the water pathway. The only pathways for liquid effluents from
44 CPNPP Units 1 and 2 to reach humans are sport fish ingestion and exposure to contaminated

1 shoreline. Luminant estimated the effective dose equivalent to be less than 0.14 mrem/yr
2 (Luminant 2008).

3 **4.9.4 Total Dose to Construction Workers**

4 Luminant estimated the annual dose to a construction worker of 2.5 mrem, assuming an
5 occupancy of 2500 hr/yr. The estimated annual dose to construction workers is less than the
6 100 mrem annual dose limit to an individual member of the public found in 10 CFR 20.1301.

7 **4.9.5 Summary of Radiological Health Impacts**

8 The NRC staff concludes that the estimate of doses to construction workers during building of
9 the proposed Units 3 and 4 are well within NRC annual exposure limits (i.e., 100 mrem)
10 designed to protect the public health. Based on information provided by Luminant and the
11 review teams' independent evaluation, the NRC staff concludes that the radiological health
12 impacts to construction workers for the proposed Units 3 and 4 would be SMALL, and no further
13 mitigation would be warranted. Radiation exposure from all NRC-licensed activities including
14 operation of CPNPP Units 1 and 2 is regulated by the NRC. The NRC staff concludes that the
15 impacts of radiological exposures to construction workers would therefore be SMALL, and no
16 further mitigation would be warranted.

17 **4.10 Nonradioactive Waste Impacts**

18 This section describes the environmental impacts that could result from the generation,
19 handling, and disposal of nonradioactive waste during building activities for Units 3 and 4. The
20 potential types of nonradioactive waste that would be generated, handled, and disposed of
21 during building activities include construction debris, municipal waste, spoils, dust, stormwater
22 runoff, sanitary waste, and air emissions. The assessment of potential impacts resulting from
23 these types of wastes is presented in the following subsections.

24 **4.10.1 Impacts to Land**

25 Building activities related to the proposed Units 3 and 4 would generate wastes, such as
26 construction debris and spoils (i.e., earthen debris, including soil and rock). Luminant would
27 sort these wastes so that it could be reclaimed as recyclable or reusable material or shipped to
28 appropriate landfills for disposal (Luminant 2010). Luminant plans to provide sufficient waste
29 receptacles and management for waste segregation for proper offsite disposal of these types of
30 wastes (Luminant 2009a). Most of the waste would be non-hazardous; however, there is
31 potential for some of the material to be contaminated during construction and preconstruction
32 (Luminant 2009a). Hazardous and nonhazardous solid wastes would be managed in accord
33 with county and state-specific handling and transportation regulations. Waste minimization
34 activities and recycling of certain nonhazardous wastes would be used to further mitigate the
35 impacts of solid wastes (Luminant 2009a).

36 Luminant indicates that the majority of soil and rock excavated while building the new reactor
37 units would be beneficially used as fill material on surface areas on the CPNPP site. Non-
38 hazardous construction wastes would be transported off-site by road and rail to be disposed of
39 at an industrial waste landfill licensed by the TCEQ. Any hazardous wastes would be treated,
40 stored, and disposed of in compliance with the Resource Conservation and Recovery Act
41 (RCRA) and other applicable federal, state, and local laws (Luminant 2009a).

42 The CPNPP site currently implements a successful waste minimization plan for Units 1 and 2.
43 Luminant proposes to apply this plan to building activities for Units 3 and 4 to reduce the

1 amount of waste generated and disposed of. In addition, Luminant intends to restrict soil
2 stockpiling and reuse to designated areas on the site and to train construction employees in the
3 appropriate handling and disposal of hazardous wastes (Luminant 2009a).

4 Based on the effective waste minimization program already in place for CPNPP Units 1 and 2
5 and Luminant's plans to manage solid and liquid wastes in a similar manner in accordance with
6 all applicable federal, state, and local requirements and standards, the review team expects that
7 impacts to land from nonradioactive wastes generated during the building of Units 3 and 4
8 would be minimal and no further mitigation would be warranted.

9 **4.10.2 Impacts to Water**

10 Surface water runoff from site development activities would be controlled under the
11 development and implementation of a SWPPP. Water collected in this manner may then be
12 discharged under a TPDES permit. As discussed in Section 4.2.3.1, stormwater runoff
13 generated by site development activities could increase turbidity and sedimentation to SCR and
14 Lake Granbury, but impacts would be minimized through the use of settling ponds and other
15 BMPs that would be implemented under the SWPPP. There would be an increase in the
16 generation of sanitary wastewater at the CPNPP site as a result of the presence of construction
17 workers, but the additional sanitary wastewater could be managed in existing onsite sewage
18 treatment facilities and through provision of portable toilets.

19 Based on the regulated practices for managing liquid discharges, including wastewater, and the
20 plans for managing stormwater, the review team expects that impacts to water from
21 nonradioactive effluents when building Units 3 and 4 would be minimal, and additional mitigation
22 would not be warranted.

23 **4.10.3 Impacts to Air**

24 As discussed in Sections 4.4.1.1 and 4.7.1, fugitive dust generated by site development
25 activities is to be managed. Luminant has committed to the development and use of a
26 Construction Environmental Controls Plan prior to beginning construction and preconstruction
27 activities (Luminant 2009a). The Construction Environmental Controls Plan would include air
28 quality protection procedures to be used to minimize the generation of fugitive dust and the
29 release of emissions from equipment and vehicles. These actions would include managing the
30 use of unpaved roads (speed limits, use of dust suppression, and minimization of dirt tracking
31 onto paved roads); covering haul trucks; phasing grading activities to minimize the exposed
32 amount of disturbed soils; stabilizing roads and excavated areas with coarse material covers or
33 vegetation; and performing proper maintenance of vehicles, generators, and other equipment.

34 Based on the regulated practices for managing air emissions from construction equipment and
35 temporary stationary sources, best management practices for controlling fugitive dust, and
36 vehicle inspection and traffic management plans, the review team expects that impacts to air
37 from nonradioactive emissions while building Units 3 and 4 would be minimal, and no further
38 mitigation would not be warranted.

39 **4.10.4 Summary of Impacts**

40 Solid, liquid, and gaseous wastes generated when building Units 3 and 4 would be handled
41 according to county, State, and Federal regulations. County and State permits and regulations
42 for handling and disposal of solid waste would ensure compliance with the Clean Water Act and
43 TCEQ water quality standards. Air emissions would be generated by vehicles and heavy
44 equipment and site development activities would create fugitive dust when building Units 3
45 and 4. These air quality impacts would be managed through the use of traffic management

1 plans, vehicle inspections, and best management practices. Based on information provided by
2 Luminant and the review team's independent evaluation, the review team concludes that
3 nonradioactive waste impacts to land, water, and air would be SMALL and that additional
4 mitigation would not be warranted. Because NRC-authorized construction activities represent
5 only a portion of the analyzed activities, the NRC staff concludes that the nonradioactive waste
6 impacts of NRC-authorized construction activities would be SMALL, and; no further mitigation
7 would be warranted.

8 Cumulative impacts to water and air from nonradioactive emissions and effluents at the CPNPP
9 site are discussed in Sections 7.2 and 7.6, respectively. For the purposes of Chapter 9
10 (alternatives), the review team expects that there would be no substantive differences between
11 the impacts of nonradioactive waste for the CPNPP site and the alternative sites, and no
12 substantive cumulative impacts that warrant further discussion beyond those discussed for the
13 alternative sites in Section 9.3.

14 **4.11 Measures and Controls to Limit Adverse Impacts during** 15 **Construction and Preconstruction Activities**

16 In its evaluation of environmental impacts during building activities for the proposed CPNPP
17 Units 3 and 4, the review team relied on Luminant's compliance with the following measures
18 and controls that would limit adverse environmental impacts:

- 19 • Compliance with applicable Federal, State, and local laws, ordinances, and regulations
20 intended to prevent or minimize adverse environmental impacts (e.g., solid waste
21 management, erosion and sediment control, air emissions, noise control, stormwater
22 management, spill response and cleanup, hazardous material management).
- 23 • Compliance with applicable requirements of permits or licenses required for construction of
24 the new units (e.g., USACE Section 404 Permit, NPDES permit).
- 25 • Compliance with existing Luminant processes and/or procedures applicable for
26 environmental compliance activities during construction and preconstruction at the CPNPP
27 site (e.g., solid waste management, hazardous waste management, and spill prevention and
28 response).
- 29 • Incorporation of environmental requirements into construction contracts.
- 30 • Identification of environmental resources and potential impacts during the development of
31 the ER and the COL process.

32 Table 4-14 summarizes the measures and controls to limit adverse impacts when building the
33 proposed Units 3 and 4 based on Table 4.6-1 supplied by Luminant (2009a), as adapted by the
34 review team. The review team considered these measures and controls in its evaluation of the
35 impacts of building proposed Units 3 and 4.

Table 4-14. Summary of measures and controls proposed by Luminant to limit adverse impacts when building proposed Units 3 and 4

Affected Environment/Resource Area	Specific Measures and Control
Land-Use Impacts	
The Site and Vicinity	<ul style="list-style-type: none"> • Limit ground disturbances to the smallest amount of area necessary to construct and maintain the plants • Ground disturbing activities are to be performed in accordance with regulatory and permit requirements; use adequate BMPs erosion control measures to minimize impacts • Limit vegetation removal to the area within the CPNPP site designated for construction activities • Minimize potential spills of chemicals and petroleum materials through training, spill prevention plans, and rigorous compliance with applicable regulations and procedures • Restrict soil stockpiling and reuse to designated areas on the CPNPP site
Transmission Line and Pipeline Corridors	<ul style="list-style-type: none"> • Site new corridor(s) to avoid impact on critical or sensitive habitats/species as much as possible • Limit vegetation removal and construction activities to corridor(s) • Restrict sites regarding access to corridor(s) for construction equipment • Minimize potential spills of hazardous wastes/materials through training and rigorous compliance with applicable regulations • Minimize potential impacts through avoidance, compliance with permitting requirements, and BMPs

Table 4-14. (contd)

Affected Environment/Resource Area	Specific Measures and Control
Water-Related Impacts	
Hydrological Alterations	<ul style="list-style-type: none"> • Adhere to applicable regulations and permits • Minimize sizes of cleared areas and employ BMPs to control erosion • Limit extent of dewatering to only that necessary to proceed with construction • Comply with TCEQ and USACE permit conditions using BMPs during construction • A formal stormwater pollution prevention plan (SWPPP) is expected to define specific control measures during construction using BMPs appropriate to the specific activity
Water Use and Quality	<ul style="list-style-type: none"> • TPDES permit requirements are expected to minimize discharge impacts to receiving waters
Ecological Impacts	
Terrestrial Ecosystems	<ul style="list-style-type: none"> • Limit clearing to the smallest amount of area necessary to construct the plant and transmission line ROW(s) • Use established (SWPPP) procedures for minimizing erosion or sediment deposition on terrestrial habitat • Confine vehicles to roadways and authorized stream crossings • Avoid, if possible, Dinosaur Valley State Park and other potentially suitable habitat for federally listed endangered species when selecting exact route for Whitney transmission line.
Aquatic Ecosystems	<ul style="list-style-type: none"> • Develop and implement a SWPPP for building activities • Develop and implement a site-specific spill prevention control and countermeasure plan for building activities • Implement erosion and sediment control plans that incorporate recognized BMPs • Install appropriate barriers and use BMPs during construction • Limit construction and preconstruction area to minimum required to complete building activities

Table 4-14. (contd)

Affected Environment/Resource Area	Specific Measures and Control
Socioeconomic Impacts	
Physical Impacts	<ul style="list-style-type: none"> • Make public announcements or give prior notification of atypically loud construction activities • Train and appropriately protect employees and construction workers to reduce the risk of potential exposure to noise, dust, and exhaust emissions • Provide on-site services for emergency first aid, and conduct regular health and safety monitoring • Use dust control measures such as watering, stabilizing disturbed areas, covering trucks • Establish procedures and perform audits to ensure that all waste is disposed of according to applicable regulations such as the Resource Conservation and Recovery Act (RCRA)
Social and Economic Impacts	<ul style="list-style-type: none"> • Stagger shifts, encourage car pooling, and time deliveries to avoid shift change or commute times • Erect signs alerting drivers of construction and potential for increased construction traffic • Mitigate housing shortage through new construction in anticipation of arrival of construction workforce • Use procedures and employee training program to reduce potential for traffic accidents
Environmental Justice	<ul style="list-style-type: none"> • No mitigating measures or controls required
Historic Properties and Cultural Resources	<ul style="list-style-type: none"> • Consult with SHPO if a cultural resource is discovered • Follow established procedures to halt work if a potential unanticipated historic, cultural, or paleontological resource is discovered
Radiation Exposure to Construction Workers	<ul style="list-style-type: none"> • Total Effective Dose Equivalent (TEDE) from all exposures has been determined to be below limits set in 10 CFR 20.1301 • Implement ALARA practices at construction site
Nonradiological Health	<ul style="list-style-type: none"> • Implement site-wide Safety and Medical Program, including safety policies, safe work practices, as well as general and topic-specific training • Take measures that could include monitoring workers, providing radiation worker training, and developing work plans that minimize worker radiation exposure • Ensure compliance with all federal and state regulatory requirements pertaining to the radiation protection program

1 4.12 Summary of Construction Impacts

2 The impact category levels determined by the review team in the previous sections are
 3 summarized in Table 4-15. The impact category levels for NRC-authorized construction
 4 discussed in this chapter are denoted in the table as SMALL, MODERATE, or LARGE as a
 5 measure of their expected adverse environmental impacts, if any. Impact levels for the
 6 combined construction and preconstruction activities are similarly noted. Some impacts, such
 7 as the addition of tax revenue from Luminant for the local economies, are likely to be beneficial
 8 and are noted as such in the Impact Level column.

Table 4-15. Summary of Impacts from Building of Proposed CPNPP Units 3 and 4

Category	Comments	NRC-authorized Construction Impact Level	Construction and Preconstruction Impact Level
Land-Use Impacts			
The Site and Vicinity	Construction activities would take place within the existing site boundaries	SMALL	SMALL
Transmission Line and Pipeline Corridors	Existing right-of-ways would be used for new pipeline corridors. New transmission line corridors could affect public and private recreational land uses. Transmission lines are not construction activities under 10 CFR 50.10(a)(2).	SMALL	MODERATE
Water-Related Impacts			
Water Use			
Surface Water	Any effects on surface water bodies would be temporary and minimal due to implementation of appropriate BMPs. Surface water usage would be a small fraction of available water supplies.	SMALL	SMALL
Groundwater	No groundwater would be used	SMALL	SMALL

9

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Table 4-15. (contd)

Category	Comments	NRC-authorized Construction Impact Level	Construction and Preconstruction Impact Level
Water Quality			
Surface Water	BMPs will be used to limit construction stormwater impacts	SMALL	SMALL
Groundwater	BMPs will prevent or mitigate spills.	SMALL	SMALL
Ecological Impacts			
Terrestrial Ecosystems	Total areas of wildlife habitat affected would be minimal; depending on exact final routes selected, transmission line could cross Dinosaur Valley State Park and other habitat potentially suitable for two federally listed as endangered species.	SMALL	SMALL to MODERATE
Aquatic and Wetlands Ecosystems	Limited construction footprint in Lake Granbury; BMPs would minimize runoff impacts on Lake Granbury, SCR, and a few small, intermittent streams. Only 2 of 48 delineated wetlands lie in the CPNPP building area; mitigation through permit with the Corps would limit or minimize impacts.	SMALL	SMALL
Socioeconomic Impacts			
Physical Impacts	Physical impacts would be minimal except for impacts to roads. Physical impacts to some roads in the six-county study area would be noticeable, but physical impacts on FM 56 would be significantly greater.	SMALL to MODERATE	SMALL to MODERATE
Demography	Population growth would be somewhat large in Somervell and Hood counties, but minimal in the rest of the six-county study area.	SMALL to MODERATE	SMALL to MODERATE

2

Table 4-15. (contd)

Category	Comments	NRC-authorized Construction Impact Level	Construction and Preconstruction Impact Level
Taxes and Economy Impacts	Tax revenues and economic impacts would be significant and beneficial in Somervell and Hood counties, but the beneficial impacts would be small in the rest of the six-county study area.	SMALL to LARGE (beneficial)	SMALL to LARGE (beneficial)
Infrastructure and Community Services	Impacts on infrastructure and community services would be minimal, with the exception of potential moderately greater impacts to wastewater treatment facilities in Somervell and Bosque counties. Impacts on traffic flow and LOS would be minimal on most roads in the six-county study, but MODERATE on FM 56 (particularly north of the CPNPP entrance).	SMALL to MODERATE	SMALL to MODERATE
Environmental Justice Impacts	Environmental justice impacts would be SMALL, except for the area of socioeconomics. Impacts on the availability and price of temporary housing could have disproportionate and adverse effects on low-income populations. In such an instance, the environmental justice impacts could be significant.	SMALL	SMALL
Historic and Cultural Resource Impacts	NRC staff believes that any impacts to historic and cultural resources would be exclusively associated with preconstruction activities	SMALL	SMALL
Air Quality Impacts	Construction would be conducted in accordance with applicable State requirements. Dust emissions would be minimized through a dust-control plan. Vehicle emissions would not be significant.	SMALL	SMALL
Nonradiological Health Impacts	Emission controls and remote location would minimize nonradiological health impacts. Adherence to Federal and State Regulations is assumed to protect occupational workers.	SMALL	SMALL
Radiological Health Impacts	Exposures would be below NRC annual occupational and public dose limits	SMALL	SMALL
Nonradiological Waste Impacts	Impacts to water, land, and air from the generation of nonradioactive waste would be minimal.	SMALL	SMALL

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5.0 Operational Impacts at the Proposed Site

1 This chapter examines environmental issues associated with operation of the proposed
2 Units 3 and 4 at the Comanche Peak Nuclear Power Plant (CPNPP) site for an initial 40-year
3 period as described by the applicant, Luminant Generation Company LLC (Luminant). As part
4 of its application for combined construction permits and operating licenses (COLs), Luminant
5 submitted an Environmental Report (ER) that discussed the environmental impacts of station
6 operation (Luminant 2009a). In its evaluation of operational impacts, the staffs of the U.S.
7 Nuclear Regulatory Commission (NRC) and the U.S. Army Corps of Engineers (Corps or
8 USACE) (hereafter known as the “review team”) relied on operation details supplied by
9 Luminant in its ER and its responses to NRC Requests for Additional Information (RAIs), and
10 additional information.

11 This chapter is divided into 14 sections. Sections 5.1 through 5.12 discuss the potential
12 operational impacts on land use, water, terrestrial and aquatic ecosystems, socioeconomics,
13 environmental justice, historic and cultural resources, meteorology and air quality,
14 nonradiological health effects, radiological health effects, nonradioactive waste, postulated
15 accidents, and applicable measures and controls that would limit the adverse impacts of station
16 operation during the 40-year operating period.

17 In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have
18 been analyzed and a significance level of potential adverse impacts (i.e., SMALL, MODERATE,
19 or LARGE) has been assigned by the review team to each impact category. In the area of
20 socioeconomics related to taxes, the impacts may be considered beneficial and are stated as
21 such. The review team’s determination of significance levels is based on the assumption that
22 the mitigation measures identified in the ER or activities planned by various state and county
23 governments, such as infrastructure upgrades, as discussed throughout this chapter, are
24 implemented. Failure to implement these upgrades might result in a change in significance
25 level. Possible mitigation of adverse impacts is also presented, where appropriate. A summary
26 of these impacts is presented in Section 5.13. The references cited in this chapter are listed in
27 Section 5.14.

28 5.1 Land-Use Impacts

29 Sections 5.1.1 and 5.1.2 contain information regarding land-use impacts associated with
30 operation of the proposed Units 3 and 4 at the CPNPP site. Section 5.1.1 discusses land-use
31 impacts at the site and in the vicinity of the site. Section 5.1.2 discusses land-use impacts with
32 respect to offsite transmission line corridors and offsite areas.

33 5.1.1 The Site and Vicinity

34 Onsite land-use impacts from operation of proposed Units 3 and 4 are expected to be minimal.
35 Of the 675 ac disturbed in building the project, about 125 ac would be landscaped or
36 revegetated, leaving approximately 550 ac (6.9 percent of the 7950 ac site) occupied by
37 permanent structures and supporting facilities (Luminant 2009a). Current uses of this land are
38 evergreen and deciduous forest, grassland, and developed (e.g., open space, parking, and
39 roadways associated with Units 1 and 2) (see Figure 2-6). Approximately 161 ac of prime
40 farmland would be permanently dedicated to power-generation use; however, this land is not
41 currently used for agriculture, and, because it is located within the boundaries of the power plant
42 site, it has low potential for future agricultural use. The amount of prime farmland affected
43 represents approximately 15.1 percent of the 1064 ac of prime farmland on the CPNPP site and
44 0.1 percent of the 144,425 ac of prime farmland in the project vicinity (Luminant 2009a).

1 Proposed Units 3 and 4 would use four mechanical draft cooling towers equipped with drift
 2 eliminators. Aerosols drifting from cooling towers have the potential to affect land use by
 3 harming surrounding vegetation. However, since Section 5.3.1.1 of this draft environmental
 4 impact statement (DEIS) concludes that operation of the cooling towers would have little impact
 5 on vegetation, there would also be little impact on land use.

6 Operations of Units 3 and 4 could affect a residential area located immediately outside the site
 7 boundary to the west-southwest through south. The closest residence in this area would be
 8 approximately 0.8 mi from the proposed cooling towers. The Applicant reports that cooling
 9 tower plumes, resembling high cumulus clouds, would commonly extend over this area during
 10 all seasons (Luminant 2009a). As indicated in Table 5-1, the eastern edge of this residential
 11 area, which is located south of the proposed cooling towers, could experience fogging for up to
 12 38 hours per year and icing for up to 15 hours per year. No arterial roads are within one mile of
 13 the proposed cooling towers. Project operations are not expected to noticeably increase noise
 14 levels in the residential area (see Section 5.4.1.5). These effects would not interfere with the
 15 residents' current overall uses and enjoyment of their properties through most of the year and
 16 thus are unlikely to result in land-use changes in the area.

Table 5-1 Annual Hours of Fogging and Icing Affecting Residential Area Adjacent to CPNPP Boundary

Distance (mi)	Fogging				Icing			
	Direction from Cooling Towers				Direction from Cooling Towers			
	S	SSW	SW	WSW	S	SSW	SW	WSW
0.75	38	1	0	0	15	0	0	0
0.81	38	1	0	0	15	0	0	0
.087	37.6	1	0	0	14.6	0	0	0
0.93	29.9	1	0	0	14.5	0	0	0
0.99	22.8	0.9	0	0	12.7	0	0	0

Source: Luminant 2009a

17 The proposed design of the CPNPP Blowdown Treatment Facility (BDTF) calls for the use of
 18 mister units located in the proposed evaporation ponds to facilitate evaporation by spraying the
 19 salty blowdown water into the air. A schematic layout of the proposed BDTF is shown on
 20 Figure 5-1. The Applicant estimates that the salt spray could drift up to 1300 ft from the misters
 21 during wind speeds of 10 mph (Luminant 2009f). In this case, salt could be deposited over an
 22 area of approximately 199 ac. Most of this area would be within the boundary of Luminant's
 23 property, but about 16 ac would be outside the CPNPP boundary. As shown on Figure 5-1, the
 24 affected off-site land would be at the northern edge of a rural residential area located along
 25 County Roads 313 and 313 Loop immediately south of the CPNPP boundary. While this level
 26 of salt deposition would not be expected to affect occupied portions of the residential area,
 27 vegetation at the rear edge of some properties could be injured.

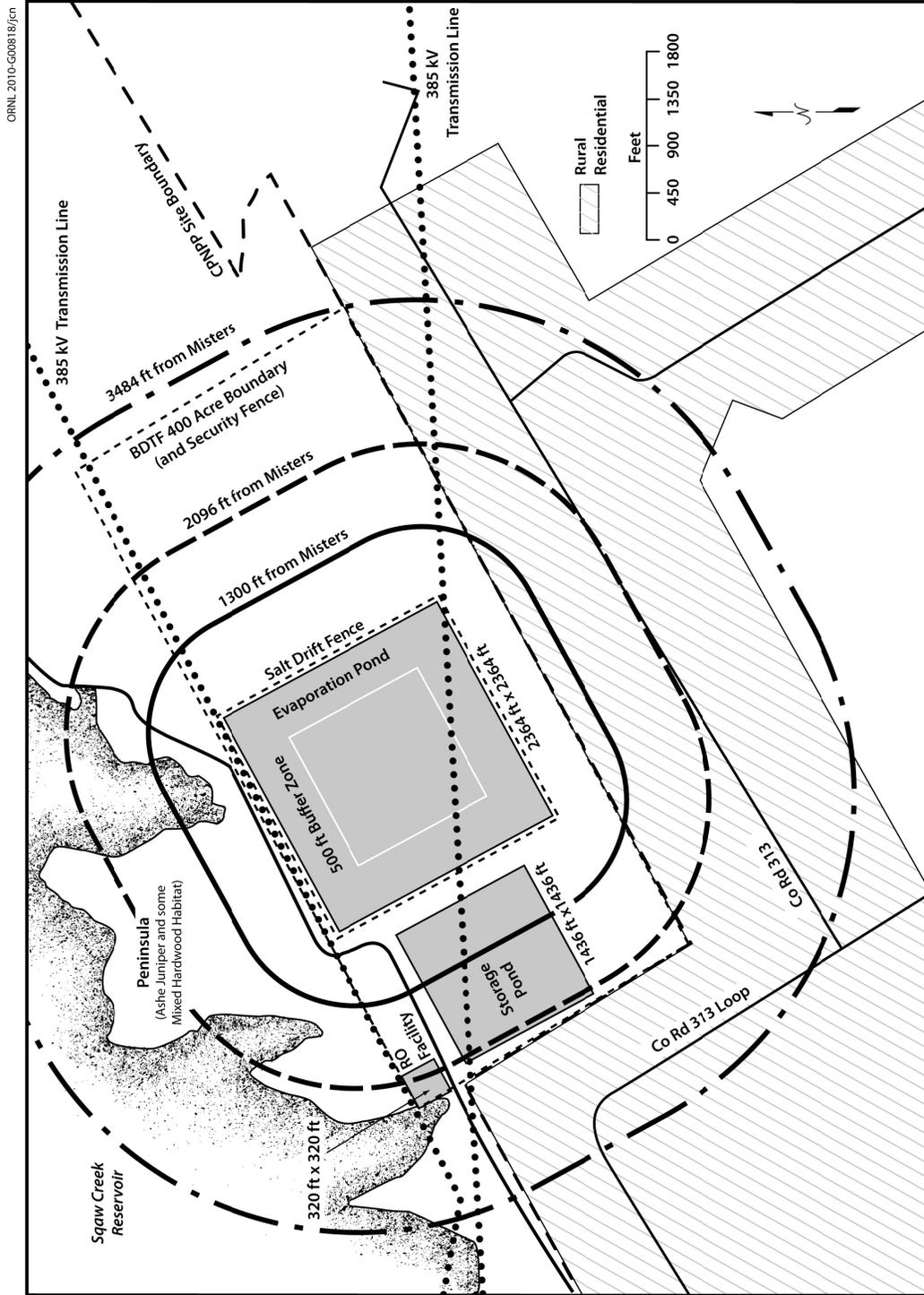


Figure 5-1. Schematic Layout of the Proposed Blowdown Treatment Facility Showing Distances from the Misters to Nearby Locations. (Adapted from Luminant 2010c)

1 As described in Section 5.3.1.1 of this DEIS, the results of a study of salt deposition from a
2 mister system similar to that proposed by the Applicant suggests that salt drift and deposition
3 could extend beyond the 1300 ft estimated by the Applicant, reaching as far as 3484 ft from the
4 misters. In this case, salt drift and deposition could affect up to 1226 ac beyond the evaporation
5 pond. As depicted on Figure 5-1, much of this area would be on the CPNPP site, but as much
6 as 438 ac outside the CPNPP boundary could also be affected. The land in the affected area is
7 covered by grassland, deciduous and evergreen forest, and pasture, some of which lies within
8 large rural residential lots in an area of low density residential development. Most of the
9 affected off-site land is within the rural residential area described in the preceding paragraph.
10 Based on examination of aerial photographs, the review team estimates that up to 44
11 residences in this area could be exposed to noticeable salt deposition levels. Salt deposition
12 could reduce the ability of residents to use and enjoy their properties.

13 To limit salt drift from the misters, the Applicant proposes to surround the evaporation ponds
14 with a 5 m (16-ft) tall salt fence that, according to the Applicant, would reduce salt deposition to
15 less than 1 kg/ha/yr outside the 400 ac boundary of the BDTF(Luminant 2010c). Further,
16 Luminant states that precautions would be taken to contain the salt within the BDTF by using
17 directional spray misting units in addition to the salt fences (Luminant 2010a). If the salt fence
18 in combination with the directional spray misting units were 100 percent effective, then the off-
19 site properties would not be affected.

20 However, the information provided by Luminant (Turbomist 2010) is not extensive enough to
21 eliminate uncertainty regarding the potential for salt to be deposited beyond the salt fence.
22 Considering the limited case history data available to the review team regarding the misters and
23 the salt fence, it is uncertain if the measures proposed by Luminant could prevent salt drift from
24 the BDTF from affecting off-site land. Salt deposition potential from the BDTF has not been
25 quantified further because the facility is only in initial design phase. Due to the high volumes of
26 salt that would be processed by the facility, even a small percentage loss of salt to the
27 surrounding environment could have the potential to affect off-site lands. Without more detailed
28 information about the BDTF, such as its exact location, directional spray misting, and more case
29 history data on the efficacy of the salt fence, the extent of land-use impacts is uncertain. The
30 review team concluded that if the mitigation measures proposed by the Applicant effectively
31 eliminate salt drift from the BDTF the impacts to land use could be minimal and without the
32 mitigation measures the effects of salt drift could be noticeable.

33 Any offsite land use changes, such as conversion of land to housing for operations and outage
34 workers, are expected to be minor. The analysis of housing impacts in Section 5.4.4.3 finds that
35 sufficient vacant permanent housing is available to accommodate the projected demand from
36 workers who would operate CPNPP Units 3 and 4. Refueling outage workers, who would come
37 to CPNPP for 1-month periods on an average of every 9 months during project operations,
38 would primarily seek short-term housing in hotels, motels, and recreational vehicle (RV) parks.
39 This could lead to limited development of additional hotels, motels, and RV parks in the region.
40 However, this impact would be lessened because the much larger construction workforce, which
41 would have also relied mainly on short-term housing, would have left the area before the outage
42 workers arrived. Because of the adequate availability of housing for operations workers and the
43 limited need for additional short-term housing for outage workers, no significant offsite land use
44 impacts are expected due to Unit 3 and 4 employment during project operations.

45 In addition, increased property tax revenue from the two new units could result in infrastructure
46 improvements (e.g., new roads and utility services) that encourage further growth and property
47 conversion. (Operations-related infrastructure impacts are discussed further in Section 5.4.4 of
48 this DEIS.) Any such induced development would likely be scattered throughout Somervell and

1 Hood Counties. Because of the rural nature of the project vicinity and region and the
2 abundance of flat to moderately sloped grassland and forested land, this potential development
3 would have minor impacts on land use.

4 The evaporation ponds at the proposed BDTF could generate 195,610 tons of dry waste salt
5 annually during project operations. Luminant indicated that the waste salt generated by the
6 BDTF could have moisture content as high as 20 percent (Luminant 20010c). Under this
7 condition the BDTF could potentially generate waste salt up to 519,375 tons per yr (Luminant
8 2010a, 2010c). The Applicant states that this waste salt would be disposed of in a licensed
9 solid waste landfill (Luminant 2009f, 2010a, 2010c).

10 The impacts of such disposal would depend on the classification of the waste, which would be
11 determined by analysis of the actual waste product during project operations. Luminant expects
12 the waste will be determined to be Class 2 or 3 non-hazardous industrial waste, but states that,
13 in a worst-case scenario, the waste could be classified as Class 1 non-hazardous industrial
14 waste (Luminant 2009f). The Texas Commission on Environmental Quality (TCEQ) reports that
15 in 2007 there were 13 landfills in the state that accepted 114,506 tons of Class 1 non-hazardous
16 industrial waste and 48 landfills that accepted 1,564,352 tons of Classes 2 and 3 non-hazardous
17 industrial waste (TCEQ 2008). In a worst-case scenario (519,375 tons annually of Class 1
18 waste), the BDTF would generate 4.53 times as much Class 1 non-hazardous industrial waste
19 annually as was disposed of in Texas in 2007. This amount and type of waste would likely lead
20 to the conversion of additional land for use as waste disposal sites. If, on the other hand, the
21 waste is classified as Class 2 or 3 non-hazardous industrial waste, the BDTF will annually
22 contribute between 12.5 percent and 33.2 percent of the amount of similarly classified waste
23 that was disposed of in the state in 2007. The TCEQ estimates that the types of landfills that
24 often accept this waste have a remaining capacity of 44 years (TCEQ 2008). In this case, it is
25 unlikely that operation of the BDTF would require the conversion of additional land to use for
26 waste disposal. To put these amounts in perspective, the TCEQ reports that a total of
27 33,183,488 tons of non-hazardous waste (all classes) were disposed of in Texas in 2007. The
28 maximum amount of waste salt from the BDTF would be approximately 1.6 percent of this
29 amount. Any resulting increase in the total amount of land in the state devoted to solid waste
30 disposal, as a result of disposing the salt waste generated by the BDTF, would be minimal. The
31 total additional solid waste generated by CPNPP Units 3 and 4 during operations is estimated to
32 be 207 tons annually and is not a significant quantity in comparison to the salt waste generated
33 by the BDTF.

34 In summary, operation of proposed Units 3 and 4 could result in limited but noticeable land-use
35 changes on the CPNPP site and in the surrounding area. In Somervell and Hood Counties,
36 land use plans and zoning ordinances are in place only in the incorporated areas of Glen Rose
37 and Granbury. Thus, local governments would have limited influence over project-induced land
38 use changes taking place outside the city limits. However, because of the relatively minor
39 degree of the expected changes and the large amount of undeveloped land available, the
40 review team concludes that the impacts of these changes in land use would be SMALL to
41 MODERATE. The SMALL to MODERATE conclusion also reflects the potential for salt drift
42 from operation of the BDTF to affect rural residential properties adjoining the CPNPP perimeter.
43 The most serious potential adverse effect of the salt drift on those properties would be salt-
44 induced injury to sensitive landscape vegetation, as well as possible increased corrosion rates
45 for aluminum siding and other metal structural components of houses. Possible mitigation
46 measures, in addition to the salt fence and directional spray misting units proposed by
47 Luminant, might include provision of salt-tolerant vegetation, compensation for corrosion of
48 metal property, and, in the worst case, purchase of affected residential properties.

1 **5.1.2 Transmission Line and Pipeline Corridors**

2 During project operations, impacts due to proposed offsite transmission line corridors and water
3 intake and discharge facilities would be minimal. Transmission line rights-of-way would have
4 been acquired and cleared and any necessary access roads would have been built during
5 erection of the lines and towers. Other than barring permanent structures and vegetation that
6 interferes with line maintenance, Oncor's transmission line easements do not restrict land use in
7 the rights-of-way. Farming and ranching activities, for example, may continue unobstructed.
8 Oncor would cut back overgrown vegetation in the rights-of-way periodically and grass would be
9 allowed to grow over access roads except when vehicular access is required. Similarly, the
10 right-of-way of underground water intake and discharge pipelines would be allowed to
11 revegetate with native grasses and would be disturbed only if required for line repairs. The
12 review team concludes that the offsite land-use impacts of transmission line corridors and water
13 intake and discharge pipelines during operation of Units 3 and 4 would be SMALL, and no
14 mitigation would be warranted.

15 **5.2 Water-Related Impacts**

16 This section discusses water-related impacts to the surrounding environment from operation of
17 the proposed Units 3 and 4 at the CPNPP site. Details of the operational modes and cooling
18 water systems associated with operation of the proposed units can be found in Chapter 3.
19 Managing water resources requires understanding and balancing the tradeoffs between various,
20 often conflicting, objectives. At the CPNPP site, these objectives include recreation, habitat for
21 fish and other aquatic life, and a variety of beneficial consumptive uses of water. The primary
22 responsibility for regulating water use and water quality is delegated to the TCEQ. Other public
23 agencies with responsibilities related to managing or protecting water in the local area include
24 the Texas Water Development Board (TWDB), Brazos River Authority (BRA), Somervell County
25 Water District (SCWD), and Texas Parks and Wildlife Department (TPWD).

26 Water-use and water-quality impacts involved with operation of a nuclear plant are similar to the
27 impacts associated with any large thermoelectric power generation facility. Accordingly, the
28 Applicant must obtain the same water-related permits and certifications as any other large
29 industrial facility. These would include:

30 Clean Water Act, Section 401 Certification. This certification would be issued by the TCEQ and
31 would ensure that operation of the plant would not conflict with State water-quality-management
32 programs. Luminant has applied to the TCEQ for water quality certification under Section 401
33 (Luminant 2010e).

34 Texas Pollutant Discharge Elimination System (TPDES) Discharge Permit. This permit would
35 be issued by the TCEQ under Clean Water Act, Section 402(p) and would regulate limits of
36 pollutants in liquid discharges to surface water. The Applicant has stated its intention to amend
37 its TPDES permit for Units 1 and 2 to include Units 3 and 4 discharge (outfall) to Lake Granbury
38 (see Section 5.2.3.6 in Luminant 2009a).

39 Clean Water Act, Section 316(a). This section regulates the cooling water discharges to protect
40 the health of the aquatic environment.

41 Clean Water Act, Section 316(b). This section regulates cooling water intake structures to
42 minimize environmental impacts associated with location, design, construction, and capacity of
43 those structures.

44 Multi-Sector Stormwater Permit. A general or individual permit may be required by TCEQ to
45 regulate discharge of stormwater (see Texas Water Code, Chapter 26). Luminant has within its

1 general stormwater permit from TCEQ a Stormwater Pollution Prevention Plan (SWPPP) for
2 Units 1 and 2, which would be revised to include facilities required for Units 3 and 4.

3 **5.2.1 Hydrological Alterations**

4 The physical alterations to the hydrologic setting that would occur during construction and
5 preconstruction activities for CPNPP Units 3 and 4 are discussed in Section 4.2. CPNPP Units 3
6 and 4 plant water uses during operations are described in Section 3.4.2.1 of this DEIS. This
7 section addresses impacts that may occur during operation of the two proposed units.
8 Operation of CPNPP Units 3 and 4 is not expected to require maintenance dredging of Lake
9 Granbury, bank stabilization, or other physical alterations of the hydrologic system beyond those
10 described in Section 4.2.

11 Water for the operation of CPNPP Units 3 and 4 would originate from Lake Granbury and the
12 Wheeler Branch Reservoir (WBR). During plant operations, raw water for the makeup water
13 system (MWS) and other in-plant uses in CPNPP Units 3 and 4 would be withdrawn from Lake
14 Granbury through five 50 percent capacity pumps. Two pumps would be used for each unit and
15 one spare pump in standby which would be common to both Units 3 and 4. The MWS supplies
16 water to the circulating water system (CWS) and the essential service water system (ESWS).
17 The CWS removes heat from the main condensers by transferring it to mechanical draft cooling
18 towers. Luminant proposes to use four wet mechanical draft cooling towers, two for each unit.
19 The MWS supplies water to the ESWS cooling tower to make up for water consumed through
20 evaporation, drift, and blowdown. The ESWS releases heat to the atmosphere through the
21 ultimate heat sink (UHS) mechanical draft cooling towers, which are separate components not
22 related to the mechanical draft cooling towers used for the CWS. There would be four 50
23 percent wet mechanical draft cooling towers used for the UHS. Portions of the make-up water
24 would be treated then discharged to Lake Granbury.

25 Hydrologic alterations during the operation of the proposed new units are expected to be limited
26 to the following activities:

- 27 • Alteration of water uses in the Brazos River Basin as a result of diversion of make-up
28 water to CPNPP Units 3 and 4 CWS;
- 29 • Alterations of surface water quality as a result of changes in water management and
30 discharges from CPNPP Units 3 and 4; and
- 31 • Alterations in groundwater quality as a result of proposed re-grading and re-contouring,
32 drainage and treatment ponds, and structures.

33 Operation of CPNPP Units 3 and 4 would not introduce any additional hydrologic alterations
34 affecting groundwater beyond those discussed in Section 4.2.1.

35 **5.2.2 Water-Use Impacts**

36 The following subsections discuss water-use impacts to surface water and groundwater. As
37 described in Section 3.4, water for use in the operation of proposed Units 3 and 4 would come
38 from Lake Granbury and Wheeler Branch Reservoir (WBR). Lake Granbury would be the
39 primary source, supplying raw water for use in cooling systems and some water for other in-
40 plant uses. WBR would supply potable water and would be the primary source of water for

1 some process water. Operation of CPNPP Units 3 and 4 would not use groundwater or SCR
2 surface water.

3 In Texas, surface water use is regulated by the Texas Water Code, which specifies that surface
4 water belongs to the State of Texas (Texas Water Code, Chapter 11, Section 11.021). The right
5 to use surface waters of the State of Texas can be acquired in accordance with the provisions in
6 Chapter 11 of the Code, currently administered by the Texas Commission on Environmental
7 Quality (TCEQ). Consistent with these provisions, the Applicant obtains its water for operation
8 of CPNPP Units 1 and 2 through the BRA, which operates Lake Granbury and diverts water for
9 its users under existing rights. The Applicant has proposed to enter into a contract with the BRA
10 for the additional water needed for the operation of Units 3 and 4. The BRA would obtain rights
11 to additional water from TCEQ to fulfill this contract by more efficient and integrated operations
12 throughout the Brazos River Basin.

13 Water from WBR would be obtained through a contract with the Somervell County Water District
14 (SCWD). The SCWD owns rights to divert water from the Paluxy River for storage in WBR and
15 to divert and use water from WBR.

16 **5.2.2.1 Surface Water Use Impacts**

17 The feasibility of water rights and appropriations in Texas is analyzed by Water Availability
18 Models (WAM) sanctioned and maintained by the TCEQ. The WAM are used by TCEQ staff
19 and others to determine whether water would be available for a newly requested water right or
20 amendment. A modified WAM for the Brazos River Basin was used in the Technical Strategy
21 Evaluation (HDR Engineering 2008) provided in conjunction with the proposed amendment to
22 the Brazos Region G water plan allowing for withdrawal and consumptive use by the proposed
23 Units 3 and 4. The findings of the evaluation were that the additional water for Units 3 and 4
24 operation could be made available without reducing existing supplies to other Brazos Region G
25 water users and without a reduction in existing supplies to downstream users in Brazos Region
26 H, relative to the supplies that were assumed to be available in the 2006 Brazos Region H
27 Water Plan.

28 The WAM provided in support of the BRA application implements more efficient system-wide
29 operations and full utilization of prior water rights. The Applicant has stated that water for
30 Units 3 and 4 will be obtained primarily from the more efficient system-wide operations and
31 would not threaten the availability of water for holders of senior rights. The BRA has filed an
32 application for a system operations permit (SOP) with the TCEQ that would enable it to
33 implement system-wide operations to achieve these efficiencies and additional water yield for its
34 customers. The Applicant has also stated that the availability of stored or "banked" water in
35 BRA reservoirs under BRA current or future water rights would not be subject to calls by senior
36 water rights holders. This banked water is assumed to mitigate the risk of supplies being
37 inadequate for Units 3 and 4 during extreme droughts. The Applicant has further stated that in
38 severe drought conditions requiring curtailment of contracted water supplies, its expectation is
39 that BRA would apportion the reductions in water availability to all of its contract customers.

40 Withdrawal and use of water from Lake Granbury for use by CPNPP Units 3 and 4 would result
41 in lower water levels in Lake Granbury and decreased flows in the Brazos River downstream
42 from Lake Granbury. In addition, Brazos River system operations would be altered to
43 accommodate the additional withdrawals. These operational changes would include changes in
44 the timing of water releases from Possum Kingdom Lake, resulting in lower water levels in that
45 lake.

1 Conditions in the Brazos River and these reservoirs were modeled using hydrologic data from
2 the period 1940 to 2007, reservoir sediment buildup projections for 2020, and Brazos River
3 system water demands projected by the Brazos G Water Planning Group for 2020. Under these
4 assumptions and with current water uses and river operating policies, the model estimates that
5 Lake Granbury would be at full pool (approximately 693 ft MSL) 57 percent of the time.
6 Additional water use by CPNPP Units 3 and 4 (the modeling assumed annual withdrawal of
7 103,717 ac-ft and consumptive use of 61,617 ac-ft) would result in a full pool condition occurring
8 for just 46 percent of the 68-year period. Possum Kingdom Lake would be full about 34 percent
9 of the time under current conditions and 26 percent of the time with CPNPP Units 3 and 4
10 operating. Operation of CPNPP Units 3 and 4 would reduce the average water levels by 0.6 ft
11 in Lake Granbury and by 1.5 ft in Possum Kingdom Lake. The water level in Lake Granbury is
12 estimated to fall 2 ft or more below full pool about 10 percent of the time under current
13 conditions and about 25 percent of the time with CPNPP Units 3 and 4 operating. Possum
14 Kingdom Lake water level is estimated to be 5 ft or more below full pool about 10 percent of the
15 time under current conditions and about 25 percent of the time with CPNPP Units 3 and 4
16 operating.

17 Operation of Units 3 and 4 would result in somewhat smaller releases from Lake Granbury and
18 lower resulting streamflow in the Brazos River near Glen Rose, except during low flow periods
19 (when a minimum release would be maintained) and peak flood flows. Seasonal distribution of
20 streamflow downstream from Possum Kingdom Lake would be altered, with lower flows during
21 the wetter months (typically May and June) and higher flows during the drier months of the year.

22 During operation of CPNPP Units 3 and 4 water for potable and sanitary requirements and other
23 uses (Section 3.3.2) would be obtained from the Somervell County Water District (SCWD) via a
24 pipeline from Wheeler Branch Reservoir (WBR). Withdrawals from WBR would occur at a rate
25 of up to 350 gpm (about 565 ac-ft/yr). This volume, which is 28 percent of this reservoir's
26 available annual supply, is expected to be allocated to the Applicant (Section 2.3.2.1) and the
27 reservoir's capacity to supply water exceeds current and projected total demand for the water.
28 Therefore, no impacts to other SCWD water users would be expected. Use of WBR water also
29 would have no more than minor impacts on stream flow in the Paluxy River (which supplies
30 WBR). The annual withdrawal to supply CPNPP would be equivalent to just 0.8 percent of the
31 mean annual flow in the Paluxy River at Glen Rose. Also, because the environmental bypass
32 provisions in the Wheeler Branch water right permit do not allow diversions of water from the
33 Paluxy River to supply WBR to cause the flow in the river to fall below specified values (Albright
34 2010), there would no adverse effects on low flows.

35 Based on the above analysis, the review team concludes that water use for operation of CPNPP
36 Units 3 and 4 would have MODERATE impacts on surface water resources. The MODERATE
37 impact level is based on the decrease in percentage of time that both Lake Granbury and
38 Possum Kingdom Lake will be at full pool and changes to flow of the Brazos River downstream
39 of Lake Granbury and Possum Kingdom Lake. These pool level changes would have a
40 noticeable effect but not destabilize potential water uses on the reservoirs. The Applicant has
41 participated fully in the Brazos Region G Water Planning Group process to ensure that Units 3
42 and 4 water use impacts are managed in coordination with other users. No mitigation measures
43 beyond this participation are necessary.

44 **5.2.2.2 Groundwater Use Impacts**

45 There would be no increase in the use of groundwater at the CPNPP site due to operation of
46 CPNPP Units 3 and 4. As discussed in Section 2.3.2.2, under agreements between the
47 Applicant, TCEQ, and U.S. Environmental Protection Agency (EPA), groundwater usage at the

1 site has decreased from 50 gpm to 16 gpm and is expected to decrease further when WBR
2 water becomes available. As a result, impacts to groundwater quantity from plant operation,
3 including impacts due to hydrologic alterations, are determined to be SMALL and no mitigation
4 would be warranted.

5 **5.2.3 Water-Quality Impacts**

6 This section discusses impacts on the quality of water resources resulting from the operation of
7 proposed CPNPP Units 3 and 4. Impacts to the quality of surface water can include thermal,
8 chemical, and radiological effects due to discharge of effluents or changes in streamflow.
9 Section 5.2.3.1 discusses impacts on surface-water quality and Section 5.2.3.2 discusses
10 impacts on groundwater quality. Impacts on water resources due to radiological releases are
11 discussed in Section 5.9.2.1.

12 **5.2.3.1 Surface Water Quality Impacts**

13 The Brazos River Authority (BRA) would operate Lake Granbury to provide additional water for
14 Units 3 and 4. The proposed contract between the Applicant and BRA will modify the operating
15 schedules for release of water from Possum Kingdom Lake and Lake Granbury in order to
16 provide supplies needed for proposed Units 3 and 4.

17 Water entering Lake Granbury from Possum Kingdom Lake carries relatively high
18 concentrations of TDS and chlorides due to naturally occurring salt deposits in upper portions of
19 the Brazos River watershed. Increased consumptive use of water that removes water from this
20 portion of the Brazos River System without also removing the salt dissolved in that water will
21 increase the salinity of Lake Granbury and the downstream Brazos River. Such increases are
22 likely to occur even in the absence of Units 3 and 4 because the 2060 Brazos G Water Plan
23 calls for full utilization of the water yield of the Brazos River System.

24 The Applicant used the WAM results for the 2060 plan to develop a baseline scenario without
25 operations of Units 3 and 4, as well as a scenario including withdrawal and consumptive use for
26 Units 3 and 4 (Ward 2008). The results of those model comparisons, combined with
27 refinements to account for differences in upper and lower Lake Granbury concentrations,
28 showed that operation of Units 3 and 4, with return of blowdown to Lake Granbury without
29 treatment to remove salts, would increase TDS concentrations in the lower 10-mi section of
30 Lake Granbury by about 530 mg/L (Ward 2008). This increase would occur in the context of
31 Lake Granbury historical TDS concentrations ranging from 500 mg/L to almost 3000 mg/L since
32 1970. The modeling results indicated that this increase would cause the Texas Surface Water
33 Quality Standard (TSWQS) of 2500 mg/L TDS for Lake Granbury to be exceeded 26 percent of
34 the time, compared with 2 percent of the time without the two new units (Ward 2008). To
35 minimize the effect of the proposed units on TDS in Lake Granbury, the Applicant has stated
36 that the proposed BDTF would be placed into service to treat effluent from Units 3 and 4 and
37 maintain discharge concentrations below the TSWQS for Lake Granbury of 2500 mg/L and
38 1000 mg/L of TDS and chloride, respectively. While the proposed facilities are projected to
39 meet TDS and chloride standards, the dissolved solids concentration of the effluent discharged
40 to Lake Granbury (2500 mg/L TDS) will be higher than the average TDS concentration in the
41 reservoir, thus resulting in a small net increase in the TDS concentration in Lake Granbury and
42 downstream.

43 Wastewater will be generated by the circulating water system (CWS), essential service water
44 system (ESWS), non-essential service water system (NESWS), potable and sanitary water
45 system (PSWS), demineralized water system (DWS), and fire protection systems (FPS).

1 Nonradioactive wastewater streams from the CPNPP Units 3 and 4 include cooling tower
 2 blowdown, auxiliary boiler blowdown, water treatment waste, floor and equipment drains, and
 3 nonradioactive laboratory waste. By volume, cooling tower blowdown would account for more
 4 than 90 percent of the wastewater. Cooling tower and auxiliary boiler blowdown would be
 5 discharged to Lake Granbury, either directly or through the BDTF. Wastewater from floor and
 6 equipment drains, laboratories, and sanitary wastes would be processed through a waste
 7 treatment system and discharged to SCR.

8 The CWS will withdraw surface water from Lake Granbury and, as a result of evaporative
 9 cooling loss, concentrate the natural minerals in the water to an average of about 2.4 times their
 10 original concentrations. Table 5-2 shows the concentrations of selected water quality
 11 constituents resulting from a 2.4-cycle cooling tower operation and subsequent discharge of
 12 blowdown waste stream directly to Lake Granbury. In addition to those constituents listed in
 13 Table 5-2, samples of ambient water from Lake Granbury were also tested for several trace
 14 metals that may be present naturally or due to other activities in the watershed and that can be
 15 toxic to humans or aquatic organisms. The water contained copper, barium, magnesium, and
 16 zinc concentrations above the laboratory detection limits, but arsenic, cadmium, chromium,
 17 lead, selenium, and nickel were not detected. Any of these constituents, if present in Lake
 18 Granbury water, would be concentrated in the CWS blowdown effluent.

Table 5-2. Estimated Concentrations of Selected Water Quality Constituents at the Discharge of CPNPP Units 3 and 4 when Diluted in Lake Granbury. All concentrations expressed as mg/L

Water quality constituent	Ambient concentrations in Lake Granbury (mg/L)		Concentrations in blowdown after 2.4 cycles in cooling tower		Diluted effluent at low flow through Lake Granbury		Diluted effluent at annual mean flow through Lake Granbury		Regulatory criterion
	Mean	Max	Mean	Max	Mean	Max	Mean	Max	
Chloride	296	594	711	1426	776	1556	334	670	1000 ^(a)
Iron, total	0.47	2.16	1.12	5.18	1.22	5.66	0.53	2.44	1 ^(c)
Nitrate-N	0.08	.019	0.20	0.44	0.22	0.48	0.09	0.21	0.37 ^(e)
Phosphorus, total	0.186	2.460	0.447	5.904	0.488	6.445	0.210	2.775	0.2 ^(e)
Sulfate	122	232	292	557	319	608	137	262	600 ^(a)
Total dissolved solids	1012	7010	2429	16824	2652	18366	1142	7908	2500 ^(a)

- (a) Texas Surface Water Quality Standard for Lake Granbury.
- (b) Criteria for Specific Metals in Water for Protection of Aquatic Life.
- (c) TPDES Permit for Comanche Peak Nuclear Power Plant Units 1 and 2.
- (d) Human Health Criteria in Water.
- (e) Screening levels for nutrient parameters.

Source: Burgess 2009a.

19 Without additional treatment, concentrated dissolved solids (primarily dissolved salts), certain
 20 metals, and other constituents in the blowdown waste stream would cause or contribute to
 21 exceedances of regulatory limits in Lake Granbury, particularly under average or low-flow
 22 ambient conditions. The Applicant has proposed the addition of the BDTF to provide additional

1 treatment of the waste stream so that the effluent discharge through the diffuser will meet the
2 Texas State Water Quality Criteria of 2500 mg/L and 1000 mg/L for TDS and chloride,
3 respectively, in Lake Granbury. The Applicant has stated that the BDTF would reduce
4 concentrations of the aforementioned metals and other water quality constituents to below
5 regulatory limits. The Applicant has also stated that the screening and regulatory limits for
6 those constituents would be determined within the application process for TPDES permit for the
7 Units 3 and 4 discharge to Lake Granbury.

8 Chemicals that will be added to the ESWS and NESWS include sodium hypochlorite, sulfuric
9 acid, and corrosion inhibitors. Blowdown from the ESWS and NESWS will be combined with
10 effluent from the CWS, treated in the BDTF as necessary, and discharged to Lake Granbury.
11 The liquid waste stream from the BDTF, which will have an estimated TDS concentration of
12 19,370 mg/L, will be routed to an onsite evaporation pond.

13 The withdrawal and discharge of large volumes of water can affect water quality in a reservoir
14 by altering flow patterns. Normal power operation of Units 3 and 4 would increase the
15 combined withdrawal rate from Lake Granbury (for all four units) significantly. The existing
16 withdrawal rate for Units 1 and 2 is approximately 29,000 gpm (65 cfs) on average (based on
17 reported 2006 withdrawals from Lake Granbury for Units 1 and 2 make up water). The
18 proposed intake structure for Units 3 and 4 will be adjacent to the existing intake structure and
19 withdraw an additional 62,932 gpm to serve Units 3 and 4. Thus, the combined withdrawal for
20 all four units will increase from 29,000 gpm (65 cfs) to 92,000 gpm (205 cfs) on average. This
21 205 cfs withdrawal rate may be compared to the average monthly mean discharge of 1031 cfs
22 for DeCordova Bend Dam.

23 The impact of this combined 205 cfs withdrawal will be imperceptible when flow releases from
24 the dam are well-above this average release. When the dam release is above this average flow
25 rate and greater than the four-unit withdrawal rate of 205 cfs, there would be a readily
26 observable effect on the flow pattern of Lake Granbury in the vicinity of the intake structure.
27 When the release of flow from the dam is comparable to or less than the four-unit withdrawal
28 rate of 205 cfs, the withdrawal of flow will dominate the flow patterns in the vicinity of the intake
29 structure and in the area between the intake structure and DeCordova Bend Dam. Under these
30 low-flow conditions, recirculation of some or all of the proposed 58 cfs of Unit 3 and 4 effluent
31 from the discharge structure to the intake structures is inevitable.

32 The ER did not include field measurements of flow patterns or hydrodynamic modeling that
33 would enable resolution of low flow condition flow patterns in Lake Granbury. In the absence of
34 field measurements of flow patterns or hydrodynamic modeling the NRC staff has done a
35 conservative bounding evaluation of the effects of low flow condition on ambient water in Lake
36 Granbury. Additionally the NRC staff has done a bounding analysis to account for recirculation
37 or significant alteration of flow patterns by the proposed intake structure not addressed in the
38 CORMIX computer model provided by the applicant.

39 Blowdown will be discharged to Lake Granbury at a total dissolved solids concentration at or
40 below 2500 mg/L. The blowdown discharged to Lake Granbury (26,076 gpm) is 5.6 percent of
41 the average Brazos River flow (462,745 gpm) at DeCordova Bend Dam. As stated above, flow
42 patterns in the vicinity of the intake and discharge structures for Units 3 and 4 will be altered to
43 the extent that withdrawal flows exceed the release rate of water through DeCordova Bend
44 Dam. During these low-flow conditions, the diffuser may operate less effectively than during
45 high-flow periods, and although the effluent concentrations are designed to be within water
46 quality criteria, they may be above ambient concentrations in Lake Granbury and result in locally

1 elevated concentrations in the vicinity of the diffuser due to less-effective mixing. The resulting
2 elevated concentrations of dissolved solids would temporarily reduce the suitability of the water
3 for various uses. When dam releases are much greater than withdrawal flow, blowdown
4 effluent from Units 3 and 4 will be diluted effectively and pass downstream through the dam to
5 the Brazos River. Modeling conducted by the Applicant for a BDTF-operation scenario similar
6 to the one currently proposed indicated that the long-term average TDS concentration in Lake
7 Granbury would increase by 50 to 60 mg/L (Freese and Nichols 2008).

8 Treated water from the PSWS (for domestic use and human consumption) would be processed
9 by the sanitary wastewater treatment system (SWWTS), which collects and treats sanitary
10 wastes from various plant areas such as restrooms and locker rooms. Treated effluent from the
11 100,000-gpd SWWTS would be discharged directly to SCR without dilution. No nutrients or pH
12 adjustment chemicals are expected to be needed for treatment of sanitary wastewater, and no
13 chemicals will be added to the treated effluent prior to discharge to SCR. Effluent from the
14 SWWTS would be treated to comply with the TPDES permit.

15 Both the DWS and the FPS supply water to the plant on an as-needed basis. Water from these
16 systems is discharged into building sumps and transferred to the wastewater system (WWS) for
17 treatment. The WWS collects and processes water from equipment and floor drains in building
18 areas. Water collected by the WWS is expected to be piped to the CPNPP Units 1 and 2
19 wastewater retention ponds for treatment and disposal.

20 Stormwater runoff from the plant site is divided into two categories: clean and potentially
21 contaminated. Clean runoff is directed to SCR. Potentially contaminated runoff (stormwater
22 that may have come into contact with oil, sediments, and chemicals) will be directed to an
23 appropriate waste stream prior to discharge, including routing to retention/sedimentation basins.
24 Discharges of stormwater will be carried out in compliance with the Stormwater permit.

25 The review team concludes that impacts on surface water quality from operation of CPNPP
26 Units 3 and 4 would be SMALL to MODERATE. The MODERATE level is based on the
27 potential impacts to ambient water conditions and downstream users from increased dissolved
28 solids, particularly during low flow conditions. Higher levels of dissolved solids would increase
29 the need for treatment to make the water suitable for public water supply and other uses.

30 **5.2.3.2 Groundwater Quality Impacts**

31 The potential sources of impacts to groundwater quality associated with operation of CPNPP
32 Units 3 and 4 are leaks, spills, and salt drift. There would be no intentional release of
33 wastewater to groundwater.

34 The potential for operational impacts to groundwater quality would be limited by site
35 characteristics and protective measures to be included in project plans. All evaporation and
36 holding ponds would be lined with clay and low-permeability membrane liners, so there should
37 be little or no leakage to groundwater. Additionally, monitoring of pond underdrains should
38 ensure early detection of any leakage that does occur, so that leakage can be stopped and any
39 contamination can be remediated quickly. Implementation of the SWPPP would reduce the
40 potential for other leaks and spills that could result in contamination of subsurface water. If any
41 contamination entered shallow groundwater in the onsite fill or shallow Glen Rose Formation
42 due to spills, it would not adversely affect groundwater users because groundwater in these
43 units is not used for water supply within a 2-mi radius and the proposed site for Units 3 and 4 is
44 bounded on three sides by SCR. Most of the shallow groundwater flows into the SCR, where
45 any contamination introduced by groundwater would add to any contaminant loading from
46 surface sources and be diluted. Potential for migration to deeper aquifers is limited by the low

1 permeability of the Glen Rose Formation relative to the higher permeability shallow fill and
2 regolith which enhances lateral flow of groundwater. As a result, any impacts to groundwater
3 quality from leaks and spills would be minor.

4 Some release and deposition of salts would occur during operation of the cooling towers for
5 Units 3 and 4. The maximum predicted water deposition rate from the cooling towers is 78,000
6 kg/km² per month at a downwind distance of 100 m from the cooling towers (Section 2.3.2 in
7 Luminant 2009b). This deposition rate is the equivalent of a rainfall rate of just 0.003 in per
8 month, which is a trivial amount compared with the normal monthly precipitation of 2 to 3 in.
9 Therefore, considerable dilution of the salts deposited from the cooling tower plume would occur
10 prior to infiltration into the onsite fill, resulting in minimal impacts on groundwater quality.

11 Salt spray discharged by the misters at the BDTF evaporation pond also could infiltrate to
12 shallow groundwater after being deposited on soil surfaces outside the liner of the evaporation
13 pond. Salt concentrations would be higher than in cooling tower drift. The rate of salt spray
14 deposition to the ground surface, both between the perimeter of the pond liner and the 16-ft-
15 high fabric enclosure to be built around the pond and outside the pond area, has not been
16 determined. Due to the high salt concentration in the spray, much of the salt likely would
17 precipitate in soil and would not infiltrate to shallow groundwater. Shallow groundwater in the
18 vicinity of the evaporation pond site is not used for water supply and potential for migration to
19 deeper aquifers is limited by the low permeability of the Glen Rose Formation, so adverse
20 impacts to groundwater users would be unlikely.

21 Based on the above analysis, the review team concludes that impacts on groundwater quality
22 from operation of CPNPP Units 3 and 4 would be SMALL.

23 **5.2.4 Water Monitoring**

24 As part of its operation of existing CPNPP Units 1 and 2, the Applicant currently monitors its
25 effluent discharges to SCR, as required by its current TPDES permit. Data are reported
26 monthly to the TCEQ. Similar monitoring of effluent discharges to Lake Granbury from
27 operation of CPNPP Units 3 and 4 would be conducted in accordance with the TPDES permit
28 that would be issued for that discharge.

29 Luminant maintains and implements a written Groundwater Protection Program for existing
30 CPNPP Units 1 and 2 (Burgess 2009b). Additional hydrological monitoring for CPNPP Units 3
31 and 4 would be incorporated into the CPNPP Groundwater Protection Program. Some existing
32 groundwater monitoring wells at the site for CPNPP Units 3 and 4 could be used for
33 groundwater monitoring during operation of proposed Units 3 and 4, but other existing
34 monitoring wells would need to be abandoned during construction and would be replaced to
35 support monitoring of groundwater after construction and during operation (Burgess 2009b).
36 Changes to the groundwater monitoring program as a result of the abandonment and
37 replacement of monitoring wells would be assessed following construction of Units 3 and 4.

38 **5.2.5 Potential Mitigation Measures for Operation-Related Water Impacts**

39 The intake structure may alter flow patterns in the vicinity of the proposed diffuser during
40 periods of low flow through DeCordova Bend Dam, which may diminish the effectiveness of the
41 diffuser in mixing effluent. Locally elevated concentrations of effluent chemicals and
42 temperature are possible under these conditions. The Applicant has stated that Brazos River
43 Authority controlled releases from Possum Kingdom Lake upstream would supply the flow
44 required by the intake structure, thereby mitigating the potential for flow pattern alteration and
45 any resultant local water quality perturbations. Additional measures and procedures that could
46 be taken by the Applicant and the Brazos River Authority to support the effectiveness of their

1 mitigation measures would be to include hourly or daily local flow monitoring, decision-support
2 systems and processes, or water management policies.

3 **5.3 Ecological Impacts**

4 This section describes the potential impacts to ecological resources from operation of two new
5 units at the CPNPP site, operation of transmission lines, and maintenance of transmission and
6 cooling water pipeline ROWs. The impacts are discussed for terrestrial ecosystems and aquatic
7 ecosystems and wetlands ecosystems.

8 **5.3.1 Terrestrial Impacts Related to Operations**

9 Concerns for potential impacts on terrestrial ecological resources from operation of nuclear
10 power plants are usually associated with cooling system operations and transmission line
11 operation and maintenance. Operation of cooling systems can result in deposition of dissolved
12 solids; increased local fogging, precipitation, or icing; a greater risk of bird collision mortality;
13 shoreline alteration of the source waterbody; and noise. Operation and maintenance of
14 transmission systems may affect terrestrial species through avian (bird) collision mortality and
15 electrocution, electromagnetic fields, and the maintenance of vegetation within transmission
16 corridors (NRC 1996).

17 As described in Chapter 3, the proposed cooling system for proposed Units 3 and 4 at the
18 CPNPP site would be a closed-loop system with mechanical draft (wet) cooling towers. The
19 heat would be transferred to the atmosphere in the form of water vapor and drift. Vapor plumes
20 and drift can affect crops, ornamental vegetation, and native plants, and water losses can affect
21 shoreline habitat. Bird collisions and noise-related impacts are possible with mechanical draft
22 cooling towers, although avian mortality is usually only a factor with much taller natural draft
23 cooling towers (NRC 1996).

24 The water to be used for cooling Units 3 and 4 would be drawn directly from Lake Granbury.
25 After passing through the cooling tower, some blowdown water would be treated at a proposed
26 onsite BDTF to remove salts and then combined with untreated blowdown water and returned to
27 Lake Granbury. The conceptual design of the BDTF includes two ponds, an evaporation pond
28 approximately 130 ac by 4 ft in depth and a three-month storage pond approximately 47 ac by
29 20 ft in depth, located on 400 ac of land south of existing Units 1 and 2 (Luminant 2009a).
30 Evaporation would be enhanced in the evaporation pond by a mister system consisting of 182
31 units comprised of 30 nozzles each. These units would create an aerosol with a water droplet
32 size of 90 microns (Luminant 2009a).

33 A power transmission line presently extends diagonally across the 400 ac area proposed for
34 development of the BDTF (see Figure 2-5). Bird collisions with the existing transmission line
35 are a potential concern if the ponds are built under that transmission line because the ponds
36 could act as attractants to the area underneath the conductors. The location of the proposed
37 ponds in relationship to the existing transmission lines has not, however, been finalized
38 (Luminant 2009a).

39 Electric transmission systems can affect terrestrial ecological resources through corridor
40 maintenance, bird collisions with transmission lines, and electromagnetic fields (EMFs) (NRC,
41 1996). Two new 345-kV transmission line rights-of-way would be required to distribute the
42 additional generation from the proposed CPNPP Units 3 and 4 (Luminant 2009a). Two double
43 circuit expansions would require the construction of new towers on new or expanded
44 transmission right-of-way 160 ft wide. The first is the 45-mi line to Whitney, and the second is
45 the 17-mi line to DeCordova. Three additional circuits, named Parker, Johnson, and Everman,

1 would be added on existing towers on presently maintained rights-of-way (see Figure 2-14).
2 These transmission lines are owned and maintained by Oncor, who would also own and
3 maintain the new segments (Oncor 2008).

4 **5.3.1.1 Terrestrial Resources – Site and Vicinity**

5 ***Cooling System Impacts on Vegetation***

6 As described in Section 2.4.1, vegetation on and in the vicinity of the CPNPP site consists
7 mostly of Ashe juniper (*Juniperus ashei*) stands (Ashe juniper woodland – savanna), mixed
8 hardwood forest, grassland, open water, wetlands, and developed land and openings from
9 previous disturbance (see Section 2.4.1.1). There is no agriculture on the CPNPP site.

10 Although the cooling towers would be equipped with drift eliminators to reduce the amount of
11 liquid particle loss, some droplets containing dissolved particles would be ejected from the
12 cooling towers. Potential impacts of salt exposure on native vegetation and agricultural crops
13 include salt-induced leaf damage and growth and seed yield reduction if salt deposition rates
14 are high. Maintaining a deposition rate below 1 to 2 kg/ha/month is expected to prevent
15 damage to vegetation (NRC 1999). Maximum salt deposition rates predicted from the cooling
16 towers has been modeled to occur approximately 0.558 kg/ha/month at a point 100 m north of
17 the towers and 0.375 kg/ha/month at a point 200 m north of the towers (Luminant 2009a).
18 Impacts to terrestrial ecosystems from salt deposition from the cooling towers are therefore,
19 expected to be minimal.

20 Salt drift from the BDTF misting system has not been modeled in detail, but salt concentrations
21 leaving the misters are estimated to be approximately 576 kg/minute (Luminant 2009f). Thus,
22 the potential for salt drift exists. Luminant estimates that salt drift from the misting units could
23 be deposited up to 1300 ft from the source during wind speeds of 10 mph (Luminant 2009f).
24 The tentative location of the evaporation pond is close to the CPNPP site boundary (Figure 2-5)
25 and nearby vegetation is primarily Ashe juniper woodland - savanna (Figure 2-15). Although the
26 exact location of the BDTF has not yet been determined, Luminant provided a conceptual
27 sketch of the location of the evaporation ponds (see Figure 2-5).

28 Luminant's response states that a salt fence would surround the evaporation ponds, and a 500
29 ft wide buffer would be provided between the first bank of misters and the outside edge of the
30 ponds to provide sufficient distance between the mister nozzles and the fence to ensure proper
31 functioning (Luminant 2010c). The salt fence (Luminant 2010c) would be 5 m (16 ft) high
32 agricultural shade cloth netting which would be attached to a framework at the top, but loose at
33 the bottom so it could blow in the wind to cause the fabric to shed accumulated salt. The
34 manufacturer of the salt fence claims that salt passing through the fabric falls out within one
35 meter (3 ft) (Turbomist 2010). Further, Luminant states that precautions would be taken to
36 contain the salt within the BDTF by using directional spray misting units in addition to the salt
37 fences (Luminant 2010a). With these measures in place, Luminant anticipates salt deposition of
38 less than 1 kg/ha/yr beyond the BDTF perimeter (Luminant 2010b).

39 The review team does not consider the information provided by Luminant (Turbomist 2010) to
40 be extensive enough to eliminate uncertainty regarding the potential for salt deposition beyond
41 one meter from the salt fence. Luminant states that without the salt fence, salt could drift 1300
42 ft from the misters (Luminant 2010c). If salt drifts to that distance, the review team estimates
43 that deposition could spread over an area of about 199 ac beyond the evaporation pond
44 (Quarles 2010). Much but not all of the potentially affected area would lie within the 400-ac
45 BDTF perimeter, where native vegetation would be removed during development of the BDTF
46 and not allowed to regenerate during the operational life of the BDTF.

1 Potential for salt drift may be even greater than 1,300 ft, however. A study of salt deposition
2 from an evaporative spray system using the same general type of mister proposed by Luminant
3 found that deposition rates of salt were substantially increased at a distance of 2,096 to 3,484 ft
4 surrounding the misters (Alonso et al. 2005). Based on this study and Luminant's sketch of
5 mister locations (Luminant 2010c), the review team estimates that drift could affect an area
6 beyond the BDTF perimeter of about 494 to 1226 ac, including an area of about 96 to 438 ac of
7 vegetation off of the CPNPP site on private property south and west of CPNPP boundary
8 (Quarles 2010). The area of increased salt deposition, assuming drift over the range of 1,300 to
9 3,484 ft, would extend over part of an isolated peninsula to the north of the proposed BDTF
10 perimeter that is covered by Ashe juniper woodland - savanna and mixed hardwood forest
11 (Figure 2-15).

12 Considering the limited case history data available to the review team regarding the misters and
13 the salt fence, the measures proposed by Luminant (including but not limited to salt fence and
14 unidirectional operation of the misters) may not prevent BDTF salt drift from noticeably affecting
15 nearby natural vegetation. Salt deposition potential from the BDTF has not been quantified at
16 this time by Luminant. Due to the high volumes of salt that would be processed by the facility,
17 even a small percentage loss of salt to the surrounding environment could have the potential to
18 noticeably damage vegetation. If the mitigation measures proposed by the Applicant are
19 effective at eliminating salt drift from the BDTF the effects to terrestrial ecology could be
20 minimal. Without effective mitigation the affects of salt drift on terrestrial resources could be
21 noticeable.

22 Fogging, precipitation, and icing in the area around the cooling towers for proposed Units 3 and
23 4 would increase due to condensation released from operations (see Section 5.7.1). The
24 resultant plume from the cooling towers would cause most fog and ice to occur within about
25 0.25 mi both north and south of the towers, based on information presented in a table provided
26 by Luminant in the ER (Luminant 2009a). The area affected around the cooling towers would
27 include a portion of the SCR and a small amount of wetlands (see Figure 2-17). Considering the
28 relatively high average winter low temperature, the icing impact would likely consist of rime ice
29 only, which is less dense than clear ice and, therefore, less likely to cause damage. Impacts
30 could be similar to those from the occasional sleet events in the region which can occur from
31 December through March (see Section 2.9). These impacts would occur when much of the
32 vegetation is dormant, and therefore less susceptible to damage.

33 Operation of the BDTF evaporation pond might cause localized fogging, but potential for fog
34 formation and other meteorological effects is considered to be much less than for the cooling
35 towers due to much smaller heat differential between the water in the pond and the surrounding
36 atmosphere (Luminant 2009g; Luminant 2010b). Impact to vegetation from fogging,
37 precipitation, and icing from cooling tower and BDTF operation is therefore expected to be
38 minimal.

39 ***Avian Collisions due to Cooling System Operation***

40 The cooling towers proposed for CPNPP would be no more than 60 ft high (Luminant 2009a);
41 most authors report bird collisions only on objects four to ten times as tall (CEC 1995)
42 (Kerlinger 2000). As opposed to taller natural-draft towers, mechanical-draft towers like those
43 that would be used at CPNPP are associated with only negligible avian mortality (NRC 1996).
44 Thus, the low profile of the proposed towers is expected to prevent most collisions. Because
45 much of the peninsula where the cooling towers would be located would be cleared and graded
46 to a level surface, there would be few topographic or ecological features left on the peninsula
47 that would attract birds to this location or "funnel" them into the vicinity of other elevated features

1 of the project (Luminant 2009a). Therefore, mortality from birds colliding with the proposed
2 cooling towers is expected to be negligible.

3 Avian collisions with existing power transmission lines through the BDTF are a potential issue.
4 Luminant's sketch of the tentative BDTF layout shows that both the storage pond, and the
5 evaporation pond, would be built beneath an existing power transmission line, and immediately
6 adjacent to another transmission line to the north (Luminant 2010c). These ponds could attract
7 waterfowl, and any fogging associated with their operation could reduce visibility to birds flying
8 through the area. Inclement weather, particularly fog, has been associated with waterfowl
9 mortality (Stout and Cornwell 1976). Reduced visibility from fogging combined with the fact that
10 the ponds may be potentially attractive habitat features may cause birds to collide with
11 transmission lines and cause mortality.

12 Due to the possibility of ponds attracting birds, USFWS recommends relocation of the ponds or
13 installation of bird diversion apparatus for the lines (USFWS 2009b). Luminant states that
14 potential for fog development from the ponds is limited due to the lack of extreme heat
15 differential of water in the ponds with the atmosphere, and that all visible plumes would
16 terminate within 295 ft (Luminant 2010b). Further, Luminant states that noise and violent spray
17 action from the misters in the evaporation pond could act as a deterrent, discouraging birds from
18 flying near the lines or landing on the pond (Luminant 2009f). Potential impacts on birds would
19 be monitored and bird deterrent procedures and equipment would be used as needed (e.g.,
20 noise cannons, netting, artificial predators, periodic patrols, and minimizing periods of time in
21 which standing water is present) (Luminant 2009f). Luminant states that bird deterrents or other
22 devices that might be used would be selected during the final design stage based on
23 discussions with the TPWD and the USFWS (Luminant 2009f).

24 **Noise**

25 The noise levels from cooling tower operation are anticipated to be 55 dBA at 1000 ft, which
26 extends beyond the CNNPP site perimeter fence (Luminant 2009a). No important terrestrial
27 species are known to be located within this area (Section 4.3.1.3). This noise level is well below
28 the 80- to-85-dBA threshold at which birds and mammals are startled or frightened (Golden et
29 al. 1980). Thus, noise from operating the cooling towers would not be likely to disturb wildlife
30 beyond the CNNPP site perimeter fence. The noise might disturb on site wildlife, but the wildlife
31 would likely become habituated or relocate. Noise levels from the proposed BDTF have not
32 been modeled but are assumed to be similar to those from the cooling towers. Consequently,
33 the potential impact on wildlife posed by the incremental noise resulting from the operation of
34 the cooling towers and the BDTF proposed for CPNPP Units 3 and 4 would be minimal.

35 **Artificial Lighting**

36 Artificial light can disrupt wildlife by both disorientation and attraction. The additional lighting
37 required for Units 3 and 4 would be lessened by using low sodium lighting as was previously
38 done to lessen lighting impact from Units 1 and 2 (Luminant 2009a). Therefore, impacts from
39 the additional lighting for Units 3 and 4 are expected to be minimal.

40 **Shoreline Habitat**

41 Consumptive water use for cooling CPNPP Units 3 and 4 would cause lower lake levels at
42 Possum Kingdom Lake and Lake Granbury, and decreased flows in the reach of the Brazos
43 River between Lake Granbury and Lake Whitney (Luminant 2009a). Based on modeling of
44 water use provided by Luminant (2009d), elevations in Possum Kingdom would be 1.3 ft lower
45 on average, and elevations in Lake Granbury would be 0.4 ft lower due to Unit 3 and 4 water
46 consumption (Luminant 2009a). The maximum modeled change during periods of extreme

1 drought in Lake Granbury is 2.5 ft, and during drought at Possum Kingdom Lake is 12.6 ft
 2 (Luminant 2010b). All but the highest outflows from Lake Granbury would be reduced as well,
 3 thus lowering flows in the Brazos downstream of Lake Granbury. Presumably, due to
 4 management of the system by BRA, stream flow between Possum Kingdom Lake and Lake
 5 Granbury would be similar with or without water use by Units 3 and 4 (Luminant 2009a).

6 Developed areas predominate the Possum Kingdom Lake shoreline followed by hardwood
 7 forest, Ashe juniper vegetation, and to a lesser extent grasses and savanna habitat; emergent
 8 wetlands are limited because the shoreline is steep and rocky (Luminant 2010b). Lake Granbury
 9 shoreline is about 85 percent developed with the remainder consisting of hardwood forest, Ashe
 10 juniper vegetation, and some pasture or grasslands (Luminant 2010b). Wetlands occur in coves
 11 but generally not on banks, which also tend to be steep and rocky (Luminant 2010b).

12 Generally, cove areas would be the first affected by drawdown, as coves tend to be shallower
 13 than the main portion of the lake. Ashe juniper habitat would not be affected by drawdown
 14 because junipers are drought resistant upland trees. Hardwood trees such as pecans and
 15 cottonwoods may be minimally affected along the periphery of the riparian zone; however, the
 16 roots of mature trees tend to be deep and hence largely unaffected by temporary groundwater
 17 drawdowns.

18 Because the lakes already experience water level fluctuations from existing water use demands,
 19 shoreline vegetation on the lakes is expected to already be adapted to some water level
 20 fluctuations. The increased drawdown from operations of Units 3 and 4 would constitute an
 21 added fluctuation that may noticeably further stress plant communities by lessening availability
 22 of water to vegetation on the existing shoreline. Through time the zone of shoreline-adapted
 23 vegetation is expected to respond by moving waterward. The stress of occasional extreme
 24 drawdowns could cause death of some of the limited herbaceous wetland species present, but
 25 these species would likely become reestablished once more typical water levels resumed. In
 26 addition, opportunities for colonization by invasive vegetation such as *Phragmites australis*
 27 could result. Although the zone of shoreline habitat would noticeably migrate to a somewhat
 28 lower elevation, overall impacts would not be drastic enough to destabilize important attributes
 29 of the resource.

30 **5.3.1.2 Terrestrial Resources—Transmission Lines and Cooling Water Pipelines**

31 This section discusses the environmental impact of operating the transmission lines and cooling
 32 water pipelines and maintaining ROWs associated with proposed CPNPP Units 3 and 4.

33 ***Vegetation Management***

34 New and expanded transmission rights-of-way would be managed by Oncor in the same
 35 manner as its existing rights-of-way, that is on a regular cycle to prevent disruptions in service
 36 resulting from overgrown or diseased woody vegetation falling or encroaching on the power
 37 lines. This maintenance requires cutting herbaceous and low woody growth on a relatively short
 38 cycle and cutting saplings, larger shrubs, and small trees on a longer cycle that varies within the
 39 service area. Right-of-way maintenance typically involves use of herbicides in addition to light
 40 power equipment such as saws, mowers, and hand tools (Luminant 2009a).

41 Undesirable species would be controlled as required by local management plans usually
 42 established at the county level. Hand cutting and mowing would be used in areas where
 43 herbicide use would be ineffective or inappropriate. Herbicides would be handled and applied
 44 by trained and licensed personnel in accordance with manufacturer specifications and
 45 regulatory requirements (Luminant 2009a).

1 Vegetation management to control tree growth in the rights-of-way exposes the area between
2 trees to more sunlight and therefore usually results in rapid growth of grasses, forbs, saplings,
3 and low shrubs. Cycles of management increase ecotone or edge habitat in what would
4 otherwise be homogeneous woodland or shrub habitat. This benefits edge-adapted species
5 including ground-nesting birds, small mammals, and white-tailed deer (*Odocoileus virginianus*),
6 while removing some habitat preferred by forest interior species. Conversely, maintenance of
7 edge habitat through woodlands can increase opportunity for nest parasites such as the brown-
8 headed cowbird (*Molothrus ater*) to penetrate woodlands and impair the nesting success of
9 woodland species. Increased nest parasitism would be a negative but minimal adverse impact
10 on local populations.

11 The impact of transmission line corridor maintenance on wildlife habitats, including floodplains
12 and wetlands was evaluated in NUREG-1437 (NRC 1996), and the impact was found to be of
13 small significance at operating nuclear power plants with associated transmission line corridors
14 of variable widths (NRC 1996). This is because control of trees and large shrubs is normally
15 required only in forested areas where trees grow tall enough to physically interfere with
16 operation of the power lines. Oncor has procedures in place that minimize adverse impacts to
17 wildlife habitat, as well as to important habitats such as floodplains and wetlands.
18 Consequently, the potential effects on terrestrial ecology from transmission line maintenance in
19 the new and expanded transmission corridor would be minimal, and mitigation beyond the use
20 of standard best management practices (BMPs) would not be warranted. Because the cooling
21 water pipeline right-of-way would be managed less intensively than the transmission rights-of-
22 way, and because only trees and large shrubs would be controlled, impacts would be minimal.

23 ***Impacts of Avian Mortality from Transmission Structures***

24 Deterrents to prevent electrocution of large birds (e.g., great blue herons and eagles) have been
25 installed on transmission towers at CPNPP. The deterrents are inverted "Vs" that are aligned
26 along tower arms to discourage perching and nesting behaviors along the arms and lower the
27 chance for electrocution. Based on a review of the Unit 1 and 2 corrective action program there
28 have been some instances of great blue herons building nests on transmission towers and
29 subsequent electrical circuit trips associated with their droppings, but there has been only one
30 reported occurrence of great blue heron mortality (Luminant 2009f). Similar deterrent structures
31 could be used where warranted to protect large birds from electrocution on new power lines that
32 would be constructed for CPNPP Units 3 and 4. The lack of previous occurrences provides
33 reasonable assurance that the threat of electrocution is minimal if appropriate deterrent
34 structures are used.

35 The NRC (1996) has determined that avian mortality from collisions with transmission lines and
36 other man-made structures is of concern if the stability of a local population of any bird species
37 is threatened or if the reduction in the numbers within any bird population significantly impairs its
38 function within the ecosystem. Collision potential typically is dependent on site-specific
39 variables such as the line location in relation to high use habitats (e.g., nesting, foraging,
40 roosting areas), line orientation to flight patterns and movement corridors, species composition,
41 visibility, and line design. Avian mortality resulting from collisions with transmission lines is
42 considered to be of minimal significance if there is no threat to the stability of local populations
43 and if there is no noticeable impairment of their functioning within the ecosystem. None of the
44 studies reviewed by the NRC (1996) suggests that collision mortality is a significant factor in
45 reducing the populations of common bird species; the conclusion presented is that bird
46 collisions with transmission lines are of small significance at operating nuclear power plants,
47 including corridors with variable numbers of transmission lines. Therefore, with the exception of
48 transmission lines crossing and adjacent to the BDTF impacts of avian mortality from collisions

1 due to operation of the new transmission lines for the proposed CPNPP Units 3 and 4 are
2 expected to be minimal, and mitigation would not be warranted.

3 ***Electromagnetic Fields***

4 **Flora.** Although strong electric fields can cause minor damage to plant foliage and buds by
5 heating leaf tips and margins, damage does not occur at lower electric field levels and even the
6 damage from strong fields would not significantly affect plant growth (NRC 1996). The NRC
7 determined that EMFs produced by operating transmission lines for existing U.S. nuclear power
8 plants up to 1100-kV were not linked to significant harmful effects on flora (NRC 1996). The
9 transmission lines that would be constructed for CPNPP would operate only at 385 kV, which is
10 much lower than the 1100-kV threshold for EMF effects on flora. Therefore, the increased EMF
11 posed by the operation of the proposed transmission lines is expected to have only a minimal
12 impact on flora.

13 **Fauna.** EMFs have been demonstrated to affect some fauna. Voltage buildup can affect the
14 overall health of honeybee hives (NRC 1996). Birds that nest within transmission line corridors
15 experience chronic EMF exposure, but lines energized at levels less than 765-kV do not affect
16 most terrestrial fauna (NRC 1996), and the transmission lines that would be constructed for
17 CPNPP would operate only at 385-kV. The NRC concluded that the impacts of EMFs on
18 terrestrial fauna are of small significance at operating U.S. nuclear power plants, including
19 transmission systems with variable numbers of transmission lines (NRC 1996). Therefore, the
20 increased EMF posed by the operation of the proposed transmission lines is expected to have
21 only a minimal impact on fauna.

22 **5.3.1.3 Important Terrestrial Species and Habitats**

23 This section discusses the environmental impact of operating Units 3 and 4 at the CPNPP site,
24 and the associated transmission line and cooling water pipeline rights-of-way, to ecologically
25 important species, including commercially and recreationally valuable species, and Federally
26 and State-listed species. There are no areas designated as critical habitat in the vicinity of the
27 CPNPP site or the rights-of-way.

28 Recreationally valuable species that would be affected by project operations include avian game
29 species and white-tailed deer. As described in Section 5.3.1.2, the avian game species could
30 experience increased mortality, due to operation of ponds in the BDTF area.

31 Most species at CPNPP are common to the region, as discussed in Section 2.4.1.3, and those
32 rare species potentially present are more abundant elsewhere in the region. There is no
33 evidence suggesting that any species present is critical to structure or function at the ecosystem
34 (landscape) level or that any species might function as a true biological indicator. Thus, there
35 would be no operational impacts to critical and indicator species.

36 Dinosaur Valley State Park, as discussed in Section 4.3.1.3, is the only important terrestrial
37 habitat within the area likely to be affected by project operations except for wetlands, which are
38 discussed in Section 5.2.3. Operational impacts to the Dinosaur Valley State Park may result
39 from the Whitney transmission line ROW, which might pass very close to, or possibly through, a
40 small portion of the northwest corner of the park. Oncor would have to periodically maintain
41 vegetation in the ROW, including any portion that crosses the park. Additionally, there could be
42 some increase in avian mortality in the Park due to electrocution of large birds, if present, unless
43 appropriate deterrent structures are used.

1 **Federally Listed Species**

2 The only Federally listed terrestrial species with recorded occurrences within 10 mi of the
3 CPNPP site and proposed new power transmission and cooling water pipeline rights-of-way are
4 the endangered black-capped vireo (*Vireo atricapillus*) and endangered golden-cheeked
5 warbler (*Dendroica chrysoparia*) (see Biological Assessment in Appendix F). These two
6 species are the only Federally listed species that have been documented or are known to occur
7 in Somervell County (USFWS 2006). Both of these species are also State listed as endangered
8 (TPWD 2009d).

9 Black-capped vireos and golden-cheeked warblers have been observed foraging and nesting in
10 Dinosaur Valley State Park within about 3.5 mi of the CPNPP site. If the Whitney transmission
11 line ROW crosses through the park, it could pass through areas where the vireos and warblers
12 are present. As stated in Section 5.3.1.2 the risk for avian collisions with structures is low.
13 Furthermore, these two bird species are too small to be at risk from electrocution due to
14 transmission lines. Other operational impacts to these species associated with the transmission
15 lines would be unlikely.

16 As discussed in Section 4.3.1.3 and in the Biological Assessment in Appendix F, various
17 surveys for the golden-cheeked warbler presence have been conducted in the Ashe juniper
18 forest areas of the CPNPP site that would be cleared for construction and preconstruction
19 activities, including the area of the BDTF. These surveys revealed only marginal habitat; and no
20 golden-cheeked warblers were actually observed. Areas other than those surveyed, however,
21 could be affected by operations due to salt drift from the BDTF as discussed in Section 5.3.1.1
22 above. The area of possible increased salt deposition, using a worst case scenario of drift
23 extending over the range of 1,300 to 3,484 ft, would extend over some or all of a peninsula that
24 is covered by Ashe juniper and mixed hardwood forest to the north of the proposed BDTF
25 location and (Figure 2-15). Depending on the exact extent of drift that results from operation of
26 the BDTF, some of this vegetation could be susceptible to salt drift injury. While no surveys or
27 observations for golden-cheeked warbler presence or habitat suitability are known to have been
28 conducted on this peninsula, if this area contains suitable habitat for golden-cheeked warbler,
29 golden-cheeked warblers may be present in this area. If, in a worst case scenario, salt drifts this
30 far, then salt drift could affect this habitat and thereby could potentially affect golden-cheeked
31 warblers present in the area. Otherwise, impacts to golden-cheeked warbler would be minimal.

32 **State-Listed Species**

33 As explained in Section 2.4.1.3, State-listed and rare species potentially in the vicinity of the
34 CPNPP site, including the pipeline right-of-way, and the proposed new power transmission
35 rights-of-way, include three bird, three reptile, and two plant species. Potential impacts to these
36 species, with the exception of black-capped vireo and golden-cheeked warbler which are also
37 Federally endangered and were discussed above, are described below. Species considered
38 are those with known occurrences in the three counties potentially affected by the proposed
39 CPNPP Units 3 and 4 facilities and the two proposed new transmission line rights-of-way
40 (Somervell, Hood, and Bosque Counties). Also considered are species without recorded
41 occurrences, but which TPWD considers could be present and impacted by the project when
42 suitable habitat is present (TPWD 2007).

43 **Fauna**

44 **Bald eagle** (*Haliaeetus leucocephalus*) (State-listed as threatened).

45 CPNPP site personnel report that wintering bald eagles forage and perch along the shore of
46 SCR. Eagle mortality could increase due to placement of ponds in the blowdown treatment

1 area beneath an existing power transmission line. There could also be some increase in eagle
 2 mortality due to operation of proposed new transmission lines unless appropriate deterrent
 3 structures would be used. With appropriate mitigation, as discussed in Section 5.3.1.1, impacts
 4 to bald eagles would be minimal.

5 **Texas garter snake** (*Thamnophis sirtalis annectens*) (Considered rare by TPWD, but with no
 6 regulatory listing). Recorded occurrences are rare in the CPNPP vicinity (TPWD 2009d). This
 7 species is therefore unlikely to be affected by project operational impacts.

8 **Texas horned lizard** (*Phrynosoma cornutum*) (State-listed as threatened). Recorded
 9 occurrences are rare in the CPNPP vicinity (TPWD 2009d). This species is therefore unlikely to
 10 be affected by project operational impacts.

11 **Timber (canebreak) rattlesnake** (*Crotalus horridus*) (State-listed as threatened). Recorded
 12 occurrences are rare in the CPNPP vicinity (TPWD 2009d). This species is therefore unlikely to
 13 be affected by project operational impacts.

14 **Comanche Peak prairie clover** (*Dalea reverchonii*) (Considered rare by TPWD, but with no
 15 regulatory listing). The single recorded occurrence of Comanche Peak prairie clover within 10
 16 mi of the CPNPP site and proposed new power transmission rights-of-way is more than 3 mi to
 17 the north of areas to be affected by project activities based on the map provided by TPWD
 18 (TPWD 2009d). Therefore, habitat is likely too distant to be affected by project operations.

19 **Glen Rose yucca** (*Yucca necopina*) (Considered rare by TPWD, but with no regulatory listing).
 20 Only one known occurrence of Glen Rose yucca occurs on or near the CPNPP plant or
 21 associated transmission and cooling water pipelines. This occurrence is near the intake area of
 22 the proposed water pipeline (TPWD 2009d). If this Glen Rose yucca is encountered during
 23 pipeline development, work in the immediate area would be halted and appropriate TPWD
 24 officials and environmental consultants would be contacted to determine proper mitigation
 25 measures so that work could resume (Luminant 2009a). The mitigation to be developed would
 26 address protection of any individuals present from maintenance operations to be conducted in
 27 the pipeline right-of-way. With development of suitable mitigation, impacts to Glenn Rose yucca
 28 due to periodic right-of-way maintenance would be minimal.

29 **5.3.1.4 Terrestrial Monitoring during Operation**

30 Luminant has stated that potential impacts on birds (due to collisions with the existing
 31 transmission line that would remain above the new evaporation pond in the BDTF) would be
 32 monitored and bird deterrent procedures and equipment would be used as needed. (Luminant
 33 2009f). There are no other terrestrial monitoring activities planned related to transmission line
 34 or plant operations on the CPNPP site or identified for proposed Unit 3 or 4 operation.
 35 However, there may be a need to monitor the efficacy of the salt fence at the BDTF evaporation
 36 ponds.

37 **5.3.1.5 Potential Mitigation Measures for Operation-Related Terrestrial Impacts**

38 Luminant has proposed the use of salt fences and unidirectional misters to reduce the impacts
 39 of salt drift from BDTF operation. Luminant has also indicated that they plan to confer with
 40 USFWS and TPWD regarding possible measures to reduce operational impacts from the BDTF.
 41 There could potentially be a need for the following mitigation measures:

- 42 • Redesign and/or relocate BDTF to reduce potential for salt drift and fogging.
- 43 • Reroute existing transmission lines away from BDTF.

1 **5.3.1.6 Summary of Impacts to Terrestrial Resources during Operation**

2 The potential impacts of operating the proposed CPNPP Units 3 and 4 and mechanical draft
3 cooling towers on vegetation, birds and other wildlife are likely to be minimal. The potential
4 impacts of transmission line corridor maintenance and similar impacts on important habitats
5 including birds, and other biota because of EMFs would be minimal, assuming BMPs are
6 followed and State and federal agencies are consulted, as appropriate. Salt drift from operation
7 of the BDTF could impact nearby vegetation, and birds attracted to the BDTF ponds could
8 collide with an existing transmission line that crosses the BDTF site. Impacts due to cooling
9 system operation to shoreline vegetation on Lake Granbury and Possum Kingdom Reservoir
10 would be noticeable, but not drastic enough to destabilize important attributes of the resource.
11 The review team therefore concludes that operational impacts to terrestrial resources would be
12 MODERATE, and additional monitoring or mitigation may be warranted.

13 **5.3.2 Aquatic and Wetlands Impacts**

14 This section discusses the potential impacts of the operation of the proposed CPNPP Units 3
15 and 4 on the aquatic and wetlands ecosystems of Lake Granbury, SCR, the Brazos River, PKL,
16 WBR, the Paluxy River, and waterbodies crossed by the ROWs for the proposed transmission
17 lines and pipelines.

18 **5.3.2.1 Impacts on the Lake Granbury Ecosystem**

19 Lake Granbury would be the source of makeup water for the proposed CPNPP Units 3 and 4
20 cooling water system and also would receive blowdown effluent from the CWS, ESWS, and
21 NESWS. Consequently, Lake Granbury is the waterbody with the greatest potential for adverse
22 impacts on its aquatic ecosystem from operation of the intake and discharge for Units 3 and 4.

23 **CPNPP Units 3 and 4 Intake**

24 For aquatic resources, the primary concerns related to water intake and consumption are the
25 impacts related to the relative amount of water drawn from the cooling water source (Lake
26 Granbury) and the potential for organisms to be impinged on the intake screens or entrained
27 within the cooling water system. Impingement occurs when organisms are trapped against the
28 intake screens by the force of the water passing through the intake structure (66 FR 65256).
29 Impingement can result in starvation and exhaustion, asphyxiation (water velocity forces may
30 prevent proper gill movement or organisms may be removed from the water for prolonged
31 periods of time), and descaling of fish (66 FR 65256). Entrainment occurs when organisms are
32 drawn through the intake structure into the cooling system. Organisms that become entrained
33 normally are relatively small forms that float (plankton) or freely swim (nekton) in the water
34 column or live on the bottom (benthos), including early life stages of fish and shellfish, and that
35 often serve as prey for larger organisms (66 FR 65256). As entrained organisms pass through
36 a plant's cooling system, they are subject to mechanical, thermal, pressure-related, and toxic
37 stresses that usually are lethal.

38 In developing its regulations addressing cooling water intake structures for new facilities that
39 withdraw water for cooling purposes, the U.S. Environmental Protection Agency (EPA) identified
40 a number of factors that can greatly influence the degree to which aquatic biota are affected by
41 impingement and entrainment. These factors include (1) the intake capacity (volume of water
42 that can be withdrawn over a period of time), which is dependent on the type of cooling system
43 used; (2) the design and construction of the intake; (3) the location of the intake; and (4) the
44 proportion of water withdrawn from the source waterbody (66 FR 65256).

1 **Capacity.** Luminant stated in its ER that the type of cooling system that would be used for the
2 proposed CPNPP Units 3 and 4 would be a closed-cycle, wet, mechanical-draft, cooling tower
3 system (Luminant 2009a). Relative to once-through power plant cooling systems, closed-cycle
4 cooling systems do not use large volumes of water; therefore, impingement and entrainment of
5 aquatic organisms would be minimal. During normal operation, the rate of water withdrawal
6 through the intake would be 62,932 gpm for both Units 3 and 4 combined (Section 5.2.1).

7 **Design and construction.** A second factor that greatly influences the rate of impingement and
8 entrainment of fish and shellfish at a facility is the design through-screen velocity of the intake
9 structure. The higher the through-screen velocity, the greater the number of fish likely to be
10 impinged or entrained. Therefore, EPA has established a national standard requiring that the
11 maximum design through-screen velocity be no more than 0.5 ft/s (66 FR 65256). EPA
12 determined that species and life stages of fishes evaluated in various studies could endure a
13 velocity of 1.0 ft/s. It then applied a safety factor of two to derive the threshold of 0.5 ft/s. The
14 data from the studies suggested that a velocity of 0.5 ft/s would protect 96 percent of the fish
15 tested.

16 To limit through-screen velocity and otherwise minimize the impact of the intake system on
17 aquatic biota, a number of features were incorporated into the design of the CPNPP Units 3 and
18 4 intake structure. The structure would use wedge wire screens. Wedge wire screens are
19 identified by EPA as a passive intake system technology that minimizes (reduces to the smallest
20 amount reasonably possible) impingement mortality and entrainment of all life stages of fish and
21 shellfish (66 FR 65256).

22 Luminant has stated that the proposed CPNPP Units 3 and 4 intake would have a design
23 through-screen velocity of less than 0.5 ft/s. The maximum velocity through clean screens at a
24 normal lake water level of 693 ft above MSL is projected to be 0.38 ft/s, which would increase to
25 0.42 ft/s at a high water level of 712.8 ft above MSL. If the screens are assumed to be 15
26 percent blocked by debris or fouling, the corresponding velocities are projected to be 0.44 ft/s
27 and 0.49 ft/s (Luminant 2009a). Thus, the maximum through-screen velocity is expected to
28 remain below 0.5 ft/s even under conditions in which the water level is high and the screens are
29 15 percent clogged (Luminant 2009a). To clean the screens, an air blast system would be
30 employed. High-pressure bursts of air would be released through a manifold of nozzles within
31 each screen assembly to dislodge material from the surface of the screens and cause the
32 material to rise in the water column with the rising air. The cleaning would be done periodically
33 based on use of a monitoring system that would measure differential pressure (head loss)
34 across the screen. Cleaning would be automatically initiated when clogging caused an increase
35 in head loss beyond a preselected differential, and this setting could be changed as necessary
36 to prevent clogging from causing the through-screen velocity to exceed 0.5 ft/s. Cleaning
37 approximately once every 24 hours is currently anticipated (URS 2008). The cylindrical screen
38 assembly (Figure 3-6) would be aligned approximately parallel to the shoreline, so water would
39 enter the screens in a direction perpendicular to the flow direction in the reservoir (Luminant
40 2009a). As a result, when current flows past the intake, it likely would sweep organisms past
41 the screens and reduce their potential to be impinged or entrained.

42 The CPNPP Units 3 and 4 intake structure would contain five pumps to supply makeup water to
43 Units 3 and 4 (two pumps for each unit and one spare pump) (Figure 3-6). A maximum of
44 18,000 gpm could be supplied by each pump, for a maximum withdrawal rate of 72,000 gpm
45 with four pumps operating to supply both reactor units (Luminant 2009a). Water would enter the
46 structure containing the pumps through four cylindrical, 6.5-ft-diameter, passive screen
47 modules. Each module would have a tee arrangement, with two 6-ft-long wedge wire drums
48 perpendicular to and separated by a central, 48-in.-diameter inlet pipe. Each 16-foot-long

1 module would have 12 ft of screen with a total area of 245 sq ft. Thus, there would be 490 sq ft
2 of screen for each reactor unit and a total of 980 sq ft for both Units 3 and 4 (Luminant 2009a).

3 The wedgewire screens would have a slot opening size of only 1 mm (URS 2008). The fish
4 species occurring in Lake Granbury (Table 2-16) have eggs with diameters ranging from
5 0.8 mm to 4 mm (Hassan-Williams and Bonner 2007). Thus, the eggs of most fishes in the lake
6 are larger than the size of the screen openings. The species that have eggs smaller than 1 mm
7 (white crappie [*Pomoxis annularis*], gizzard shad [*Dorosoma cepedianum*], threadfin shad [*D.*
8 *petenense*], and white bass [*Morone chrysops*]) have eggs that are demersal (i.e., eggs that
9 sink) and adhesive, so that they adhere to the bottom or other substrates. As a result, they
10 would not be suspended in the water column and thus would not be subject to entrainment. The
11 screens would prevent the entrainment of the larger, more buoyant fish eggs that have a
12 potential to be present in the water column at the intake. However, the presence of fish eggs at
13 the intake is very unlikely given the egg characteristics and spawning habits and habitats of the
14 fishes in the lake (Table 5-3). For example, most of these species deposit their eggs in nests or
15 over other bottom structure to which they can adhere, usually at relatively shallow depths in the
16 littoral zone. The larvae of these fishes similarly are likely to remain in contact with or in close
17 proximity to substrates (Hassan-Williams and Bonner 2007). The lake bottom in the vicinity of
18 the proposed intake slopes steeply into the former river channel, resulting in very limited
19 shallow-water habitat suitable for nesting by fishes. This area also lacks coves or other
20 protected habitats that would support vegetation and generally lacks underwater structure (other
21 than boat docks and the water intakes for CPNPP Units 1 and 2 and the Wolf Hollow electric
22 power plant) that may be attractive to fish and invertebrates. Thus, viable eggs and numerous
23 larvae of these species would not be expected to be present in the water column in the deep
24 area of the lake where the intake would be located. (The relationship between the locations of
25 fish spawning habitat and the intake is discussed further below.) Spawning may occur from
26 March to October depending on the species, but most of these species spawn in the spring and
27 early summer.

28 The eggs of all but two of the species in Table 5-3 are demersal and adhesive. The two species
29 that lack demersal, adhesive eggs are the striped bass (*M. saxatilis*) and freshwater drum
30 (*Aplodinotus grunniens*). The striped bass is a nonnative species that is stocked in the reservoir
31 and is unlikely to successfully spawn there. It typically spawns in riverine habitats from mid
32 February through April, and egg survival appears to be dependent on sufficient flow to keep the
33 fertilized eggs suspended in the water column for the 2 to 3 days between fertilization and
34 hatching (Hassan-Williams and Bonner 2007). The freshwater drum, which spawns in the water
35 column and has buoyant eggs, is the only species collected in the reservoir with a reproductive
36 strategy that could result in a notable potential for viable eggs to be present at the intake. Its
37 fertilized eggs are 1.4 mm to 1.5 mm in diameter (Hassan-Williams and Bonner 2007),
38 sufficiently large that they may be impinged but not entrained. Freshwater drum spawn in May
39 and June, so their eggs and larvae would be unlikely to be present after early summer (Hassan-
40 Williams and Bonner 2007).

41

Table 5-3. Egg and Spawning Characteristics of Lake Granbury Fish Species

Family Scientific Name	Common Name	Egg Diameter (mm)	Egg and Spawning Characteristics
Catostomidae			
<i>Ictiobus bubalus</i>	smallmouth buffalo	1.6 - 2.4	Demersal, adhesive; attach to bottom
Centrarchidae			
<i>Lepomis cyanellus</i>	green sunfish	1.0 - 1.4	Demersal, adhesive; deposited in nest
<i>Lepomis gulosus</i>	warmouth	1	Demersal; deposited in nest (gravel)
<i>Lepomis macrochirus</i>	bluegill	1.1 - 1.4	Demersal, adhesive; deposited in nest
<i>Lepomis megalotis</i>	longear sunfish	1	Demersal, adhesive; deposited in nest
<i>Lepomis microlophus</i>	redeer sunfish	1.3 - 1.6	Demersal, adhesive; deposited in nest
<i>Micropterus salmoides</i>	largemouth bass	1.4 - 1.8	Demersal, adhesive; attach to nest
<i>Pomoxis annularis</i>	white crappie	0.9	Demersal, adhesive; attach to nest or nearby
Clupeidae			
<i>Dorosoma cepedianum</i>	gizzard shad	0.8	Demersal, adhesive; sink slowly and adhere to surfaces
<i>Dorosoma petenense</i>	threadfin shad	0.75 - 1.2	Demersal, adhesive; attach to plants, brush, or other objects
Cyprinidae			
<i>Cyprinus carpio</i>	common carp	1.5 - 2.1	Demersal, adhesive; attach to plants, brush, or other objects
Ictaluridae			
<i>Ictalurus punctatus</i>	channel catfish	3.5 - 4.0	Demersal; laid in holes
Moronidae			
<i>Morone chrysops</i>	white bass	0.8 - 0.9	Demersal, adhesive; attach to bottom
<i>Morone saxatilis</i>	striped bass	2.4 - 3.9	Nonadhesive, semibuoyant; hatch best if stay suspended
Sciaenidae			
<i>Aplodinotus grunniens</i>	freshwater drum	1.4 - 1.5	Buoyant; released to water column
Sources: Hassan-Williams and Bonner (2007) for all information except gizzard shad egg diameter, which was obtained from Willis (1987)			

1 Thus, the design and construction of the screen system is expected to prevent the entrainment
2 of fish eggs and most organisms other than plankton, and to prevent the impingement of most of
3 the fish or other swimming organisms that may come into contact with the intake structure. Fish
4 eggs or other small organisms that become impinged would be dislodged periodically from the
5 screen surface by the air-blast cleaning system and may survive, depending upon the duration
6 of impingement and any associated injuries.

7 **Location.** A third factor that influences impingement and entrainment mortality is the location of
8 the intake structure. EPA indicated that the optimal design requirement for the intake location is
9 that it is in an area of the source waterbody that is away from areas with the potential for high
10 productivity. Such a location would be identified by taking into account the location of the
11 shoreline, the depth of the waterbody, and the presence and abundance of aquatic organisms
12 or sensitive habitat (66 FR 65256). The proposed location of the intake structure is on the
13 southwest bank of Lake Granbury next to the existing intake and pumping station for CPNPP
14 Units 1 and 2 makeup water and approximately 7200 ft (1.3 mi) upstream of the DeCordova
15 Bend Dam (Figure 2-11). The intake screens would be located approximately 110 ft from shore
16 at a depth of approximately 34 ft at a location where the depth of the lake is approximately 40 ft.

17 As discussed above, the slope of the bottom in this area of the lake is relatively steep and the
18 water is deep, providing minimal littoral habitat and unsuitable conditions for nesting by fishes.
19 In addition, this area of the shoreline lacks coves or other protected habitats supportive of an
20 abundant or diverse biota and generally lacks underwater structure that may be attractive to fish
21 and invertebrates, except for scattered submerged trees and man-made structures such as boat
22 docks and water intakes. Accordingly, a 2007–2008 fish survey of this area of the lake above
23 the dam collected few individuals of only ten species (Bio-West 2008a). Thus, the area of Lake
24 Granbury in which the intake structure would be located is not particularly supportive of fish or
25 invertebrate foraging or reproduction and does not appear to be highly productive relative to
26 other areas, such as the upstream reaches of the lake.

27 **Proportion of water withdrawn.** A fourth factor affecting impingement and entrainment losses
28 is the proportion of the flow of the source waterbody that is withdrawn by the intake. EPA
29 developed requirements for proportional flow limitations that vary according to the type of
30 waterbody in which the intake is located; that is, the requirements differ for intakes in an estuary
31 or tidal river, a freshwater river or stream, or a lake or reservoir. Because the proposed CPNPP
32 Unit 3 and 4 intake is in a reservoir, the relevant requirement is that the intake “must not disrupt
33 the natural thermal stratification or turnover pattern (where present) of the source water except
34 in cases where the disruption is determined to be beneficial to the management of fisheries for
35 fish and shellfish by any fishery management agency(ies)” (66 FR 65256). This requirement
36 was intended to protect aquatic organisms in mainly small to medium-sized lakes and reservoirs
37 by limiting the intake flow to a capacity appropriate for the size of the waterbody (66 FR 65256).

38 This requirement is expected to be met in Lake Granbury, which is a large reservoir that
39 experiences relatively weak stratification during the warmest part of the year, usually late spring
40 to early fall. Temperatures were measured in the lower portion of Lake Granbury in April, July,
41 and October 2007 and January 2008 in three locations at two depths: 0.3 ft below the surface
42 and 35 to 50 ft below the surface. The differences in temperature at these three locations
43 between the surface and bottom was approximately 5°F in April, 3°F in July, less than 1°F in
44 October, and 1°F in January. At a fourth location where the deeper temperature was recorded
45 at only 10 ft, temperatures were essentially equal throughout the year (Luminant 2009a),
46 indicating that the thermocline was between 10 and 35 ft deep in depth and not well-defined.
47 These temperature differences indicate a weak thermocline and relatively limited differences in
48 water density, which indicate that the reservoir is well-mixed and likely turns over frequently
49 (Bio-West 2008a).

1 The stratification in Lake Granbury appears to be sufficiently weak that it may be disrupted by
2 natural disturbances such as thunderstorms or floodwater inflows. Under conditions of high
3 flow, data for the lower reach of the lake were not indicative of stratification even in summer
4 (Luminant 2009f). Thus, the existing aquatic community of Lake Granbury would not be
5 expected to be dependent on the maintenance of stable, stratified conditions from spring to fall.
6 In addition, the proposed intake structure would be installed such that the top of the inlet
7 screens would be at a depth slightly less than 34 ft below the lake surface, and the bottom of
8 these 4-ft-diameter screens would be approximately 38 ft below the surface (Figure 3-6). At this
9 depth, the intake would be near the approximate lower depth of the thermocline, resulting in the
10 withdrawal of water of moderate temperatures intermediate between the warmer surface water
11 and the cooler bottom water. Based on these lines of evidence, the withdrawal of water by the
12 CPNPP Units 3 and 4 intakes from a localized area of this large reservoir would not be expected
13 to disrupt the normal thermal stratification pattern of the lake.

14 Entrainment/impingement studies have not been conducted for the existing CPNPP Units 1 and
15 2 makeup water intake on Lake Granbury. This intake is located adjacent to the planned
16 location of the intake for Units 3 and 4. From 1994 to 2006, the annual average withdrawal
17 through this intake was 34,128 ac-ft/yr, in 2006 the withdrawal was 46,746 ac-ft/yr, and an
18 agreement between the BRA and Luminant provides for up to 48,300 ac-ft/yr to be withdrawn
19 (Luminant 2009a). The latter withdrawal is less than half the expected withdrawal from Lake
20 Granbury through the proposed intake for Units 3 and 4. Studies that identified ecological
21 impacts in Lake Granbury attributable to the current Units 1 and 2 makeup water withdrawals
22 were not found.

23 **Intake conclusions.** Based on the use of closed-cycle cooling, the design and construction of
24 the intake, the location of the intake, and the proportion of water that would be withdrawn, the
25 staff concludes that impacts from entrainment and impingement of fish and other organisms due
26 to the operation of the proposed CPNPP Units 3 and 4 would be minimal, and additional
27 mitigation of such impacts would not be warranted.

28 **CPNPP Units 3 and 4 Cooling Water Discharge**

29 The effluent from the proposed CPNPP Units 3 and 4 would be discharged into Lake Granbury.
30 Section 3.3.1.13 discusses the location and design of the discharge structure (shown in
31 Figure 3-7). Impacts on aquatic organisms due to the discharge could result from thermal
32 effects, chemical effects, and physical effects on the substrate.

33 **Thermal impacts from the discharge.** Thermal impacts may include heat stress, cold shock,
34 and potential effects on the growth of invasive nuisance organisms.

35 **Heat stress.** The thermal tolerance of aquatic organisms can be measured and described in a
36 variety of ways. Among the metrics used are temperatures that are preferred for spawning,
37 temperatures that are avoided, and temperatures (upper and lower) that may kill individual fish.
38 Terms for these metrics include maximum tolerance temperatures, preferred temperatures,
39 upper avoidance temperatures, and upper lethal temperatures. A list of the thermal tolerances
40 for several species found in Lake Granbury is presented in Table 5-4.

Table 5-4. Thermal Tolerances of Some Fish Species of Lake Granbury

Species	Maximum Temperature Tolerance ⁽¹⁾		Preferred Temperature Range ⁽²⁾		Upper Lethal Temperature ⁽²⁾	
	°C	°F	°C	°F	°C	°F
white crappie	31.0	87.8	–	–	–	–
white bass	31.4	88.5	–	–	–	–
freshwater drum	32.6	90.7	–	–	–	–
gizzard shad	34.0	93.2	–	–	–	–
green sunfish	34.0	93.2	–	–	–	–
longear sunfish	34.0	93.2	–	–	–	–
smallmouth buffalo	34.0	93.2	–	–	–	–
warmouth	34.0	93.2	–	–	–	–
common carp	35.0	95.0	16-36	60-96	37	98
channel catfish	35.0	95.0	–	–	35	95
largemouth bass	35.5	95.9	25-29	77-85	–	–
bluegill	36.0	96.8	16-27	60-80	34	94

(1) Maximum weekly average temperature tolerance, determined using a technique that matched fish presence records from throughout the U.S. with stream temperature records to estimate the highest weekly mean temperatures encountered by each species in its natural environment (Eaton and Sheller 1996).

(2) Source: Bell 1991

1 Under TCEQ regulations, the TPDES program regulates discharges of waste heat into state
2 waters. TCEQ specifies 93°F as the thermal water quality criterion for Lake Granbury. In
3 addition, TCEQ mixing-zone regulations require that for freshwater lakes and impoundments the
4 temperature increase within the thermal plume beyond the mixing zone not exceed 3°F above
5 the ambient water temperature (TCEQ 2000). The applicant's assessment conservatively
6 assumed the temperature of the effluent discharge to be equal to the water quality criterion of
7 93°F, although the actual discharge temperature is expected to be lower (Luminant 2009a).
8 The thermal plume was modeled under conditions of minimum downstream flow (28 cfs
9 discharge through the dam) and three water temperature scenarios in the reservoir (minimum,
10 mean, and maximum) based on historical data for Lake Granbury from 1997 to 2007. The rate
11 of effluent discharge was assumed to be 58 cfs, representing the maximum expected blowdown
12 in combination with other effluents from the operation of CPNPP Units 3 and 4 (Luminant
13 2009a).

14 The staff's independent assessment included modeling of the extent of the thermal plume based
15 on the isotherm defined by the 3°F temperature increase above ambient. The maximum
16 temperature difference (44.4°F) would occur when the reservoir temperature is lowest, based on
17 the maximum discharge temperature (93°F) and a low ambient temperature in winter (48.6°F).
18 Under the worst-case scenario of minimum lake temperature, maximum discharge temperature,
19 and maximum discharge flow, the model indicated that the largest thermal plume based on the
20 3°F isotherm would have a length of approximately 682 ft and a width of 356 ft. The longer
21 dimension of the plume would extend in a downstream direction toward the dam. The reservoir
22 width in the area of the discharge is approximately 1950 ft. The 356-ft width of the plume would
23 extend across only about 18 percent of the width of the reservoir and would not create a thermal

1 barrier that would impede the movement of fish through this area. In summer, assuming an
2 ambient water temperature of 89.2°F, the maximum temperature difference between the
3 discharge and ambient water temperatures in Lake Granbury would be much less than in winter,
4 and the potential for measurable increases in downstream water temperatures would be
5 similarly minimized.

6 A thermal plume may cause heat stress or heat shock to fish when the water temperature
7 exceeds the thermal tolerance of the fish. The occurrence of heat stress is also affected by the
8 duration of exposure to high water temperatures. Fish thermoregulate by avoiding extreme
9 temperatures and seeking optimal temperatures. As shown by the data in Table 5-4, the
10 thermal tolerances of many of the fishes that occur in Lake Granbury are similar to or exceed
11 the maximum permitted discharge temperature of 93°F. Thus, adult fish would be unlikely to be
12 exposed to potentially lethal temperatures even under worst-case conditions, and they could
13 readily avoid adverse effects from the relatively small area of the thermal plume. Although it is
14 possible that eggs or larvae drifting near the discharge could enter the plume, the small area of
15 the plume and the limited numbers of pelagic eggs and larvae in the reservoir would minimize
16 the potential for mortality or impacts on fish populations as a result.

17 Based on reviews of literature and operational monitoring reports, consultations with utilities and
18 regulatory agencies, and public comments, thermal effects were not found to cause reductions
19 in aquatic populations near any existing nuclear power plants with closed-cycle cooling systems
20 (NRC 1996). Those findings are consistent with the results of this evaluation of the potential
21 thermal impacts from the proposed CPNPP Units 3 and 4 discharge on Lake Granbury. The
22 thermal plume is predicted to be small, to dissipate within a limited area near the dam, and to
23 have negligible ecological effects on the reservoir. Based on the foregoing, the staff concludes
24 that thermal impacts on populations of fish or other organisms due to the discharge of waste
25 heat from CPNPP Units 3 and 4 into Lake Granbury would be minimal, and additional mitigation
26 would not be warranted.

27 **Cold shock.** Another factor related to thermal discharges that may affect aquatic biota is cold
28 shock. Cold shock occurs when aquatic organisms that have been acclimated to warm water,
29 such as fish in a power plant's discharge canal, are exposed to a sudden temperature decrease.
30 This sometimes occurs when power plants shut down suddenly in winter (NRC 1996). Cold
31 shock is less likely to occur at a multiple-unit facility because the temperature decrease from
32 shutting down one unit is moderated by the heated discharge from the units that continue to
33 operate; it is not common to shut down all units simultaneously. Given the very small area of
34 Lake Granbury near the dam that potentially would be affected by the thermal discharge, the
35 small additional contribution of both Units 3 and 4 to the discharge, and the warm climate where
36 the reservoir is located, the likelihood of fish populations being affected by cold shock is
37 negligible. Accordingly, the staff concludes that impacts on fish populations due to cold shock
38 would be minimal, and additional mitigation would not be warranted.

39 **Invasive nuisance organisms.** As described in Section 2.4.2.3.2, with the exception of golden
40 alga (*Prymnesium parvum*), non-native and nuisance species of aquatic plants are not currently
41 a problem in Lake Granbury. The conditions that promote fish kills by golden alga, described in
42 Section 2.4.2.1.1, are not well understood but appear to be conditions that are stressful to
43 golden alga, including low temperatures (TWRI 2009, Wythe 2008). Golden alga grows
44 optimally at warm temperatures of 25 to 30°C (77 to 86°F), yet it blooms in Texas mainly in
45 winter and causes the majority of fish kills when the water is cold. This seeming paradox may
46 be the result of reduced competition from green algae under cold conditions (TPWD 2009e)
47 and/or the proliferation of cyanobacteria (blue-green algae), which release cyanotoxins that
48 impair competitors, in warmer water (TWRI 2009, Wythe 2008). Thus, the release of heated

1 water from the CPNPP Units 3 and 4 discharge near the Lake Granbury dam would not be
2 expected to promote golden alga blooms or associated fish kills.

3 Two nuisance animals present in Lake Granbury, the Asian clam (*Corbicula fluminea*) and
4 estuarine mud crab (*Rhithropanopeus harrisi*), have the potential to cause biofouling problems,
5 but the thermal discharge from CPNPP Units 3 and 4 would not be expected to promote
6 increases in their populations.

7 **Chemical impacts from the discharge.** In Section 5.2.3.1, the staff describes its independent
8 assessment of the impacts of the proposed CPNPP Units 3 and 4 discharge on water quality in
9 Lake Granbury. Discharge-related ecological impacts may result from the concentration of
10 metals and other naturally occurring inorganic constituents in the blowdown (Table 5-2) and also
11 may result from chemicals added to treat the facility water systems that contribute to the
12 discharge. Chemicals would be added to various water systems within the CPNPP Units 3 and
13 4 facilities to control water quality, inhibit scale and corrosion, and prevent biological fouling
14 (Luminant 2009a). As a result, these chemicals would be present in the effluent discharged to
15 Lake Granbury. The chemicals expected to be used include sodium hypochlorite (source of
16 chlorine for biocide to control bacteria and algae), sulfuric acid (pH adjustment),
17 orthopolyphosphate and phosphonate (corrosion/scale inhibitor), and sodium bisulfite
18 (dechlorination of blowdown) (Luminant 2009a).

19 Table 5-2 provides a list of the water quality constituents expected to be present in the effluent
20 discharged to Lake Granbury. As a result of evaporative cooling losses, the natural minerals in
21 the water of Lake Granbury would be concentrated in the blowdown to about 2.4 times their
22 concentration in the water withdrawn from the lake. Without additional treatment, concentrated
23 dissolved solids (mainly salts), certain naturally occurring metals, and other constituents in the
24 blowdown would exceed regulatory limits under average or low flow conditions in Lake
25 Granbury. Therefore, the applicant has proposed to use a BDTF, constructed and operated as
26 described in Chapter 3, to provide additional treatment of the waste stream so that the effluent
27 discharged through the diffuser would meet the Texas State Water Quality Criteria for Lake
28 Granbury of 2500 mg/L for TDS and 1000 mg/L for chloride, as well as the criteria for the other
29 constituents present. Discharges to Lake Granbury would be regulated under a TPDES permit
30 from TCEQ specifying acceptable chemical concentrations at the proposed CPNPP Units 3 and
31 4 diffuser. The applicant has stated that the BDTF would reduce concentrations of these water
32 quality constituents and metals to below regulatory limits. The concentrations of these
33 constituents, which are anticipated to be within regulatory criteria when discharged into Lake
34 Granbury, would be further diluted by mixing of the discharged water with the water of the lake.

35 Section 5.2.1 describes changes in the flow patterns in the vicinity of the intake and discharge
36 structures for CPNPP Units 3 and 4 that would occur under low-flow conditions, when the flow
37 released from the dam would be comparable to the total rate of water withdrawal for all four
38 CPNPP units. Under these low-flow conditions, recirculation would occur, in which a flow
39 pattern would develop between the discharge structure and the intakes for all four units, and the
40 diffuser would operate less effectively than during conditions of higher flow in mixing and diluting
41 the effluent. Such a recirculation pattern may result in constituent concentrations that are locally
42 elevated above ambient concentrations in a larger than normal area in the vicinity of the
43 diffuser. However, the effluent concentrations discharged would remain below water quality
44 criteria.

45 Because the concentrations of TDS, metals, and other water quality constituents in the
46 discharge from the diffuser are expected to be less than water quality criteria established by
47 TCEQ to be protective of aquatic life, the aquatic ecology of Lake Granbury would not be

1 adversely affected by chemicals discharged as a result of the operation of CPNPP Units 3 and
2 4.

3 **Physical impacts from the discharge.** The operation of a discharge potentially can have
4 physical impacts on the receiving waterbody in the form of effects such as scouring, siltation,
5 and increased turbidity. Section 3.3.1.13 discusses the location and design of the discharge
6 structure. The design is expected to include two multipoint diffusers, each 82 ft long with 18
7 diffuser nozzles, resting on or buried in the bottom of the reservoir (Luminant 2009a). The
8 diffuser nozzles would be angled away from the substrate (30 degrees from vertical) in the
9 downstream direction to provide optimal dispersion of the effluent into the waters of Lake
10 Granbury while avoiding scouring of the bottom (Luminant 2009a) and any associated increases
11 in turbidity and siltation.

12 **Discharge conclusions.** Based on the analyses presented above of the potential for thermal,
13 chemical, and physical impacts on the aquatic ecosystem from the discharge of cooling system
14 blowdown to Lake Granbury, and the staff's independent review, the staff concludes that
15 impacts due to discharges from operation of the proposed CPNPP Units 3 and 4 would be
16 minimal, and additional mitigation would not be warranted.

17 **Impacts from Hydrological Changes**

18 As discussed in Section 5.2.3.1, the BRA would alter its operation of the Brazos River system,
19 including Lake Granbury and PKL, in order to provide the additional water needed for CPNPP
20 Units 3 and 4 as well as other future water uses. These operational changes would include
21 increases in the release of water from PKL to Lake Granbury. The water of PKL normally has
22 higher concentrations of chloride and TDS than Lake Granbury due to naturally occurring salt
23 deposits in the PKL watershed. Consequently, increased inflows to Lake Granbury from PKL
24 would increase the concentrations of these constituents in Lake Granbury. These increases are
25 likely to occur even without the operation of CPNPP Units 3 and 4 because the 2060 Brazos G
26 Water Plan calls for full utilization of the yield from the Brazos River system between now and
27 2060. This would require increased releases from PKL, which would be allocated to Units 3 and
28 4 and/or other water users, or would be allocated entirely to other users eventually if Units 3 and
29 4 were not built.

30 Historical TDS concentrations in Lake Granbury since 1970 have ranged from 500 mg/L to
31 almost 3000 mg/L. Evaluation by the applicant of modeling results from the WAM indicated that
32 the operation of CPNPP Units 3 and 4 would increase TDS concentrations in the lower 10-mi
33 reach of Lake Granbury by about 530 mg/L (Ward 2008). Thus, TDS concentrations would
34 remain within the historical range under most conditions, but the upper and lower boundaries of
35 the range of TDS concentrations in Lake Granbury potentially would increase under extreme
36 conditions. Because the aquatic biota of Lake Granbury are adapted to the range of TDS
37 concentrations that have occurred in the lake historically, they would not be expected to be
38 adversely affected by the predicted TDS increases under most conditions. However, under
39 extreme conditions in which TDS may increase potentially over 500 mg/L beyond the upper end
40 of the historical range, some organisms may be adversely affected if their salinity tolerance is
41 exceeded.

42 Alterations in the operation of the Brazos River system also would result in changes in water
43 levels in Lake Granbury, which could cause ecological impacts. As discussed in Section 5.2.1,
44 consumption of water from Lake Granbury by the operation of CPNPP Units 3 and 4 would
45 result in lake water levels that typically are lower than in the past. Based on historical data from
46 1940 to 2007, modeling by the staff for the year 2020 indicates that Lake Granbury would be at
47 full pool about 57 percent of the time in the absence of CPNPP Units 3 and 4, but it would be at

1 full pool only 46 percent of the time if Units 3 and 4 were operating. The modeling also
2 indicated that in the absence of Units 3 and 4 Lake Granbury would be 2 ft or more below full
3 pool about 10 percent of the time, but with Units 3 and 4 operating, the lake would be 2 ft or
4 more below full pool about 25 percent of the time. Thus, with Units 3 and 4 operating, Lake
5 Granbury would be expected to be 2 ft or more below full pool an additional 15 percent of the
6 time. The modeling also indicated that the operation of Units 3 and 4 would reduce the average
7 water level in Lake Granbury by 0.6 ft.

8 The aquatic biota of Lake Granbury historically has been exposed to fluctuating water levels of
9 similar magnitude though somewhat different frequency compared to the levels predicted by the
10 model for operation of CPNPP Units 3 and 4. If the increased frequency of lower water levels
11 were to occur during spawning season and result in the desiccation of shallow habitats where
12 fish nest or otherwise deposit their eggs, the spawning success of these fish potentially could be
13 reduced. The potential for populations of fish to be measurably affected by reductions in
14 reproductive success would be dependent on the timing and duration of low water levels, the
15 characteristics of the species, and the proportion of their spawning habitats affected. Given
16 these uncertainties, adverse effects on aquatic biota and habitat may range from negligible to
17 noticeable.

18 **5.3.2.2 Impacts on the Squaw Creek Reservoir Ecosystem**

19 Discharges to SCR from the existing CPNPP Units 1 and 2 are regulated by a TPDES permit
20 granted by the TCEQ. The majority (more than 90 percent by volume) of the effluents from the
21 proposed CPNPP Units 3 and 4 would be blowdown and would be discharged to Lake Granbury
22 rather than SCR. Effluents that would discharge into SCR include treated effluent from the
23 sanitary wastewater treatment plant for Units 3 and 4 facility and treated effluents from the liquid
24 waste management system, including radioactive wastewaters. (See Section 5.9.5 for
25 discussion of radiological dose and lack of impacts to aquatic biota of SCR.) Also, a minor
26 quantity of process wastewater (from equipment and floor drains from nonradioactive building
27 areas) would be discharged to the Units 1 and 2 wastewater treatment system (Luminant
28 2009a). Thermal effluents from operation of the proposed CPNPP Units 3 and 4 would not
29 enter SCR, and these effluents would have essentially no effect on the temperature of makeup
30 water withdrawn from Lake Granbury and pumped to SCR in conjunction with the operation of
31 Units 1 and 2. Therefore, impacts from discharges to SCR as a result of the operation of the
32 proposed Units 3 and 4 would be negligible.

33 Because CPNPP Units 3 and 4 would be located adjacent to the shoreline and upgradient of
34 SCR, the reservoir could be affected by stormwater drainage during the period of operation.
35 The facility would have an extensive stormwater drainage system to manage runoff prior to
36 discharge to SCR, in accordance with a stormwater management plan to be developed.
37 Potentially contaminated stormwater runoff that may have contacted contaminants, such as oil
38 or chemicals, would be directed to an appropriate wastewater stream for treatment prior to
39 discharge. Other stormwater runoff, such as from roof drains, would be directed into
40 retention/sedimentation basins that would be located northeast of Unit 3 and northwest of
41 Unit 4.

42 Based on this analysis of the potential for thermal, chemical, or physical impacts on the aquatic
43 ecosystem of SCR, and the staff's independent review, the staff concludes that impacts on SCR
44 from the operation of the proposed CPNPP Units 3 and 4 would be minimal, and additional
45 mitigation would not be warranted.

1 **5.3.2.3 Impacts on the Brazos River Ecosystem**

2 The operation of the proposed CPNPP Units 3 and 4 would involve the diversion of water from
3 Lake Granbury as makeup water as well as the discharge into Lake Granbury of blowdown from
4 the cooling water system. Consequently, the Brazos River downstream of the DeCordova Bend
5 Dam potentially could be affected by hydrological changes resulting from the diversion of river
6 flow from the reservoir and by water quality changes resulting from the effluent discharged to
7 the reservoir.

8 ***Impacts from Hydrological Changes***

9 In Section 5.2.1, the staff describes its independent assessment of the impact of the diversion of
10 makeup water for the proposed CPNPP Units 3 and 4 on the hydrology of the Brazos River
11 downstream of Lake Granbury, as well as the impact of changes in water management
12 practices on the river upstream between Lake Granbury and PKL. The hydrology assessment
13 determined that the seasonal distribution of streamflow in the reach downstream from PKL and
14 upstream of Lake Granbury would be altered, with lower flows during the wetter months of the
15 year (typically May and June) and higher flows during the drier months. Such alterations likely
16 would reduce the variability of the flow regime in this reach, further attenuating the naturally
17 wide range of flow that was characteristic of the river before PKL was built. Reductions in flow
18 variability may be beneficial for aquatic organisms that prefer a stable environment and cannot
19 move rapidly to avoid desiccation, such as certain mussels. However, reductions in flow
20 variability may have adverse effects on other native organisms that are adapted to the highly
21 variable flow regime and sediment transport of the natural river before it was impounded.
22 The hydrology assessment determined that the operation of Units 3 and 4 would result in
23 somewhat smaller releases from Lake Granbury and lower resulting streamflow in the Brazos
24 River downstream near Glen Rose, except during peak flood flows and periods of low flow,
25 when a minimum release would be maintained. Thus, there would be somewhat lower flows in
26 the river between Lake Granbury and Lake Whitney the majority of the time (when not flooding
27 or affected by drought). This likely would reduce the average extent and volume of aquatic
28 habitat available in the river relative to existing conditions. As a result, fish and invertebrates
29 could lose protective cover and nesting, spawning, foraging and nursery areas. Such habitat
30 losses could result in increased predation, crowding, and competition. Lower flows also can
31 affect substrate characteristics by altering processes such as sediment transport, suspension,
32 siltation, and sorting. Changes in sediment composition and other characteristics could alter the
33 benthic habitats available on and within the substrate for invertebrates, fish, and their eggs. In
34 addition, lower flows and shallower water can increase water temperatures and reduce
35 turbulence, which may reduce dissolved oxygen levels in some areas of the river. Effects on
36 riverine habitat such as these potentially could result in reductions in populations of some
37 species of fish and invertebrates.

38 The magnitude of potential changes in flow in the Brazos River above and below Lake Granbury
39 has not been well defined, and the likelihood and magnitude of associated effects on the aquatic
40 communities of these river reaches similarly are undefined. Riverine organisms are adapted to
41 the highly variable flow regime of the Brazos River, and there is uncertainty about the
42 magnitude of the impacts on riverine biota that may result from the relatively limited alterations
43 in river flow associated with the operation of CPNPP Units 3 and 4. Such impacts may range
44 from negligible to substantial depending on the species and the degree to which its habitat is
45 affected.

1 **Water Quality Impacts**

2 As discussed above for Lake Granbury, the greatest temperature increase above ambient in the
3 thermal plume within Lake Granbury would occur during winter, and any associated increase in
4 temperature of the river would not result in river temperatures approaching the thermal
5 tolerances of resident fishes. Increases above ambient in Lake Granbury in summer would be
6 much less than in winter, and the potential for measurable increases in downstream water
7 temperatures would be similarly minimized. Based on the foregoing, the staff concludes that
8 thermal impacts on populations of fish or other organisms downstream in the Brazos River due
9 to the discharge of waste heat from CPNPP Units 3 and 4 into Lake Granbury would be
10 minimal, and additional mitigation would not be warranted.

11 Also as discussed above, discharges to Lake Granbury and SCR would be regulated under a
12 TPDES permit at the proposed CPNPP Units 3 and 4 outfall in Lake Granbury. The
13 concentrations of the constituents in the effluent, which are anticipated to be within State
14 surface water criteria protective of aquatic life when discharged into Lake Granbury, would be
15 further diluted by mixing of the discharged water with the water of the lake. Therefore, the
16 concentrations of TDS, metals, and other water quality constituents in the river below the dam
17 are expected to be substantially lower than surface water criteria, and the aquatic ecology of the
18 Brazos River would not be adversely affected by chemicals discharged as a result of the
19 operation of CPNPP Units 3 and 4.

20 Based on this analysis of the potential for thermal and chemical impacts on the aquatic
21 ecosystem of the Brazos River, and the staff's independent review, the staff concludes that
22 impacts from the operation of the proposed CPNPP Units 3 and 4 would be minimal, and
23 additional mitigation would not be warranted.

24 **5.3.2.4 Impacts on Possum Kingdom Lake**

25 As discussed in Section 5.2.3.1, the BRA would alter its operation of the Brazos River system,
26 including PKL, in order to provide the additional water to Lake Granbury needed for CPNPP
27 Units 3 and 4. These operational changes would include increases in the release of water from
28 PKL to Lake Granbury. These increases are likely to occur even without the operation of
29 CPNPP Units 3 and 4 because the 2060 Brazos G Water Plan calls for full utilization of the yield
30 from the Brazos River system between now and 2060, which would require increased releases
31 from PKL to provide for the water allocated to Units 3 and 4 and/or other downstream water
32 users. Increased water releases from PKL would result in changes in water levels in PKL, which
33 could cause ecological effects. As discussed in Section 5.2.1, releases of water from PKL to
34 support the operation of CPNPP Units 3 and 4 would result in lake water levels that typically are
35 lower than in the past. Based on historical data from 1940 to 2007, modeling by the staff for the
36 year 2020 indicates that PKL would be at full pool about 34 percent of the time in the absence of
37 CPNPP Units 3 and 4, but it would be at full pool only 26 percent of the time if Units 3 and 4
38 were operating. During the time that PKL would be below full pool in the absence of Units 3 and
39 4, the modeling indicated that it would be 5 ft or more below full pool about 10 percent of the
40 time. But during the time that the lake would be below full pool with Units 3 and 4 operating, the
41 modeling indicated that it would be 5 ft or more below full pool about 25 percent of the time.
42 Thus, with Units 3 and 4 operating, PKL would be expected to be 5 ft or more below full pool an
43 additional 15 percent of the time. The modeling also indicated that the operation of Units 3 and
44 4 would reduce the average water level in PKL by 1.5 ft.

45 The aquatic biota of PKL historically has been exposed to fluctuating water levels of similar
46 magnitude though somewhat different frequency compared to the levels predicted by the model
47 for operation of CPNPP Units 3 and 4. If the increased frequency of lower water levels were to

1 occur during spawning season and result in the desiccation of shallow habitat where fish nest or
2 deposit their eggs, the spawning success of these fish potentially could be reduced. Declines in
3 water levels of several feet, particularly in spring or early summer, could expose fish nests or
4 eggs adhering to surfaces. As shown in Table 5-4, the majority of fishes inhabiting Lake
5 Granbury, which also occur in PKL, have demersal, adhesive eggs that are deposited in nests
6 or attached to other surfaces. Thus, these eggs remain in place and would die if present where
7 they are exposed by a decline in water levels. If the increased frequency of lower water levels
8 were to occur during spawning season and result in the desiccation of shallow habitats where
9 fish nest or otherwise deposit their eggs, the spawning success of these fish potentially could be
10 reduced. The potential for populations of fish to be measurably affected by reductions in
11 reproductive success would be dependent on the timing and duration of low water levels, the
12 characteristics of the species, and the proportion of their spawning habitats affected. Given
13 these uncertainties, adverse effects on aquatic biota and habitat may range from negligible to
14 noticeable.

15 **5.3.2.5 Impacts on Wheeler Branch Reservoir and the Paluxy River**

16 As discussed in Sections 2.3.2.1 and 5.2.2.1, water withdrawals from the recently completed
17 WBR have been allocated to Luminant for use at CPNPP (up to 565 ac-ft/yr, which is 28 percent
18 of available annual supply from the reservoir). The Paluxy River, which supplies water to WBR
19 from an impoundment behind a low channel dam 1.8 mi to the southeast in the City of Glen
20 Rose, would experience only a very small reduction in flow from the use of this allocation: 0.4
21 percent of the mean annual flow in the Paluxy River at Glen Rose. Also, because the WBR
22 water right permit does not allow diversions of water from the Paluxy River for supplying WBR to
23 cause the flow in the river to fall below specified values, there would be no adverse effects on
24 low flows in the river. The low dam on the Paluxy River at Glen Rose is approximately 2.5 river
25 mi upstream of the confluence of the Paluxy River with the Brazos River, so this is the short
26 reach of the Paluxy River where flows potentially would be affected. Given the planning for and
27 management of the CPNPP water supply allocation by the SCWD, the minimal effects on
28 Paluxy River flow, and regulations to prevent low-flow withdrawals, adverse effects on the
29 aquatic communities of WBR and the Paluxy River from water supply withdrawals associated
30 with the operation of CPNPP Units 3 and 4 would be negligible.

31 **5.3.2.6 Impacts on Wetland Ecosystems**

32 Wetlands that could be affected by operation of Units 3 and 4 are those that lie along the edges
33 of the southwest peninsula on which the cooling towers would be located (Figure 2-17). As
34 reported in Section 5.3.1.1, salt deposition from the cooling towers would be too low to be a
35 factor, but some surface fogging and icing at the CPNPP site are expected. Impacts would
36 probably be similar to those from the occasional natural icing events in the region (freezing rain
37 and sleet), which occur from December through March (see Section 2.9). These impacts would
38 occur when the vegetation is dormant. Therefore, impacts to wetlands from fogging and icing
39 associated with cooling tower operation are expected to be minimal, and mitigation would not be
40 warranted.

41 **5.3.2.7 Impacts on Aquatic and Wetland Resources from Transmission Lines and** 42 **Cooling Water Pipelines**

43 Maintenance activities along the 345-kV transmission line ROWs that would be utilized during
44 operation of the proposed CPNPP Units 3 and 4 potentially could have periodic, temporary
45 impacts on streams, ponds, and waterways crossed by the lines. The lines and potentially
46 affected aquatic resources were described in Section 2.4.2.2. The exact routes to be followed

1 by these two new lines have not been determined pending completion of transmission routing
2 studies, so this evaluation is based on approximate routes (Figure 2-14). The DeCordova
3 transmission line would cross Squaw Creek and several inlets along the shoreline of SCR, the
4 Brazos River, and Lake Granbury. The Whitney transmission line would cross only one major
5 waterbody, the Paluxy River, and several small tributaries of the Brazos River and Lake Whitney
6 (Figure 2-14).

7 The potential for transmission lines and water pipelines to affect aquatic resources principally is
8 associated with procedures for management of vegetation and maintenance of service roads in
9 ROWs adjacent to waterbodies. The same management practices currently employed by Oncor
10 Electric Delivery for the existing CPNPP Units 1 and 2 transmission line ROWs are expected to
11 be employed for the proposed DeCordova and Whitney transmission line ROWs. These
12 practices include procedures to prevent impacts on surface waters and wetlands. For example,
13 service roads near water would be maintained to prevent erosion and its potential to affect
14 aquatic and wetland communities through increased turbidity and sedimentation, and vegetated
15 buffers would be maintained between roads and waterbodies/wetlands. Vegetation within
16 ROWs near water would be managed through hand cutting, mowing, and application of
17 herbicides. Herbicides would be applied selectively by qualified personnel in accordance with
18 manufacturer recommendations and regulatory guidance in order to prevent the possibility of
19 herbicide runoff into surface water. Similar procedures are expected to be employed in
20 maintaining the pipeline ROW.

21 Effects from transmission line and pipeline ROW maintenance and vegetation management
22 activities on floodplains and wetlands were evaluated in the *Generic Environmental Impact*
23 *Statement for License Renewal of Nuclear Plants*, NUREG-1437 (NRC 1996). Effects of these
24 activities in wetland and floodplain areas were found to be minimal at operating nuclear power
25 plants. Control of trees and large shrubs is normally required only in forested areas where trees
26 grow tall enough to physically interfere with operation of the powerlines. Ponds, marshes, and
27 other types of wetlands lacking trees generally are not subjected to vegetation control and
28 would not be affected. Wetlands occur on only 2.5 percent or less of the area of the
29 transmission line ROWs (Tables 2-9 and 2-10) and no wetlands are present on the proposed
30 pipeline ROW.

31 As a result of these management practices and other lines of evidence described above, the
32 operation and maintenance of the proposed transmission lines and pipelines would be unlikely
33 to adversely affect aquatic or wetland ecosystems. The staff concludes that the impacts of
34 transmission line and pipeline ROW maintenance activities on aquatic and wetland resources
35 would be minimal and that additional mitigation beyond the practices described above would not
36 be warranted.

37 **5.3.2.8 Impacts on Important Aquatic Species and Habitats**

38 This section describes the potential impacts to important aquatic species, including
39 recreationally important fishes and Federally and State-listed threatened or endangered aquatic
40 species, and their habitats that may result from operation of the proposed CPNPP Units 3 and 4
41 and associated new transmission lines and pipelines. The biology and life histories of
42 representative important species are presented in Section 2.4.2. The potential impacts from
43 operation of the proposed facilities on these species are described in the following sections.

44 ***Recreational Fishery Species***

45 As discussed in Section 5.3.2.2, there would be negligible impacts on the aquatic ecosystem of
46 SCR, including fishery species, as a result of the operation of CPNPP Units 3 and 4. (See

1 Section 5.9.5 for discussion of radiological dose and lack of impacts to aquatic biota of SCR.)
2 Lake Granbury, however, would be affected by the intake that would provide makeup water to
3 Units 3 and 4 and the discharge of blowdown from the facility. Water-based recreation is
4 among the uses for which Lake Granbury is operated by the BRA. Current fishing opportunities
5 provided by Lake Granbury are rated by TPWD as good for largemouth bass, striped bass,
6 white bass, catfish, and sunfish, and fair for crappie (TPWD 2009b). Although game fish
7 populations in Lake Granbury have been reduced annually since 2001 by toxic blooms of
8 golden alga, stocking has been used to mitigate the losses of striped bass and largemouth bass
9 (Baird and Tibbs 2006). As discussed above, populations of these recreational fishery species
10 in Lake Granbury are unlikely to be noticeably affected by operations, including intake-related
11 entrainment or impingement or discharge-related increases in water temperature and chemical
12 effluents or reductions in water quality. Based on the evaluations described above, the staff
13 concludes that impacts from operation of the proposed CPNPP Units 3 and 4 on recreational
14 fishery species in Lake Granbury, and the forage species on which they feed, would be minimal,
15 and mitigation would not be warranted.

16 Fishes that inhabit the Brazos River below Lake Granbury and are likely to be pursued by
17 recreational anglers include largemouth bass, white bass, sunfish, channel catfish, and blue
18 catfish (*Ictalurus furcatus*). Based on the evaluations described in Sections 5.2 and 5.3.2.3,
19 populations of recreational fishery species in the Brazos River downstream of Lake Granbury
20 would be unlikely to be adversely affected by changes in temperature or water chemistry
21 resulting from operation of the CPNPP Units 3 and 4 intake and discharge in the lake. Changes
22 in hydrology in this river reach due to modifications to water management practices and
23 releases from Lake Granbury likely would result in some reduction in base flows. As discussed
24 in Section 5.3.2.3, there is uncertainty about the magnitude of the impacts on riverine biota,
25 including game fish that may result from the relatively limited alterations in river flow associated
26 with the operation of CPNPP Units 3 and 4. Such impacts may range from negligible to
27 noticeable depending on the species and the degree to which their habitat is affected.

28 PKL is similar to Lake Granbury in that it is used for recreational fishing for the same species,
29 fish populations have been reduced by golden alga toxicity since 2001, and stocking is used to
30 mitigate the losses of some species. The fishing opportunities provided by PKL currently are
31 rated by TPWD as fair for largemouth bass, crappie, striped bass, and sunfish; good for catfish;
32 and excellent for white bass (TPWD 2009c). Operation of CPNPP Units 3 and 4 potentially
33 could affect fishery species in PKL as a result of changes in water management by the BRA that
34 would affect water levels in this lake upstream of Lake Granbury. As described above, the
35 water levels in PKL would typically be lower than in the past. The likelihood that PKL water
36 levels would be lower more frequently increases the potential for adverse effects on the
37 reproductive success of fishes that spawn in shallow littoral habitats. Declines in water levels of
38 several feet, particularly in spring or early summer, could expose fish nests or eggs adhering to
39 surfaces. As shown by the information in Table 5-4, the majority of fishes inhabiting Lake
40 Granbury, and which also occur in PKL, have demersal, adhesive eggs that are deposited in
41 nests or attached to other surfaces. Thus, these eggs remain in place and would die if located
42 where they are exposed by a decline in water levels, and lower water levels during spawning
43 may reduce the area of bottom habitat suitable for spawning. As discussed above, the potential
44 for populations of fish to be measurably affected by reductions in reproductive success would be
45 dependent on the timing and duration of low water levels, the characteristics of the species, and
46 the proportion of their spawning habitats affected. Given these uncertainties, the effects of
47 water level changes on individual fish populations may vary from negligible to noticeable.

48 WBR was first stocked to establish a recreational fishery in 2007. Largemouth bass,
49 smallmouth bass, bluegill, and channel catfish fingerlings were released that year and again in

1 2008; then in 2009 smallmouth bass fingerlings and walleye fry were stocked (TPWD 2010c).
2 The Paluxy River from the low dam at Glen Rose to the Brazos River, a reach of approximately
3 2 mi, potentially supports a recreational fishery similar to that described above for the Brazos
4 River. As described in Section 5.3.2.5, the Paluxy River at Glen Rose, which supplies water to
5 WBR from an impoundment behind a low channel dam, would experience only a very minor
6 reduction in flow (0.8 percent of the mean annual flow) as a result of the use of the allocation of
7 water from WBR for operation of CPNPP Units 3 and 4. Diversion of water from the Paluxy to
8 supply WBR would not occur during periods of minimal streamflow, so there would be no
9 adverse effects from low flows. The dam on the Paluxy River at Glen Rose is approximately 2.5
10 mi upstream of the confluence of the Paluxy River with the Brazos River, so only this short
11 segment of the river would be affected. Thus, impacts on recreational fishery species, and
12 forage species on which they feed, in WBR or the Paluxy River as a result of water supply
13 withdrawals associated with the operation of CPNPP Units 3 and 4 would be negligible.

14 ***Non-Native and Nuisance Species***

15 With the exception of golden alga, non-native and nuisance species of aquatic plants are not
16 currently a problem in Lake Granbury (Baird and Tibbs 2006), SCR, PKL, or the Brazos River in
17 the vicinity of the CPNPP site (Luminant 2009a). As discussed in Section 2.4.2.1, golden alga
18 is a nuisance species, and possibly non-native, that can develop toxic blooms and has caused
19 extensive fish kills in Lake Granbury and PKL. The conditions that promote fish kills by golden
20 alga are not well understood and are the subject of ongoing research. Certain conditions that
21 are stressful to golden alga are associated with increased toxicity, such as low temperatures,
22 low nutrient levels, low salinity, and high pH (TWRI 2009, Wythe 2008). It is an apparent
23 paradox that golden alga grows optimally at warm temperatures of 25 to 30 °C (77 to 86 °F), yet
24 in Texas it blooms mainly in winter. Thus, the majority of fish kills due to golden alga take place
25 during winter when the water is cold. This may be because cold conditions are not favorable for
26 (1) the growth of green algae, resulting in reduced competition for golden alga (TPWD 2009e),
27 and/or (2) the growth of cyanobacteria (blue-green algae), which produce a variety of
28 cyanotoxins that impair competitors and may suppress the growth of golden alga (TWRI 2009,
29 Wythe 2008). The discharge of warm, blowdown water into Lake Granbury would not result in
30 colder conditions or otherwise inhibit the growth of green algae or cyanobacteria that may
31 suppress golden alga growth. Therefore, toxic blooms of golden alga would not be expected to
32 be promoted in Lake Granbury as a result of the operation of CPNPP Units 3 and 4, and the
33 occurrence of toxic blooms of golden alga also would not be promoted in the other water bodies
34 in the region. The characteristics of the other nuisance species that occur in at least some of
35 these water bodies, the Asian clam (*Corbicula fluminea*) and estuarine mud crab
36 (*Rhithropanopeus harrisi*), were described in Section 2.4.2.4 and provide no indication that their
37 growth would be promoted by effects from the operation of CPNPP Units 3 and 4.

38 ***Aquatic Threatened and Endangered Species***

39 As discussed in Section 2.4.2.4 and shown in Table 2-18, there are no Federally listed aquatic
40 species within the three counties in which the CPNPP Units 3 and 4 facilities and new
41 transmission line and pipeline ROWs would operate (Hood, Somervell, and Bosque Counties),
42 or the two counties upstream of Lake Granbury (Palo Pinto and Parker Counties). However,
43 there are two Federally designated candidate species potentially occurring in these counties in
44 the vicinity of the proposed CPNPP Units 3 and 4: the sharpnose shiner (*Notropis oxyrinchus*)
45 and smalleye shiner (*N. buccula*). Candidate species are under consideration for listing but are
46 not currently legally protected under the Endangered Species Act. Based on their habitat
47 requirements, the sharpnose shiner and smalleye shiner would not occur in area reservoirs
48 such as Lake Granbury, SCR, PKL, WBR, or Lake Whitney. Due to their current distributions

1 within the Brazos River drainage, these shiners are unlikely to occur in the river downstream of
2 Lake Granbury, in the Brazos River between Lake Granbury and PKL, in Squaw Creek, in the
3 Paluxy River, or in other streams in the vicinity of the proposed facilities. Consequently,
4 operation of CPNPP Units 3 and 4 would not affect any Federally listed threatened or
5 endangered species and would have a negligible potential to affect these two candidate
6 species.

7 Also as discussed in Section 2.4.2.4 and shown in Table 2-19, there are four aquatic species
8 that are State-listed as threatened and three State species of concern that potentially may occur
9 in the vicinity of or be affected by operation of the proposed CPNPP Units 3 and 4. The Brazos
10 water snake (*Nerodia harteri*), which has a State listing status of threatened, historically has
11 occurred in Somervell, Hood, and Bosque Counties. However, review of available literature
12 indicates that there have been no reported observations of this species in the vicinity of the
13 proposed CPNPP Units 3 and 4 location in over 20 years. In addition, operation of the
14 submerged intake and discharge structures in Lake Granbury would not be expected to
15 substantially alter the shallow, shoreline habitat potentially utilized by the Brazos water snake or
16 reduce the populations of small forage fishes on which the snake potentially would feed. The
17 Brazos water snake also has occurred historically in Palo Pinto County (TPWD 2010c) and
18 Parker County (TPWD 2010d), so there is a small potential that this species could occur along
19 the shoreline of PKL or the Brazos River between PKL and Lake Granbury. The limited
20 alterations in hydrology associated with the operation of CPNPP Units 3 and 4 would not be
21 expected to adversely affect the shoreline habitat available in these areas for use by the Brazos
22 water snake.

23 Three species of freshwater mussels that are State-listed as threatened are designated by
24 TPWD as potentially occurring or having been recorded in at least one of the three counties in
25 which proposed facilities would be located: the Texas fawnsfoot (*Truncilla macrodon*) in Hood,
26 Somervell, and Bosque Counties; and the false spike (*Quincuncina mitchelli*) and smooth
27 pimpleback (*Quadrula houstonensis*) in Bosque County. Two other mussels, the pistolgrip
28 (*Tritogonia verrucosa*) and rock pocketbook (*Arcidens confragosus*), are State species of
29 concern designated by TPWD as potentially occurring or having been recorded in all three of
30 the counties in which proposed facilities would be located (TPWD 2010a, 2010b, and 2010e).
31 The Texas fawnsfoot, pistolgrip, and rock pocketbook also have been recorded in Palo Pinto
32 County (TPWD 2010c) and Parker County (TPWD 2010d), where hydrological alterations would
33 occur in conjunction with the operation of CPNPP Units 3 and 4.

34 The Texas Natural Diversity Database includes no reported observations of any of these
35 mussels within 10 mi of the proposed CPNPP Units 3 and 4 or the proposed new transmission
36 line ROWs (TPWD 2009f). The false spike possibly has been extirpated in Texas (TPWD
37 2010b). Although habitats supportive of all five species potentially could be present in the
38 Brazos River between Lake Granbury and Lake Whitney, these mussels are not known to occur
39 in this river segment and were not found in recent biological surveys at a location downstream
40 of the DeCordova Bend Dam (Bio-West 2008a). Although the smooth pimpleback and rock
41 pocketbook may occur in reservoirs, they have not been reported in recent surveys of
42 invertebrate organisms in Lake Granbury and SCR. Thus, none of the five species of mussels
43 is likely to occur in Lake Granbury, where they would have the greatest potential to be affected
44 by the operation of the proposed intake and discharge. Of the three species in Palo Pinto and
45 Parker Counties, only the rock pocketbook potentially may occur in a reservoir environment
46 such as PKL. Given the existing and historical variability in reservoir levels, the mussel species
47 that can occur in reservoirs would be unlikely to be adversely affected by the relatively limited
48 changes in water levels that may result from water management alterations associated with the
49 operation of CPNPP Units 3 and 4. The Texas fawnsfoot, pistolgrip, and rock pocketbook

1 potentially could occur in the Brazos River between PKL and Lake Granbury but are unlikely to
2 be adversely affected by the reduced variability of the flow regime that would occur in this reach.

3 An additional species designated as a State species of concern with the potential to occur in
4 Bosque and Palo Pinto Counties is the Guadalupe bass (*Micropterus treculii*) (TPWD 2010a).
5 The Guadalupe bass utilizes habitats with flowing water, preferring downstream segments of
6 small streams, and it would not occur in reservoirs such as Lake Granbury, SCR, PKL, or WBR.
7 The range of the Guadalupe bass is limited to the northern and eastern parts of the Edwards
8 Plateau region of south-central Texas, including portions of the Brazos River drainage well
9 downstream of Lake Whitney, such as the Lampasas, Leon, and Little Rivers (Lee et al. 1980,
10 TPWD 2009a). Thus, the Guadalupe bass is unlikely to occur in the Brazos River drainage in
11 Hood, Somervell, or Palo Pinto Counties, and review of available records in the Texas Natural
12 Diversity Database indicates that its last reported observation within 10 mi of the proposed new
13 CPNPP Units 3 and 4 transmission line ROWs in Bosque County was in 1979 (TPWD 2009f).
14 Consequently, the Guadalupe bass would not be likely to occur in these reservoirs or the
15 Brazos River above Lake Whitney and would not be affected by operation of the proposed
16 CPNPP Units 3 and 4.

17 Based on threatened and endangered species surveys, historical records, life history
18 information, known species occurrence locations, and information provided by Luminant in its
19 ER (Luminant 2009a) and request for additional information (RAI) responses, the staff
20 concludes that the impacts on aquatic Federally or State-listed threatened and endangered
21 species from operation of the proposed CPNPP Units 3 and 4 would be minimal, and additional
22 mitigation would not be warranted.

23 **5.3.2.9 Aquatic Monitoring during Operation**

24 Luminant does not plan to perform formal monitoring of aquatic ecosystems or wetlands during
25 operations. Its basis for this decision is that operational impacts are expected to be minimal.
26 Accordingly, the applicant (Luminant 2009a) states that “No additional preoperational or
27 operational monitoring is warranted or planned, with the possible exception of specific locations
28 along the new transmission line ROWs, unless the need for monitoring arises during the course
29 of obtaining the necessary regulatory permits or approvals required to construct and operate the
30 proposed additional units at CPNPP.” Thus, USACE or TCEQ may require aquatic monitoring
31 in conjunction with their permitting requirements.

32 **5.3.2.10 Potential Mitigation Measures for Operation-related Aquatic and Wetland** 33 **Impacts**

34 Luminant does not plan to perform mitigation measures for operation-related impacts to aquatic
35 resources beyond those discussed above. Mitigation for project impacts to wetlands, including
36 potential operational impacts, would be considered during the USACE permitting process. No
37 other potential mitigation measures are recommended.

38 **5.3.2.11 Summary of Operational Impacts on Aquatic and Wetland Resources**

39 Operation of the proposed CPNPP Units 3 and 4 potentially could affect the aquatic ecosystems
40 of Lake Granbury, SCR, the Brazos River, PKL, WBR, the Paluxy River below the City of Glen
41 Rose, and waterbodies crossed by the proposed new transmission line and pipeline ROWs.
42 Evaluation of these ecosystems identified Lake Granbury and the Brazos River as the
43 waterbodies with the greatest potential to be affected.

44 Lake Granbury would be the source of makeup water for the proposed CPNPP Units 3 and 4
45 cooling water system and also would receive blowdown effluent from the cooling system.

1 Consequently, impacts on the aquatic resources of Lake Granbury from operation of the intake
2 and discharge were assessed. Evaluation of the use of a closed-cycle cooling system in
3 conjunction with the proposed design and construction of the intake, the location of the intake
4 within the reservoir, and the relatively small proportion of water that would be withdrawn from
5 the reservoir supported the conclusion that impacts of the intake due to impingement and
6 entrainment of aquatic organisms would be minimal. In order to provide the additional water
7 needed for CPNPP Units 3 and 4, the BRA would alter its operation of the Brazos River system,
8 including Lake Granbury and PKL. These operational changes would include increases in the
9 release of water from PKL to Lake Granbury.

10 Liquid effluent from the proposed CPNPP Units 3 and 4 predominantly would be cooling system
11 blowdown that would be discharged into Lake Granbury. Much smaller amounts of effluent
12 would be discharged into SCR, including sanitary wastewater and radioactive and other
13 effluents from the liquid waste management system, which would be discharged via the CPNPP
14 Units 1 and 2 circulating water return line. Impacts on aquatic organisms in Lake Granbury due
15 to the discharge could result from thermal effects, chemical effects, physical effects on the
16 substrate, and hydrological changes. Modeling of the thermal plume predicted it to be small, to
17 dissipate within a limited area near the dam, and to have negligible ecological effects on
18 populations of fish or other organisms in the reservoir. Evaluation of predicted and permitted
19 chemical concentrations in the lake that may result from the discharge indicated adverse effects
20 on biota would be unlikely. Physical impacts such as scouring, siltation, and increased turbidity
21 also would be unlikely. Hydrological changes would include water levels in the lake 2 ft or more
22 below full pool an additional 15 percent of the time and an average water level 0.6 ft lower than
23 under current conditions. The effects of these changes on the aquatic resources in Lake
24 Granbury are somewhat uncertain but likely would range from negligible to noticeable.

25 The evaluation determined that the Brazos River would not be substantially affected by thermal
26 or chemical effects of the discharge to Lake Granbury. Operation of the Unit 3 and 4 cooling
27 systems would result in a net consumptive loss of water from the Brazos River system due to
28 withdrawal and subsequent evaporation. The BRA would alter its operation of the Brazos River
29 system, including Lake Granbury and PKL, in order to provide the additional water needed for
30 CPNPP Units 3 and 4. These operational changes would include increases in the release of
31 water from PKL to the river upstream of Lake Granbury and smaller releases from Lake
32 Granbury to the river downstream. There is uncertainty about the magnitude of the impacts on
33 riverine biota that may result from these relatively limited alterations in river flow. Such impacts
34 may range from negligible to substantial depending on the species and the degree to which its
35 habitat is affected.

36 Impacts to wetlands from fogging, precipitation, and icing from cooling tower operation would
37 likely be similar to those from occasional natural icing events in the region in winter and would
38 occur when vegetation is dormant. Impacts to wetlands from vegetation maintenance on power
39 transmission line and pipeline ROWs would be minimized or prevented by management
40 practices that reduce or eliminate erosion, provide vegetated buffers, and prescribe selective
41 cutting, mowing, and herbicide use. Accordingly, impacts to wetlands from operation of CPNPP
42 Units 3 and 4 are expected to be minor.

43 The staff reviewed the potential aquatic ecological impacts of operating new generation facilities
44 at the CPNPP site, including Units 3 and 4 at the facility on SCR, cooling water intake and
45 effluent discharge structures on Lake Granbury, and new transmission lines and pipelines.
46 Potential indirect impacts from the operation of CPNPP Units 3 and 4 also were evaluated,
47 including (1) impacts from hydrological changes in PKL due to alterations in water management
48 in the Brazos River Basin to accommodate cooling system losses, (2) impacts in the Brazos
49 River from hydrological changes due to alterations in water management, and (3) impacts in the

1 Paluxy River and WBR from withdrawals to supply water for potable and other uses at CPNPP.
2 There is substantial uncertainty associated with the magnitude of ecological effects that may
3 result from the hydrological changes in the Brazos River as well as Lake Granbury and PKL.
4 Given the information provided in Luminant's ER (Luminant 2009a), their responses to requests
5 for additional information, interactions with the Texas Parks and Wildlife Department (TPWD)
6 and the U.S. Fish and Wildlife Service (USFWS), the public scoping process, and NRC's own
7 independent review, the staff concludes that impacts from operation of the new facilities on
8 aquatic resources may range from SMALL to MODERATE. Additional mitigation may be
9 warranted to help reduce adverse effects of flow alterations on the Brazos River. Such
10 measures could include managing water releases from PKL and Lake Granbury to maintain
11 higher base flows and to periodically provide episodic high flows that would better simulate the
12 natural instream flow regime of the river.

13 **5.4 Socioeconomic Impacts**

14 Operations activities at CPNPP Units 3 and 4 could affect individual residents and communities
15 in the surrounding region. Although the review team considered the entire 50-mi CPNPP region
16 when assessing socioeconomic impacts, the primary Economic Impact Area (EIA) is the six-
17 county area in which over 96 percent of the current CPNPP work force resides. These six
18 counties are Somervell, Hood, Bosque, Erath, Johnson, and Tarrant Counties in Texas. Section
19 2.5 of this EIS provides additional details regarding the socioeconomic baseline in the vicinity of
20 the CPNPP site.

21 The review team reviewed the ER prepared by Luminant and verified the data sources used in
22 its preparation by examining cited references (Luminant 2009a). The review team requested
23 clarifications and additional information from Luminant where needed to verify data in the ER.
24 Unless otherwise specified in the following sections, the review team has drawn upon verified
25 data from Luminant's ER and responses to requests for additional information. Where the
26 review team used different analytical methods or additional information for its own analysis, the
27 following sections include explanatory discussions and citations for additional sources.

28 **5.4.1 Physical Impacts**

29 This section identifies and assesses the potential direct physical impacts of operations-related
30 activities on the community, including disturbances from noise, odors, exhausts, thermal
31 emissions, and visual intrusions. The review team believes that these direct physical impacts
32 would be avoided or minimized by operating CPNPP Units 3 and 4 in accordance with all
33 applicable Federal, State, and local regulations and therefore would not significantly affect the
34 surrounding region. The following subsections assess the potential operations-related physical
35 impacts of CPNPP Units 3 and 4 on specific segments of the population, the existing CPNPP
36 plant, and nearby communities.

37 **5.4.1.1 Workers and the Local Public**

38 There are no residential areas located within the CPNPP site boundary. The nearest residence
39 is located 0.8 mi southwest of the center point between CPNPP Units 3 and 4, to the east of
40 Farm-to-Market Road (FM) 56 and adjacent to the CPNPP site boundary. As discussed in
41 Section 2.5.1.1, the area near the CPNPP site is rural, with a relatively low population density.
42 The 2007 estimated population within 5.0 mi of the CPNPP site was only 3530 individuals, with
43 a population density of 45 people per square mile. There are no large industrial or commercial
44 facilities in the immediate vicinity of the CPNPP site.

1 **5.4.1.2 Buildings**

2 Operations activities would not affect any offsite buildings, primarily due to distance. The
3 nearest residence is 0.8 mi southwest of the CPNPP Units 3 and 4 center point. Because of
4 their distance from the CPNPP site, no offsite industrial or commercial facilities would be
5 affected by operations activities.

6 Many existing onsite buildings related to the safety of CPNPP Units 1 and 2 were constructed to
7 meet seismic qualification criteria, which makes them resistant to the effects of vibration and
8 shock. Other onsite facilities were constructed to the appropriate building codes and standards,
9 which included consideration of seismic loads. Regardless of the applicable design standard,
10 operations activities would be planned, reviewed, and conducted in a manner that would ensure
11 no adverse effect on CPNPP Units 1 and 2 and the other buildings on site.

12 The distance of the nearest offsite structures would minimize the interaction of the buildings with
13 operations activities, while the design of onsite buildings would ensure no adverse effects on
14 CPNPP Units 1 and 2. Thus, the impact of plant operations on buildings would be SMALL, and
15 no mitigation would be required.

16 **5.4.1.3 Roads**

17 Operations activities at CPNPP Units 3 and 4 would increase vehicular traffic on local roads and
18 highways because additional workers would drive to and from the CPNPP site each day and in-
19 migrating workers and their families would drive on local roads and highways for personal travel.
20 There would also be additional trucks related to the removal of solid/salt waste from the
21 proposed Blowdown Treatment Facility (BDTF), unless rail cars are used to remove the BDTF
22 solid/salt waste. Section 2.5.2.3 describes the local transportation network around the CPNPP
23 site, and Figure 2-21 illustrates the road and highway systems in Somervell and Hood Counties.

24 Given that the overall traffic increase that would occur during operations would be much smaller
25 than during the peak building period (Section 4.4.4.1), the review team concludes that operating
26 Units 3 and 4 would have only a SMALL physical impact on roads in the six-county study area
27 because potential impacts would be reduced by mitigation measures implemented during the
28 building phase. Section 5.4.4.1 discusses the impacts of the additional vehicular traffic on local
29 roads and highways in the context of existing traffic volumes, road capacities, and level of
30 service (LOS).

31 **5.4.1.4 Aesthetics**

32 Operations activities at CPNPP Units 3 and 4 would be visible primarily to workers on site and
33 to residents across SCR because visibility from other areas off site would be obstructed by the
34 hilly topography of the area. Federal regulations require that any temporary or permanent
35 structure, including all accompaniments, that exceeds an overall height of 200 ft above ground
36 level be appropriately marked with lighting.

37 The tallest structures associated with CPNPP Units 3 and 4 would be smaller than the existing
38 reactor domes for CPNPP Units 1 and 2, which are 266 ft tall. Thus, because CPNPP Units 1
39 and 2 have been in operation since the early 1990s, it is likely that the most severe impacts to
40 local viewsheds have already occurred. The Units 1 and 2 reactor domes are visible from
41 Dinosaur Valley State Park and Oakdale Park. Because visual effects are inversely related to
42 distance, the effects of the CPNPP reactor domes on most other parks in the region are
43 minimal. Most of the parks in the region are located more than 14 mi from the CPNPP site.
44 Although structures associated with Units 3 and 4 may be visible at that distance, they would
45 occupy less than 1 degree of vision. Further, visual impacts from the additional lighting required
46 for Units 3 and 4 would be minimized by using low sodium lighting, as has been done at Units 1

1 and 2. Thus, the visual impact of operating Units 3 and 4 at the CPNPP site would be SMALL
2 and would require no mitigation beyond the measures proposed by Luminant in its ER
3 (Luminant 2009a).

4 **5.4.1.5 Noise**

5 As discussed in more detail in Section 5.8.2, CPNPP Units 3 and 4 would produce noise from
6 the operation of pumps, transformers, turbines, generators, and switch yard equipment. While
7 there are no applicable local noise ordinances, noise levels below 60 to 65 decibels adjusted¹
8 (dBA) are considered to be of small significance (HUD 1996). Most equipment would be located
9 inside structures, reducing the outdoor noise level. Luminant would use a mechanical draft
10 (wet) cooling tower for each unit to remove excess heat; these cooling towers are expected to
11 be the primary source of noise during operation. Luminant expects noise levels of 55 decibels
12 adjusted 1000 ft from the towers, while the receptors of concern are more than 4400 ft away.
13 Luminant calculates that the noise levels from Units 3 and 4 would be less than those recorded
14 at the same locations in 2006 (Luminant 2009a), which includes the operational noise from
15 Units 1 and 2. The day-night noise levels from the CPNPP plant operations (specifically the
16 cooling towers) would be less than 65 decibels adjusted at the site boundary, which the review
17 team believes would have only a SMALL impact on the public.

18 The high-voltage transmission lines are not expected to be a source of noise, as line voltages
19 would be no higher than 345 kV (Luminant 2009a). The one uncertainty in noise levels would
20 be the noise from the pumps moving cooling water from Lake Granbury to the cooling towers.
21 Noise reflects off water and could increase the pump noise levels; however, Luminant has
22 identified mitigation measures to reduce the pumping noise (Luminant 2009a). With this
23 qualification, the maximum sound level generated by the operation of Units 3 and 4 at the site
24 boundary would not affect the usage of nearby recreational and residential areas and would not
25 require mitigation. Therefore, the review team determined that the noise related effect on
26 workers, residents, and recreational users of nearby areas would be SMALL and that no
27 mitigation would be required (Section 5.8.2).

28 **5.4.1.6 Air Quality**

29 Once CPNPP Units 3 and 4 have begun operation, the facility would produce air emissions due
30 to the periodic testing and operation of standby diesel generators and auxiliary power systems
31 and to commuter vehicle dust and exhaust (see Section 5.7). The generators and power
32 systems would be used on an infrequent basis and pollutants discharged (e.g., particulates,
33 sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides) would be permitted in
34 accordance with the facility's TCEQ air permit. Therefore, the review team expects that the
35 impact of these systems on air quality would be SMALL.

36 Emissions associated with commuter vehicles would also be generated as a result of the
37 proposed project. As discussed in Section 5.4.4.1, vehicular traffic on local roads would
38 increase during operation of Units 3 and 4, so air emissions would increase in proportion to the
39 increase in traffic. In addition, many measures taken by Luminant to mitigate traffic impacts
40 during project building, including staggering shift times and encouraging car-pooling, would
41 similarly reduce vehicle-related emissions during operations. Because the CPNPP area is in
42 attainment for all criteria air pollutants with respect to the National Ambient Air Quality
43 Standards and is subject to State Implementation Plan requirements, the increase in vehicle
44 traffic-related emissions would not change the air quality status of the local area. Therefore, the

¹ "Decibel adjusted" is a unit used to show the relationship between the interfering effect of a noise frequency, or band of noise frequencies, and a reference noise power level..

1 addition of Units 3 and 4 at the CPNPP site would have only a SMALL impact on air quality and
2 would not require mitigation. Air quality impacts of plant operation are discussed in more detail
3 in Section 5.7 of this document.

4 **5.4.1.7 Summary of Physical Impacts**

5 Overall, the physical impacts of operating CPNPP Units 3 and 4 on workers and the local public,
6 buildings, roads, aesthetics, noise, and air quality would be SMALL and would require no
7 mitigation beyond that proposed by Luminant (Luminant 2009a).

8 **5.4.2 Demography**

9 Section 2.5.1 provides population estimates and projections for the 50-mi CPNPP region and
10 the EIA. Section 2.5.2.1 provides data on the labor force, employment, and unemployment in
11 the EIA.

12 During 2018, the peak operating year at CPNPP Units 3 and 4, Luminant estimates that there
13 would be a total of 1494 operations workers on site, with 1000 workers at Units 1 and 2 and 494
14 workers at Units 3 and 4. Of the 494 workers at Units 3 and 4, 248 would be on site during
15 project building and the remaining 246 would arrive after project building. The number of
16 operations workers at Units 3 and 4 would decrease slightly after the initial start-up period, and
17 then remain relatively constant for the term of the license. The review team's analysis focuses
18 on the peak ("start-up") operations period because it serves as the upper bound to the expected
19 socioeconomic impacts of operations. The impacts of the 248 operations workers who would be
20 on site during project building are included in the discussion of impacts in Section 4.4.

21 Therefore, in most cases this section focuses on the additional 246 operations workers at
22 Units 3 and 4. For impacts that cannot be characterized by the peak period alone because they
23 would continue to accrue over time (e.g., economic impacts related to employment, income, and
24 taxes), this analysis uses the full operations workforce of 494 workers.

25 During the operations period there would be 800 to 1200 additional workers onsite for outages,
26 which would occur every 18 months for Units 1 and 2 and every 24 months for Units 3 and 4.
27 However, this analysis of population growth does not include these outage workers because
28 they are part of the existing baseline. This analysis also does not include any population growth
29 related to the creation of indirect jobs during the operations period because the review team
30 assumes that all the indirect jobs would be filled by existing residents of the EIA
31 (Section 5.4.3.1).

32 Luminant expects that 50 percent of the 246 operations workers (123 workers) would come from
33 inside the CPNPP region, and that the other half would in-migrate from outside the region
34 (Table 5-5). Because operations jobs such as those on CPNPP Units 3 and 4 provide
35 permanent employment, the review team expects that all of the in-migrating operations workers
36 with families would relocate their families to the CPNPP region. In 2000, the average household
37 size in Texas was 2.74 persons (USCB 2009a). However, the state average includes
38 households that do not typically have children (e.g., elderly people). Therefore, the review team
39 assumes an average household size of 3.0 as a more reasonable estimate of the family size
40 that would be associated with the operations workforce. Multiplying this household size (3.0) by
41 the 123 operations workers expected to in-migrate with a family after the building period results
42 in an additional 369 people in the CPNPP region (Table 5-5).

43 Based on the residential pattern of current CPNPP workers (Table 2-21), the review team
44 assumes that 23 percent of the total in-migrants (84 persons) would reside in Somervell County,
45 44 percent (162 persons) in Hood County, 11 percent (42 persons) in Johnson County, 9

Operational Impacts at the Proposed Site

- 1 percent (33 persons) in Tarrant County, 5 percent (18 persons) in Erath County, and 4 percent
 2 (15 persons) in Bosque County. Table 5-5 presents the calculations behind these assumptions.

Table 5-5. Potential Population Growth in the EIA due to Peak Operations Employment at CPNPP Units 3 and 4

	County							
	Total	Somervell	Hood	Bosque	Erath	Johnson	Tarrant	Other
Operations workers ^(a)	246							
In-migrants (50% of total)	123	28	54	5	6	14	11	5
With family (100%)	123	28	54	5	6	14	11	5
Ave. household size = 3.0								
Total including family	369	84	162	15	18	42	33	15
Without family (0%)	0							
Total operations in-migrants	369	84	162	15	18	42	33	5
Total in-migrants	369	84	162	15	18	42	33	15

(a) Does not include the 248 operations workers at CPNPP Units 3 and 4 during peak building, existing operations workers at CPNPP Units 1 and 2, or outage workers.

Source: The review team, based on Luminant 2009a

3 This influx of operations workers and their families after building would represent about 1.0
 4 percent and 0.3 percent increases in the projected 2020 populations (Table 2-18) of Somervell
 5 and Hood Counties, respectively. The percentage increases in the projected 2020 populations
 6 for the other study area counties would be much smaller, as follows: Johnson County (0.02
 7 percent); Tarrant County (0.002 percent); Erath County (0.04 percent); and Bosque County
 8 (0.07 percent). Thus, the in-migrating workers and their families would represent a SMALL
 9 population increase for each of the counties in the EIA.

10 The review team discusses the impacts of this population growth on transportation, recreation,
 11 housing, public services, and education in the EIA in Sections 5.4.4.1 through 5.4.4.5.
 12 However, most of the impacts of this relatively small population growth would be more than
 13 offset by the large population decrease that would occur when building is completed and most
 14 of the in-migrating construction workers and their families leave the EIA. Although it is likely that
 15 some of the in-migrating construction workers would find permanent jobs and choose to remain
 16 in the area, as many as 5201 residents (the total population increase due to construction
 17 workers during peak building) (Table 4-4) could leave the area. Such a population decrease
 18 would be over 14 times as large as the population increase associated with the operations
 19 workers that would arrive after building. Sections 5.4.4.1 through 5.4.4.5 also discuss the
 20 impacts of this population decrease on transportation, recreation, housing, public services, and
 21 education.

5.4.3 Economic Impacts to the Community

23 This section evaluates the economic and social impacts on the area within 50 mi of the CPNPP
 24 site as a result of operating CPNPP Units 3 and 4. The evaluation focuses on the impacts of
 25 operations that would occur because of the presence of the operations workforce.

1 5.4.3.1 Economy

2 The impacts of operations on the local and regional economy depend on the region's current
3 and projected population and economy. Section 2.5.1 provides population estimates and
4 projections for the 50-mi CPNPP region and the EIA. Section 2.5.2.1 describes the economic
5 characteristics of the EIA, including the labor force, employment by industry type,
6 unemployment, total personal income, and per capita income. This section discusses economic
7 impacts in the EIA from direct and indirect jobs and incomes and increased purchases of goods
8 and services. Section 5.4.3.2 discusses tax revenues separately.

9 The review team assumes that 50 percent of the 246 operations workers would in-migrate from
10 outside the region or the state. Thus, the project would provide 123 operations jobs for workers
11 who already reside in the EIA. These direct jobs would help reduce unemployment in the study
12 area, which had a total of 49,062 unemployed workers in 2008 (Table 2-21).

13 In addition, the 123 in-migrating operations workers would create new indirect jobs in the study
14 area through a process called the multiplier effect (Section 4.4.3.1). The U.S. Department of
15 Commerce Bureau of Economic Analysis provides regional multipliers ("RIMS II Multipliers") for
16 industry jobs and earnings. Luminant used RIMS II multipliers to estimate the number of
17 indirect jobs and expenditures of money that would result from operations at CPNPP Units 3
18 and 4. For the in-migrating operations workers, Luminant used the power generation and
19 supply multiplier from the RIMS II Multipliers, resulting in a multiplier value of 2.1. This means
20 that for every new operations worker in the project area, 1.1 indirect jobs would be created.
21 Thus, the 123 in-migrating operations workers would result in 135 indirect jobs (in addition to the
22 136 indirect jobs that would be created by the 124 in-migrating operations workers during the
23 building peak). Because most of these indirect jobs would be service-related and not highly
24 specialized, the review team assumes that all of the indirect jobs would be filled by existing
25 residents of the EIA. Therefore, these indirect jobs would help reduce unemployment in the
26 EIA.

27 The employment of a large operations work force at CPNPP Units 3 and 4 (494 workers total)
28 would have long-term positive effects on income in the EIA. Luminant has stated that
29 operations at Units 3 and 4 would require 150 reactor operators and 344 support personnel,
30 including security, administration, and technicians (Luminant 2009a). To estimate income
31 effects, the review team assumes that these 344 support personnel would include 250
32 technicians, 64 administrative personnel, and 30 security personnel. Table 5-6 shows the
33 average annual wages of all operations period workers based on national averages in 2007.
34 Based on these average annual wages, the Units 3 and 4 operations workforce could earn over
35 \$31 million annually.

36 The review team estimates that the average annual wage (based on 2000 hours) associated
37 with the indirect jobs created during operations would be about \$26,000 (CPPP 2007). Based
38 on 135 indirect jobs created, total annual indirect income would be about \$3.5 million.

39 Annual direct and indirect earnings of over \$35 million would have a positive effect on the total
40 and per capita income of the EIA (Table 2-22). Based on information found in *Update of the*
41 *MIT 2003 Future of Nuclear Power* (MIT 2009), the review team estimates that the combined
42 annual expenditures for operating and maintaining CPNPP Units 3 and 4 would be about \$175
43 million (excluding fuel costs). Operation of CPNPP Units 3 and 4 would have a beneficial effect
44 on the economy of the EIA and, to a lesser extent, the entire 50-mi CPNPP region, by creating
45 direct jobs, incomes, and expenditures that would generate indirect jobs, incomes, and
46 expenditures. However, this beneficial effect would be offset by the loss of jobs, incomes, and
47 expenditures (as well as indirect jobs and expenditures) that would occur when project building
48 is completed. With the exception of the 494 direct jobs and the 271 indirect jobs created by

1 operations, unemployment in the EIA could return to near current levels. Although this
 2 economic downturn would have adverse short-term consequences for the local economy, the
 3 economic benefits of the two new units at CPNPP would last for at least 40 years. Therefore,
 4 the overall long-term economic benefits of operating CPNPP Units 3 and 4 are likely to be
 5 MODERATE to LARGE in Somervell and Hood Counties but SMALL in the rest of the EIA and
 6 the 50-mi CPNPP region.

Table 5-6. Average Annual Salary for Operations Workforce at CPNPP Units 3 and 4

Specialty	Number of workers ¹	Average annual salary (2007 \$)	Total annual salary (million 2007 \$)
Mechanical technician	50	66,581	3.3
Electrical technician	50	67,517	3.4
Instrumentation and control technician	50	72,238	3.6
Chemistry technician	50	70,990	3.5
Radiation protection technician	50	69,056	3.4
Non-licensed operator	50	70,793	3.5
Reactor operator	50	77,782	3.9
Senior reactor operator	50	85,426	4.3
Administrative	64	28,000	1.8
Security	30	35,000	1.1
Total	494		31.8

Sources: The review team, based on Luminant 2009a and CTEC 2005

7 **5.4.3.2 Taxes**

8 Section 2.5.2.2 discusses current tax revenues within the EIA. Operations activities and
 9 purchases at CPNPP Units 3 and 4 and personal expenditures made by operations workers
 10 would generate several types of taxes, including income taxes on corporate profits, wages, and
 11 salaries; sales and use taxes on corporate and employee purchases; real property ad valorem
 12 taxes related to the CPNPP facilities; and personal property taxes.

13 While the State of Texas has no personal income tax, the wages paid to the operations workers
 14 would generate Federal income tax revenue. As discussed in Section 5.4.3.1, the Units 3 and 4
 15 operations work force and associated indirect workers could earn a total of over \$35 million
 16 annually during operations. The workers' wages would also generate state and local revenues
 17 through sales and use taxes because it is likely that a large amount of the workers' discretionary
 18 income would be spent in the EIA.

19 As discussed in Section 2.5.2.2, the sales and use tax rate in most of the study area is
 20 8.25 percent including local and state taxes. The review team's experience indicates that about
 21 10 percent of annual operations expenditures are spent locally. Annual expenditures are
 22 estimated in Section 5.4.3.1 at \$175 million (MIT 2009). Therefore, the review team expects
 23 that about \$17.5 million in operations expenditures (not including workers' personal
 24 expenditures) would occur in the study area.

25 Luminant currently pays ad valorem taxes on CPNPP Units 1 and 2 to Somervell and Hood
 26 Counties and to several taxing jurisdictions within those counties (Section 2.5.2.2), and the

1 review team assumes that Luminant would pay ad valorem taxes on Units 3 and 4. Although
 2 the tax rates for Units 3 and 4 have not been finalized, Section 4.4.3.2 provides an estimate of
 3 the potential tax revenues for affected jurisdictions assuming that Luminant pays the same ad
 4 valorem taxes on Units 3 and 4 as on Units 1 and 2. As with Units 1 and 2, the review team
 5 expects that most of the ad valorem tax revenue from Units 3 and 4 would go to Glen Rose
 6 Independent School District (ISD) and Somervell County. Table 5-7 shows that Glen Rose ISD
 7 could receive over \$17.4 million annually and that Somervell County could receive over \$5.1
 8 million annually.

Table 5-7. Potential Total Annual ad Valorem Taxes Paid on
 CPNPP Units 3 and 4 During Operations

Somervell County	5,124,604
Glen Rose	35
Somervell County Water District	1,882,099
Glen Rose ISD ^(a)	17,355,171
Hood County	5595
Tolar	37
Granbury ISD ^(a)	18,734
Tolar ISD ^(a)	15,073
Hood County Library District	255

(a) ISD = Independent School District

Source: The review team, based on Luminant 2009a

9 During the operations period, local tax revenues, especially from ad valorem taxes and sales
 10 and use taxes, would remain high in the study area. The relatively large tax revenues would be
 11 of particular benefit to the local jurisdictions in Somervell and Hood Counties. However, some
 12 of this beneficial effect would be offset by the loss of sales and use and property tax revenues
 13 that would occur when building is completed and most of the in-migrating construction workers
 14 and their families leave the EIA. Although this decrease in tax revenues would have short-term
 15 adverse consequences for local governments, the long-term tax revenue benefits of operating
 16 CPNPP Units 3 and 4 are likely to remain LARGE in Somervell County and, to a lesser extent,
 17 Hood County. Tax revenue benefits would be SMALL elsewhere in the EIA and the 50-mi
 18 CPNPP region.

19 **5.4.3.3 Summary of Economic Impacts to the Community**

20 In terms of employment and income, the long-term economic benefits of operating CPNPP Units
 21 3 and 4 are likely to be MODERATE to LARGE in Somervell and Hood Counties, but SMALL in
 22 the rest of the EIA and the 50-mi CPNPP region. With regard to tax revenues, the long-term
 23 economic benefits of operating CPNPP Units 3 and 4 are likely to be LARGE in Somervell
 24 County and, to a lesser extent, Hood County, but SMALL elsewhere in the EIA and the 50-mi
 25 CPNPP region.

26 **5.4.4 Infrastructure and Community Services**

27 The local infrastructure and community services that would be affected by operation of CPNPP
 28 Units 3 and 4 include transportation, recreation, housing, public services (including water and
 29 wastewater, solid waste, police, fire, and medical services, and social services), and education.

1 **5.4.4.1 Transportation**

2 Operation of CPNPP Units 3 and 4 would increase vehicular traffic on local roads and highways
3 compared to current conditions because additional workers would drive to and from the CPNPP
4 site each day and in-migrating workers and their families would drive on local roads and
5 highways for personal travel. There would also be additional traffic from trucks removing
6 solid/salt waste from the proposed blow down treatment facility (BDTF), unless rail cars are
7 used to remove the BDTF solid/salt waste. As discussed in Section 3.3.4, Luminant estimates
8 that removing solid/salt waste from the BDTF could generate up to 65 truck trips per day.

9 Overall, however, the total increase in traffic during operations would be much smaller than the
10 increase experienced during the building of CPNPP Units 3 and 4. Section 4.4.4.1 describes
11 the expected traffic increases associated with project building, focusing primarily on FM 56.
12 These building-period impacts become the new baseline for the operations-period impacts
13 discussed in this section, which focuses on the 246 operations workers who would arrive after
14 project building and the additional 65 trucks per day related to the BDTF. To estimate the
15 potential impacts of this additional traffic (311 vehicles per day), the review team considered the
16 following factors:

- 17 • The traffic associated with the 246 operations workers and the 65 BDTF-related trucks (a
18 total of 311 vehicles) represents less than 15 percent of the peak traffic volume associated
19 with the Units 3 and 4 construction workers;
- 20 • Units 3 and 4 operations workers would be divided among various shifts, so no more than
21 about one-third of the workers (82 workers) would enter or exit the site at any one time.
22 Assuming no carpooling, these 82 vehicle trips would represent less than 9 percent of the
23 peak project building volume assessed in Section 4.4.4.1.
- 24 • Operations-related traffic impacts could be further reduced by road improvements
25 implemented by Luminant or the Texas Department of Transportation to facilitate peak
26 building traffic.

27 Therefore, the review team concludes that the traffic-related impacts of the 246 operations
28 workers who would arrive after project building and the additional 65 trucks per day related to
29 the BDTF would be minimal compared to the traffic-related impacts of the construction workers.
30 Given that building-period traffic impacts would be SMALL to MODERATE, operations-period
31 traffic impacts would be SMALL.

32 If rail cars are used to remove solid/salt waste from the BDTF, Luminant estimates that about 13
33 rail cars per day would be needed (Section 3.3.4). As discussed in Section 2.5.2.3, the CPNPP
34 rail spur connects to the Ft. Worth Western Railroad Company line that runs through Tolar
35 approximately 10 mi northwest of the CPNPP site. Currently, an average of two trains use this
36 railway each day, with four to five cars of hazardous materials from various sources transported
37 each month. Given this existing use of the rail line, the review team concludes that the increase
38 in rail traffic associated with the BDTF (about 13 rail cars per day) would not have significant
39 adverse impacts on the local rail system.

40 **5.4.4.2 Recreation**

41 Section 5.4.2 discusses the population growth that could occur in the EIA as a result of
42 operations at CPNPP Units 3 and 4. The review team expects that the population growth
43 associated with the in-migrating operations workers arriving after project building (i.e., 369 new
44 residents) would slightly increase the use of existing recreational facilities and the demand for
45 additional facilities. However, this additional demand would be offset by the large out-migration

1 of construction workers and their families after project building. Also, it is likely that the potential
2 effects of any increased use and demand, such as the cost to repair or replace existing
3 recreational facilities or provide new ones, could be offset by increased funding related to user
4 fees and local tax revenues. Thus, the impacts of operations-related population growth are
5 expected to be SMALL and would require no mitigation.

6 Luminant's proposal to reopen Squaw Creek Reservoir (SCR) to members of the public via
7 controlled access would likely have a positive effect on recreation by providing local residents
8 with additional opportunities for boating, fishing, and shoreline activities. Luminant plans to
9 allow a maximum of 100 boats on SCR at any given time, but more than 100 boats may be
10 allowed for special events (Luminant 2010d).

11 Operating CPNPP Units 3 and 4 could affect the recreational use of Lake Granbury and
12 Possum Kingdom Lake by decreasing water level elevations, especially during the summer
13 months. As discussed in Section 5.2.1, water use for CPNPP Units 3 and 4 could result in an
14 average decrease in the water level elevation of Lake Granbury of 0.6 ft, with a maximum
15 decrease of 2.9 ft (Luminant 2009f). During the drought in 2009, Lake Granbury's water level
16 dropped by 3.5 ft to an elevation of 688.83 MSL in September (BRA 2009b), the lake's lowest
17 elevation since 1984 (Luminant 2010b). With this 3.5-ft decrease in 2009, three of the six
18 public boat ramps (Luminant 2010b) and many of the private boat ramps and fixed boat docks
19 (BRA 2009b) on Lake Granbury were out of the water and could not be used. The review team
20 concludes that a 0.6-ft water level decrease in Lake Granbury during non-drought conditions
21 would have only a SMALL impact on recreational use of the lake. However, the review team
22 concludes that a 2.9-ft water level decrease during drought conditions would have a
23 MODERATE impact on recreational use of the lake, especially on the ability to use boat ramps
24 and fixed boat docks. This impact would be especially noticeable given that most of the 3,137
25 residential boat docks on Lake Granbury are fixed docks (Luminant 2010b) that cannot adjust to
26 changes in the water level.

27 As discussed in Section 5.2.1, water use for CPNPP Units 3 and 4 could result in an average
28 decrease in the water level elevation of Possum Kingdom Lake of 1.5 ft, with a maximum
29 decrease of 14.8 ft (Luminant 2009f). During the drought in 2009, Possum Kingdom's water
30 level elevation decreased to 994.8 ft MSL in September, which is 5.2 ft below the lake's full pool
31 elevation of 1000 ft (U.S. Lakes Online 2010). Given the extent of the water level decrease in
32 2009, the review team concludes that a 1.5-ft decrease in Possum Kingdom during non-drought
33 conditions would have only a SMALL impact on recreational use of the lake. However, because
34 operating CPNPP Units 3 and 4 could reduce Possum Kingdom's water level by as much as
35 14.8 ft, the review team concludes that operations during drought conditions would have a
36 MODERATE impact on recreational use of the lake, especially on the ability to use boat ramps
37 and boat docks. This impact to recreation on Possum Kingdom might be somewhat less
38 noticeable than on Lake Granbury, however, because most of the 1,995 residential boat docks
39 on Possum Kingdom are floating docks (rather than fixed docks) that can adjust somewhat to
40 changes in the water level (Luminant 2010b).

41 **5.4.4.3 Housing**

42 Operation of CPNPP Units 3 and 4 would increase the demand for both short-term and long-
43 term housing in the EIA due to the in-migration of operations workers and their families. Section
44 2.5.2.5 provides data on existing housing in the study area, including the total number of units,
45 the total number and types of occupied units, the total number of vacant units, and vacancy
46 rates. As discussed in Section 2.5.2.5, most of the current CPNPP employees (over 66
47 percent) live in Hood and Somervell Counties, and over 96 percent live in the EIA. This analysis

1 assumes that the operations workers for Units 3 and 4 would follow this same residential
 2 pattern.

3 The in-migration of operations workers and their families after the building period would result in
 4 a population increase of 369 people in the CPNPP region (Section 5.4.2). This analysis
 5 assumes that each of the 123 operations workers in-migrating would represent one household.
 6 Given this assumption, the operations period at CPNPP Units 3 and 4 would create 123 new
 7 households in the EIA. Thus, the total demand for short-term and long-term housing units for
 8 the in-migrating operations workers would be 123 units. Table 5-8 shows the distribution of
 9 these households in the EIA. The data in Table 5-8 indicate that each of the six counties has an
 10 adequate number of existing vacant housing units to accommodate projected worker demand.

Table 5-8. Vacant Housing Units^(a) and Projected Housing Demand from In-migrating CPNPP Operations Workers in the EIA

County	Vacant units	Projected demand	Surplus (or shortage)
Somervell	312	28	284
Hood	2880	54	2826
Bosque	1918	5	1913
Erath	2473	6	2467
Johnson	4708	14	4694
Tarrant	65,514	11	65,503

(a) Data are for 2007 except for 2000 data used for Somervell and Bosque Counties.

Sources: The review team, based on USCB 2007; USCB 2009b; Luminant 2009a

11 With the number housing units available in the EIA, the review team expects that the in-
 12 migrating operations workers would be able to find sufficient housing within a relatively short
 13 commuting distance. This is especially true given the large population decrease that would
 14 occur when project building is completed and the construction workers and their families leave
 15 the EIA. Although it is likely that some of the in-migrating construction workers would find
 16 permanent jobs and choose to remain in the area, as many as 5201 residents (Table 4-4) could
 17 leave the area. Although this decrease in housing demand could have short-term adverse
 18 consequences for the local economy, the overall impact on long-term housing availability and
 19 price is likely to be SMALL.

20 **5.4.4.4 Public Services**

21 Operation of CPNPP Units 3 and 4 would increase the demand for a variety of public services in
 22 the EIA due to the in-migration of operations workers and their families. Section 2.5.2.6
 23 provides data on existing public services in the study area, including water and wastewater,
 24 solid waste, police, fire, and medical services, and social services (educational services are
 25 discussed separately in Sections 2.5.2.7 and 5.4.4.5). This analysis of public service impacts
 26 assumes that over 66 percent of the onsite workers during CPNPP operations would live in
 27 Hood and Somervell Counties, and that over 96 percent would live in the EIA (Section 2.5.2).

1 As discussed in Section 5.4.2, the in-migration of 123 operations workers and their families after
 2 the project building period would result in a population increase of 369 people in 123
 3 households in the CPNPP region. Table 5-8 shows the distribution of these households in the
 4 EIA. The following sub-sections discuss the impacts of this population growth on existing and
 5 planned public services.

6 ***Water and Wastewater***

7 Operation of CPNPP Units 3 and 4 would increase the demand for water and wastewater
 8 services in the EIA due to the projected in-migration of 369 new residents (Sections 3.3.1 and
 9 5.2 discuss the increased demand for water and wastewater due to onsite operations activities).
 10 In 2006, municipal water use [defined as “city-owned, districts, water supply corporations, or
 11 private utilities supplying residential, commercial (non-goods-producing businesses), and
 12 institutional (schools, governmental operations)”] in the EIA averaged 148 gallons per person
 13 per day (TWDB 2009c).

14 Based on the population growth patterns discussed in Section 5.4.2 and a projected demand of
 15 148 gallons of water per person per day, the review team estimates that 12,432 additional
 16 gallons per day (gpd) would be used each year in Somervell County and that 23,976 additional
 17 gpd would be used each year in Hood County. Annual increases in the other counties would be
 18 6216 additional gpd in Johnson County, 4884 additional gpd in Tarrant County, 2664 additional
 19 gpd in Erath County, and 2220 additional gpd in Bosque County.

20 The data in Table 4-9 indicate that all of the counties in the EIA have adequate water treatment
 21 capacity to accommodate the additional demand that would result from population growth during
 22 the operations period. Moreover, Somervell, Hood, and Johnson Counties are planning
 23 expansions of their existing water supply and treatment systems (Section 2.5.2.6), so the
 24 available capacity in those counties should be even larger in 2016.

25 Given the excess capacities of the existing and planned water treatment facilities in the EIA, the
 26 increased demand for water associated with operations-related population growth would have
 27 only a SMALL impact.

28 Conventional wastewater planning assumes that all of the water consumed by residents is
 29 disposed of through wastewater treatment facilities. The data in Table 4-9 indicate that all of the
 30 counties in the EIA have adequate wastewater treatment capacity to accommodate the
 31 additional demand during the operations period. Moreover, Hood and Johnson Counties are
 32 planning expansions of their existing wastewater treatment systems (Section 2.5.2.6), so the
 33 available capacity in those counties should be even larger in 2016.

34 Given the excess capacities of the existing and planned wastewater treatment facilities in the
 35 EIA, the increased demand for wastewater treatment associated with operations-related
 36 population growth would have only a SMALL impact.

37 ***Solid Waste***

38 Operation of CPNPP Units 3 and 4 would increase the generation of solid waste in the EIA due
 39 to the projected in-migration of 369 new residents after the building period (Section 3.3.1
 40 discusses the increased generation of solid waste due to onsite operations activities). In 2007,
 41 per capita solid waste generation in the United States was over 4.6 lb per day (or 1679 lb/yr)
 42 (EPA 2008a).

43 Based on the population growth patterns discussed in Section 5.4.2 and a per capita generation
 44 rate of 1,679 lb of solid waste per year, the review team estimates that 71 additional tons of
 45 solid waste per year would be generated in Somervell County, 136 tons in Hood County, 35

1 tons in Johnson County, 28 tons in Tarrant County, 15 tons in Erath County, and 13 tons in
2 Bosque County.

3 As discussed in Section 2.5.2.6, there are no active landfills in Somervell or Hood Counties. In
4 2005, the IESI, Inc. Somervell County Transfer Station handled 14,284 tons of waste, and the
5 IESI, Inc. Granbury Transfer Station handled 16,153 tons. Thus, the additional solid waste
6 generated annually by the in-migrating residents of Somervell and Hood Counties during the
7 operations period would represent a 0.5 percent increase for the IESI, Inc. Somervell County
8 Transfer Station and a 0.8 percent increase for the IESI, Inc. Granbury Transfer Station.

9 The total amount of additional solid waste from these two stations (207 tons) would be
10 transported to the IESI, Inc. Weatherford Landfill in Parker County. The Weatherford Landfill
11 has an estimated 1.1 million tons of space remaining, so the total amount of solid waste
12 generated annually by the new residents of Somervell and Hood Counties would represent only
13 0.02 percent of that excess capacity. Even considering the additional solid waste that would be
14 generated annually in Bosque, Erath, Johnson, and Tarrant Counties, the review team expects
15 that the overall impact on solid waste management and landfill capacity in the study area would
16 be SMALL. This is especially true given the large population decrease that would occur when
17 project building is completed in 2016 and most of the in-migrating construction workers and their
18 families leave the EIA.

19 ***Police, Fire, and Medical Services***

20 Operation of CPNPP Units 3 and 4 would increase the need for police, fire, and medical
21 services in the EIA due to the projected in-migration of 369 new residents after the building
22 period (Section 3.3.1 discusses CPNPP onsite security, fire, and medical services during project
23 operations).

24 The projected population of Somervell County in 2020 is 8,659 (TSDC 2009a). Assuming the
25 county's current number of full-time police officers (19), the county would have 2.2 police
26 officers per 1000 residents without the CPNPP in-migrating workers. With the operations
27 workers that would in-migrate after project building, the number of police officers per 1000
28 residents in Somervell County would remain at 2.2.

29 The projected population of Hood County in 2020 is 56,847 (TSDC 2009a). Assuming the
30 county's current number of full-time police officers (67), the county would have 1.2 police
31 officers per 1,000 residents without the CPNPP in-migrating workers. With the operations
32 workers that would in-migrate after project building, the number of police officers per 1000
33 residents in Hood County would remain at 1.2.

34 Because the number of police officers per 1000 residents in Somervell and Hood Counties
35 would not change due to the in-migration of operations workers and their families, the review
36 team expects that the operations-related impact on police services would be SMALL. Given the
37 existing police resources that are available in Bosque, Erath, Johnson, and Tarrant Counties,
38 and the relatively small proportion of the CPNPP in-migrating workers that would settle in those
39 counties, the increased demand for police services would also have only a SMALL impact.

40 Assuming Somervell County's projected population in 2020 and current number of firefighters
41 (40), the county would have 4.6 firefighters per 1000 residents without the CPNPP in-migrating
42 workers. With the operations workers that would in-migrate after project building, the number of
43 firefighters per 1000 residents in Somervell County would remain at 4.6.

44 Assuming Hood County's projected population in 2020 and current number of firefighters (250),
45 the county would have 4.4 firefighters per 1,000 residents without the CPNPP in-migrating

1 workers. With the operations workers that would in-migrate after project building, the number of
2 firefighters per 1000 residents in Hood County would remain at 4.4.

3 Given the existing fire department resources that are available in Somervell and Hood Counties,
4 and the relatively small proportion of the CPNPP in-migrating workers that would settle in
5 Bosque, Erath, Johnson, and Tarrant Counties, the review team expects that the increased
6 demand for fire protection would have only a SMALL impact.

7 Currently, the combined daily load at Glen Rose Medical Center and Lake Granbury Medical
8 Center is 23 beds. When planned expansions are complete, the two medical centers would
9 have a combined capacity of 142 beds, well above the current demand. The population growth
10 associated with onsite workers during operations would increase the populations of Somervell
11 and Hood Counties by only 1.0 percent and 0.3 percent, respectively (Section 5.4.2).
12 Therefore, the review team expects that the existing and planned medical facilities would be
13 more than adequate to accommodate the demands of this in-migrating population. Thus, the
14 impacts of CPNPP operations on local medical services would be SMALL and require no
15 mitigation.

16 **Social Services**

17 Social services in the EIA are provided by the Texas Department of Family and Protective
18 Services and local nongovernmental organizations (NGOs) and religious groups. To the extent
19 that Luminant and its contractors would hire individuals who would otherwise rely on these
20 social services, operation of CPNPP Units 3 and 4 would help reduce demands on the service
21 providers. Therefore, the review team concludes that the overall impact of CPNPP operations
22 on social services would be SMALL and would not warrant mitigation.

23 **5.4.4.5 Education**

24 Section 2.5.2.7 contains information about current enrollments and capacities of the school
25 districts most likely to be affected by CPNPP worker in-migration in Somervell and Hood
26 Counties. As discussed in Sections 2.5 and 4.4, the review team assumes that 123 operations
27 workers would in-migrate with families after the building period (Section 5.4.2) and that the
28 average operations worker household size would be 3.0. Further, the review team assumes
29 that the CPNPP worker households would average one child (aged between 0 and 18 yr), for a
30 total of 123 new children in the EIA. Of these 123 new children, the review team estimates that
31 73.5 percent (90 children) would be school-aged (i.e., 5 to 18 yr old) based on an even
32 distribution of children aged 0 to 18 yr. Thus, this analysis assumes that the operations workers
33 that in-migrate after project building would bring 90 new K-12 students to the EIA.

34 Based on the residential pattern of current CPNPP workers (Table 2-21), the review team
35 estimates that 21 new K-12 students would reside in Somervell County, 40 students in Hood
36 County, ten students in Johnson County, eight students in Tarrant County, five students in Erath
37 County, and three students in Bosque County. The remaining three students would reside in
38 Hamilton and Parker Counties.

39 In Somervell County, Glen Rose ISD has a maximum capacity of 2862 students with enrollment
40 for the 2007-2008 school year at 1657 students. Thus, the addition of 21 new students after
41 CPNPP building would not put Glen Rose ISD at capacity. Officials with Glen Rose ISD have
42 indicated that the school system is capable of handling the influx of students generated by the
43 anticipated construction and operations workers (Luminant 2009a).

44 In Hood County, Granbury ISD has a maximum capacity of 8556 students and a September
45 2007 enrollment of 6882 students. Thus, the addition of 40 new students after CPNPP building
46 would not put Granbury ISD at capacity.

1 Given the existing enrollments and capacities of the school districts in the EIA, and the relatively
2 small proportion of the CPNPP in-migrating workers that would settle in Bosque, Erath,
3 Johnson, and Tarrant Counties, the review team expects that any potential adverse impacts to
4 the school districts would be SMALL.

5 **5.4.4.6 Summary of Impacts to Public Services**

6 Overall, the population growth associated with the in-migrating operations workers at CPNPP
7 Units 3 and 4 would have only a SMALL impact on public services in the EIA, including water
8 and wastewater, solid waste, police, fire, and medical services, social services, and education.

9 **5.4.5 Potential Mitigation Measures for Operation-Related Socioeconomic** 10 **Impacts**

11 All of the adverse socioeconomic impacts of operating CPNPP Units 3 and 4 would be SMALL
12 and would not require additional mitigation, with one exception. For recreation, the review team
13 concludes that the maximum water level decreases in Lake Granbury (2.9 ft) and Possum
14 Kingdom Lake (14.8 ft) associated with operating CPNPP Units 3 and 4 would have a
15 MODERATE impact on recreational use of the lakes during drought periods (Section 5.4.4.2).
16 Potential mitigation measures related to reservoir water use for plant operations are discussed
17 in Section 5.2.5.

18 **5.4.6 Summary of Socioeconomic Impacts**

19 Overall, operation of CPNPP Units 3 and 4 would have both adverse and beneficial impacts on
20 socioeconomic resources in the EIA. Population growth resulting from the in-migration of
21 CPNPP operations workers after the building period would create additional traffic, demand for
22 recreation, housing, public services, and education. However, the impacts of this increased
23 demand would be SMALL given existing and planned resources and facilities. The only
24 MODERATE adverse impacts of operating Units 3 and 4 would occur in recreation, where
25 maximum water level decreases in Lake Granbury and Possum Kingdom Lake could have a
26 MODERATE impact on recreational use of the lakes during drought periods.

27 **5.5 Environmental Justice Impacts**

28 Environmental justice refers to a Federal policy under which each Federal agency identifies and
29 addresses disproportionately high and adverse human health or environmental effects of its
30 programs, policies, and activities on minority or low-income populations. On August 24, 2004,
31 the Commission issued its policy statement on the treatment of environmental justice matters in
32 licensing actions (69 FR 52040). Section 2.6 discusses the locations of minority and low-
33 income populations around the CPNPP site and within the 50-mi radius.

34 The scope of the review as defined in NRC guidance should include an analysis of the impacts
35 on minority and low-income populations, the location and significance of any environmental
36 impacts during operations on populations that are particularly sensitive, and any additional
37 information pertaining to mitigation. The descriptions to be provided should state whether the
38 impacts are likely to be disproportionately high and adverse. The review should also evaluate
39 the significance of such impacts.

40 The review team evaluated whether the health and welfare of minority or low-income
41 populations at those Census blocks identified in Section 2.6 and along downstream pathways
42 from the CPNPP site could be disproportionately affected by the potential impacts of operating

1 two new reactors. To perform this assessment, the review team used the same process
2 employed in Section 4.5.

3 **5.5.1 Health and Environmental Impacts**

4 The review team evaluated whether the health or welfare of minority and low-income
5 populations in those Census blocks identified in Section 2.6 of this EIS could be
6 disproportionately affected by operating the proposed Units 3 and 4 at the CPNPP site. To
7 perform this assessment, the review team followed the methodology described in Section 2.6.1.
8 In the context of operations at the CPNPP site, the review team considered the questions
9 outlined in Section 2.6.1.

10 As discussed in Section 2.6.3, the review team did not find any evidence of unique
11 characteristics or practices in the region that could lead to a disproportionate impact on any
12 minority or low-income population.

13 For all three health-related considerations described in Section 2.6.1, the review team
14 determined through consultations with NRC staff health physics experts that the expected
15 operations-related level of environmental emissions is well below the protection levels
16 established by NRC and EPA regulations and cannot impose a disproportionately high and
17 adverse radiological health effect on any identified minority or low-income populations. The
18 results of the normal operations dose assessments (Section 5.9) indicate that the maximum
19 individual dose from all identified exposure pathways would be insignificant—well below the
20 regulatory guidelines in Appendix I of 10 CFR Part 50 and the regulatory standards of
21 10 CFR Part 20.

22 NRC staff's evaluation of postulated accidents (Section 5.10) demonstrates that the radiological
23 consequences of these accidents would meet the site acceptance criteria of 10 CFR 50.34 and
24 10 CFR Part 100 for the exclusion boundary area and the low population zone boundary. In
25 demonstrating compliance with these criteria, NRC staff determined that the US-APWR design
26 offers an adequate level of protection from design basis accidents. In addition, the review team
27 found no long-term health conditions in local minority or low-income populations that would
28 make them exceptionally vulnerable to radiological doses. There would be no significant
29 adverse health impacts on the most exposed members of the public, and there would be no
30 disproportionate and adverse health impacts on minority or low-income members of the public.

31 In terms of the health and environmental effects of operating a nuclear power plant, there are
32 three primary exposure media: soil, water, and air. The following subsections discuss the
33 potential impacts of project operations through each of these pathways.

34 **5.5.1.1 Soil Pathway**

35 As discussed in Section 5.8, the review team believes that there would be no operations-related
36 environmental effects to soils at the CPNPP site that would extend beyond the site boundary.
37 Therefore, the review team concludes that there would be no disproportionate and adverse soil-
38 related impact on any minority or low-income populations.

39 **5.5.1.2 Water Pathway**

40 As discussed in Sections 5.2.2 and 5.2.3, the review team concludes that the water use and
41 water quality impacts of operating CPNPP Units 3 and 4 would be MODERATE and SMALL to
42 MODERATE respectively. However, there are no identified unique characteristics among the
43 minority or low-income populations in the CPNPP area that would make these groups
44 significantly more vulnerable than the rest of the population to the water use or water quality

1 impacts identified (Section 2.6.3). Therefore, the review team concludes that water use and
2 water quality impacts from operating Units 3 and 4 would not have disproportionately high and
3 adverse human health or environmental effects on minority or low-income populations.

4 **5.5.1.3 Air Pathway**

5 The review team determined that the total liquid and gaseous effluent doses from all four units
6 (existing Units 1 and 2 plus proposed Units 3 and 4) would be well within the regulatory limits of
7 40 CRF 190. As described in Section 5.7, the review team determined that Luminant's findings
8 were reasonable and that the potential impacts from all air medium sources would be small.
9 Furthermore, there are no identified unique characteristics among the minority or low-income
10 populations in the CPNPP area that would make these groups significantly more vulnerable
11 than the rest of the population to air quality impacts (Section 2.6.3). Therefore, the review team
12 concludes that the impacts from operating Units 3 and 4 on air quality would not have
13 disproportionately high and adverse human health or environmental effects on minority or low-
14 income populations.

15 **5.5.1.4 Noise**

16 As discussed in Section 5.4.1.5, the review team concluded that noise impacts on workers,
17 residents, and recreational users of nearby areas of operating CPNPP Units 3 and 4 would be
18 SMALL. There are no identified unique characteristics among the minority or low-income
19 populations in the CPNPP area that would make these groups significantly more vulnerable
20 than the rest of the population to the noise impacts identified (Section 2.6.3). Therefore, the
21 review team concludes that noise impacts from operating Units 3 and 4 would not have
22 disproportionately high and adverse human health or environmental effects on minority or low-
23 income populations.

24 **5.5.2 Socioeconomic Impacts**

25 The review team assessed the socioeconomic impacts of operating CPNPP Units 3 and 4
26 (Section 5.4) to determine if there would be any human health or environmental effects on
27 minority or low-income populations. The adverse socioeconomic impacts from operation of the
28 proposed CPNPP Units 3 and 4 will be similar in nature to the building-related impacts, except
29 on a smaller scale. Based on the evaluations in Section 4.5, the review team believes there
30 would be no disproportionate and adverse impact from operations because all impacts from
31 operation would be smaller than the impacts of construction and pre-construction activities due
32 to the smaller size of the workforce. Because the review team did not find any potential
33 building-related environmental justice issues, the review team determined that there would be
34 no disproportionately high and adverse effects from operations.

35 **5.5.3 Subsistence and Special Conditions**

36 As discussed in Section 2.6.3, the review team's scoping and outreach did not identify any
37 unique socioeconomic characteristics or potential pathways for disproportionate health and
38 environmental impacts. Regarding subsistence populations, the review team did not identify
39 any unique characteristics that could result in disproportionate impacts to minority or low-income
40 populations. Specifically, based on U.S. Census data, the review team identified no low-income
41 populations within the immediate vicinity of the CPNPP site, where potential CPNPP-related
42 impacts would be expected to be most significant. Moreover, the low-income populations
43 identified in the larger 50-mi CPNPP region are located principally within urban areas near the
44 City of Fort Worth where subsistence type dependence on natural resources (e.g., fish, game,
45 agricultural products, and natural water sources) is less likely.

1 **5.5.4 Summary of Environmental Justice Impacts**

2 The review team concludes that operating CPNPP Units 3 and 4 would not have any
3 disproportionately high and adverse human health or environmental effects on minority or low-
4 income populations through the pathways of soil, water, and air. Similarly, the impacts of
5 operations on socioeconomic resources would not have any disproportionately high and
6 adverse effects on minority or low-income populations. Therefore, the review team concludes
7 that the environmental justice impacts of operating CPNPP Units 3 and 4 would be SMALL.

8 **5.6 Historic and Cultural Resource Impacts from Operation**

9 The National Environmental Policy Act of 1969, as amended, (NEPA) requires Federal agencies
10 to take into account the potential effects of their undertakings on the cultural environment, which
11 includes archaeological sites, historic buildings, and traditional places important to local
12 populations. The National Historic Preservation Act of 1966, as amended, (NHPA), also
13 requires Federal agencies to consider impacts to those resources if they are eligible for listing
14 on the National Register of Historic Places (NRHP) (such resources are referred to as “historic
15 properties” in the NHPA) (National Park Service 2009). As outlined in 36 CFR 800.8,
16 “Coordination with the National Environmental Policy Act of 1969,” the NRC coordinated
17 compliance with Section 106 of the NHPA in meeting the requirements of NEPA. For specific
18 historic and cultural information on the CPNPP site, see section 2.7.

19 Building, operating, and decommissioning new nuclear power units is an undertaking that could
20 affect either known or potential historic properties that may be located at the CPNPP site.
21 Therefore, in accordance with the provisions of NHPA and NEPA, the review team is required to
22 make a reasonable and good faith effort to identify historic properties in the Area of Potential
23 Effect (APE) and, if present, determine if any significant impacts are likely to occur.

24 Identification is to occur in consultation with the State Historic Preservation Officer (SHPO),
25 American Indian Tribes, interested parties, and the public. If significant impacts are possible,
26 efforts should be made to mitigate them. As part of the NEPA/NHPA integration, if no historic
27 properties (i.e., places eligible for listing on the NRHP) are present or affected, the review team
28 is required to notify the SHPO before proceeding. If it is determined that historic properties are
29 present, the NRC staff is required to assess and resolve adverse effects of the undertaking.

30 For the purposes of NHPA 106 consultation, the review team does not expect any significant
31 impacts on cultural and historic resources during the operation of proposed Units 3 and 4.
32 Therefore, the review team concludes with a finding of no historic properties affected
33 [36 CFR 800.4(d)(1)].

34 For the purposes of the NEPA analysis, the review team does not expect any significant impacts
35 on cultural and historic resources during operation of Units 3 and 4. Luminant plans to monitor
36 land disturbing activities that may occur during operation of CPNPP Units 3 and 4 to identify
37 potential cultural resources that may not have been identified during the Section 106 review
38 process (Luminant 2009a). In the event of an inadvertent find Luminant plans to stop work and
39 notify the appropriate county authority, SHPO, and Tribal Historic Preservation Office (THPO).
40 Therefore, the staff concludes that with procedures in place the impacts from operations would
41 be SMALL. Mitigation may be warranted in the event of an inadvertent find. Any necessary
42 mitigative measures would be determined by Luminant in consultation with the Texas SHPO.

43 **5.7 Meteorological and Air Quality Impacts**

44 The primary impacts of operation of two new units on local meteorology and air quality would be
45 from releases to the environment of heat and moisture from the primary cooling system

1 (mechanical draft cooling towers), operation of auxiliary equipment (generators and boilers), and
 2 emissions from workers' vehicles. The potential impacts of releases from operation of the
 3 cooling system are discussed in Section 5.7.2. Section 5.7.1 covers potential air-quality impacts
 4 from nonradioactive effluent releases at the CPNPP site, and Section 5.7.1 covers the potential
 5 air-quality impacts of transmission line corridors during plant operation.

6 **5.7.1 Air Quality Impacts**

7 Standby diesel generators and auxiliary power systems would be used for emergency power
 8 and auxiliary steam purposes. These systems would be used on an infrequent basis and
 9 pollutants discharged (e.g., particulates, sulfur oxides, carbon monoxide, hydrocarbons, and
 10 nitrogen oxides) would be permitted in accordance with the facility's TCEQ Air Permit Number
 11 19225. The air emissions sources, and their estimated annual emissions, are provided in
 12 Table 5-9. These air emissions would be regulated under the facility's TCEQ Air Permit. This
 13 permit is currently held by the facility for operations associated with CPNPP Units 1 and 2, and
 14 could be modified 12 months prior to the beginning of operations to add the new emissions
 15 sources, and associated emissions limits, associated with Units 3 and 4. A modified permit
 16 could regulate emissions from the existing sources associated with Units 1 and 2 as well as the
 17 newly added sources associated with Units 3 and 4.

Table 5-9. Air Emissions Associated with CPNPP Units 3 and 4 (lb/yr)

	NO_x	CO	SO₂	Particulate matter	Hydrocarbons
Gas Turbine Generators (GTGs)	24,283	1719	1095	260	87
Fuel Tanks for GTGs	-	-	-	-	433
Diesel Fire Pump	88*	16	-	4	-
Fuel Tank for Fire Pump	-	-	-	-	0.29
Auxiliary Boilers	3564	2288	9208	1486	148
Fuel Tank for Auxiliary Boilers	-	-	-	-	67
Totals	27,935	4023	10303	1750	735

* Value reported as NO_x and non-methane hydrocarbons, assumed to be primarily NO_x

Source: Luminant 2009a, Tables 3.6-2 through 3.6-7, and Luminant 2010b, the revision to
 Table 3.6-6, p. 44

18 Operation of proposed CPNPP Units 3 and 4 would also result in impacts to local air quality as a
 19 result of emissions associated with increased vehicle use, including transportation of workers to
 20 and from the site. These emissions would occur simultaneously with the emissions from the
 21 onsite sources and would continue for the entire duration of site operations. As discussed in
 22 Section 5.4.4.1, operation of the new units would result in a maximum increase of 246 vehicles
 23 per day.

24 Because Somervell County is in attainment or unclassified for all criteria pollutants for which
 25 National Ambient Air Quality Standards have been established (40 CFR 81.344), a conformity
 26 analysis on direct and indirect emissions is not required (58 FR 63214).

27 Impacts of existing transmission lines on air quality are addressed in NUREG-1437(NRC 1996).
 28 Small amounts of ozone and smaller amounts of NO_x are produced by transmission lines. The
 29 production of these gases was found to be insignificant for 745-kV transmission lines (the

1 largest lines in operation) and for a prototype 1200-kV transmission line. In addition, it was
2 determined that potential mitigation measures, such as burying transmission lines, would be
3 very costly and would not be warranted. The five new 345-kV transmission lines constructed to
4 accommodate the new power generating capacity would be well within the range of
5 transmission lines provided in NUREG-1437, and the review team therefore concludes that air
6 quality impacts from transmission lines would not be noticeable.

7 Finally, the operation of a nuclear power plant involves the emission of some greenhouse
8 gases, primarily carbon dioxide (CO₂). The review team has estimated that the annual carbon
9 footprint for actual plant operations of Units 3 and 4 for 40 years, including the nuclear fuel
10 cycle, is on the order of 1,200,000 metric tons of CO₂ equivalent, as compared to a total United
11 States annual CO₂ emissions rate of 6,000,000,000 metric tons (EPA 2010). The uranium fuel
12 cycle accounts for most of the total, while workforce transportation and periodic testing of diesel
13 generators account for the remainder. These estimates are based on carbon footprint estimates
14 in Appendix J. Based on its assessment of the relatively small plant operations carbon footprint
15 as compared to the United States annual CO₂ emissions, the review team concludes that the
16 atmospheric impacts of greenhouse gases from plant operations would not be noticeable and
17 additional mitigation would not be warranted.

18 The review team has considered the timing and magnitude of atmospheric releases related to
19 operation of proposed Units 3 and 4, the existing air quality at the CPNPP site and the distance
20 to the closest Class I Federal Area, and the Luminant commitment to manage and mitigate
21 emissions in accordance with applicable regulations. On these bases, the review team
22 concludes that the air quality impacts of operation of proposed Units 3 and 4 would not be
23 noticeable. Based on its assessment of the carbon footprint of plant operations, the review
24 team concludes that the atmospheric impacts of greenhouse gases from plant operations would
25 not be noticeable.

26 **5.7.2 Cooling System Impacts**

27 The operation of the cooling system is described in Section 3.4 of the ER (Luminant 2009a).
28 The proposed cooling system for the proposed Units 3 and 4 at the CPNPP site is mechanical
29 draft cooling towers. A total of four cooling towers would be constructed—two for each new
30 nuclear unit. Mechanical draft cooling towers remove excess heat by evaporating water. Upon
31 exiting the cooling tower, water vapor mixes with the surrounding air and this process can lead
32 to condensation and the formation of a visible plume. Aesthetic impacts from the visible plume
33 as well as land-use impacts from cloud shadowing, fogging, icing, increased humidity, and drift
34 from dissolved salts and chemicals found in the cooling water can result.

35 The Seasonal and Annual Cooling Tower Impacts Prediction Code (SACTI) computer model
36 was used by Luminant to estimate impacts associated with operating the cooling towers.
37 Meteorological data used as input into the SACTI model included seasonal mixing height data
38 from the Stephenville meteorological station and 6 years of meteorological data (2001 through
39 2006) from the Mineral Wells airport station. Cooling towers were simulated using a discharge
40 height of 55.4 ft (Luminant 2009a).

41 Results from the SACTI analysis, as reported in the ER (Luminant 2009a), indicate that on
42 average the longest plume lengths would occur during the winter and the shortest plume lengths
43 would occur during the summer. The longest plumes in all seasons would move from the
44 towers towards the west and northwest. The longest plume length is 4.17 mi. Ground-level
45 fogging or icing is predicted to occur to the north and the south, on the shoreline and on the lake
46 surface within 1 mi of the towers. Deposition of salts from cooling tower drift would occur in all
47 directions from the towers. Deposition of solids would occur within 100 m north of the towers, at

1 a maximum rate of 55.8 kg/km²/month. Based on experience with cooling towers reported in
2 NUREG-1437 (NRC 1996), Luminant concluded that the impacts of salt deposition from cooling
3 towers would be minimal and would not require mitigation.
4 On the basis of the analysis presented by Luminant in the ER and the review team's
5 independent evaluation of that analysis, the review team concludes that atmospheric impacts of
6 the cooling tower operation would be minimal.

7 **5.7.3 Summary**

8 The review team evaluated potential impacts on air quality associated with criteria pollutants
9 and greenhouse gas emissions from operating proposed Units 3 and 4. The review team also
10 evaluated potential impacts of cooling system emissions and transmission lines. In each case,
11 the review team determined that the impacts would be minimal. On this basis, the review team
12 concludes that the impacts of operation of proposed Units 3 and 4 on air quality from emissions
13 of criteria pollutants, CO₂ emissions, and cooling system emissions are SMALL and that no
14 further mitigation is warranted.

15 **5.8 Nonradiological Health Impacts**

16 This section addresses the nonradiological human health impacts of operating the proposed
17 new units at the Comanche Peak. Health impacts to the public from the cooling system, noise
18 generated by operations, EMFs, and transporting operations are discussed. Health impacts
19 from the same sources are also evaluated for workers at the new units. Health impacts from
20 radiological sources during operations are discussed in Section 5.9.

21 **5.8.1 Etiologic Agents**

22 Etiologic agents consist of all microorganisms that can cause infectious disease in humans.
23 One class of etiologic agents is thermophilic; these microorganisms thrive in hot water generally
24 well above 40°C. Operation of Comanche Peak Units 3 and 4 would result in a thermal
25 discharge to Lake Granbury. The thermal discharge to Lake Granbury is expected to result in a
26 temperature increase of 1°C or less.

27 Thermal discharges have the potential to increase the growth of microorganisms, including
28 *Salmonella* species, *Shigella* species, and *Pseudomonas* species, as well as thermophilic
29 organisms, including fungi, bacteria such as *Legionella* species, and free-living amoeba such as
30 *Naegleria fowleri* and *Acanthamoeba* species. These microorganisms could result in potentially
31 serious human health concerns, particularly at high exposure levels.

32 *Salmonella* and *Shigella* species are mostly associated with areas of poor sanitation, but they
33 can also be transmitted by the common house fly. Although the organisms can live for several
34 weeks in water, they do not multiply there. *Pseudomonas* can be found in soil, humidifiers, on
35 the skin of healthy individuals, and anywhere *Salmonella* and *Shigella* are found (NRC 1996,
36 Appendix D). While *Pseudomonas* could be found in Lake Granbury (and other waterbodies),
37 there is no known sanitation pathway for large numbers of these organisms to enter the
38 reservoir.

39 Legionnaires' disease can be very serious and can cause death in up to 5 to 30 percent of
40 cases. Each year, between 8000 and 18,000 people are hospitalized with Legionnaires'
41 disease in the U.S. However, many infections are not diagnosed or reported, so this number
42 may be higher. More illness is usually found in the summer and early fall, but it can occur any
43 time of year (CDC 2009). Most cases can be treated successfully with antibiotics (drugs that kill
44 bacteria in the body), and healthy people usually recover from infection. Mild forms of the

1 disease go away on their own without treatment (CDC 2009). One population-based study
2 estimated that more than three-quarters of cases are currently undiagnosed or unreported.
3 Incidence rates per 100,000 persons vary from 1.8 in Delaware to less than 0.3 in Texas (Neil
4 and Berkelman 2008).

5 The *Legionella* bacteria are found naturally in the environment, usually in water. The bacteria
6 grow best in warm water, like the kind found in hot tubs, cooling towers, hot water tanks, large
7 plumbing systems, or parts of the air-conditioning systems of large buildings. They do not seem
8 to grow in car or window air-conditioners. People get Legionnaires' disease when they breathe
9 in a mist or vapor (small droplets of water in the air) that has been contaminated with the
10 bacteria. For example, one might breathe in the mist from a whirlpool spa that has not been
11 properly cleaned and disinfected (NRC 1996, Appendix D).

12 People most at risk of getting sick from the bacteria are older people (usually 65 yr of age or
13 older), as well as people who are smokers, or those who have a chronic lung disease (such as
14 emphysema). People who have weak immune systems from diseases such as cancer,
15 diabetes, or kidney failure are also more likely to get sick from *Legionella* bacteria. Patients
16 who take drugs to suppress (weaken) the immune system (often after a transplant operation or
17 chemotherapy) are also at higher risk (CDC 2009).

18 Primary amebic meningoencephalitis (PAM) is a rare but nearly always fatal disease caused by
19 infection with *Naegleria fowleri*. In 2007, six cases of PAM in the United States were reported to
20 CDC; all six patients died (CDC 2008). Two of the six were in Texas. In response to the six
21 PAM cases reported in 2007, CDC and the Council of State and Territorial Epidemiologists
22 formed the *Naegleria* Workgroup to review future actions related to *N. fowleri* and to determine
23 whether the six cases represented an increase in the annual number of cases. The workgroup
24 used multiple resources to conduct a review of all PAM cases reported in the United States from
25 1937 to 2007 (CDC 2008). Analyses of the data are still being conducted. Preliminary results
26 indicate that a total of 121 cases (range: 0–8 cases per yr) occurred in the United States from
27 1937 to 2007. The six cases of PAM reported in 2007 were among the six highest annual totals
28 of cases reported during the study period; the other five highest totals were 1980 (eight cases),
29 2002 (seven cases), and 1978, 1986, and 1995 (six cases each). During 1937–2007, the
30 median age of the patients was 12 yr (range: 8 months–66 yr). Among the 119 cases for which
31 sex of the patient was known, males accounted for 93 (78 percent) of the cases. Only one
32 reported survivor met the case criteria.

33 Exposure to PAM primarily occurred in untreated, warm, freshwater lakes or rivers in
34 15 southern tier states (Arizona, Arkansas, California, Florida, Georgia, Louisiana, Mississippi,
35 Missouri, Nevada, New Mexico, North Carolina, Oklahoma, South Carolina, Texas, and
36 Virginia); the state of exposure for four cases was unknown. Among the 112 cases for which
37 month of exposure was known, 95 (85 percent) occurred from July through September
38 (CDC 2008).

39 The new units at Comanche Peak will use two banks of mechanical-draft cooling towers with a
40 closed-loop cooling system to reduce the temperature of water discharged to Lake Granbury.
41 The maximum temperature of the discharged water is 93°F; it begins to mix and cool
42 immediately after discharge (Luminant 2009a). The temperature of the lake will be well below
43 the optimal temperatures for the thermophilic bacteria to grow and reproduce.

44 The BDTF will also be a source of heated water. Water in the cooling tower basin has a
45 maximum design temperature of 88.5°F and a high salt concentration. Most infectious agents,
46 including the salt-tolerant *Acanthamoeba* amoeba, cannot thrive under these conditions. The
47 bacteria responsible for cholera (*Vibrio cholerae*) could theoretically grow under these
48 conditions. *V. cholerae* has not been found in source water for Lake Granbury, and there are no

1 known naturally occurring populations of the bacteria near Comanche. Luminant has stated that
2 it will monitor for *V. cholerae* if the State authorities require it (Luminant 2010b).

3 In or downstream of Lake Granbury, any increases in water temperature should be extremely
4 small, and most organisms cannot survive the salinity of the cooling tower basin. Any
5 temperature increase resulting from operating the new nuclear units would not significantly
6 increase the abundance of the organisms discussed above. The review team concludes that
7 the impacts on human health from thermophilic organisms in Lake Granbury and the cooling
8 towers would be SMALL and that mitigation would not be warranted.

9 **5.8.2 Noise**

10 In NUREG-1437 (NRC 1996), the staff discusses the environmental impacts of noise at existing
11 nuclear power plants. Common sources of noise from plant operation include cooling towers,
12 and transformers, with intermittent contributions from loud speakers and auxiliary equipment
13 such as diesel generators. These noise sources are discussed in this section.

14 The existing units at the CPNPP site use water from the SCR to remove waste heat with once-
15 through condenser units. No cooling towers are used for CPNPP Units 1 and 2. Units 3 and 4
16 would have a secondary-side cooling water system with a closed-loop system with mechanical
17 draft (wet) cooling towers. Cooling water would be pumped from Lake Granbury by an intake
18 pipeline, and blowdown from the cooling tower basins is returned to the lake through a
19 discharge pipeline, with part of the blowdown passing through a treatment facility.

20 The U.S. Department of Housing and Urban Development (HUD) has established noise impact
21 guidelines for residential areas based on day-night average sound levels (DNL) (HUD 1996). A
22 sound level in DNL is valid for a 24-hr period and is computed the same as a 24-hr Leq except
23 that the prevailing sound level in the calculation has a 10-dB penalty added between 2 a.m. and
24 7 a.m. Neither the State of Texas nor Hood and Somervell Counties have developed noise
25 regulations specifying acceptable community noise levels.

26 Luminant assessed noise against the HUD DNL of 60–65 dBA, below which the noise would be
27 considered acceptable for residential and outdoor recreational uses. HUD's goal is to have the
28 exterior noise level not exceed a day-night average of 55 dB (HUD 2006). When considering
29 cost and feasibility, HUD says a day-night sound level of 65 dB is acceptable and allowable
30 (HUD 2006). According to NUREG-1437 (NRC 1996), noise levels below 60 to 65 dBA are
31 considered to be of small significance. More recently, the impacts of noise were considered in
32 the Final *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*
33 (NUREG-0586, Supplement 1) (NRC 2002). The criterion for assessing the level of significance
34 was not expressed in terms of sound levels but based on the effect of noise on human activities
35 and on threatened and endangered species. The criterion in NUREG-0586, Supplement 1
36 (NRC 2002), is stated as follows:

37 The noise impacts are considered detectable if sound levels are sufficiently high to disrupt
38 normal human activities on a regular basis. The noise impacts are considered destabilizing
39 if sound levels are sufficiently high that the affected area is essentially unsuitable for normal
40 human activities, or if the behavior or breeding of a threatened and endangered species is
41 affected.

42 The main source of continuous noise is anticipated to be the mechanical draft cooling towers.
43 Per NUREG-1817 (NRC 2006), cooling towers generate approximately 85 dBA in close
44 proximity and approximately 55 dBA at a distance of 1000 feet during operation (Luminant
45 2009a). Luminant identified HVAC systems, vents, transformers and electrical equipment,
46 transmission lines, water pumps, material-handling equipment, motors, public address systems,

1 cooling towers, trucks and vehicular traffic as additional noise sources from plant operation. A
2 firearms shooting range on site is a source of sporadic noise. Many of the noise sources are
3 expected to be confined indoors or underground or used infrequently (Luminant 2009a). The
4 nearest offsite receptors are all more than 4400 ft from the cooling tower. The calculated noise
5 levels from Units 3 and 4 are less than the noise levels recorded at those locations in 2006 (see
6 Table 5-10), so the impact of the cooling towers would not significantly affect the noise
7 background.

8 The waterlines from the Lake Granbury are underground, but the pumps for cooling water for
9 Units 3 and 4 would be located next to those for Units 1 and 2. The noise levels generated by
10 the new pumps are not yet known. Pump noise may reflect off the water and increase the noise
11 from current levels. Therefore, the operation of the water pumps could have an impact on the
12 areas around the lake (Luminant 2009a).

13 Until further information is available on noise of the water pumps, it is possible that some
14 mitigation would be warranted. Possible mitigation measures could include finding low-noise-
15 producing pump motors, mounting the motors on sound-dampening material, relocating the
16 motors away from the water, or enclosing the pump motors in a sound-absorbing structure
17 (Luminant 2009a).

18 Luminant plans to construct an evaporation pond as part of the BDTF complex. The exact
19 location of this pond has not been determined. Figure 1 in the Luminant response (Luminant
20 2010c) shows the evaporation pond only for the purpose of indicating that there is adequate
21 space in the designated parcel of land. The evaporation pond will be divided into sections by
22 berms. Luminant calculates that 182 misters would be required. Each mister has 30 nozzles.
23 The manufacturer has provided noise data for one mister (Slimline 1999). Given the noise vs
24 distance profile provided by Slimline (1999), receptors beyond 250 to 300 ft from the closest
25 mister should experience less than the 65 DNL recommended by HUD and probably much
26 lower.

27 The impact of noise from the operation of Comanche Peak 3 and 4 could range from SMALL to
28 MODERATE, depending on the final pump design and equipment choices.

29 **5.8.3 Acute Effects of Electromagnetic Fields**

30 Electric shock resulting from either direct access to energized conductors or induced charges in
31 metallic structures is an example of an acute effect from EMF associated with transmission lines
32 (NRC 1999). Such acute effects are controlled and minimized by conformance with National
33 Electrical Safety Code (NESC) criteria and adherence to the standards for transmission systems
34 regulated by the Public Utility Commission of Texas (PUCT).

Table 5-10. Predicted Noise Levels (DbA) Expected due to Plant Operations

Receptor Position ^(a)	Approximate Distance from nearest Cooling Tower (ft)	Recorded Ambient Leq dBA Day-Night average 2006	CPNPP Units 3 and 4 Calculated Noise Emissions dBA ^(b)	Projected Average Noise level ^(b)
1 – Approximate Southwest fence line along access road.	4,746	57	42	57
2 – Approximate east fence line between cooling tower and residential property located across SCR.	14,794	56	33	56
3 – Approximate nearest western fence line.	4,693	56	43	56
15 Swim beach north of site.	4,482	56	42	56
23 Nearest residential neighborhood south-southwest of site.	4,746	44–65 ^(c)	42	44–65
25 Nearest Church and Cemetery	8,591	44–68 ^c	36	44–68

(a) Locations obtained from Figure 2.5–20 in Luminant 2009a.

(b) Calculations were made using a noise level of 55 dBA at 1000 ft. The combination of cooling towers for units 3 and 4 would not have a significant impact due to distance and shielding from each cooling tower and other structures. Noise attenuation calculation. Secondary noise level (SPL₂, dBA) = Initial noise level (SPL₁, dBA) – 20 log (d¹ / d²) where d¹ is the original distance from the source and d² is the measured distance from the source.

(c) Area noise levels were collected at these locations utilizing a Quest Type 2 sound level meter with octave band analysis.

Source: Luminant 2009a

1 In its ER, Luminant suggests that additional transmission capacity might be constructed by
2 Oncor Electric Delivery to service new generation at the CPNPP site (see Section 5.6.3.1 in the
3 ER [Luminant 2009a]). The Applicant commits to design any new transmission lines to ensure
4 that all lines would be in compliance with the 5-milliamp standard in the present NESC. The
5 Applicant states that

6 Adding circuitry to existing transmission lines high enough to comply with the 5-ma standard
7 eliminates the possibility of dangerous electrical shocks and continues Oncor Electric
8 Delivery's long-standing commitment to operate and maintain facilities that ensure public
9 and worker safety (see Section 5.8.3.1 in the ER [Luminant 2009a]).

1 With the Applicant's, and Oncor Electric Delivery's commitment to design new transmission
 2 lines to meet the present NESC criteria when transmission lines are combined and the staff's
 3 assumption that new transmission lines constructed for the additional generation at the CPNPP
 4 site would be constructed to the NESC standards in effect at the time of construction, the review
 5 team concludes that the impact to the public from acute effects of EMFs would be SMALL and
 6 that additional mitigation would not be warranted.

7 **5.8.4 Chronic Effects of Electromagnetic Fields**

8 Research on the potential for chronic effects from 60-Hz EMFs from energized transmission
 9 lines was reviewed and addressed by the NRC in the NUREG-1437 (NRC 1996). At that time,
 10 research results were not conclusive. The National Institute of Environmental Health Sciences
 11 (NIEHS) directed related research on this topic through the U.S. Department of Energy. An
 12 NIEHS report (1999) contains the following conclusion.

13 The NIEHS concludes that ELF-EMF (extremely low frequency-electromagnetic field)
 14 exposure cannot be recognized as entirely safe because of weak scientific evidence that
 15 exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant
 16 aggressive regulatory concern. However, because virtually everyone in the United States
 17 uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is
 18 warranted such as a continued emphasis on educating both the public and the regulated
 19 community on means aimed at reducing exposures. The NIEHS does not believe that other
 20 cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently
 21 warrant concern.

22 The staff reviewed recently available scientific literature on chronic effects to human health from
 23 ELF-EMF published since the NIEHS report, and found that several other organizations reached
 24 the same conclusions (AGNIR 2006; WHO 2007). The report by the World Health Organization
 25 (WHO) updated the assessments of a number of scientific groups reflecting the potential for
 26 transmission line EMF to cause adverse health impacts in humans. The report summarized the
 27 potential for ELF-EMF to cause disease such as cancers in children and adults, depression,
 28 suicide, reproductive dysfunction, developmental disorders, immunological modifications, and
 29 neurological disease. The results of the review by WHO (2007) found that the extent of
 30 scientific evidence linking these diseases to EMF exposure is not conclusive.

31 The review team reviewed available scientific literature on chronic effects of EMF on human
 32 health and found that the scientific evidence regarding potential chronic effects of ELF-EMF on
 33 human health does not conclusively link ELF-EMF to adverse health impacts.

34 **5.8.5 Occupational Health**

35 In general, occupational health risks for new units are expected to be dominated by
 36 occupational injuries (e.g., falls, electric shock, asphyxiation) to workers engaged in activities
 37 such as maintenance, testing, and plant modifications. Historically, actual injury and fatality
 38 rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. In
 39 2007, the incidence rate of nonfatal injuries and illnesses for the nuclear electric power
 40 generation industry was 0.9 total recordable cases per 100 full-time-equivalent employees, with
 41 0.4 cases per 100 full-time-equivalent employees involving days away from work, job transfer,
 42 or restriction (BLS 2008a).

43 Luminant (2009a) states that workers at Units 3 and 4 may be vulnerable to accidents such as
 44 falls, electric shock, burns, occupational injury due to noise exposure, and exposure to toxic or
 45 oxygen-replacing gases. At Units 1 and 2, the total recordable case rate for the CPNPP
 46 workforce for 2003–2006 was 1.06 cases per 100 workers. This rate is similar to the national

1 rate for nuclear generation and lower than the total recordable case rate for electric power
 2 generation, transmission and distribution (3.1 per 100 full-time employees) in Texas
 3 (BLS 2008b). Nationally, the reportable case rate for nuclear electrical power generation is
 4 lower than for other forms of electrical generation (BLS 2008a). Luminant would use the same
 5 safety program to guide operations at CPNPP Units 3 and 4. Table 5-11 shows the expected
 6 cases in the 2018 Unit 3 and 4 workforce.

Table 5-11. Expected Annual Total Recordable Cases of Injuries and Illnesses

	Luminant (Units 1 and 2)	National nuclear power generation	Texas electric power generation
Incidence Per 100 Workers	1.06 ^a	0.9 ^b	3.1 ^c
Workforce 2018	494 ^d	494 ^d	494 ^d
Expected Cases	5.2	4.4	15.3

(a) Comanche Peak Nuclear Power Plant, Units 3 and 4 COL Application, Part 3, Environmental Report, Luminant 2009a, p. 5.13-1.

(b) Table 1. Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2007," BLS 2008a.

(c) Table 6. Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2007," BLS 2008b.

(d) Luminant 2009a, p. 5.8-1.

7 Occupational injury and fatality risks are reduced by strict adherence to NRC and Occupational
 8 Safety and Health Administration (OSHA) safety standards (29 CFR Part 1910), practices, and
 9 procedures. Appropriate State and local statutes must also be considered when assessing the
 10 occupational hazards and health risks for new nuclear unit operation. The review team
 11 assumes adherence to NRC, OSHA, and State safety standards, practices, and procedures
 12 during new nuclear unit operations.

13 Additional occupational health impacts may result from exposure to hazards such as noise, toxic
 14 or oxygen-replacing gases, etologic microorganisms, as discussed in Section 5.8.1, in the
 15 condenser bays, and caustic agents. Luminant's current safety and health programs promote
 16 safe work practices and respond to occupational injuries and illnesses. The Personal Safety
 17 Program that includes procedures to provide workers a means of preventing accidents due to
 18 unsafe conditions and unsafe acts. These procedures address hearing protection, confined
 19 space entry, personal protective equipment, heat stress, electrical safety, ladders, chemical
 20 handling, storage, and use, and other industrial hazards. The Senior Safety Committee and the
 21 Safety and Training Departments oversee Luminant safety procedures and training. Luminant
 22 states that the same program would be used to guide operations at CPNPP Units 3 and 4
 23 (Luminant 2009a). Health impacts to workers from nonradiological emissions, noise, and EMFs
 24 would be monitored and controlled in accordance with the applicable OSHA regulations and
 25 would be SMALL.

26 **5.8.6 Impacts of Transporting Operations Personnel and Waste Salt**

27 The general approach used to calculate nonradiological impacts of fuel and waste shipments is
 28 the same as that used to calculate the impacts of transporting operations and outage personnel
 29 to and from the CPNPP site. However, preliminary estimates are the only data available to

1 estimate these impacts. The assumptions made to fill in reasonable estimates of the data
2 needed to calculate nonradiological impacts are discussed below.

3 The April 24, 2009 update to the ERs estimates 474 workers for Units 3 and 4, 1000 workers at
4 Units 1 and 2 (Luminant 2009a), and 800-1200 refueling workers every 18 months (Luminant
5 2009a). NRC staff assumed that the average commute distance for operators and outage
6 workers would be 20 mi one way, 250 days a yr for the permanent workers, and 24 days for
7 outage workers. Incident rates for 2007 were taken from the National Highway Transportation
8 Safety Administration, *Traffic Safety Facts 2007* (NHTSA 2009).

9 The estimated impacts of transporting operations and outage workers to/from the CPNPP site
10 are shown in Table 5-12. The total annual traffic fatalities during operations, including both
11 operations and outage personnel, are expected to be less than 0.5. There may be 13–22
12 injuries from traffic accidents each year in both the permanent and outage workforces. The
13 addition of the operational personnel at Units 3 and 4 is expected to result in a small, if not
14 imperceptible, increase relative to the current traffic fatality risk in the area surrounding the
15 CPNPP site.

16 Luminant (2010d) provided estimates of the annual number of rail or truck shipments that would
17 be necessary. These estimates included both the expected number of shipments and a
18 maximum number of shipments each year. The waste salt is expected to be classified as a
19 non-hazardous waste. The average distance to candidate landfills is 64 mi by rail and 46 mi by
20 truck. The estimated health effects of transportation of waste salt are shown in Table 5-13.

21 If all the salt were shipped by rail, the number of accidents, injuries, or fatalities expected from
22 the shipments in a given year would be negligible. Using 2007 large truck (gross vehicle weight
23 rating greater than 10,000 pounds) risk data, fatalities from a truck accident would be unlikely. A
24 few truck accidents could occur, with a low number of injuries each year. These numbers
25 represent small increases relative to the current traffic fatality risks in this area. The health
26 effects from transporting the waste salt would be minimal.

27 **5.8.7 Summary of Nonradiological Health Impacts**

28 The review staff evaluated health impacts to the public and the workers from the cooling
29 systems, noise generated by unit operations, and acute and chronic impacts of EMFs, and
30 transporting operations and outage workers to/from the two additional units. Health risks to
31 workers are expected to be dominated by occupational injuries at rates below the average U.S.
32 industrial rates. Health impacts to the public and workers from etiologic microorganisms, noise
33 generated by unit operations, and acute impacts of EMFs would be minimal. Based on the
34 information provided by Luminant's and the staff's own independent review, the staff concludes
35 that the potential impacts of nonradiological effects resulting from the operation of Units 3 and 4
36 would be SMALL to MODERATE. The impact of noise from the operation of Comanche Peak 3
37 and 4 could range from SMALL to MODERATE, depending on the final pump design and
38 equipment choices.

39

1

Table 5-12. Annual Expected Impacts of Transporting Operations Personnel to the Comanche Peak Site

Workforce	Miles Driven Annually	Expected Fatalities ^(a)	Expected Injuries ^(a)	Expected Fatalities (Texas rate) ^(b)
Units 1 and 2	10,000,000 ^(c)	0.14	8.2	0.14
Units 3 and 4	4,940,000 ^(d)	0.07	4.0	0.07
Permanent Workforce	14,940,000 ^(e)	0.20	12.2	0.21
Outage Workforce	768,000 ^(f) – 11,520,000 ^(g)	0.01–0.16	0.63–9.4	0.16–0.21

(a) NHTSA 2009, Table 2. U.S. fatality rate: 1.36 per 100 million mi driven; U.S. injury rate: 82 per 100 million mi driven
(b) NHTSA 2009, Table 122. Texas fatality rate: 1.38 per million mi driven.
(c) 1000 employees × 40 mi/day × 250 days/yr
(d) 494 employees × 40 mi/day × 250 days/yr
(e) 1494 employees × 40 mi/day × 250 days/yr
(f) 800 outage workers × 40 mi/day × 24 days/yr
(g) 1200 outage workers × 40 mi/day × 24 days/yr

2

Table 5-13. Annual Expected Impacts of Transporting Salt Waste from CPNPP Units 3 and 4

Rail transportation					
	Loads/yr	Distance Traveled (km/yr) ^(c)	Expected Accidents ^(e)	Expected Injuries ^(e)	Expected Fatalities ^(e)
Expected	1,773 ^(a)	365,000	0.022	0.016	0.008
Worst case	4,711 ^(b)	970,000	0.059	0.041	0.022
Truck transportation					
	Loads/yr	Distance Traveled (mi/yr) ^(d)	Expected Accidents ^(f)	Expected Injuries ^(f)	Expected Fatalities ^(f)
Expected	8,866 ^(a)	816,000	2.53	0.58	0.028
Worst case	23,555 ^(b)	2,170,000	6.73	1.6	0.074

(a) Luminant 2010c.
(b) This figure assumes a 25% increase in the worst case in (a) due to a 20% moisture content in the salt.
(c) Assumes average distance of 64 mi by rail to landfill.
(d) Assumes average distance of 46 mi by truck to landfill.
(e) Incident rates per 100,100 km traveled: accident rate: 6.10; injury rate: 4.26; fatality rate: 2.27. Table 6, Saricks and Tompkins 1999 (ANL/ESD/TM-150).
(f) Incident rates per 100,000 mi traveled: accident rate 193; injury rate: 44.5; fatality rate 2.12. Federal Motor Carrier Safety Administration (FMCSA) 2009.

3

5.9 Radiological Impacts of Normal Operations

This section addresses the radiological impacts of normal operations of the proposed new units 3 and 4 on the Comanche Peak Nuclear Power Plant (CPNPP) site, including a discussion of the estimated radiation dose to a member of the public and to the biota inhabiting the area around the site. Radiological impacts were determined using the Mitsubishi Heavy Industries (MHI) U.S. Advanced Pressurized Water Reactors (US-APWR) reactor design (MHI 2009) with expected direct radiation and liquid and gaseous radiological effluent rates in the evaluation.

5.9.1 Exposure Pathways

The public and biota would be exposed to increased ambient background radiation from a nuclear reactor unit via the liquid effluent, gaseous effluent, and direct radiation pathways. In the ER (Luminant 2009a), Luminant estimated the potential exposures to the public and biota by evaluating exposure pathways typical of the area surrounding a nuclear reactor site. They considered pathways that could cause the highest calculated radiological dose based on the use of the environment by residents of the area. For example, factors such as the location of homes in the area, consumption of meat from the area, and consumption of vegetables grown in area gardens were considered. An illustration of the pathways leading to exposure to members of the public is shown in Figure 5-2.

For the liquid effluent release pathway, Luminant (2009a) considered the following exposure pathways in evaluating the dose to the maximally exposed individual (MEI): ingestion of aquatic food (i.e., fish), ingestion of water, and direct radiation exposure from shoreline activities. Liquid effluents were assumed to be released into Squaw Creek Reservoir (SCR). Water from SCR is not utilized in any way for public consumption. Access to SCR for recreational activity is controlled by Luminant. Boating, fishing and shoreline activities are allowed (Luminant 2010). To limit the concentration of tritium (H-3) in SCR the liquid effluents of the proposed units may be diverted to an evaporation pond from which the tritium and other volatile materials become airborne emissions. The analysis for population (or collective) dose considered the following exposure pathways: ingestion of aquatic food and direct radiation exposure from shoreline, swimming, and boating activities. The exposure pathways associated with airborne emission, discussed in the next paragraph, are applicable to the emissions from the evaporation pond. Drinking water was evaluated although the current land-use census information indicates no drinking water use of the river within 50 mi downstream of the site. Luminant noted a potential future water diversion about 49 mi south of the Squaw Creek Dam and considered in the ER (Luminant 2009a).

For the gaseous effluent release pathway, the ER (Luminant 2009a) considered the following exposure pathways in evaluating the dose to the MEI: submersion in the radioactive plume, direct radiation exposure from deposited radioactivity, inhalation, ingestion of garden fruit and vegetables, and ingestion of milk and beef. There is no milk production within 5 mi of the site. For population doses from the gaseous effluents, Luminant used the same exposure pathways in assessing the dose to individuals, including the assumed cow milk ingestion pathway. In some counties within 50-mi of the site the current land-use census information indicates no milk cows are present. If an earlier land-use census indicated the presence of milk cows in the region then Luminant (2009a) elected to use the earlier information. All agricultural products grown within 50 mi of the CPNPP site were assumed to be consumed by the population dose within 50 mi of the site.

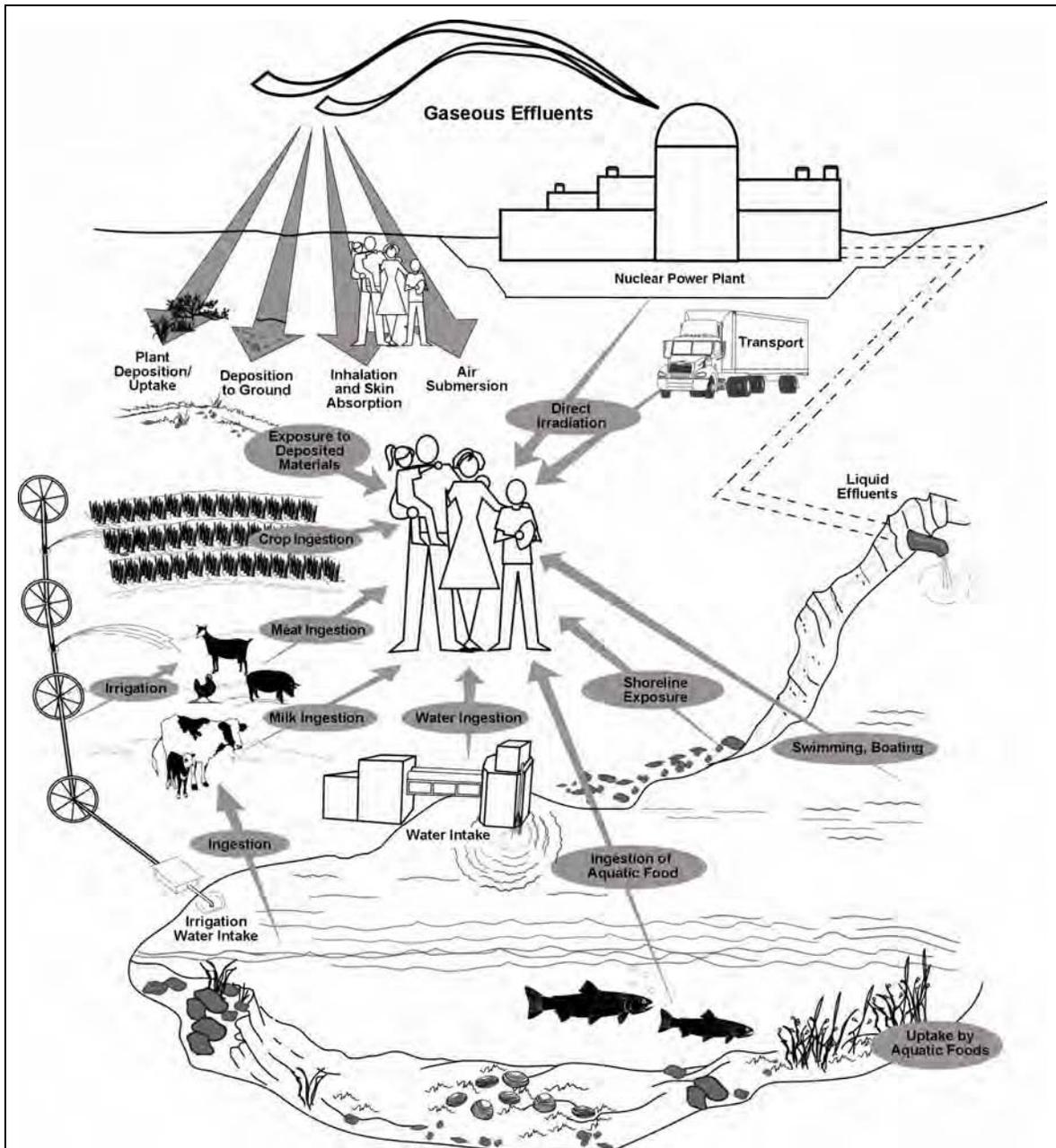


Figure 5-2. Exposure Pathways to Man (adapted from Soldat et al. 1974).

- 1 Luminant (2009a) stated that direct radiation from the reactor buildings for Units 3 and 4 and the
- 2 planned Independent Spent Fuel Storage Installation (ISFSI) would be a source of radiation
- 3 exposure to the public from the CPNPP site. However, Luminant assumes that the contained
- 4 sources of radiation would be shielded and would not contribute to the external dose to the MEI
- 5 or to the population.
- 6

- 1 Exposure pathways considered in evaluating dose to the biota are shown in Figure 5-3 and
- 2 include:
- 3 • Ingestion of aquatic foods
- 4 • Ingestion of water
- 5 • External exposure from water immersion and shoreline sediments
- 6 • Inhalation of airborne radionuclides
- 7 • External exposure to submersion in gaseous effluent plumes, and
- 8 • Surface exposure from deposition of iodine and particulates from gaseous effluents.

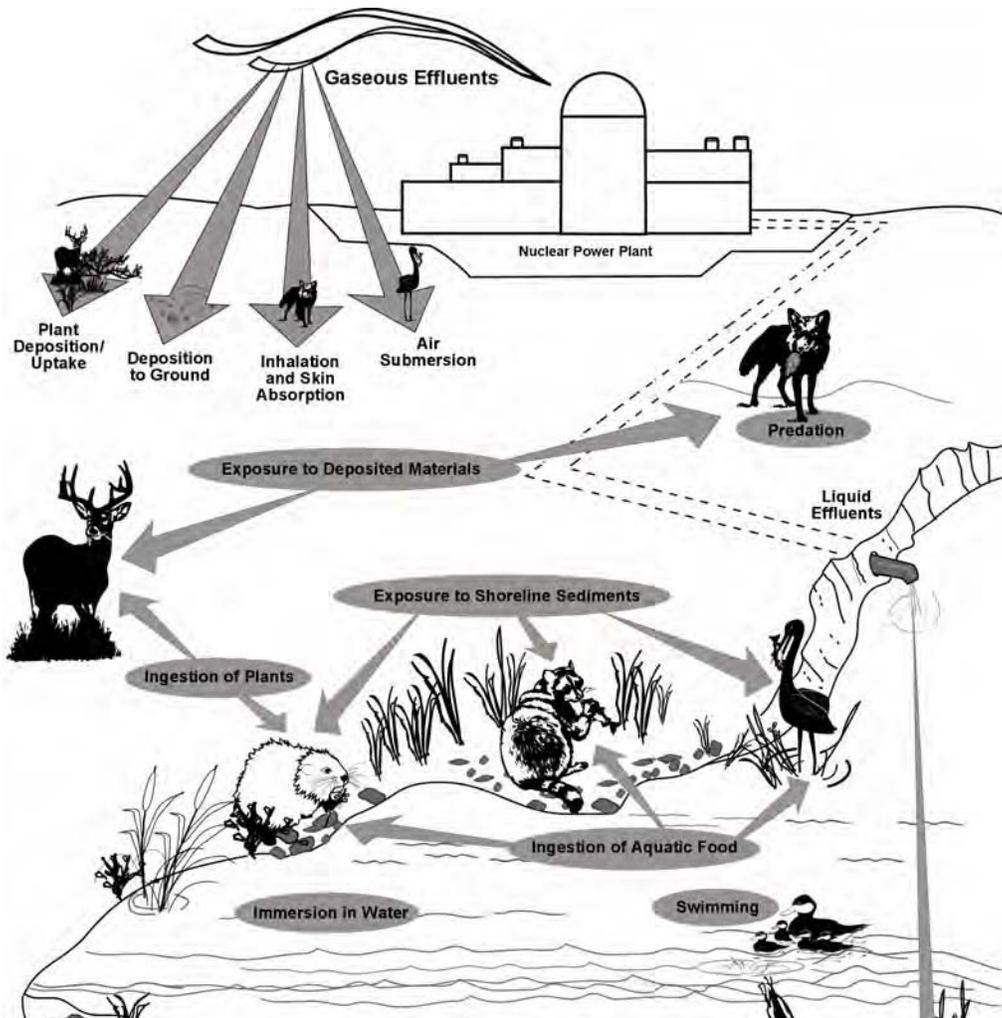


Figure 5-3. Exposure Pathways to Biota Other Than Man (adapted from Soldat et al. 1974).

- 9 The NRC staff reviewed the exposure pathways for the public and non-human biota identified by
- 10 Luminant (Luminant 2009a) and found them to be appropriate, based on a documentation
- 11 review and a tour of the environs with Luminant staff and contractors during the site visit in
- 12 February 2009.

1 5.9.2 Radiation Doses to Members of the Public

2 Luminant calculated the dose to the MEI and to the population living within a 50-mi radius of the
3 site from both the liquid and gaseous effluent release pathways (Luminant 2009a). As
4 discussed in the previous sections, direct radiation exposure to the MEI from sources of
5 radiation at CPNPP Units 3 and 4 was considered to be negligible.

6 5.9.2.1 Liquid Effluent Pathway

7 Liquid effluents would be released into the SCR; therefore, the highest concentration of the
8 radiological material would be in the SCR. Liquid pathway doses to the MEI were calculated for
9 the SCR by Luminant (2009a) using the LADTAP II computer program (Streng et al. 1986).

10 The liquid effluent releases used in the estimates of dose are found in Table 5.4-8 of the ER
11 (Luminant 2009a). Other parameters used as inputs to the LADTAP II program include effluent
12 discharge rate, dilution factor for discharge, transit time to receptor, and liquid pathway
13 consumption and usage factors (i.e., fish consumption and drinking water consumption), can be
14 found in Table 5.4-1 of the ER (Luminant 2009a).

15 Luminant (2009a, 2010b) calculated liquid pathway doses to the MEI as shown in ER
16 Table 5.4-4 and the LADTAP output files (Luminant 2009g) which assumed all liquid effluents
17 would be released to SCR. Table 5-14 is derived from those output files. The MEI was an adult
18 (total body dose) ingesting fresh water sport fish and receiving shoreline exposure from SCR.
19 The highest organ dose would be to the liver of a teenager (Luminant 2009a).

Table 5-14. Annual Doses to the MEI for Liquid Effluent Releases from a New Unit^(a)

Pathway	Age Group	Annual Dose (mrem/yr)		
		Total Body ^(b)	Maximum Organ (Liver) ^(c)	Thyroid
Shoreline Use	Adult	0.0020	0.0013	0.0013
	Teenager	0.011	0.0073	0.0073
	Child	0.0023	0.0015	0.0015
Water Ingestion	Adult	0.0064	0.0064	0.0064
	Teenager	0.0045	0.0045	0.0045
	Child	0.0086	0.0086	0.0086
Fish Ingestion	Adult	0.88	1.2	0.14
	Teenager	0.52	1.3	0.10
	Child	0.25	1.1	0.086

(a) Bounding values based on liquid effluent release to SCR.

(b) An adult receives the maximum individual total body dose.

(c) A teenager received the maximum individual organ dose.

20 Luminant (2009a, 2010b) also calculated the doses to the MEI and the population assuming
21 one-half the liquid effluents of ER Table 5.4-8 would be diverted to an evaporation pond. The
22 resultant airborne emissions were evaluated using the GASPARI computer program (Streng
23 et al. 1987). The fish ingestion pathway is the dominant dose contributor for liquid effluents, and
24 radionuclides released to the air from the evaporation pond do not contribute to the fish
25 ingestion pathway. Assuming no diversion of liquid effluents to the evaporation pond results in
26 a higher dose to the MEI compared to the combination of some liquid effluent going to the SCR

1 and some going into the air through evaporation. Therefore, the doses for the liquid effluent
2 calculated assuming no diversion to the evaporation pond are bounding.

3 The NRC staff's evaluation of the liquid effluent releases includes the doses due to airborne
4 emissions from the evaporation pond with the liquid effluents dose. However, the dose to the
5 MEI for the liquid effluent releases is bounded by the direct release to SCR not by the airborne
6 emissions from the evaporation pond.

7 The staff recognizes the LADTAP II and GASPAR II computer programs as appropriate
8 methods for calculating dose to the MEI for liquid effluent releases and atmospheric emission,
9 respectively. The staff performed an independent evaluation of liquid pathway doses using
10 input parameters from the ER (Luminant 2009a) and found similar results. All input parameters
11 used in Luminant's calculations were judged by the staff to be appropriate. Further discussion
12 of the staff's independent evaluation is found in Appendix G.

13 **5.9.2.2 Gaseous Effluent Pathway**

14 Gaseous pathway doses to the MEI were calculated by Luminant (2009a) using the GASPAR II
15 computer program (Streng et al. 1987) at the nearest residence, the exclusion area boundary
16 (EAB), the nearest garden, nearest meat cow, and nearest milk cow. The following activities
17 were considered in the dose calculations: (1) direct radiation from immersion in the gaseous
18 effluent cloud and from particulates deposited on the ground; (2) inhalation of gases and
19 particulates; (3) ingestion of meat from animals eating contaminated grass; and (4) ingestion of
20 garden vegetables contaminated by gases and particulates. Luminant (2009a) stated that no
21 milk cows or milk goats are located within 5 mi of the proposed site. However, Luminant did
22 provide individual dose results for the milk pathway in its ER (Luminant 2009a) for information
23 purposes, but those results are not included in the total doses reported here. Luminant (2009a)
24 did include the milk pathway in the calculation of population dose based on an earlier
25 agricultural census.

26 Other parameters used as inputs to the GASPAR II program, including population data,
27 atmospheric dispersion factors, ground deposition factors, receptor locations, and consumption
28 factors, are found in Tables 5.4-3, 5.4-4, and 5.4-5 of the ER (Luminant 2009a). Gaseous
29 pathway doses to the MEI calculated by Luminant are found in Table 5.4-13 of the ER
30 (Luminant 2009a) and summarized in Table 5-15.

31 These doses include releases of radioactive material to the air from the plant vents and the
32 evaporation pond (see ER Table 5.4-7) (Luminant 2009a). These are bounding calculations
33 because the same radioactive materials in the liquid effluents cannot be released to both the
34 SCR and the atmosphere. The doses presented in Table 5-7 for the liquid pathways already
35 included all the radioactive material in the liquid release. The doses presented in Table 5-16
36 include some of the same radioactive material already addressed in Table 5-7.

37 The NRC staff recognizes the GASPAR II computer program as an appropriate tool for
38 calculating dose to the MEI and population from gaseous effluent releases. The NRC staff
39 reviewed the input parameters and values used by Luminant and concluded that the parameters
40 were appropriate. The NRC staff performed an independent evaluation of the gaseous pathway
41 doses and obtained similar results for the MEI. Further discussion of the NRC staff's
42 independent review is found in Appendix G.

Table 5-15. Annual Doses to MEI from Gaseous Effluent Releases from a New Unit^(a)

Pathway	Age Group	Annual Dose (mrem)			
		Total Body	Max. Organ (GI Tract)	Skin	Thyroid
Plume (0.37 mi SSE)	All	0.054	0.054	0.50	0.054
Ground (0.37 mi SSE)	All	0.12	0.12	0.15	0.12
Inhalation (0.79 mi SSW)	Adult	0.065	0.067	0.064	0.086
	Teen	0.065	0.067	0.065	0.076
	Child	0.058	0.058	0.057	0.071
	infant	0.033	0.033	0.033	0.045
Vegetation (0.79 mi SSW)	Adult	0.014	0.32	0.12	0.17
	Teen	0.017	0.39	0.15	0.20
	Child	0.029	0.44	0.26	0.36
Meat (0.79 mi SSW)	Adult	0.028	1.9	0.022	0.024
	Teen	0.019	1.2	0.015	0.016
	Child	0.029	0.74	0.022	0.024
Milk (0.79 mi SSW)	Adult	0.061	0.049	0.043	0.098
	Teen	0.081	0.068	0.061	0.15
	Child	0.13	0.11	0.11	0.28
	Infant	0.21	0.19	0.18	0.61

Source: ER Table 5.4-12 (Luminant 2009a, 2010g)

(a) Based on gaseous effluent release and one-half of liquid effluents being diverted to evaporation pond.

1

Table 5-16. Comparison of Annual MEI Dose for Single Unit with 10 CFR 50, Appendix I Dose Design Objectives

Pathway / Type of Dose	Luminant ^(a)	Appendix I Dose Design Objectives
Liquid Effluents		
Total Body	0.90 mrem/yr	3 mrem/yr
Maximum Organ	0.15 mrem/yr	10 mrem/yr
Gaseous Effluent (Noble Gases)		
Gamma Air	0.08 mrad/yr	10 mrad/yr
Beta Air	0.61 mrad/yr	20 mrad/yr
Total Body	0.05 mrem/yr	5 mrem/yr
Skin	0.50 mrem/yr	15 mrem/yr
Gaseous Effluent (Radioiodine and Particulates)		
Maximum Organ (Bone)	2.6 mrem/yr	15 mrem/yr

(a) Luminant (2009a, 2010g).

- 2 Luminant has opened SCR for recreational use (Luminant 2010d) and has evaluated the doses
3 from the gaseous effluent releases of the new units, including the emissions from the
4 evaporation pond, to members of the public using SCR for recreational activities (Luminant

1 2010g). Luminant evaluated gaseous pathways doses for recreational activities at a location
2 about 0.1 mi NNW of the proposed new units (0.41 mi NNW of the evaporation pond) and
3 added those doses to the plume, ground, and inhalation pathway doses estimated for the MEI.
4 The NRC staff performed an independent evaluation of these gaseous pathway doses and
5 obtained similar results. Further discussion of the NRC staff's independent review is found in
6 Appendix G. The doses presented in Table 5-15, 5-16, and 5-17 include the doses from
7 recreational use of SCR.

8 **5.9.3 Impacts to Members of the Public**

9 This section (1) compares the estimated doses from operation of CPNPP Units 3 and 4 to the
10 dose design criteria of Appendix I to 10 CFR Part 50, (2) compares the doses from CPNPP site
11 (Units 1, 2, 3, and 4) to the dose standards of 40 CFR Part 190, and (3) estimates the
12 population dose from operation of CPNPP Units 3 and 4.

13 **5.9.3.1 Maximally Exposed Individual**

14 Luminant states that total body and organ dose estimates to the MEI from liquid and gaseous
15 effluents for each new unit would be within the design objectives of 10 CFR Part 50, Appendix I.
16 Luminant determined the annual total body and maximum organ doses at SCR from liquid
17 effluents were well within the respective 3 mrem and 10 mrem Appendix I dose design
18 objectives. Annual doses at the exclusion area boundary from gaseous effluents were well
19 within the Appendix I dose design objectives of 10 mrad air dose from gamma radiation, 20
20 mrad air dose from beta radiation, 5 mrem to the total body, and 15 mrem to the skin. In
21 addition, the annual dose to bone was within the 15 mrem Appendix I dose design objective. A
22 comparison of dose estimates for each of two new units to the Appendix I design objectives is
23 found in Table 5-16.

24 Table 5-17 compares the combined dose estimates from direct radiation and gaseous and liquid
25 effluents from existing Units 1 and 2 and the proposed Units 3 and 4 against the 40 CFR Part
26 190 standards. Information for Units 1 and 2 presented in Table 5-17 was developed by the
27 NRC staff using the 2008 effluent monitoring report for Units 1 and 2 (Luminant 2009d, 2009f).
28 The table shows that the total doses to the MEI at the CPNPP site would be below the 40 CFR
29 Part 190 standards. As noted in Section 5.9.1, Luminant indicated no offsite dose contribution
30 from direct radiation from Units 3 and 4 and the ISFSI.

31 **5.9.3.2 Population Dose**

32 Luminant (2009a) estimates the annual collective total body dose within a 50-mi radius of the
33 CPNPP site to be 8.0 person-rem from the proposed Units 3 and 4 from gaseous and liquid
34 effluent pathways. The estimated annual collective dose to the same population from natural
35 background radiation is estimated to be 985,000 person-rem. The dose from natural
36 background radiation was calculated by multiplying the 50-mi population estimate for 2058 of
37 approximately 3,490,000 people by the annual U.S. average background dose of 311 mrem
38 (NCRP 2009).

39 Collective population doses from gaseous and liquid effluent pathways were estimated by
40 Luminant using GASPARI and LADTAP II computer codes, respectively. The NRC staff
41 performed an independent evaluation of population doses and obtained similar results (see
42 Appendix G).

Table 5-17. Comparison of MEI Annual Doses (mrem/yr) with 40 CFR Part 190 Standards

	CPNPP Units 1 and 2 ^(a)				CPNPP Units 3 and 4 ^(b)			Site Total	Regulatory Standard
	Liquid	Gaseous	Direct ^(c)	Total	Liquid	Gaseous	Total		
Total Body	0.087	0.088	0.13	0.31	1.8	1.6	3.4	3.7	25
Thyroid	0.13	0.41	0.13	0.67	0.3	2.1	2.4	3.1	75
Other ^(d)	<0.001	0.0028	0.13	0.13	2.6	5.1	7.7	7.8	25

(a) Liquid and gaseous dose values reported by Luminant (2009a, 2010b).

(b) Derived from ER Table 5.4-12 (Luminant 2009a).

(c) Direct radiation values from ER Section 5.4.1.3 (Luminant 2009g).

(d) The maximum organ dose was to the GI Tract.

1 Radiation protection experts assume that any amount of radiation may pose some risk of
2 causing cancer or a severe hereditary effect, and that the risk is higher for higher radiation
3 exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the
4 relationship between radiation dose and detriments such as cancer induction. A recent report
5 by the National Research Council (2006), the Biological Effects of Ionizing Radiation (BEIR) VII
6 report, uses the linear, no-threshold model as a basis for estimating the risks from low doses.
7 This approach is accepted by the NRC as a conservative method for estimating health risks
8 from radiation exposure, recognizing that the model may overestimate those risks. Based on
9 this method, the staff estimated the risk to the public from radiation exposure using the nominal
10 probability coefficient for total detriment. This coefficient has the value of 570 fatal cancers,
11 nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv),
12 equal to 0.00057 effects per person-rem. The coefficient is taken from International Commission
13 on Radiological Protection (ICRP) Publication 103 (ICRP 2007). The estimated annual
14 collective whole body dose to the population living within 50 mi of the proposed two new units at
15 CPNPP site is 8.0 person-rem, which is less than the 1754 person-rem value that ICRP and
16 National Council on Radiation Protection and Measurements (NCRP) suggests would most
17 likely result in zero excess health effects (NCRP 1995; ICRP 2007).

18 In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a
19 study and published in 1990 a report entitled, "Cancer in Populations Living Near Nuclear
20 Facilities," in 1990 (NCI 1990). This report included an evaluation of health statistics around all
21 nuclear power plants, as well as several other nuclear fuel cycle facilities, in operation in the
22 United States in 1981 and found "no evidence that an excess occurrence of cancer has resulted
23 from living near nuclear facilities" (NCI 1990).

24 **5.9.3.3 Summary of Radiological Impacts to Members of the Public**

25 The health impacts from routine gaseous and liquid radiological effluent releases from the two
26 proposed units have been calculated by both Luminant and NRC staff. Based on the
27 information provided by Luminant and NRC's evaluation, the NRC staff concludes there would
28 be no observable health impacts to the public from normal operation of the proposed units.
29 Therefore, the health impacts would be SMALL, and additional mitigation would not be
30 warranted.

1 **5.9.4 Occupational Doses to Workers**

2 Luminant (2009a) reported an annual average occupational dose of 73 person-rem per unit for
 3 existing CPNPP Units 1 and 2. Based on available data for the MHI US-APWR design, the
 4 projected annual occupational dose, including outages, is estimated to be 73 person-rem for
 5 each unit or 150 person-rem for both units (Luminant 2009a). The occupational doses for
 6 APWR designs are estimated to be less than the annual average occupational doses for current
 7 light-water reactors.

8 The licensee of a new plant would need to maintain individual doses to workers within 5 rem
 9 annually as specified in 10 CFR 20.1201 and incorporate provisions to maintain doses As Low
 10 As Reasonably Achievable (ALARA).

11 The NRC staff concludes that the health impacts from occupational radiation exposure would be
 12 SMALL based on individual worker doses being maintained within 10 CFR 20.1201 limits and
 13 collective occupational doses being typical of doses found in current operating light-water
 14 reactors. Additional mitigation would not be warranted because the operating plant would be
 15 required to maintain doses ALARA.

16 **5.9.5 Dose to Biota Other Than Humans**

17 Luminant (2009a) estimated doses to biota in the site environs; in many cases using surrogate
 18 species. Surrogate species used in the ER are well defined and provide an acceptable method
 19 for evaluating doses to biota (Soldat et al. 1974). Surrogate species analysis was performed for
 20 aquatic species such as fishes, invertebrates, and algae; and for terrestrial species such as
 21 muskrats, raccoons, herons, and ducks. Important biota species for the CPNPP site and the
 22 corresponding surrogate species are as follows: (1) pistol grip mussel – invertebrates, (2)
 23 channel catfish, largemouth bass, striped bass – fish, (3) white-tailed deer, turkey, rabbit,
 24 squirrel, and raccoon – raccoon and muskrat, (4) ducks (various species) – duck, and (5)
 25 sandpipers and heron – heron. Exposure pathways considered in evaluating dose to the biota
 26 were discussed in Section 5.9.1 and shown in Figure 5-3.

27 **5.9.5.1 Liquid Effluent Pathway**

28 Liquid effluents are released into the SCR; therefore, the highest concentration of radiological
 29 material would be in the SCR. Luminant (2009a) used the LADTAP II computer code to
 30 calculate doses to the biota from liquid effluent pathways. Liquid pathway doses were higher for
 31 biota compared to humans because of consideration of bioaccumulation of radionuclides,
 32 ingestion of aquatic plants, ingestion of invertebrates, and increased time spent in water and
 33 along the shoreline compared to humans. The liquid effluent releases used in estimating biota
 34 dose are found in Table 5.4-6 of the ER (Luminant 2009a). Table 5-18 presents Luminant's
 35 estimates of the doses to biota from liquid and gaseous pathway from proposed Units 3 and 4.
 36 As discussed in Appendix G, the NRC staff obtained similar results in confirmatory calculations
 37 for the liquid pathway.

38 **5.9.5.2 Gaseous Effluent Pathway**

39 Gaseous effluents would contribute to the total body dose of the terrestrial surrogate species
 40 (i.e., muskrat, raccoon, heron, and duck). The exposure pathways include inhalation of airborne
 41 radionuclides, external exposure because of immersion in gaseous effluent plumes, and surface
 42 exposure from deposition of iodine and particulates from gaseous effluents (Figure 5-3). The
 43 dose calculated to the MEI from gaseous effluent releases in Table 5-19 would also be
 44 applicable to terrestrial surrogate species with two modifications. One modification defined in
 45 Luminant was increasing the ground deposition parameter by a factor of two as terrestrial

1

Table 5-18. Biota Annual Doses for Proposed Units 3 and 4

Luminant's Annual Absorbed Dose Estimate (mrad)			
Biota	Liquid Pathway^(a)	Gaseous Pathway^(b)	Total
Fish	19.0	NA	19.0
Invertebrate	32.0	NA	32.0
Algae	41.0	NA	41.0
Muskrat	67.0	2.6	70.0
Raccoon	20.3	1.8	22.0
Heron	200.0	1.7	202.0
Duck	68.0	2.4	70.0

(a) ER Table 5.4-21 (Luminant 2009a).

(b) ER Table 5.4-22 (Luminant 2009a).

2

Table 5-19. Comparison of Biota Doses from the Proposed Units 3 and 4 at the CPNPP Site to Relevant Guidelines for Biota Protection

Absorbed Dose Rate (mrad/d)		
Biota	Luminant Estimate^(a)	IAEA/NCRP Guidelines^(b)
Fish	0.052	1000
Invertebrates	0.088	1000
Algae	0.11	1000
Muskrat	0.19	100
Raccoon	0.060	100
Heron	0.55	100
Duck	0.19	100

(a) ER Tables 5.4-21 and 5.4-22 (Luminant 2009a).

(b) Published guidelines reported in mGy/d (1 mGy equals 100 mrad).

3 animals would be closer to the ground than the MEI. The second modification was to assume
 4 no vegetation intake pathway for muskrat and heron because they are not known to consume
 5 vegetation. The gaseous effluent releases used in estimating dose are found in Table 5.4-7 of
 6 the ER (Luminant 2009a). The ER used doses at the EAB (0.37 mi NNW) in estimating
 7 terrestrial species doses. Luminant's dose estimates to the surrogate species from gaseous
 8 and liquid pathways are shown in Table 5-19. As discussed in Appendix G, the NRC staff
 9 reviewed Luminant's estimates and concluded that they are reasonable.

10 5.9.5.3 Impact of Estimated Non-Human Biota Doses

11 Radiation doses to non-human biota are evaluated using the absorbed dose (mrad) because
 12 dose equivalent (mrem) only applies to humans. The biota dose estimates for the new units are
 13 conservative because they are based on the maximum exposure conditions.

1 The ICRP (1977, 1991, 2007) states that if humans are adequately protected, other living things
2 are also likely to be sufficiently protected. The International Atomic Energy Agency (IAEA 1992)
3 and the NCRP (1991) reported that a chronic absorbed dose rate of no greater than 1000
4 mrad/d to the MEI in a population of aquatic organisms would ensure protection of the
5 population. IAEA (1992) also concluded that a chronic absorbed dose rate of 100 mrad/d or
6 less does not appear to cause observable changes in terrestrial animal populations. Table 5-19
7 compares Luminant's estimated total body dose to the biota from the proposed Units 3 and 4 to
8 the IAEA chronic dose rate values for aquatic and terrestrial biota. The dose rates are far less
9 than the NCRP and IAEA guidelines.

10 Based on the information provided by Luminant and NRC's review, the NRC staff concludes that
11 the radiological impact on biota from the routine operation of the proposed Units 3 and 4 at the
12 CPNPP site would be SMALL, and additional mitigation would not be warranted.

13 **5.9.6 Radiological Monitoring**

14 A radiological environmental monitoring program (REMP) has been in place for the CPNPP site
15 since 1981 to include preoperational sample collection began before the construction and
16 operation of CPNPP Units 1 and 2 (Luminant 2009a). The REMP includes monitoring of the
17 airborne exposure pathway, direct exposure pathway, water exposure pathway, aquatic
18 exposure pathway from the SCR, and the ingestion exposure pathway within a 5-mi-radius of
19 the station, with indicator locations near the plant perimeter and control locations at distances
20 greater than 10 mi. Milk is not currently sampled because there is no known production within 5
21 mi of the site. An annual land use census is conducted for the area surrounding the site to
22 verify the accuracy of assumptions used in the analyses, including the occurrence of milk
23 production. The preoperational REMP sampled various media in the environment to determine
24 a baseline from which to observe the magnitude and fluctuation of radioactivity in the
25 environment once the units began operation. The preoperational program included collection
26 and analysis of samples of air particulates, precipitation, crops, soil, well water, surface water,
27 fish, and silt as well as measurement of ambient gamma radiation. After operation of CPNPP
28 Unit 1 began in April 1990 (Unit 2 in 1993), the monitoring program continued to assess the
29 radiological impacts on the public and the environment. Radiological releases and the results of
30 the REMP are summarized in the two annual reports: the Annual Radiological Environmental
31 Operating Report (Luminant 2009f) and Annual Radioactive Effluent Release Report (Luminant
32 2009d). No additional monitoring program has been established for the new units. To the
33 greatest extent practical, REMP for the COL program would use the procedures and sampling
34 locations used by the existing CPNPP site. The NRC staff reviewed the documentation for the
35 existing REMP, the Offsite Dose Calculation Manual, and recent monitoring reports from
36 Luminant, and determined that the current operational monitoring program is adequate to
37 establish the radiological baseline for comparisons with the expected impacts on the
38 environment related to the construction and operation of the proposed new units at the CPNPP
39 site.

40 The year 2008 monitoring data for the waters of the SCR shows a tritium concentration ranging
41 from 11,800 to 14,300 picocuries per liter (pCi/L) (Luminant 2009d). The trend in the SCR tritium
42 levels indicates that SCR is in equilibrium with the tritium release rate of the existing CPNPP
43 Units 1 and 2. The equilibrium value is less than Luminant's administrative action level of
44 30,000 pCi/L. The tritium content of SCR is the only consistent detectable indicator of CPNPP
45 operations found in the site environment.

5.10 Nonradioactive Waste Impacts

This section describes the potential impacts to the environment that could result from the generation, handling, and disposal of nonradioactive waste and mixed waste during the operation of proposed Units 3 and 4 at the CPNPP site.

Section 3.4.4 describes the nonradioactive waste systems for CPNPP Units 3 and 4. The potential types of nonradioactive waste that would be generated, handled, and disposed of during operational activities at proposed Units 3 and 4 include solid wastes, liquid effluents, and air emissions. Solid wastes include municipal waste, sewage treatment sludge, and industrial wastes. Liquid waste includes TPDES-permitted discharges such as effluents containing chemicals or biocides, wastewater effluents, site stormwater runoff, and other liquid wastes such as used oils, paints, and solvents that require offsite disposal. Air emissions would primarily be generated by vehicles, diesel generators, and combustion generators. The assessment of potential impacts resulting from these types of wastes is presented in the following sections.

5.10.1 Impacts to Land

Operation of proposed Units 3 and 4 would generate solid and liquid wastes similar to those already generated by current operations of CPNPP Units 1 and 2. These wastes would consist of typical industrial wastes (metal, wood, and paper), as well as process wastes such as nonradioactive resins, filters, and sludge. The principal hazardous waste generated is expected to be Freon-contaminated waste oil. Petroleum wastes may include fuels such as gasoline and diesel oil along with used oil and greases from equipment maintenance (Luminant 2009a).

Operation of Units 3 and 4 would generate one type of waste not associated with Units 1 and 2: salt wastes from the BDTF. Between 195,610 tons and 519,375 tons of salt would be removed from the BDTF evaporation ponds each year for disposal in licensed industrial landfills. The impacts of this waste stream are discussed in Section 5.1.1 of this EIS.

Non-hazardous solid wastes resulting from operations of Units 3 and 4 would be collected at the site by private, municipal, or county solid waste transporters for disposal in a landfill licensed by the TCEQ. Based on information regarding the capacity of non-hazardous solid waste landfills in the region (TCEQ 2008), disposal of the wastes from Units 3 and 4 would result in the conversion of additional land for waste disposal use. Water treatment and purification waste reverse-osmosis filters would be containerized before disposal at a non-hazardous waste landfill. It is expected that used liquid petroleum materials will be recycled for fuel blending, while petroleum residue wastes (such as oil rags) will be disposed of at an off-site industrial waste facility licensed by TCEQ (Luminant 2009a).

Hazardous wastes generated by the operation of Units 3 and 4 would be collected and stored on-site in the same enclosed hazardous-waste storage building currently serving Units 1 and 2. These wastes would be removed from the storage building within 90 days of generation, manifested, and transported for disposal at an off-site, RCRA-permitted Treatment, Storage, and Disposal Facility. Luminant expects that operations at Units 3 and 4 will generate about the same amount of hazardous waste as current operations at Units 1 and 2, which is less than 220 pounds per month. With this additional amount, the CPNPP site would continue to be classified as a Small Quantity Generator of hazardous waste under TCEQ criteria (Luminant 2009a).

Current operations on the CPNPP site follow a waste minimization plan that has proved successful in significantly reducing the amount of hazardous and non-hazardous waste. The Applicant proposes to apply this plan to operations at Units 3 and 4. The Applicant also intends

1 to train operations employees in chemical awareness and in the appropriate implementation of
2 waste-handling procedures and regulations (Luminant 2009a).

3 Based on the effective practices for recycling and minimizing waste already in place for CPNPP
4 Units 1 and 2 and the plans to manage solid and liquid wastes in a similar manner in
5 accordance with all applicable Federal, State, and local requirements and standards, the review
6 team expects that impacts to land from nonradioactive wastes generated during the operation of
7 proposed Units 3 and 4 would be minimal, and no further mitigation would be warranted.

8 **5.10.2 Impacts to Water**

9 Operation of proposed CPNPP Units 3 and 4 would result in discharge to surface water of
10 effluents containing various chemical and biological constituents.

11 Treated sanitary wastewater effluent, site stormwater runoff, and effluents from nonradioactive
12 floor drains would be discharged to SCR. As discussed in Section 5.2.3.1, nonradioactive
13 wastewater streams from the CPNPP Units 3 and 4 would include cooling tower blowdown,
14 auxiliary boiler blowdown, water treatment waste, floor and equipment drains, and
15 nonradioactive laboratory waste.

16 The new sanitary wastewater treatment plant that would be installed as part of the Units 3 and 4
17 construction project would treat sanitary wastewater and effluents from floor and equipment
18 drains, laboratories, and sanitary waste. The treated effluent would be discharged to SCR.
19 SCR would also receive uncontaminated site stormwater runoff. As discussed in Section
20 5.2.3.1, discharges to SCR would be required to comply with water quality limitations specified
21 in a TPDES discharge permit, and impacts to SCR would be minor.

22 Effluents from cooling systems and the BDTF would be directed to Lake Granbury. Potential
23 surface water impacts to Lake Granbury are discussed in Section 5.2.3.1. Based on the TPDES
24 permit conditions, operation of the BDTF to reduce the concentrations of dissolved substances,
25 surface water quality impacts to Lake Granbury and the Brazos River would be minor.

26 As discussed in Section 5.2.3.2, potential impacts to groundwater are minor and no mitigation
27 would be warranted.

28 Based on the regulated practices for managing liquid discharges containing chemicals or
29 biocide, and other wastewater, and the plans for managing stormwater, the review team expects
30 that impacts to water from nonradioactive effluents during the operation of Units 3 and 4 would
31 be minimal, and no further mitigation would be warranted.

32 **5.10.3 Impacts to Air**

33 Operation of proposed Units 3 and 4 would result in gaseous emissions from the intermittent
34 operation of gas turbine generators, auxiliary boilers, and diesel fire pumps. In addition,
35 increased vehicular traffic associated with personnel necessary to operate Units 3 and 4 would
36 increase vehicle emissions in the area. Impacts to air quality are discussed in detail in
37 Section 5.7. Increases in air emissions from operation of Units 3 and 4 would be in accordance
38 with permits issued by TCEQ that would ensure compliance with the Federal Clean Air Act.

39 Based on the regulated practices for managing air emissions from stationary sources, the
40 review team expects that impacts to air from nonradioactive emissions during the operation of
41 proposed Units 3 and 4 would be minimal, and no further mitigation would be warranted.

1 **5.10.4 Mixed Waste Impacts**

2 Mixed waste contains both low-level radioactive waste and hazardous waste. The generation,
3 storage, treatment, or disposal of mixed waste is regulated by Atomic Energy Act of 1954, the
4 Solid Waste Disposal Act of 1965, as amended by the Resource, Conservation, and Recovery
5 Act (RCRA) in 1976, and the Hazardous and Solid Waste Amendments (which amended RCRA
6 in 1984). The EPA Mixed Waste Rule finalized on May 16, 2001 provides increased flexibility to
7 generators and facilities that manage low-level mixed waste (LLMW). Luminant has put in place
8 programs to minimize the generation of mixed waste; the two new units are expected to produce
9 on the order of 1 m³ per year of mixed waste. Mixed waste from the existing CPNPP Units 1 and
10 2 is maintained in a designated storage area and is monitored on a regular inspection schedule
11 (Luminant 2009a). Mixed waste can be reduced through decay, stabilization, neutralization, or
12 filtration. Mixed waste may be shipped to an approved offsite treatment or disposal facility,
13 using a licensed hazardous/mixed waste carrier.

14 Based on the effective practices for minimizing waste already in place for CPNPP Units 1 and 2,
15 and the plans to manage mixed wastes in a similar manner in accordance with all applicable
16 Federal, State, and local requirements and standards, the review team expects that impacts
17 from the generation of mixed waste at CPNPP Units 3 and 4 would be minimal, and no further
18 mitigation would be warranted.

19 **5.10.5 Summary of Waste Impacts**

20 Solid, liquid, gaseous, and mixed wastes generated during operation of proposed Units 3 and 4
21 would be handled according to county, State, and Federal regulations. County and State
22 permits and regulations for handling and disposal of solid waste. Wastewater discharge would
23 be compliant with TPDES limitations. Air emissions from Units 3 and 4 operations would be
24 compliant with air quality standards as permitted by TCEQ. Mixed waste generation, storage,
25 and disposal impacts during operation of proposed Units 3 and 4 would be compliant with
26 requirements and standards.

27 Based on the information provided by Luminant, the effective practices for recycling, minimizing,
28 managing, and disposing of wastes already in use at the CPNPP site, the review team's
29 expectation that regulatory approvals would be obtained to regulate the additional waste that
30 would be generated from proposed Units 3 and 4, and the review team's independent
31 evaluation, the review team concludes that the potential impacts from nonradioactive waste
32 resulting from the operation of the proposed two additional units at the CPNPP site would be
33 SMALL, and mitigation would not be warranted.

34 Cumulative impacts to water and air from nonradioactive emissions and effluents are discussed
35 in Sections 7.2 and 7.6, respectively. For the purposes of Chapter 9 (alternatives), the review
36 team expects that there would be no substantive differences between the impacts of
37 nonradioactive waste for the CPNPP site and the alternative sites and no substantive
38 cumulative impacts that warrant further discussion beyond those discussed for the alternative
39 sites in Section 9.3.

40 **5.11 Environmental Impacts of Postulated Accidents**

41 The staff considered the radiological consequences on the environment of potential accidents at
42 the proposed new units at the CPNPP site. Consequence estimates are based on the MHI US-
43 APWR standard design, which is being evaluated for design certification by the NRC staff. The
44 term "accident," as used in this section, refers to any off-normal event not addressed in
45 Section 5.9 that results in release of radioactive materials into the environment. The focus of

1 this review is on events that could lead to releases substantially in excess of permissible limits
2 for normal operations. Normal release limits are specified in 10 CFR Part 20, Appendix B,
3 Table 2.

4 Numerous features combine to reduce the risk associated with accidents at nuclear power
5 plants. Safety features in the design, construction, and operation of the plants, which comprise
6 the first line of defense, are intended to prevent the release of radioactive materials from the
7 plant. The design objectives and the measures for keeping levels of radioactive materials in
8 effluents to unrestricted areas ALARA are specified in 10 CFR Part 50, Appendix I. There are
9 additional measures that are designed to mitigate the consequences of failures in the first line of
10 defense. These include the NRC's reactor siting criteria in 10 CFR Part 100, which require the
11 site to have certain characteristics that reduce the risk to the public and the potential impacts of
12 an accident, and emergency preparedness plans and protective action measures for the site
13 and environs, as set forth in 10 CFR 50.47, 10 CFR Part 50, Appendix E, and
14 NUREG-0654/FEMA-REP-1 (NRC 1980). All of these safety features, measures, and plans
15 make up the defense-in-depth philosophy to protect the health and safety of the public and the
16 environment.

17 This section discusses (1) the types of radioactive materials; (2) the potential paths for their
18 release to the environment; (3) the relationship between radiation dose and health effects; and
19 (4) the environmental impacts of reactor accidents, both design-basis accidents (DBA) and
20 severe accidents. The environmental impacts of accidents during transportation of spent fuel
21 are discussed in Chapter 6.

22 The potential for dispersion of radioactive materials in the environment depends on the
23 mechanical forces that physically transport the materials and on the physical and chemical
24 forms of the material. Radioactive material exists in a variety of physical and chemical forms.
25 The majority of the material in the fuel is in the form of nonvolatile solids. However, after
26 operation, a significant fraction of the material is in the form of volatile solids or gases. The
27 gaseous radioactive materials include the chemically inert noble gases (e.g., krypton and
28 xenon), which have a high potential for release. Radioactive forms of iodine, which are created
29 in substantial quantities in the fuel by fission, are volatile. Other radioactive materials formed
30 during the operation of a nuclear power plant have lower volatilities and, therefore, have lower
31 tendencies to escape from the fuel than the noble gases and iodines.

32 Radiation exposure to individuals is determined by their proximity to radioactive material, the
33 duration of their exposure, and the extent to which they are shielded from the radiation.
34 Pathways that lead to radiation exposure include (1) external radiation from radioactive material
35 in the air, on the ground, and in the water; (2) inhalation of radioactive material; and
36 (3) ingestion of food or water containing material initially deposited on the ground and in water.

37 Radiation protection experts conservatively assume that any amount of radiation exposure may
38 pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for
39 higher radiation exposures. Therefore, a linear, no-threshold response relationship is used to
40 describe the relationship between radiation dose and detriments such as cancer induction. A
41 recent report by the National Research Council (2006), the BEIR VII report, uses the linear, no-
42 threshold dose response model as a basis for estimating the risks from low doses. This
43 approach is accepted by the NRC as a conservative method for estimating health risks from
44 radiation exposure, recognizing that the model probably overestimates those risks.

45 Physiological effects are clinically detectable should individuals receive radiation exposure
46 resulting in a dose greater than about 25 rem over a short period of time (hours). Untreated
47 doses of about 250 to 500 rem received over a relatively short period (hours to a few days) can
48 be expected to cause some fatalities.

1 5.11.1 Design Basis Accidents

2 Luminant evaluated the potential consequences of postulated accidents to demonstrate that two
 3 US-APWRs could be constructed and operated at the CPNPP site without undue risk to the
 4 health and safety of the public (Luminant 2009a). These evaluations used the US-APWR
 5 reactor design being considered for the CPNPP site and site-specific meteorological data. The
 6 set of accidents covers events that range from relatively high probability of occurrence with
 7 relatively low consequences to relatively low probability with high consequences.

8 The bases for analyses of postulated accidents for this design are well established because the
 9 reactors are pressurized water type reactors that are being reviewed in the NRC's reactor
 10 design certification process. Potential consequences of DBAs are evaluated following
 11 procedures outlined in regulatory guides and standard review plans. The potential
 12 consequences of accidental releases depend on the specific radionuclides released, the amount
 13 of each radionuclide released, and the meteorological conditions. The source terms for the US-
 14 APWR and methods for evaluating potential accidents are based on guidance in Regulatory
 15 Guide 1.183 (NRC 2000a).

16 For environmental reviews, consequences are evaluated assuming realistic meteorological
 17 conditions. Meteorological conditions are represented in these consequence analyses by an
 18 atmospheric dispersion factor, which is also referred to as relative concentration (χ/Q), which
 19 has units of s/m^3 . Small χ/Q values are associated with greater dilution capability. Acceptable
 20 methods of calculating χ/Q for DBAs from meteorological data are set forth in Regulatory
 21 Guide 1.145 (NRC 1983).

22 5-20 lists χ/Q values pertinent to the environmental review of DBAs for the CPNPP site
 23 (Luminant 2009a). The first column lists the time periods and boundaries for which χ/Q and
 24 dose estimates are needed. For the exclusion area boundary, the postulated DBA dose and its
 25 atmospheric dispersion factor are calculated for a short-term (i.e., 2 hours); for the low-
 26 population zone, they are calculated for the course of the accident in four time increments
 27 totaling 30 days (720 hours). The second column in Table 5-20 lists the χ/Q values presented
 28 in Table 7.1-11 of Luminant's ER. Luminant calculated the χ/Q values listed in Table 5-20 using
 29 six years of onsite meteorological data (2001 to 2006) for the CPNPP site, assuming that the
 30 release point was located at ground level.

Table 5-20. Atmospheric Dispersion Factors for Comanche Peak Site
DBA Calculations

Time Period and Boundary	χ/Q (s/m^3)
0 to 2 hr, or worst 2 hr period Exclusion Area Boundary	5.75×10^{-5}
0 to 8 hr, Low Population Zone	3.32×10^{-6}
8 to 24 hr, Low Population Zone	2.75×10^{-6}
1 to 4 d, Low Population Zone	1.83×10^{-6}
4 to 30 d, Low Population Zone	1.01×10^{-6}

31 The staff reviewed the meteorological data used by Luminant and the Luminant atmospheric
 32 dispersion factors. Based on these reviews, the staff concludes that the atmospheric dispersion
 33 factors for the CPNPP site are acceptable for use in evaluating potential environmental
 34 consequences of postulated DBAs for the US-APWR design at the CPNPP site.

1 Table 5-21 lists the set of DBAs considered by Luminant and presents estimates of the
 2 environmental consequences of each accident in terms of total effective dose equivalent
 3 (TEDE). In these analyses, TEDE is the sum of the committed effective dose equivalent from
 4 inhalation and the effective dose equivalent from external exposure. Dose conversion factors
 5 from Federal Guidance Report 11 (Eckerman et al. 1988) were used to calculate the committed
 6 effective dose equivalent. Similarly, dose conversion factors from Federal Guidance Report 12
 7 (Eckerman and Ryman 1993) were used to calculate the effective dose equivalent.

Table 5-21. DBA Doses for a US-APWR for Proposed CPNPP Units 3 and 4

Accident	Standard Review Plan Section ^(b)	TEDE in rem ^(a)		
		EAB ^(c)	LPZ ^(d)	Review Criterion
Main steam line break	15.1.5			
Pre-existing iodine spike		3×10^{-2}	1×10^{-2}	$2.5 \times 10^{+1(e)}$
Accident-initiated iodine spike		4×10^{-2}	1×10^{-2}	$2.5 \times 10^{+0(f)}$
Steam generator rupture	15.6.3			
Pre-existing iodine spike		4.2×10^{-1}	3×10^{-2}	$2.5 \times 10^{+1(e)}$
Accident-initiated iodine spike		1.1×10^{-1}	1×10^{-2}	$2.5 \times 10^{+0(f)}$
Loss-of-coolant accident	15.6.5	1.5×10^0	2.6×10^{-1}	$2.5 \times 10^{+1(e)}$
Rod ejection	15.4.8	5.9×10^{-1}	9.0×10^{-2}	$6.25 \times 10^{+0(f)}$
Reactor coolant pump rotor seizure (locked rotor)	15.3.3	6×10^{-2}	2×10^{-2}	$2.5 \times 10^{+0(f)}$
Failure of small lines carrying primary coolant outside containment	15.6.2	1.8×10^{-1}	1×10^{-2}	$2.5 \times 10^{+0(f)}$
Fuel handling	15.7.4	3.84×10^{-1}	3×10^{-2}	$6.25 \times 10^{+0(f)}$

(a) To convert rem to Sv, divide by 100.

(b) NUREG-0800 (NRC 2007).

(c) Exclusion area boundary.

(d) Low population zone.

(e) 10 CFR 52.79(a)(1) and 10 CFR 100.21 criteria.

(f) Standard Review Plan criterion.

8 The staff reviewed Luminant's selection of DBAs by comparing the accidents listed in the
 9 application with the DBAs considered in the US-APWR Design Control Document (MHI 2009)
 10 and the pressurized water reactor (PWR) DBAs listed in NUREG-0800 (NRC 2007) and
 11 NUREG-1555 (NRC 2000b). The DBAs in the ER are the same as those considered in the
 12 design certification; therefore, the staff concludes that the set of DBAs is appropriate. In
 13 addition, the staff reviewed the calculation of the site-specific consequences of the DBAs and
 14 found the results of the calculations to be reasonable for use in its evaluation of environmental
 15 consequences of DBAs.

16 There are no environmental criteria related to the potential consequences of DBAs.
 17 Consequently, the review criteria used in the staff's safety review of DBA doses are included in

1 Table 5-21 to illustrate the magnitude of the calculated environmental consequences (TEDE
2 doses). In all cases, the calculated TEDE values are considerably smaller than the TEDE
3 doses used as safety review criteria.

4 *Summary of DBA Impacts.* The NRC staff reviewed the Luminant DBA analysis in the ER,
5 which is based on analyses performed for design certification of the US-APWR design with
6 adjustment for CPNPP site-specific characteristics. The results of the Luminant analyses
7 indicate that the environmental risks associated with DBAs if two US-APWRs were to be located
8 at the CPNPP site would be small. The NRC staff performed an independent assessment of the
9 environmental consequences of DBAs at the CPNPP site and concludes that the environmental
10 consequences of DBAs if two US-APWRs were to be located at the CPNPP site would be
11 SMALL.

12 **5.11.2 Severe Accidents**

13 In its ER (Luminant 2009a), Luminant considers the potential consequences of severe accidents
14 for a US-APWR at the CPNPP site. Three pathways are considered: (1) the atmospheric
15 pathway, in which radioactive material is released to the air; (2) the surface-water pathway, in
16 which airborne radioactive material falls out on open bodies of water; and (3) the groundwater
17 pathway, in which groundwater is contaminated by a basemat melt-through with subsequent
18 contamination of surface water by the groundwater.

19 Luminant bases its evaluation of the potential environmental consequences for the atmospheric
20 and surface water ingestion pathways on the results of the MACCS2 computer code
21 (Chanin et al. 1990; Jow et al. 1990) run using US-APWR source term information and site-
22 specific meteorological, population, and land-use data. The NRC staff has reviewed Luminant's
23 input and output files, has run confirmatory calculations, and finds the Luminant results
24 reasonable.

25 The MACCS computer code was developed to evaluate the potential offsite consequences of
26 severe accidents for the sites covered by NUREG-1150 (NRC 1990). MACCS2 (Chanin and
27 Young 1998) is the current version of MACCS. The MACCS and MACCS2 codes evaluate the
28 consequences of atmospheric releases of material following a severe accident. The pathways
29 modeled include exposure to the passing plume, exposure to material deposited on the ground
30 and skin, inhalation of material in the passing plume and resuspended from the ground, and
31 ingestion of contaminated food and surface water.

32 Three types of severe accident consequences were assessed: (1) human health, (2) economic
33 costs, and (3) land area affected by contamination. Human health effects are expressed in
34 terms of the number of cancers that might be expected if a severe accident were to occur.
35 These effects are directly related to the cumulative radiation dose received by the general
36 population. MACCS2 estimates both early cancer fatalities and latent fatalities. Early fatalities
37 are related to high doses or dose rates and can be expected to occur within a year of exposure
38 (Jow et al. 1990). Latent fatalities are related to exposure of a large number of people to low
39 doses and dose rates and can be expected to occur after a latent period of several (2 to 15)
40 years. Population health-risk estimates are based on the population distribution within a 50-mi
41 radius of the site. Economic costs of a severe accident include the costs associated with short-
42 term relocation of people; decontamination of property and equipment; interdiction of food
43 supplies, land, and equipment use; and condemnation of property. The affected land area is a
44 measure of the areal extent of the residual contamination following a severe accident.
45 Farmland decontamination is an estimate of the area that has an average whole body dose rate
46 for the 4-yr period following the release that would be greater than 0.005 Sv/yr if not reduced by

1 decontamination and that would have a dose rate following decontamination of less than
2 0.005 Sv/yr. Decontaminated land is not necessarily suitable for farming.

3 Risk is the product of the frequency and the consequences of an accident. For example, the
4 probability of a severe accident (also called core damage frequency [CDF]) without loss of
5 containment for a US-APWR is estimated to be 1.1×10^{-6} per reactor year (Ryr) for internal
6 events. The cumulative population dose associated with a severe accident without loss of
7 containment at the CPNPP site is calculated to be 9 person-Sv. The population dose risk for
8 this release class is the product of 1.1×10^{-6} Ryr⁻¹ and 9 person-Sv, which equals 1.1×10^{-5}
9 person-Sv Ryr⁻¹.

10 The following sections discuss the estimated risks associated with each pathway. The risks
11 presented in Tables 5-22 through 5-23 are risks per year of reactor operation. Luminant plans to
12 build two US-APWR reactors on the CPNPP site. The consequences of a severe accident
13 would be the same regardless of whether one or two US-APWR reactors were built at the
14 CPNPP site. However, if two reactors were built, the risks would apply to each reactor, and the
15 total risk for the two new reactors at the site would be double the risk for a single reactor.

16 **5.11.2.1 Air Pathway**

17 The MACCS2 code directly estimates consequences associated with releases to the air
18 pathway. Luminant used the MACCS2 code to estimate consequences to the population in
19 2056 based on meteorological data for 2001, 2003 and 2006. The results of the MACCS2 runs
20 (Luminant 2009a) based on 2006 meteorological data are presented in Table 5-23. These
21 values are based on 2006 meteorological data, and have the highest dose risk for the three
22 years of meteorological data. The CDFs given in these tables include internally initiated
23 accident sequences while the plant is at power. Internally initiated accident sequences include
24 sequences that are initiated by human error, equipment failures, loss of offsite power, etc. The
25 health effects resulting from internal fire, internal flood, and low-power and shutdown events
26 were determined using the ratio of the CDF values for these events and the CDF value for the
27 internal events. Core damage frequencies for other at power events, including tornadoes,
28 hurricanes, and external floods were evaluated by Luminant on a plant-specific basis and
29 determined to be negligible (Luminant 2009a). The total CDF for events occurring while the
30 reactor is at low power or shutdown is estimated to be about an order of magnitude less than
31 the total CDF at power (Luminant 2009a). Table 5-24 shows the total health effects for internal
32 events, internal flood events, fire events, and low power and shutdown events

33 In Table 5-24, the health risks estimated for a US-APWR for 2006 meteorological data, at the
34 CPNPP site, are compared with health-risk estimates for the five reactors considered in
35 NUREG-1150 (NRC 1990). Although risks associated with both internally and externally
36 initiated events were considered for the Peach Bottom and Surry reactors in NUREG-1150, only
37 risks associated with internally initiated events are presented in Table 5-23. The health risks
38 shown for a US-APWR at the CPNPP site exclude external events as these were shown to be
39 negligible compared to internal events (Luminant 2009a). Even with the addition of the
40 externally initiated events for a US-APWR reactor the resulting health risks for Comanche Peak
41 are significantly lower than the risks associated with current-generation reactors presented in
42 NUREG-1150.

Table 5-22. Environmental Risks from a US APWR Severe Accident at the Comanche Peak Site (2006 Meteorological data)

Release Category (Accident Class)	Description ^(b)	Environmental Risk ^(a)						
		Core Damage Frequency (Ryr ⁻¹) ^(a)	Population Dose (person-Sv Ryr ⁻¹) ^(c)	Fatalities Early ^(d)	Fatalities Latent ^(e)	Cost ^(f) (\$ Ryr ⁻¹)	Farm Land Decontamination ^(g) (ha Ryr ⁻¹)	Population Dose from Water Ingestion (person Sv Ryr ⁻¹) ^(c)
RC1	Containment bypass which includes both core damage after steam generator tube rupture (SGTR) and thermal induced SGTR after core damage	7.5 x 10 ⁻⁹	2.9 x 10 ⁻⁴	2.0 x 10 ⁻⁰⁹	2.0x 10 ⁻⁵	99	1.5 x 10 ⁻¹¹	1.9 x 10 ⁻⁵
RC2	Containment isolation failure	2.1 x 10 ⁻⁹	6.1 x 10 ⁻⁵	2.5 x 10 ⁻¹⁰	4.4 x 10 ⁻⁶	17	1.5 x 10 ⁻¹²	1.3 x 10 ⁻⁶
RC3	Containment overpressure failure before core damage due to loss of heat removal	2.0 x 10 ⁻⁸	9.0 x 10 ⁻⁴	6.5 x 10 ⁻⁸	1.3 x 10 ⁻⁴	338	1.1 x 10 ⁻¹⁰	1.2 x 10 ⁻⁴
RC4	Early containment failure due to dynamic loads which includes hydrogen combustion before or just after reactor vessel failure, in-vessel and ex-vessel steam explosion, rocket-mode reactor vessel failure, and direct containment heating	1.1 x 10 ⁻⁸	2.7 x 10 ⁻⁴	4.7 x 10 ⁻¹⁰	1.6 x 10 ⁻⁵	57	2.7 x 10 ⁻¹¹	6.9 x 10 ⁻⁶
RC5	Late containment failure which includes containment overpressure failure after core damage, hydrogen combustion long after reactor vessel failure, and basemat melt through	6.5 x 10 ⁻⁸	1.5 x 10 ⁻³	0.0 x 10 ⁻⁰	7.1 x 10 ⁻⁵	195	1.1 x 10 ⁻⁹	1.5 x 10 ⁻⁵
RC6	Intact containment in which fission products are released at design leak rate	1.1 x 10 ⁻⁶	1.0 x 10 ⁻⁵	0.0 x 10 ⁻⁰	5.3 x 10 ⁻⁷	8	8.5 x 10 ⁻¹²	2.4 x 10 ⁻⁸
	Total	1.2 x 10 ⁻⁶	3.0 x 10 ⁻³	6.8 x 10 ⁻⁸	2.4 x 10 ⁻⁴	714	3.2 x 10 ⁻⁸	1.6 x 10 ⁻⁴

(a) All values in the table are based on data supplied by Luminant (2009b).

(b) Release categories contributing less than 1 percent of the risk in all categories are not shown. Totals include all release categories. In all cases, the risks shown exceed 98 percent of the total risk.

(c) To convert person-Sv to person-rem, multiply by 100.

(d) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).

(e) Latent fatalities are fatalities related to low doses or dose rates that can be expected to occur after a latent period of several (2 to 15) years.

(f) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).

(g) Land risk is area where the average whole body dose rate for the 4-yr period following the accident exceeds 0.005 Sv/yr but can be reduced to less than 0.005 Sv/yr by decontamination.

(h) MCC1 – molten corium-to-concrete interaction.

Table 5-23. Total Severe Accident Health Effects (based on 2006 Meteorological data)

Accident Type	Core Damage Frequency (per Ryr ⁻¹)	Scaling Factor	Dose-Risk (person-Sv Ryr ⁻¹)	Number of Early Fatalities (Ryr ⁻¹)	Number of Latent Fatalities (Ryr ⁻¹)	Water Ingestion Pathway (person-Sv Ryr ⁻¹)
Internal Events	1.2 x 10 ⁻⁶	1	3.0 x 10 ⁻³	6.7 x 10 ⁻⁸	2.4 x 10 ⁻⁴	1.6 x 10 ⁻⁴
Internal Fire	1.8 x 10 ⁻⁶	1.50	4.5 x 10 ⁻³	1.0 x 10 ⁻⁷	3.6 x 10 ⁻⁴	2.5 x 10 ⁻⁴
Internal Flood	1.4 x 10 ⁻⁶	1.17	3.5 x 10 ⁻³	7.9 x 10 ⁻⁸	2.8 x 10 ⁻⁴	1.9 x 10 ⁻⁴
LPSD	2.0 x 10 ⁻⁷	0.167	5.0 x 10 ⁻⁴	1.1 x 10 ⁻⁸	4.0 x 10 ⁻⁵	2.7 x 10 ⁻⁵
Total	4.6 x 10 ⁻⁶	-	1.2 x 10 ⁻²	2.6 x 10 ⁻⁷	9.2 x 10 ⁻⁴	6.3 x 10 ⁻⁴

1

Table 5-24. Comparison of Environmental Risks for a US-APWR at the Comanche Peak Site using 2006 Meteorological Data with Risks for Current-generation Reactors at Five Sites Evaluated in NUREG-1150 (NRC 1990)

	Core Damage Frequency (Ryr ⁻¹)	50-mi Population Dose Risk (person-Sv Ryr ⁻¹) ^(a)	Fatalities Ryr ⁻¹		Average Individual Fatality Risk Ryr ⁻¹	
			Early	Latent	Early	Latent Cancer
Grand Gulf ^(b)	4.0×10^{-6}	5×10^{-1}	8×10^{-9}	9×10^{-4}	3×10^{-11}	3×10^{-10}
Peach Bottom ^(b)	4.5×10^{-6}	$7 \times 10^{+0}$	2×10^{-8}	5×10^{-3}	5×10^{-11}	4×10^{-10}
Sequoyah ^(b)	5.7×10^{-5}	$1 \times 10^{+1}$	3×10^{-5}	1×10^{-2}	1×10^{-8}	1×10^{-8}
Surry ^(b)	4.0×10^{-5}	$5 \times 10^{+0}$	2×10^{-6}	5×10^{-3}	2×10^{-8}	2×10^{-9}
Zion ^(b)	3.4×10^{-4}	$5 \times 10^{+1}$	4×10^{-5}	2×10^{-2}	9×10^{-9}	1×10^{-8}
US-APWR ^(c) at the Comanche Peak site	1.2×10^{-6}	3.0×10^{-3}	6.8×10^{-8}	2.4×10^{-4}	$1.6 \times 10^{-9(d)}$	$3.3 \times 10^{-10(e)}$

(a) To convert person-Sv to person-rem, multiply by 100.

(b) Risks were calculated using the MACCS code and are presented in NUREG-1150 (NRC 1990).

(c) Calculated with MACCS2 code using Comanche Peak site-specific input for internal and external at power initiating events (Luminant 2009a).

(d) See Section 7.2.4 of ER. Calculated based on the highest early fatality per year from the 3 yr of meteorological data for the population living within 2 km from the site (rather than 1 mi as per safety goal).

(e) See Section 7.2.4 of ER. Calculated based on the highest latent fatality per year from the 3 yr of meteorological data and for the year 2056 population estimate that is expected to be living within 50 mi radius around the site.

- 2 The last two columns of Table 5-24 provide average individual fatality risk estimates. To put
3 these estimates into context for the environmental analysis, the staff compares these estimates
4 to the safety goals. The Commission has set safety goals for average individual early fatality
5 and latent cancer fatality risks from reactor accidents in the *Safety Goal Policy Statement*
6 (51 FR 30028). These goals are presented here solely to provide a point of reference for the
7 environmental analysis and do not serve the purpose of a safety analysis. The Policy
8 Statement expressed the Commission's policy regarding the acceptance level of radiological
9 risk from nuclear power plant operation as follows:
- 10 • Individual members of the public should be provided a level of protection from the
11 consequences of nuclear power plant operation such that individuals bear no significant
12 additional risk to life and health
 - 13 • Societal risks to life and health from nuclear power plant operation should be comparable to
14 or less than the risks of generating electricity by viable competing technologies and should
15 not be a significant addition to other societal risks.

1 The following quantitative health objectives are used in determining achievement of the safety
2 goals:

- 3 • The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities
4 that might result from reactor accidents should not exceed one-tenth of 1 percent
5 (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which
6 members of the U.S. population are generally exposed.
- 7 • The risk to the population in the area near a nuclear power plant of cancer fatalities that
8 might result from nuclear power plant operation should not exceed one-tenth of 1 percent
9 (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

10 These quantitative health objectives are translated into two numerical objectives as follows:

- 11 • The individual risk of a prompt fatality from all “other accidents to which members of the
12 U.S. population are generally exposed,” is about 4.0×10^{-4} per yr, including a 1.6×10^{-4} per
13 yr risk associated with transportation accidents (NSC 2006); one-tenth of 1 percent of these
14 figures imply that the individual risk of prompt fatality from a reactor accident should be less
15 than 4×10^{-7} per Ryr.
- 16 • “The sum of cancer fatality risks resulting from all other causes” for an individual is taken to
17 be the cancer fatality rate in the U.S., which is about 1 in 500 or 2×10^{-3} per yr (Reed 2007);
18 one-tenth of 1 percent of this implies that the risk of cancer to the population in the area
19 near a nuclear power plant because of its operation should be limited to 2×10^{-6} per Ryr.

20 MACCS2 calculates average individual early and latent cancer fatality risks. The average
21 individual early fatality risk is calculated using the population distribution within 1 mi of the plant
22 boundary. The average individual latent cancer fatality risk is calculated using the population
23 distribution within 10 mi of the plant. For the plants considered in NUREG-1150, these risks
24 were well below the Commission’s safety goals (NRC 1990). Risks calculated for the US-APWR
25 design at the CPNPP site as shown in Table 5-25 are also well below the Commission’s safety
26 goals.

27 The staff compared the CDF and population dose risk estimate for a US-APWR at the CPNPP
28 site with statistics summarizing the results of contemporary severe accident analyses performed
29 for 76 reactors at 44 sites. The results of these analyses are included in the final site-specific
30 Supplements 1 through 37 to NUREG-1437 (NRC 1996) and in the ERs included with license
31 renewal applications for those plants for which supplements have not been published. All of the
32 analyses were completed after publication of NUREG-1150 (NRC 1990); the analyses for 72 of
33 the reactors used MACCS2, which was released in 1997. Table 5-25 shows that the CDF
34 estimated for the US-APWR is significantly lower than those of current-generation reactors.
35 Similarly, the population doses estimated for a US-APWR at the CPNPP site are well below the
36 mean and median values for current-generation reactors that have undergone or are
37 undergoing license renewal.

Table 5-25. Comparison of Environmental Risks from Severe Accidents for a US-APWR at the Comanche Peak Site with Risks for Current Plants from Operating License Renewal Reviews, Including CPNPP Units 1 and 2

	Core Damage Frequency (Ryr ⁻¹)	50-mi Population Dose Risk (person-Sv Ryr ⁻¹) ^(a)
Current Reactor Maximum ^(b)	2.4×10^{-4}	6.9×10^{-1}
Comanche Peak Unit 1 and 2 ^(c)	9.6×10^{-6} and 9.8×10^{-6}	not available ^(d)
Current Reactor Mean ^(b)	2.7×10^{-5}	1.6×10^{-1}
Current Reactor Median ^(b)	1.6×10^{-5}	1.3×10^{-1}
Current Reactor Minimum ^(b)	1.9×10^{-6}	3.4×10^{-3}
US-APWR ^{(e)(f)} at Comanche Peak	5.3×10^{-7}	4.1×10^{-3}

(a) To convert person-Sv to person-rem, multiply by 100.

(b) Based on MACCS and MACCS2 calculations for 76 current plants at 44 sites.

(c) Westinghouse 2007).

(d) No license renewal has been submitted for Comanche Peak Units 1 and 2; hence, no data are available.

(e) Population dose risk includes risk associated with internal and externally initiated events with the reactor at power.

(f) Calculated with MACCS2 code using Comanche Peak site-specific input (Luminant 2009a).

1 Finally, the population dose risk from a severe accident for a new US-APWR at the CPNPP site
2 (3.0×10^{-3} person-Sv/Ryr) would be smaller than the dose risk for normal operation of a US-
3 APWR at the CPNPP site. Section 5.9.3.2 of this EIS indicates that the population dose from
4 normal operation of proposed Units 3 and 4 would be approximately 8.0 person-rem/yr (8.0×10^{-2}
5 person-Sv/yr).

6 In developing a probabilistic risk assessment for a nuclear power plant, criteria are included to
7 “screen out” information that is insignificant. Regulatory Guide 1.200 (NRC 2009a) discusses
8 methods and criteria for determining if the contribution to risk from an initiating event is
9 insignificant. For example, the risk potential of a severe accident at a co-located nuclear unit as
10 an initiating event is insignificant compared to other initiating events because the event
11 frequency is very low. First, the frequency of a severe accident that results in an early large
12 release of radioactive material to the environment is on the order of 1×10^{-6} per reactor year for
13 current operating nuclear power plants such as CPNPP Units 1 and 2 (even lower for new
14 reactors such as CPNPP Units 3 and 4). Then that accident or the radioactive release from that
15 accident has to create a problem that leads to the initiation of a severe accident at a co-located
16 nuclear power plant. The radioactive release from the accident does not initiate an accident at
17 the co-located reactor; however, it may set up conditions that could eventually lead to a severe
18 accident at the co-located reactor. The wind direction must move the accident release toward
19 the co-located units; the release must overwhelm the habitability systems such that operators
20 on the co-located units have to be evacuated because of high dose rates; and the lack of
21 continuous operator attention and action must eventually result in multiple system failures that

1 lead to a loss of reactor cooling and containment failure. There is no detailed estimate of the
 2 combined probability of this sequence of events; however, the overall probability of a severe
 3 accident initiating a severe accident at a co-located reactor is expected to be several orders of
 4 magnitude less than the frequency of large early release (i.e., several orders of magnitude less
 5 than 1×10^{-6} per reactor year). Based on this explanation, the NRC staff concludes that the
 6 potential environmental impact of this accident scenario does not need to be evaluated because
 7 it is remote and speculative.

8 Even though this accident scenario is remote and speculative, Luminant made a bounding
 9 estimate of the population dose risk by postulating that a severe accident at one CPNPP unit
 10 could cause a severe accident at the remaining units. Luminant estimated the population dose
 11 risk for one PWR at the CPNPP site to be about 3×10^{-1} person-rem per Ryr^{-1} and further
 12 indicated that the cumulative dose risk from all four units would be about 1.2 person-rem/yr
 13 (Luminant 2010f). The NRC staff reviewed the applicant's bounding analysis and concludes
 14 that the corresponding environmental risks would still be small based on comparisons with the
 15 environmental risks shown in Table 5-22.

16 The ER does address the risk from internal flood, internal fire, and low power shutdown (LPSD)
 17 as a part of the site specific SAMA analysis. The core damage frequency (CDF) and LRF
 18 associated with fire, flood, and LPSD were estimated in the US-APWR PRA and the results
 19 have been reported in US-APWR DCD, Chapter 19. Table 5-26 presents the mean estimates
 20 for CDF and Large Release Frequency (LRF) for each of these contributors. Furthermore, the
 21 US-APWR DCD evaluated the uncertainties associated with these estimates and provided the
 22 95 percent upper confidence bounds. The seismic risk was addressed in Chapter 19 of US-
 23 APWR DCD via Seismic Margin Analysis (SMA). SMA demonstrated that sufficient margin in
 24 seismic design exists by showing that the high confidence of low probability of failures
 25 (HCLPFs) of the plant structures and components are greater than review level earthquake
 26 (RLE). The RLE of US-APWR is 0.5g. Considering the safe shutdown earthquake for
 27 Comanche Peak Steam Electric Station Units 1 and 2 is conservatively set at 0.12g in the FSAR
 28 for Units 1 and 2 (CPSES 2001), the seismic risk contribution is judged to be negligible.

Table 5-26. The Mean CDF and LRF Estimated Contributions for US-APWR at CPNPP

Contributions	Mean estimated value CDF (Ryr^{-1})	Mean estimated value LRF (Ryr^{-1})
Internal	1.2×10^{-6}	$1.0 \times 10^{-7(a)}$
Fire	1.7×10^{-6}	1.2×10^{-7}
Internal Flood	1.5×10^{-6}	4.0×10^{-7}
External Flood	Negligible	Negligible
Seismic	Negligible	Negligible
Hurricane	Negligible	Negligible
High Wind/Tornado	7×10^{-8}	Negligible
Low Power Shutdown	2.5×10^{-7}	2.5×10^{-7}

Notes:

(a) LPSD contribution ($2.0 \times 10^{-7} \text{ Ryr}^{-1}$) includes base contribution of LPSD operation ($2.0 \times 10^{-7} \text{ Ryr}^{-1}$) internal fire ($4.8 \times 10^{-8} \text{ Ryr}^{-1}$), flood ($9.6 \times 10^{-9} \text{ Ryr}^{-1}$), and seismic (negligible). All CDF scenarios are conservatively assumed to lead to LRF.

1 The contributions from high winds/tornadoes and external floods are site specific, and were
2 evaluated by Luminant in support of the COL application. For high winds/tornadoes, Luminant
3 assumed that the plant switchyard and selected turbine building related equipment will be
4 damaged on a tornado strike. However, all systems and components essential for safe
5 shutdown are located within seismic category 1 buildings and have substantial resistance to
6 failure for all but the largest tornado strikes. The Luminant analysis finds that the total CDF
7 caused by a tornado strike is less than 7×10^{-8} per reactor year. For external flood, Luminant
8 found this contribution to be insignificant as the design basis flood elevation provides 14 ft of
9 freeboard under the worst potential flood considerations (Luminant COL 2008). Based on this
10 explanation, the NRC staff concludes that the treatment of high winds/tornadoes and external
11 floods is reasonably addressed.

12 **5.11.2.2 Surface-Water Pathways**

13 Surface-water pathways are an extension of the air pathway. These pathways consider the
14 effects of radioactive material deposited on open bodies of water. The surface water pathways
15 of interest include external radiation from submersion in water and activities near the water,
16 ingestion of water, and ingestion of fish and other aquatic creatures. Of these pathways, the
17 MACCS2 code evaluates only the ingestion of contaminated water. The risks associated with
18 this surface water pathway calculated for the CPNPP site are included in the last column of
19 Table 5-23.

20 Doses from other surface water pathways are not modeled in MACCS2. However, the NUREG-
21 1437 (NRC 1996) contains a bounding estimate of the risk associated with uninterdicted
22 consumption of aquatic foods for the current units based on the Fermi 2 site located on Lake
23 Erie (NRC 1981). The Fermi site has similar annual precipitation and wind data to other sites
24 analyzed within the scope of the NUREG-1437, and has surface-water areas of the same order
25 of magnitude or greater than all other sites evaluated. This risk is $14 \text{ person-Sv/ Ryr}^{-1}$. The
26 Fermi analysis of water-related exposure pathways also suggests that population exposures
27 from swimming are significantly lower than exposures from the aquatic ingestion pathway.
28 Considering the estimated population of about 2.7 millions within 50 mi radius of CPNPP site by
29 the year 2056, the individual dose from aquatic consumption around the CPNPP site would be
30 about $6 \times 10^{-6} \text{ person-Sv/ Ryr}^{-1}$. Comparing this dose risk with the average individual dose risk
31 from water ingestion from Table 5-23 (i.e., $1.6 \times 10^{-4} \text{ person-SV/ Ryr}^{-1}$) confirms the position
32 taken by both NUREG-1437 (NRC 1996), and the ER is correct and in fact for CPNPP site the
33 dose risk from aquatic food ingestion is negligible. Further, should a severe accident occur at a
34 US-APWR located at the CPNPP site, it is likely that Federal, State, and local officials would
35 restrict access to SCR near the site. These actions would further reduce aquatic food ingestion
36 pathway risk. At sites such as the CPNPP site, interdiction could reduce the risk by a factor of 2
37 to 10 (NRC 1996). Thus, the dose risk for the aquatic food path is expected to be significantly
38 smaller than other pathway dose risk estimates.

39 **5.11.2.3 Groundwater Pathway**

40 MACCS2 does not evaluate the environmental risks associated with severe accident releases of
41 radioactive material to groundwater. However, this pathway has been addressed by NUREG-
42 1437 for current generation reactors (NRC 1996). In NUREG-1437, the staff assumes a 1×10^{-4}
43 Ryr^{-1} probability of occurrence of a severe accident with a basemat melt-through leading to
44 potential groundwater contamination. The staff concluded that groundwater contribution to risk
45 is generally a small fraction of the risk attributable to the atmospheric pathway.

46 The staff has re-evaluated its assumption of a $1 \times 10^{-4} \text{ Ryr}^{-1}$ probability of a basemat melt-
47 through. The staff believes that the 1×10^{-4} probability is too large for new plants because the

1 probability of core melt with basemat melt-through should be no larger than the total CDF
2 estimate for the reactor.

3 Table 5-26 gives a total CDF estimate of 4.7×10^{-6} Ryr⁻¹ for the US-APWR. NUREG-1150
4 indicates that the conditional probability of a basemat melt-through ranges from 0.05 to 0.25 for
5 current-generation reactors. New designs include features to reduce the probability of basemat
6 melt-through in the event of a core melt accident. On this basis, the staff believes that a
7 basemat melt-through probability of less than 1.7×10^{-7} Ryr⁻¹ (MHI 2008) is reasonable and still
8 conservative. Further, if the CDF for US-APWR severe accidents in which containment remains
9 intact are subtracted from the total US-APWR CDF to get the CDF for severe accidents in which
10 basemat melt-through is a possibility, the remaining CDF is on the order of 1.0×10^{-7} Ryr⁻¹ for
11 internal event initiators and 8.0×10^{-7} Ryr⁻¹ for all initiators including internal events and LPSD.
12 Considering that the US-APWR provides a highly reliable reactor cavity flooding system, and
13 coolant water is continuously supplied during a severe accident the likelihood of the basemat
14 melt-through is expected to be reasonably low.

15 The groundwater pathway is more tortuous and affords more time for implementing protective
16 and remedial actions than the atmospheric pathway and, therefore, results in a lower risk to the
17 public. As a result, the staff concludes that the risks associated with releases to groundwater
18 are sufficiently small that they would not have a significant effect on overall risk of a severe
19 accident for the two US-APWRs at the CPNPP site.

20 **5.11.2.4 Summary of Severe Accident Impacts**

21 The NRC staff has reviewed the analysis in the ER, FSAR, and DCD for the purpose of
22 determining the potential environmental impacts of severe accidents. Based on this review, the
23 NRC staff concludes that the overall severe accident risk for proposed Comanche Peak Units 3
24 and 4 is low. The NRC staff is currently reviewing the risk analyses presented in the FSAR to
25 confirm this conclusion and determine compliance with the NRC's safety regulations (10 CFR
26 52.79) and the Commission's safety goals. The results of that review will be presented in the
27 Safety Evaluation Report prepared by the staff regarding the COL application. The NRC staff
28 also conducted a confirmatory analysis of the probability-weighted consequences of severe
29 accidents for proposed Comanche Peak Units 3 and 4 using the MACCS2 code. The results of
30 the Luminant analysis and the NRC analysis indicate that the environmental risks associated
31 with severe accidents if two US-APWRs were to be located at Comanche Peak site would be
32 small compared to risks associated with operation of the current-generation reactors at the
33 Comanche Peak site and other sites. On these bases, the NRC staff concludes that the
34 environmental impact of the probability-weighted consequences of severe accidents at the
35 Comanche Peak site would be SMALL for the proposed US-APWR reactors.

36 **5.11.3 Severe Accident Mitigation Alternatives**

37 Luminant references a US-APWR design that incorporates many features intended to reduce
38 severe accident CDFs and risks associated with severe accidents. The expected effectiveness
39 of the US-APWR reactor design features in reducing risk is evident in Tables 5-25 and 5-26,
40 which compare CDFs and severe accident risks for the design with CDFs and risks for current-
41 generation reactors including CPNPP Units 1 and 2. Core damage frequencies and risks have
42 generally been reduced by a factor of 2 or more when compared to the existing units.

43 The purpose of the evaluation of severe accident mitigation alternatives (SAMAs) is to
44 determine whether there are severe accident design mitigation alternatives (SAMDA) or
45 procedural modifications or training activities that can be justified to further reduce the risks of
46 severe accidents (NRC 2000b). Consistent with direction from the Commission to consider the

1 SAMDAs at the time of certification, the US-APWR vendor has considered 156 design
2 alternatives for a US-APWR at a generic site (MHI 2009).

3 The US-APWR design already has numerous plant features intended to reduce CDF and risk;
4 as a result, the benefits and risk reduction potential of any additional plant improvements are
5 significantly reduced from those of existing reactors. This reduction is true for both internally
6 and externally initiated events. Moreover, with the features already incorporated in the US-
7 APWR design, the ability to estimate CDFs and risk is approaching the limits of probabilistic
8 techniques. Specifically, when estimated CDFs are on the order of 1 in 1,000,000 years, areas
9 of the probabilistic risk assessment where modeling is least complete, or supporting data are
10 sparse or even nonexistent, may include important contributors to the remaining risk. However,
11 the NRC staff does not expect that either improvements in modeling or data would change its
12 conclusions.

13 In its ER (Luminant 2009a), Luminant assesses 156 SAMDAs that were considered in the US-
14 APWR DCD (MHI 2009) using the CPNPP site-specific information. Using procedures set forth
15 in NUREG/BR-0184 (NRC 1997), Luminant determined that the maximum averted cost risk for a
16 single US-APWR at the CPNPP site is so low that none of the SAMDAs is cost beneficial. A
17 more realistic assessment would show that the potential reductions in cost risk are substantially
18 less than the maximum averted cost risk because no SAMDA can reduce the remaining risk to
19 zero.

20 SAMDAs are a subset of the SAMA review. The other portion of the SAMA review includes
21 procedural modifications and training activities. Alternatives in these areas were not addressed
22 in the generic SAMDA analysis conducted by MHI for design certification (MHI 2009). Luminant
23 has stated that administrative SAMAs would not be appropriate to evaluate until the plant design
24 is finalized, and that the appropriate administrative controls on plant operations would be
25 incorporated into the plant's managements systems as part of its baseline configuration
26 (Luminant FSAR 2009, Chapter 19; Luminant 2009b).

27 Appendix I contains a detailed review of the MHI and Luminant SAMA analyses and presents
28 the staff conclusions related to the Luminant Comanche Peak site-specific analysis. After
29 reviewing the Luminant analysis, the staff concludes that there are no US-APWR SAMDAs that
30 would be cost beneficial at the Comanche Peak site.

31 As discussed in Appendix I, because the maximum attainable benefit is so low, a SAMA based
32 on procedures or training for an US-APWR at the Comanche Peak site would have to reduce
33 the CDF or risk by 20 percent to become cost beneficial. Based on its evaluation, the staff
34 concludes that it is unlikely that any of the SAMAs based on procedures or training would
35 reduce the CDF or risk that much. Therefore, the staff further concludes it is unlikely that these
36 SAMAs would be cost effective. In addition, based on statements by Luminant in the ER
37 (Luminant 2009a), the staff expects that Luminant will consider risk insights in the development
38 of procedures and training. However, this expectation is not crucial to the staff's conclusions
39 because the staff already concluded procedural and training SAMAs would be unlikely to be
40 cost effective. Therefore, the NRC staff concludes that SAMAs have been appropriately
41 considered.

42 **5.11.4 Summary of Postulated Accident Impacts**

43 The NRC staff evaluated the environmental impacts from DBAs and severe accidents for a US-
44 APWR reactor at the CPNPP site. Based on the information provided by Luminant and the
45 NRC's own independent review, the staff concludes that the potential environmental impacts
46 (risks) from a postulated accident from the operation of the proposed CPNPP Units 2 and 3
47 would be SMALL, and no further mitigation would be warranted.

5.12 Measures and Controls to Limit Adverse Impacts During Operation

In its evaluation of environmental impacts during operation of the proposed Units 3 and 4, the staff relied on Luminant's compliance with the following measures and controls that would limit adverse environmental impacts:

- Compliance with applicable Federal, State, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental impacts (e.g., solid waste management, erosion and sediment control, air emissions, noise control, storm-water management, spill response and cleanup, hazardous material management);
- Compliance with applicable requirements of permits or licenses required for operation of the new units (e.g., Corps' Section 404 Permit, NPDES);
- Compliance with existing CPNPP Unit 1 and 2 processes and/or procedures applicable to environmental compliance activities during operation of proposed Units 3 and 4 at the CPNPP site (e.g., solid waste management, hazardous waste management, and spill prevention and response);
- Incorporation of environmental requirements into construction contracts; and
- Implementation of BMPs.

Table 5-27, which is the staff's adaptation from sections of Luminant's Table 5.10-1 in Luminant's ER (Luminant 2009a), lists a summary of measures and controls to limit adverse impacts during operation proposed by Luminant. The review team considered these measures and controls in its evaluation of the impacts of plant operation.

5.13 Summary of Operational Impacts

The review team's evaluation of the environmental impacts of operations of proposed Units 3 and 4 is summarized in Table 5-28. Impact category levels are denoted in the table as SMALL, MODERATE, or LARGE as a measure of their expected adverse impacts. Some impacts, such as the addition of tax revenue from Luminant for the local economies, are likely to be beneficial and are noted as such in the Impact Level column.

Table 5-27. Summary of Measures and Controls Proposed by Luminant to Limit Adverse Impacts During Operation

Impact Category	Specific Measures and Controls
Land-Use Impacts	
The Site and Vicinity	<ul style="list-style-type: none"> • Limit continued disturbance of vegetation to the area within the site designated for CPNPP construction
Transmission Line ROW and Offsite Areas	<ul style="list-style-type: none"> • Unknown – Pending transmission line study
Water-Related Impacts	
Hydrologic Alterations and Plant Water Supply	<ul style="list-style-type: none"> • Avoid usage of groundwater sources. • Implement Storm Water Pollution Prevention Plan (SWPPP) as part of the proposed Units 3 and 4 NPDES permit to minimize releases. • Install multi-port diffuser pipes to maximize thermal and chemical dissolution. • Install erosional control devices to stabilize the banks, if needed.
Water-Use Impacts	<ul style="list-style-type: none"> • Cooling and Plant Water Systems are designed to minimize the amount of water needed, SCR spillage for Brazos, and use of Luminant contracted water. • Effluent discharges are limited, compliance with Clean Water Act regulations (40 CFR Part 423), compliance with the sites amended TPDES regulations and blowdown is treated to minimize discharge of residual chemicals. • Compliance with Wheelers Branch Reservoir and supply water from the Paluxy River, tributary to the Brazos River, SCR spillage for BRA use, and use of Luminant contracted water
Cooling System Impacts	
<u>Intake Structure</u>	
Hydrodynamic Descriptions and Physical Impacts	<ul style="list-style-type: none"> • To limit impact of noise associated with operations of water makeup pumps protective hearing equipment will be used, as appropriate, by employees working near the pumps and cooling towers. • Stabilize banks of the embayment and shoreline with erosion controls, as needed. • Water intake design to avoid buildup of sediment deposits and littoral debris

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Aquatic Ecosystems	<ul style="list-style-type: none"> • Utilization of closed-cycle cooling and cooling towers using the best technology available. • Design of intake structures to ensure minimum water velocity through screens that are designed to prevent fish from being drawn into the intake structure. • Makeup water is expected to be supplied by the low-flow reservoir during low flow conditions to minimize impact resulting from Lake Granbury water consumption.
<u>Discharge System</u> Aquatic Ecosystems	<ul style="list-style-type: none"> • To the extent practical, equipment is employed and positioned so as to reduce scouring and turbidity effects. • Blowdown is treated to minimize discharge of residual chemicals. • Intake structure constructed using Best Available Technology. • Reduction of thermal plume effects on aquatic organisms through use of cooling towers and closed-loop cooling cycle. <p>Hazardous effluents are treated according to RCRA, CWA, and TPDES permit requirements.</p>
<u>Heat Discharge System</u> Heat Dissipation to the Atmosphere	<ul style="list-style-type: none"> • Drift eliminators are used in cooling towers to minimize the amount of water lost for the towers via drift. • Blowdown is treated to minimize total dissolved content of circulating water.
Terrestrial Ecosystems	<ul style="list-style-type: none"> ▪ Cooling towers are designed to minimize noise levels. ▪ Use a salt fence around the perimeter of the BDTF to reduce salt drift in adjoining terrestrial habitats. ▪ Redesign and/or relocate BDTF to reduce potential for salt drift and fogging. ▪ Reroute existing transmission lines away from BDTF.

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Impacts to Members of the Public	<ul style="list-style-type: none"> • As applicable, workers are trained in compliance with Noise Control Act (NCA), 42 USC 4901 et seq. and Occupational Safety and Health Act (OSHA) • To limit impact of noise associated with operations of water makeup pumps protective hearing equipment will be used, as appropriate, by employees working near the pumps and cooling towers • Water is periodically monitored and tested for thermophilic microorganisms according to the Centers for Disease Control's Surveillance for Waterborne-Disease Outbreaks-United States. • Workers are trained on safe work procedures including, as appropriate, the use of air respirators.
Radiological Impacts of Normal Operation	
Exposure Pathways	<ul style="list-style-type: none"> • Calculated doses for all exposure pathways less than guidelines established in 10 CFR Part 50, Appendix I, and regulatory limits set in 40 CFR Part 190. • Effluent discharges must comply with requirements specified in 10 CFR Part 20. • Comply with requirements and design to maintain dose ALARA. • Implement radiological monitoring program.
Radiation doses to Members of the Public	<ul style="list-style-type: none"> • Calculated doses for all exposure pathways less than guidelines established in 10 CFR Part 50, Appendix I, and regulatory limits set in 40 CFR Part 190. • Comply with requirements and design to maintain dose ALARA. • Implement radiological monitoring program.
Impact to Members of the Public	<ul style="list-style-type: none"> • Calculated doses for all exposure pathways less than guidelines established in 10 CFR Part 50, Appendix I, and regulatory limits set in 40 CFR Part 190. • Comply with requirements and design to maintain dose ALARA. • Implement radiological monitoring program.

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Impacts to Biota Other than Members of the Public	<ul style="list-style-type: none"> • Use of exposure guidelines, such as 40 CFR Part 190, which apply to members of the public in unrestricted areas, is considered very conservative when evaluating calculated doses to biota. The international Council on Radiation Protection states that "... if man is adequately protected then other living things are also likely to be sufficiently protected," and uses human protection to infer environmental protection from the effects of ionizing radiation.
Occupational Radiation Doses	<ul style="list-style-type: none"> • Based on the available data on the US-APWR design, the maximum annual occupational dose is estimated to be 0.7 person-Sv. Impacts to workers from occupational radiation doses are SMALL and do not warrant additional mitigation.
Accidents	
Design Basis Accidents	<ul style="list-style-type: none"> • Calculated dose consequences of design basis accidents for the US-APWR at the CPNPP site were found to be within regulatory limits.
Severe Accidents	<ul style="list-style-type: none"> • Calculated probability-weighted consequences of severe accidents for the US-APWR at the CPNPP site were found to be lower than the probability-weighted consequences for current operating reactors.

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Environmental Impacts of Waste	
Nonradioactive Waste System Impacts	<ul style="list-style-type: none"> • All discharges will comply with TCEQ NPDES permit and applicable water quality standards. • Hazardous waste is carefully monitored. • Approved transporters and approved offsite disposal facilities for disposal of solid wastes are used. A waste program for waste minimization through reuse, recycling and product selection will be created. • Sanitary waste is treated at an approved sewage treatment plant by licensed operators. • Non-hazardous non-radioactive waste is generated and disposed of according to applicable local, state, and federal regulations, including the Solid Waste Disposal Act, as amended, 42 USC 6901 et seq. • Inspections are performed to ensure that all waste is managed according to applicable laws and regulations • Employees are trained to follow applicable procedures, waste regulations, and chemical awareness information. • Discharges from the sediment retention pond are monitored in accordance with the SWPPP. • Minor air emissions sources are operated in accordance with applicable federal state, and local regulations.
Mixed Waste Impacts	<ul style="list-style-type: none"> • The inventory of mixed waste is maintained in a designated storage area and monitored prior to offsite disposal. • Transport of mixed waste is done by licensed hazardous/mixed waste carriers. • Mixed waste is limited through source reduction, recycling and treatment options. • Inspections are performed to ensure that all waste is managed according to applicable laws and regulations. • Mixed-waste storage assures that chemical and radiological exposures are minimized both by ALARA and chemical awareness training programs.
Waste Minimization	<ul style="list-style-type: none"> • Comply with current Waste Minimization Plan developed for existing Units 1 and 2 to address hazardous waste management, treatment (decay in storage), work planning, waste tracking, and awareness training.

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Transmission and Pipeline ROW Impacts	
Terrestrial Ecosystems	<ul style="list-style-type: none"> • Employees are trained on how to perform work in a manner that reduces adverse environmental impacts. • Minimize potential impacts through compliance with permitting requirements and best management practices. • To the extent feasible, avoid any additional disturbances on critical or sensitive terrestrial habitats/species. • As practical, machinery use, noise suppression//mufflers, and vehicles are maintained to reduce emissions. • Readily available spill response materials and personnel trained to respond to, clean-up and report spills. • Employees are trained in hazardous materials/waste procedures to minimize the risk of spills. • Herbicides are applied by trained employees licensed to apply herbicides.
Aquatic Ecosystems	<ul style="list-style-type: none"> • Minimize potential impacts through compliance with permitting requirements and best management practices. • To the extent feasible, avoid any additional disturbances on critical or sensitive aquatic habitats/species. • As practical, cleared areas are reseeded to limit erosion, • Apply appropriate erosion control (grassed or wooded buffer strips, board roads, and removable mats). Obtain a permit before dredge or fill activities • Herbicides are applied by using proper management practices by trained employees who possess an application permit • Employees are trained in hazardous materials/waste procedures to minimize the risk of spills. • Perform routine over-flights to prevent unauthorized encroachment.

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Impacts to Members of the Public	<ul style="list-style-type: none"> • Transmission lines built to standards. • Natural vegetation is retained at road and river crossings during construction to help minimize ground-level visual impacts unless engineering requirements dictate otherwise. • Transmission towers would be designed to reduce any impact to important scenic view areas. • No towers along the new transmission lines are expected to exceed 200 ft in height, nor are there any airports, airstrips, or heliports within 20,000 ft of the transmission line corridors currently under review.
Uranium Fuel Cycle Impacts	<ul style="list-style-type: none"> • Comparison of the US-APWR reactor, which was normalized for a reference 1,000 MWe LWR, to Table S-3 values, as shown in Table 5.7-1 in Luminant's ER, show that the impacts evaluated (land use, water use, fossil fuels, chemical effluents, radioactive effluents and wastes, occupational exposure, and transportation), would all be minor and require no action to warrant mitigation. • Possible use of centrifuge uranium enrichment process in lieu of gaseous diffusion process, which significantly reduces energy use and resultant environmental effects
Socioeconomic Impacts	
Physical Impacts of Proposed Units	<ul style="list-style-type: none"> • Improvement of SH 144 and FM 56 and the potential additional entrance to the site. • Zoning and land-use restriction may be used to help manage development. • Train and appropriately protect CPNPP employees to reduce the risk or potential exposure to noise. • Monitor release of waste emissions and effluents. • Train workers on procedures and regulations involving waste emissions and effluents

Table 5-27. (contd)

Impact Category	Specific Measures and Controls
Social and Economic Impacts of Proposed Units	<ul style="list-style-type: none"> • Based on vacancy data from the 2000 Census, sufficient housing units are available. • Diversify settlement of new workers into several communities. • Increased property and worker-related taxes can help offset some of the problems related to increased population such as community facilities and infrastructure, police, fire protection, and schools. • Local land zoning and ordinances can help mitigate potential socioeconomic growth problems. • Optimization study completed to design the cooling towers to economically limit the amount of water potentially consumed. • Provide appropriate job-training to workers. • Community relation group to manage concerns from adjacent residents or visitors on a case-by-case basis through an employee-concerns resolution program. • Provide onsite services for emergency first aid, and conduct regular health and safety monitoring.
Air Quality	<ul style="list-style-type: none"> • Obtain air permits and operate systems within permit limits, and monitor emissions as required.
Historic and Cultural Resources	<ul style="list-style-type: none"> ▪ Consult with SHPO if a cultural resource is discovered. ▪ Follow established procedures to halt work if a potential unanticipated historic, cultural, or paleontological resource is discovered.
Nonradiological Health Impacts	<ul style="list-style-type: none"> ▪ Implement site-wide Safety and Medical Program, including safety policies, safe work practices, as well as general and topic-specific training. ▪ Take measures that could include monitoring workers, providing radiation worker training, and developing work plans that minimize worker radiation exposure.

Source: Adapted from Luminant 2009a

1

2

1

Table 5-28. Characterization of Operational Impacts at the Proposed Unit 3 and 4 Comanche Peak Site

Category	Comments	Impact Level
Land-Use Impacts		
The Site and Vicinity	Without more case history data on the mists and salt fence, the review team cannot rule out possible vegetation injury on private property located south of the BDTF due to salt drift.	SMALL to MODERATE
Transmission Line and Pipeline Corridors	No substantial impacts expected.	SMALL
Water-Related Impacts		
Water Use		
Surface Water	Withdrawal and use of water from Lake Granbury for use by CPNPP Units 3 and 4 would result in lower water levels in the lake and decreased flows in the Brazos River downstream of the DeCordova Dam. In addition, Brazos River system operations would be altered to accommodate the additional withdrawals. These operational changes would include changes in the timing of water releases from Possum Kingdom Lake, resulting in lower water levels in that lake. Seasonal distribution of streamflow downstream from Possum Kingdom Lake would be altered, with lower flows during the wetter months (typically May and June) and higher flows during the drier months of the year.	MODERATE
Groundwater	There would be no increase in the use of groundwater at the CPNPP site due to operation of CPNPP Units 3 and 4.	SMALL

2

1

Table 5-28. (contd)

Category	Comments	Impact Level
Water Quality		
Surface Water	The increased inflows from Possum Kingdom Lake to Lake Granbury will increase the ambient concentrations of naturally-occurring TDS and chlorides in Lake Granbury. During low-flow conditions, the blowdown discharge diffuser may operate less effectively than during high-flow periods, and although the effluent concentrations are designed to be within water quality criteria, they may be above ambient concentrations in Lake Granbury and result in locally elevated concentrations in the vicinity of the diffuser due to less-effective mixing.	SMALL to MODERATE
Groundwater	Implementation of the SWPPP would reduce the potential for leaks and spills such that any impacts to groundwater quality from leaks and spills would be minor. Some release and deposition of salts would occur during operation of the cooling towers and/or the salt spray discharged by the misters at the BDTF. Impacts to groundwater quality from salt deposition would be minor because shallow groundwater in the vicinity of the evaporation pond site is not used for water supply.	SMALL
Ecological Impacts		
Terrestrial Ecosystems	Without more case history data on the misters and salt fence, the review team cannot rule out possible vegetation injury due to salt drift from the BDTF. Impacts due to cooling system operation to shoreline vegetation on Lake Granbury and Possum Kingdom Reservoir would be noticeable, but not drastic enough to destabilize important attributes of the resource.	MODERATE

2

Table 5-28. (contd)

Category	Comments	Impact Level
Aquatic Ecosystems and Wetlands	The effects on water levels in Lake Granbury due to withdrawals to support the operation of Units 3 and 4 would result in potential impacts to aquatic resources in the lake; while these impacts are somewhat uncertain, they likely would range from negligible to noticeable. Impacts to wetlands during operations would be minor.	SMALL to MODERATE
Socioeconomic Impacts		
Physical Impacts	No significant physical impacts on workers and the local public, buildings, roads, aesthetics, noise, or air quality.	SMALL
Demography	Population growth would be small and more than offset by the large population decrease when operations begin and most of the in-migrating construction workers leave the area.	SMALL
Impacts to Community – Social and Economic		
Economy	Significant employment and income benefits in Somervell and Hood Counties, but much less significant in the rest of the six-county study area.	MODERATE to LARGE (Beneficial)
Taxes	Significant tax benefits to Somervell County and, to a lesser extent, Hood County. Much less significant in the rest of the six-county study area.	LARGE (Beneficial) in Somervell County to SMALL elsewhere
Infrastructure and Community Services		
Transportation	Minimal traffic impacts compared to those expected during project development, especially given possible mitigation measures implemented during project development.	SMALL

1

Table 5-28. (contd)

Category	Comments	Impact Level
Recreation	No significant impacts to most recreational resources; noticeable adverse impacts to recreational use of Lake Granbury and Possum Kingdom Lake due to decreased water levels during drought periods.	SMALL to MODERATE
Housing	No significant impacts; possible short-term, minor impact on housing prices as more units become available when operations begin and some in-migrating construction workers leave the area.	SMALL
Public Services	No significant impacts on water and wastewater, solid waste, police, fire, and medical services, or social services	SMALL
Education	No significant impacts on educational services.	SMALL
Environmental Justice	The operation of CPNPP Units 3 and 4 would not have any disproportionately high and adverse human health or environmental effects on minority or low-income populations through the pathways of soil, water, and air. Similarly, the impacts of operations on socioeconomic resources would not have any disproportionately high and adverse effects on minority or low-income populations.	SMALL
Historic and Cultural Resources	There are no known historic or cultural impacts at this site. Luminant has agreed to follow procedures if historic or cultural resources are discovered during ground-disturbing activities.	SMALL
Air Quality	Operation of the cooling towers and intermittent operation of various diesel generators would be the primary emissions sources for air pollutants.	SMALL

2

Table 5-28. (contd)

Category	Comments	Impact Level
Nonradiological Health Impacts	Traffic accident impacts during operations would increase local traffic impacts by a small, if not imperceptible, amount. The impact of noise from the operation of water pumps could be noticeable, depending on the final pump design and equipment choices.	SMALL to MODERATE
Radiological Impacts		
Members of the Public	Doses to members of the public would be below NRC and EPA standards and there would be no observable health impacts (10 CFR Part 20, Appendix I to 10 CFR Part 50, 40 CFR Part 190).	SMALL
Plant Workers	Occupational doses to plant workers would be below NRC standards and program to maintain doses ALARA would be implemented.	SMALL
Biota other than Humans	Doses to biota other than humans would be well below NCRP and IAEA guidelines.	SMALL
Nonradioactive Waste	Current Luminant practices and procedures would help minimize waste generation at Units 3 and 4. Solid, liquid, gaseous and mixed wastes generated during the operation of Units 3 and 4 would be handled according to county, State and Federal regulations.	SMALL
Impacts of Postulated Accidents		
Design-Basis Accidents	Impacts of design basis accidents would be well below regulatory criteria.	SMALL
Severe Accidents	Probability-weighted consequences of severe accidents would be lower than the Commission's safety goals and probability-weighted consequences for currently operating reactors.	SMALL

5.14 References

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Operational Impacts at the Proposed Site

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6.0 Fuel Cycle, Transportation, and Decommissioning

1 This chapter addresses the environmental impacts from (1) the uranium fuel cycle (UFC) and
2 solid waste management, (2) the transportation of radioactive material, and (3) the
3 decommissioning of proposed Units 3 and 4 at the Comanche Peak Nuclear Power Plant
4 (CPNPP) site.

5 In its evaluation of uranium fuel cycle impacts from the proposed CPNPP Units 3 and 4,
6 Luminant Power Generation Company LLC (Luminant) used the design for the U.S. Advanced
7 Pressurized-Water Reactor (US-APWR), an advanced light-water reactor (LWR), by Mitsubishi
8 Heavy Industries Ltd. (MHI) (MHI 2009). The capacity factor reported by Luminant for the
9 US-APWR is 95 percent. The results reported here assume two units with a capacity factor of
10 95 percent.

6.1 Fuel Cycle Impacts and Solid Waste Management

12 This section discusses the environmental impacts from the uranium fuel cycle and solid waste
13 management for the US-APWR design. The environmental impacts of this design are evaluated
14 against specific criteria for LWR designs at Title 10 of the Code of Federal Regulations (CFR)
15 51.51.

16 The regulations in 10 CFR 51.51(a) state that:

17 Under §51.50 every environmental report (ER) prepared for the construction permit stage
18 or early site permit or combined license stage of a light-water-cooled nuclear power reactor,
19 and submitted on or after September 4, 1979, shall take Table S-3, Table of Uranium Fuel
20 Cycle Environmental Data in 10 CFR Part 51.51, as the basis for evaluating the contribution
21 of the environmental effects of uranium mining and milling, the production of uranium
22 hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel,
23 transportation of radioactive materials, and management of low level wastes and high level
24 wastes related to uranium fuel cycle activities to the environmental costs of licensing the
25 nuclear power reactor. Table S-3 shall be included in the environmental report and may be
26 supplemented by a discussion of the environmental significance of the data set forth in the
27 table as weighed in the analysis for the proposed facility.

28 The US-APWRs proposed for Units 3 and 4 at the CPNPP site are LWRs that will use uranium
29 dioxide (UO₂) fuel; therefore, Table S-3 (10 CFR 51.51[b]) can be used to assess environmental
30 impacts of the uranium fuel cycle. Table S-3 values are normalized for a reference 1000-MW(e)
31 LWR at an 80 percent capacity factor. The 10 CFR 51.51(a) Table S-3 values are reproduced
32 in Table 6-1. Each US-APWR unit is rated at 4451 MW(t) (MHI 2009). For the two US-APWR
33 units to be located on the CPNPP site, the combined power rating for both units is 8902 MW(t).
34 Each US-APWR reactor unit is rated at 1700 MW(e), of which 100 MW(e) is used for station and
35 auxiliary loads, leaving 1600 MW(e) net electrical output when the reactor is operating (MHI
36 2009). With a capacity factor of 95 percent (Luminant 2009a), each US-APWR unit produces
37 an average of 1520 MW(e). For two US-APWR units, this corresponds to 3040 MW(e).

Table 6-1. Uranium fuel cycle environmental data as provided in Table S-3 of 10 CFR 51.51(b)^(a)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Natural Resource Use		
Land (acres):		
Temporarily committed ^(b)	100	
Undisturbed area	79	
Disturbed area	22	<u>Equivalent to a 100-MW(e) coal-fired power plant.</u>
Permanently committed	13	
Overburden moved (millions of MT)	2.8	<u>Equivalent to a 95-MW(e) coal-fired power plant.</u>
Water (millions of gallons):		
Discharged to air	160	<u>= 2 percent of model 1000-MW(e) LWR with cooling tower.</u>
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	<u><4 percent of model 1000 MW(e) with once-through cooling.</u>
Fossil fuel:		
Electrical energy (thousands of MW-hr)	323	<u><5 percent of model 1000 MW(e) LWR output.</u>
Equivalent coal (thousands of MT)	118	<u>Equivalent to the consumption of a 45-MW(e) coal-fired power plant.</u>
Natural gas (millions of standard cubic feet)	135	<u><0.4 percent of model 1000 MW(e) energy output.</u>

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Effluents--Chemical (MT)		
Gases (including entrainment): ^(c)		
SO _x	4400	
NO _x ^(d)	1190	<i><u>Equivalent to emissions from 45 MW(e) coal-fired plant for a year.</u></i>
Hydrocarbons	14	
CO	29.6	
Particulates	1154	
Other gases:		
F	0.67	<i><u>Principally from uranium hexafluoride (UF₆) production, enrichment, and reprocessing. The concentration is within the range of state standard-below level that has effects on human health.</u></i>
HCl	0.014	
Liquids:		
SO ₄ ⁻	9.9	<i><u>From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH₃—600 cfs, NO₃—20 cfs, Fluoride—70 cfs.</u></i>
NO ₃ ⁻	25.8	
Fluoride	12.9	
Ca ⁺⁺	5.4	
Cl ⁻	8.5	
Na ⁺	12.1	
NH ₃	10	
Fe	0.4	
Tailings solutions (thousands of MT)	240	<i><u>From mills only—no significant effluents to environment.</u></i>
Solids	91,000	<i><u>Principally from mills—no significant effluents to environment.</u></i>

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Effluents—Radiological (curies)		
Gases (including entrainment):		
Rn-222		<i>Presently under reconsideration by the Commission.</i>
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	0.14	<i>Principally from fuel reprocessing plants.</i>
I-129	1.3	
I-131	0.83	
Tc-99		<i>Presently under consideration by the Commission.</i>
Fission products and transuranics	0.203	
Liquids:		
Uranium and daughters	2.1	<i>Principally from milling—included tailings liquor and returned to ground—no effluents; therefore, no effect on environment.</i>
Ra-226	0.0034	<i>From UF₆ production.</i>
Th-230	0.0015	
Th-234	0.01	<i>From fuel fabrication plants—concentration 10 percent of 10 CFR Part 20 for total processing 26 annual fuel requirements for model LWR.</i>
Fission and activation products	5.9×10^{-6}	
Solids (buried onsite):		
Other than high level (shallow)	11,300	9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning—buried at land burial facilities. 600 Ci comes from mills—included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^7	Buried at Federal Repository.
Effluents—thermal (billions of British thermal units)	4063	<5 percent of model 1000-MW(e) LWR.

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management.

Source: Adapted from Table S-3 in 10 CFR 51.51(b). Some minor changes have been made to format and wording but not to the data as it appears in Table S-3.

(a) In some cases where no entry appears it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the table. Table S-3 does not include health effects from the effluents described in the table, or estimates of releases of radon-222 from the uranium fuel cycle, or estimates of technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in the *Environmental Survey of the Uranium Fuel Cycle*, WASH-1248 (AEC 1974); the *Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle*, NUREG-0116 (Supp.1 to WASH-1248) (NRC 1976); the *Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*, NUREG-0216 (Supp. 2 to WASH-1248) (NRC 1977b); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM-50-3. The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of Sec. 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

(b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

(c) Estimated effluents based upon combustion of equivalent coal for power generation.

(d) 1.2 percent from natural gas use and process.

2 Specific categories of environmental considerations are included in Table S-3 (see Table 6-1).
 3 These categories relate to land use; water consumption and thermal effluents; radioactive
 4 releases; burial of transuranic waste, high-level waste, and low-level waste (LLW); and radiation
 5 doses from transportation and occupational exposures. In developing Table S-3, the staff
 6 considered two uranium fuel cycle options that differed in the treatment of spent fuel removed
 7 from a reactor. The “no-recycle” option treats all spent fuel as waste to be stored at a Federal
 8 waste repository, whereas the “uranium-only recycle” option involves reprocessing spent fuel to
 9 recover unused uranium and returning it to the system. Neither cycle involves the recovery of
 10 plutonium or the use of mixed-oxide (MOX) fuel derived from recycle. The contributions in
 11 Table S-3 resulting from reprocessing, waste management, and transportation of wastes are
 12 maximized for both of the two fuel cycles (uranium only and no-recycle); that is, the identified
 13 environmental impacts are based on the cycle that results in the greater impact. The uranium
 14 fuel cycle is defined as the total of those operations and processes associated with provision,
 15 utilization, and ultimate disposition of fuel for nuclear power reactors.

16 The Nuclear Non-Proliferation Act of 1978 (22 USC 3201, et seq.), significantly impacted the
 17 disposition of spent nuclear fuel by deferring indefinitely the commercial reprocessing and

1 recycling of spent fuel produced in the U.S. commercial nuclear power program. While the ban
 2 on the reprocessing of spent fuel was lifted during the Reagan administration, economic
 3 circumstances changed, reserves of uranium ore increased, and the nuclear power industry in
 4 the United States stagnated, providing little incentive for the industry to resume reprocessing.
 5 During the 109th Congress, the Energy Policy Act of 2005 (Public Law 109-58) was enacted. It
 6 authorized the U.S. Department of Energy (DOE) to conduct an advanced fuel-recycling
 7 technology research and development program to evaluate proliferation-resistant fuel recycling
 8 and transmutation technologies that minimize environmental or public health and safety
 9 impacts. Consequently, while Federal policy does not prohibit reprocessing, additional DOE
 10 efforts would be necessary before commercial reprocessing and recycling of spent fuel
 11 produced in the U.S. commercial nuclear power plants could commence.

12 The no-recycle option is presented
 13 schematically in Figure 6-1. Natural
 14 uranium is mined in either open-pit or
 15 underground mines or by an *in situ* leach
 16 solution mining process. *In situ* leach
 17 mining, presently the primary form of
 18 uranium mining in the United States,
 19 involves injecting a lixiviant solution into
 20 the uranium ore body to dissolve
 21 uranium and then pumping the solution
 22 to the surface for further processing.
 23 The ore or *in situ* leach solution is
 24 transferred to mills where it is processed
 25 to produce “yellowcake” (U_3O_8). A
 26 conversion facility accepts the uranium
 27 oxide as feed and then converts it to
 28 uranium hexafluoride (UF_6), which is
 29 then processed by an enrichment facility
 30 to increase the percentage of the more-
 31 fissile isotope uranium-235 and to

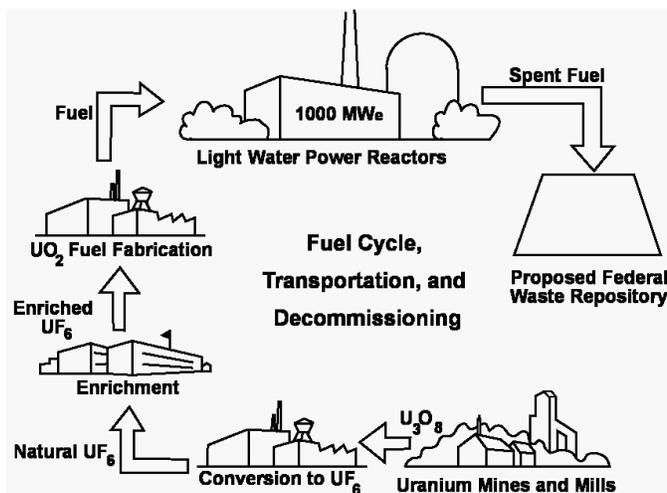


Figure 6-1. The Uranium Fuel Cycle: No-Recycle Option (derived from NRC 1999).

32 decrease the percentage of the nonfissile isotope uranium-238. At a fuel fabrication facility, the
 33 enriched UF_6 , which is approximately 5 percent uranium-235, is converted to UO_2 . The UO_2
 34 is milled, pelletized, sintered, and inserted into tubes to form fuel assemblies, which are placed in
 35 a reactor to produce power. When the content of the uranium-235 reaches a point at which the
 36 nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are
 37 withdrawn from the reactor as spent fuel. After onsite storage for sufficient time to allow for
 38 short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies
 39 would be transferred to a waste repository for geologic interment. Disposal of spent fuel
 40 elements in a repository constitutes the final step in the no-recycle option.

41 The following assessment of the environmental impacts of the uranium fuel cycle as related to
 42 the operation of the proposed CPNPP Units 3 and 4 project is based on the values given in
 43 Table S-3 (Table 6-1) and on the staff’s analysis of the radiological impact from radon-222 and
 44 technetium-99. In NUREG-1437, *Generic Environmental Impact Statement for License
 45 Renewal of Nuclear Plants* (GEIS) (NRC 1996, NRC 1999)^(a), the staff provides a detailed
 46 analysis of the environmental impacts from the uranium fuel cycle. Although NUREG-1437 is
 47 specific to the impacts related to license renewal, the information is relevant to this review

(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999. Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

1 because the advanced LWR design considered here uses the same type of fuel; the staff's
2 analyses in Section 6.2.3 of NUREG-1437 are summarized and provided here.

3 The uranium fuel cycle impacts in Table S-3 are based on a reference 1000-MW(e) LWR
4 operating at an annual capacity factor of 80 percent for a net electric output of 800 MW(e). As
5 explained above, the total net electric output for the proposed two new units at the CPNPP site
6 is 3040MW(e) ; this is about 3.8 times the impact values in Table S-3 (Table 6-1)
7 [i.e., 3040 MW(e) divided by 800 MW(e) yields 3.8]. In the following review and evaluation of
8 the environmental impacts of the uranium fuel cycle, the staff multiplied the values in Table S-3
9 by a factor of 4 rather than 3.8, scaling the impact upward to account for the increased electric
10 generation of the two proposed US-APWRs. Throughout this chapter, this will be referred to as
11 the 1000-MW(e) LWR-scaled model reflecting 3040 MW(e) for the site.

12 Recent changes in the uranium fuel cycle may have some bearing on environmental impacts;
13 however, as discussed below, the staff is confident that the contemporary normalized uranium
14 fuel cycle impacts are below those identified in Table S-3. This assertion is true in light of the
15 following recent uranium fuel cycle trends in the United States:

- 16 • Increasing use of *in situ* leach uranium mining, which does not produce mine tailings.
- 17 • Transitioning of U.S. uranium enrichment technology from gaseous diffusion to gas
18 centrifugation. The latter process uses only a small fraction of the electrical energy per
19 separation unit compared to gaseous diffusion.
- 20 • Current LWRs use nuclear fuel more efficiently due to higher fuel burnup. Therefore, less
21 uranium fuel per reactor-year of reactor operation is required than in the past to generate
22 the same amount of electricity.
- 23 • Fewer spent fuel assemblies per reactor-year are discharged; hence the waste
24 storage/repository impact is lessened.

25 The values in Table S-3 were calculated from industry averages for the performance of each
26 type of facility or operation within the uranium fuel cycle. Recognizing that this approach meant
27 that there would be a range of reasonable values for each estimate, the staff followed the policy
28 of choosing the assumptions or factors to be applied so that the calculated CPNPP Units 3 and
29 4 values would not be underestimated. This approach was intended to ensure that the actual
30 environmental impacts would be less than the quantities shown in Table S-3 for all LWR nuclear
31 power plants within the widest range of operating conditions. Many subtle uranium fuel cycle
32 parameters and interactions were recognized by the staff as being less precise than the
33 estimates and were not considered or were considered but had no effect on the Table S-3
34 calculations. For example, to determine the quantity of fuel required for a year's operation of a
35 nuclear power plant in Table S-3, the staff defined the model reactor as a 1000-MW(e) LWR
36 reactor operating at 80 percent capacity with a 12-month fuel reloading cycle and an average
37 fuel burnup of 33,000 megawatt days per metric ton of uranium (MWd/MTU). This is a "reactor
38 reference year" or "reference reactor year," depending on the source (either Table S-3 or
39 NUREG-1437), but it has the same meaning. If approved, the combined licenses (COLs) for the
40 proposed Units 3 and 4 would allow 40 years of operation. In NUREG-1437, the sum of the
41 initial fuel loading plus all of the reloads for the lifetime of the reactor can be divided by the 60-
42 year lifetime (40-year initial license term and 20-year license renewal term) to obtain an average
43 annual fuel requirement. This was the approach followed by the U.S. Nuclear Regulatory
44 Commission (NRC) staff in NUREG-1437 for both boiling water reactors (BWRs) and
45 pressurized water reactors (PWRs); the higher annual requirement, 35 metric tons (MT) of
46 uranium made into fuel for a BWR, was chosen in NUREG-1437 as the basis for the reference
47 reactor year (NRC 1996). The average annual fuel requirement presented in NUREG-1437
48 would only be increased by 2 percent if a 40-year lifetime were evaluated. However, a number

1 of fuel management improvements have been adopted by nuclear power plants to achieve
2 higher performance and to reduce fuel and separative work (enrichment) requirements per
3 reactor-year. Since the time when Table S-3 was promulgated, these improvements have
4 reduced the annual fuel requirement, which means the Table S-3 assumptions remain bounding
5 as applied to the proposed Units 3 and 4.

6 Another change is the elimination of the U.S. restrictions on the importation of foreign uranium.
7 Until recently, the economic conditions of the uranium market favored utilization of foreign
8 uranium at the expense of the domestic uranium industry. From the mid-1980s to 2004, the
9 price of U_3O_8 remained below \$20/lb. These market conditions forced the closing of most U.S.
10 uranium mines and mills, substantially reducing the environmental impacts in the United States
11 from these activities. However, more recently the spot price of uranium has increased
12 dramatically (from \$24/lb in April 2005 to \$135/lb in July 2007) and has remained in the range of
13 \$45 to \$65/lb range as of June 2009 (Platts 2009). As a result, there is a renewed interest in
14 uranium mining and milling in the United States, and the NRC anticipates receiving multiple
15 license applications for uranium mining and milling in the next several years. Most of the
16 applications are expected to be for in situ leach-solution mining, which does not produce
17 tailings. Factoring in changes to the uranium fuel cycle suggests that the environmental impacts
18 of mining and tail millings could drop to levels below those given in Table S-3; however,
19 Table S-3 estimates have not been reduced for these analyses.

20 In sum, these reasons highlight why Table S-3 is likely to overestimate impacts from the
21 proposed Units 3 and 4 and therefore remains a bounding approach for this analysis.

22 Section 6.2 of NUREG-1437 discusses the sensitivity to changes in the uranium fuel cycle on
23 the environmental impacts in greater detail (NRC 1996).

24 **6.1.1 Land Use**

25 The total annual land requirement for the uranium fuel cycle supporting the 1000-MW(e) LWR-
26 scaled model for the proposed two 1600 MW(e) (net) units is about 452 acres (ac).
27 Approximately 52 ac are permanently committed land, and 400 ac are temporarily committed. A
28 “temporary” land commitment is a commitment for the life of the specific uranium fuel cycle plant
29 (e.g., a mill, enrichment plant, or succeeding plants). Following completion of decommissioning,
30 such land can be released for unrestricted use. “Permanent” commitments represent land that
31 may not be released for use after plant shutdown and decommissioning because
32 decommissioning activities do not result in removal of sufficient radioactive material to meet the
33 limits in 10 CFR Part 20, Subpart E, for release of that area for unrestricted use. Of the 400 ac
34 of temporarily committed land, 316 ac are undisturbed and 84 ac are disturbed. In comparison,
35 a coal-fired power plant producing the same megawatt-electric-adjusted output (3200 MWe) as
36 the LWR-scaled model and using strip-mined coal requires the disturbance of about 2500 ac/yr
37 for fuel alone (Fthenakis and Kim 2009). The staff concludes that the impacts on land use to
38 support the 1000-MW(e) LWR-scaled model would be SMALL.

39 **6.1.2 Water Use**

40 The principal water use for the uranium fuel cycle supporting a 1000-MW(e) LWR-scaled model
41 is that required to remove waste heat from the power stations supplying electrical energy to the
42 enrichment step of the uranium fuel cycle, which for Table S-3 is assumed to be based on
43 energy-intensive gaseous diffusion technology. By scaling values found in Table S-3, the staff
44 determined that, of the total annual water use of 4.55×10^{10} gal, about 4.44×10^{10} gallons (gal)
45 are required for the removal of waste heat. Other water uses involve the discharge to air (e.g.,

1 evaporation losses in process cooling) of about 6.40×10^8 gal/yr and water discharged to the
 2 ground (e.g., mine drainage) of about 5.13×10^8 gal/yr.

3 On a thermal effluent basis, annual discharges from the uranium fuel cycle are about 4 percent
 4 of the 1000-MW(e) LWR-scaled model using once-through cooling. The consumptive water use
 5 is about 2 percent of the 1000-MW(e) LWR-scaled model using cooling towers. The maximum
 6 consumptive water use (assuming that all plants supplying electrical energy to the uranium fuel
 7 cycle use cooling towers) would be about 6 percent of the 1000-MW(e) LWR-scaled model
 8 using cooling towers. Under this condition, thermal effluents would be negligible. As uranium
 9 enrichment technology evolves more toward the gas centrifuge method, water use effects will
 10 decrease significantly. The staff concludes that the impacts on water use for those
 11 combinations of thermal loadings and water consumption would be SMALL.

12 **6.1.3 Fossil Fuel Impacts**

13 Electric energy and process heat are required during various phases of the uranium fuel cycle
 14 process. Most of the electric energy is usually produced by the combustion of fossil fuel at
 15 conventional power plants. Electric energy associated with the uranium fuel cycle represents
 16 about 5 percent of the annual electric power production of the reference 1000-MW(e) LWR.
 17 This assumes that domestic gaseous diffusion is the sole method of uranium enrichment.
 18 Process heat for uranium fuel cycle facilities is primarily generated by the combustion of natural
 19 gas. Gas consumption, if used to generate electricity, would represent less than 0.4 percent of
 20 the electrical output from the model plant.

21 The largest source of carbon dioxide (CO₂) emissions associated with nuclear power is from the
 22 fuel cycle, not the operation of the plant, as indicated in the previous paragraph and in
 23 Table S-3. The CO₂ emissions from the fuel cycle are about 5 percent of the CO₂ emissions
 24 from an equivalent fossil fuel-fired plant.

25 The largest use of electricity in the fuel cycle comes from the enrichment process. It appears
 26 that gaseous centrifuge technology is likely to eventually replace gaseous diffusion technology
 27 for uranium enrichment in the United States. The same amount of enrichment from a gaseous
 28 centrifuge facility uses less electricity and therefore results in lower amounts of air emissions
 29 such as CO₂ than a gaseous diffusion facility. The transition toward centrifuge enrichment and
 30 the availability of foreign uranium fuel cycle services will continue to decrease the domestic
 31 fossil fuel effects of the uranium fuel cycle. Therefore, the NRC staff concludes that the values
 32 for electricity use and air emissions in Table S-3 continue to be appropriately bounding values.

33 In Appendix J, the NRC staff estimates that the carbon footprint of the fuel cycle to support a
 34 reference 1000-MW(e) LWR for a 40-year plant life is on the order of 1.8×10^7 MT of CO₂
 35 including a very small contribution from other greenhouse gases. Scaling this footprint to the
 36 3040 MW(e) power level of the two US-APWR reactors, the NRC staff estimates the carbon
 37 footprint for 40 years of fuel cycle emissions to be 7.2×10^7 metric tons of CO₂.

38 On this basis, the NRC staff concludes that the fossil fuel impacts including greenhouse gas
 39 emissions from the direct and indirect consumption of electric energy for uranium fuel cycle
 40 operations would be SMALL relative to the net power production of the proposed project.

41 **6.1.4 Chemical Effluents**

42 The quantities of chemical, gaseous, and particulate effluents with uranium fuel cycle processes
 43 are given in Table S-3 (Table 6-1) for the reference 1000-MW(e) LWR and, according to WASH-
 44 1248 (AEC 1974), result from the generation of electricity for uranium fuel cycle operations. The
 45 principal effluents are sulfur oxides, nitrogen oxides, and particulates. Table S-3 states that the

1 uranium fuel cycle for the reference 1000-MW(e) LWR requires 323,000 MW-hr of electricity
2 annually. The uranium fuel cycle for the 1000-MW(e)-scaled model would therefore require four
3 times that annually (1.29 million MW-hr/yr), or 0.031 percent of the 4.1 billion MW-hr of
4 electricity generated in the United States in 2008 (DOE/EIA 2009). Therefore, the gaseous and
5 particulate emissions would add about 0.031 percent to the national emissions for electricity
6 generation. Improvements in enrichment technology and increasing use of foreign uranium fuel
7 cycle services will result in fewer domestic impacts from chemical effluent related to the uranium
8 fuel cycle.

9 Liquid chemical effluents produced in uranium fuel cycle processes are related to fuel
10 enrichment and fabrication and may be released to receiving waters. These effluents are
11 usually present in dilute concentrations, and only small amounts of dilution water are required to
12 reach levels of concentration that are within established standards. Table S-3 (Table 6-1)
13 specifies the amount of dilution water required for specific constituents. In addition, all liquid
14 discharges into the navigable waters of the United States from plants associated with uranium
15 fuel cycle operations would be subject to requirements and limitations set by appropriate
16 Federal, State, Tribal, and local agencies.

17 Tailings solutions and solids are generated during the milling process and are not released in
18 quantities sufficient to have a significant impact on the environment.

19 Based on the discussions above, the NRC staff concludes that the impacts of chemical effluents
20 would be SMALL.

21 **6.1.5 Radiological Effluents**

22 Radioactive effluents estimated to be released to the environment from waste management
23 activities and certain other phases of the uranium fuel cycle process are set forth in Table S-3
24 (Table 6-1). Using these effluents in NUREG-1437 (NRC 1996), the NRC staff calculated the
25 100-year environmental dose commitment to the U.S. population from the uranium fuel cycle for
26 1 year of operation of the model 1000-MW(e) LWR. The total overall whole body gaseous dose
27 commitment and whole body liquid dose commitment from the uranium fuel cycle (excluding
28 reactor releases and dose commitments because of exposure to radon-222 and technetium-99)
29 were calculated to be approximately 400 person-rem and 200 person-rem, respectively. Scaling
30 these dose commitments by a factor of about 4 for the 1000-MW(e) LWR-scaled model results
31 in whole body dose commitment estimates of 1600 person-rem for gaseous releases and
32 800 person-rem for liquid releases. For both pathways, the estimated 100-year environmental
33 dose commitment to the U.S. population would be approximately 2400 person-rem for the
34 1000-MW(e) LWR-scaled model.

35 Currently, the radiological impacts associated with radon-222 and technetium-99 releases are
36 not addressed in Table S-3. Principal radon releases occur during mining and milling
37 operations and as emissions from mill tailings whereas principal technetium-99 releases occur
38 from gaseous diffusion enrichment facilities. Luminant provided an assessment of radon-222
39 and technetium-99 in its ER (Luminant 2009a). This evaluation relied on the information
40 discussed in NUREG-1437 (NRC 1996).

41 In Section 6.2 of NUREG-1437 (NRC 1996), the staff estimated the radon-222 releases from
42 mining and milling operations and from mill tailings for each year of operation of the reference
43 1000-MW(e) LWR. The estimated releases of radon-222 for the reference reactor year for the
44 1000-MW(e) LWR-scaled model, or for the total electric power rating for proposed Units 3 and 4
45 for a year, are approximately 20,763 curies (Ci). Of this total, about 78 percent would be from
46 mining, 15 percent from milling operations, and 7 percent from inactive tails before stabilization.
47 For radon releases from stabilized tailings, the staff assumed that the LWR-scaled model would

1 result in an emission of 4 Ci per site year, [i.e., about four times the estimate found for the
2 reference reactor year in NUREG-1437 (NRC 1996)]. The major risks from radon-222 are from
3 exposure to bone and lung, although there is a small risk from exposure to the whole body. The
4 organ-specific dose-weighting factors from 10 CFR Part 20 were applied to the bone and lung
5 doses to estimate the 100-year dose commitment from radon-222 to the whole body. The
6 estimated 100-year environmental dose commitment from mining, milling, and tailings before
7 stabilization for each site year (assuming the 1000-MW(e) LWR-scaled model) would be
8 approximately 3680 person-rem to the whole body. From stabilized tailings piles, the estimated
9 100-year environmental dose commitment would be approximately 70 person-rem to the whole
10 body. Additional insights regarding Federal policy and resource perspectives concerning
11 institutional controls comparisons with routine radon-222 exposure and risk and long-term
12 releases from stabilized tailing piles are discussed in NUREG-1437 (NRC 1996).

13 Also, as discussed in NUREG-1437, the staff considered the potential health effects associated
14 with the releases of technetium-99. The estimated releases of technetium-99 for the reference
15 reactor year for the 1000-MW(e) LWR-scaled model are 28 mCi from chemical processing of
16 recycled UF₆ before it enters the isotope enrichment cascade and 20 mCi into the groundwater
17 from a repository. The major risks from technetium-99 are from exposure of the gastrointestinal
18 tract and kidney, although there is a small risk from exposure to the whole body. When organ-
19 specific dose-weighting factors from 10 CFR Part 20 are applied to the doses to the
20 gastrointestinal tract and kidneys, the total-body 100-year dose commitment from technetium-99
21 to the whole body was estimated to be 400 person-rem for the 1000-MW(e) LWR-scaled model.

22 Radiation protection experts assume that any amount of radiation may pose some risk of
23 causing cancer or a severe hereditary effect and that the risk is higher for higher radiation
24 exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the
25 relationship between radiation dose and detriments such as cancer induction. A recent report
26 by the National Research Council (2006), the Biological Effects of Ionizing Radiation (BEIR) VII
27 report, uses the linear, no-threshold model as a basis for estimating the risks from low doses.
28 This approach is accepted by the NRC as a conservative method for estimating health risks
29 from radiation exposure, recognizing that the model may overestimate those risks. Based on
30 this method, the staff estimated the risk to the public from radiation exposure using the nominal
31 probability coefficient for total detriment. The nominal probability coefficient for total detriment is
32 a factor for the incidence of cancer and other health effects. This coefficient has the value of
33 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem,
34 equal to 0.00057 effects per person-rem. The coefficient is taken from International
35 Commission on Radiological Protection's (ICRP) Publication 103 (ICRP 2007).

36 Based on this model, the staff estimated the risk to the public from radiation exposure using the
37 nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and
38 severe hereditary effects per 1,000,000 person-rem) from ICRP Publication 60 (ICRP 1991).
39 This coefficient was multiplied by the sum of the estimated whole body population doses from
40 gaseous effluents, liquid effluents, radon-222, and technetium-99 (approximately 3400 person-
41 rem/yr) to calculate that the U.S. population would incur a total of approximately three fatal
42 cancers, nonfatal cancers, and severe hereditary effects annually.

43 Radon-222 releases from tailings are indistinguishable from background radiation levels at a
44 few miles from the tailings pile (at less than 0.6 mi in some cases) (NRC 1996). The public
45 dose limit in the U.S. Environmental Protection Agency's (EPA's) regulation, 40 CFR Part 190,
46 is 25 mrem/yr to the whole body from the entire uranium fuel cycle, but most NRC licensees
47 have airborne effluents resulting in doses of less than 1 mrem/yr (61 FR 65120).

1 In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a
 2 study and published *Cancer in Populations Living Near Nuclear Facilities* in 1990 (NCI 1990).
 3 The report included an evaluation of health statistics around all nuclear power plants and
 4 several other uranium fuel cycle facilities in operation in the United States in 1981 and found “no
 5 evidence that an excess occurrence of cancer has resulted from living near nuclear facilities”
 6 (NCI 1990). The contribution to the annual average dose received by an individual from
 7 uranium fuel cycle-related radiation and other sources as reported in a report published by the
 8 National Council on Radiation Protection and Measurements (NCRP 2009) is listed in Table 6-2.
 9 The uranium fuel cycle contribution to an individual’s annual average radiation dose is extremely
 10 small (less than 0.01 mrem per year) compared to the annual average background radiation
 11 dose (about 311 mrem/yr).

12 **Table 6-2.** Comparison of annual average dose received by an individual from all sources

	Source	Dose (mrem/yr) ^(a)	Percent of Total
Ubiquitous background	Radon & Thoron	228	37
	Space	33	5
	Terrestrial	21	3
	Internal (body)	29	5
	Total background sources	311	50
Medical	Computed tomography	147	24
	Medical x-ray	76	12
	Nuclear medicine	77	12
	Total medical sources	300	48
Consumer	Construction materials, smoking, air travel, mining, agriculture, fossil fuel combustion	13	2
Other	Occupational	0.5 ^(b)	0.1
	Nuclear fuel cycle	0.05 ^(c)	0.01
Total		624	

Source: NCRP 2009. Report 160, Ionizing Radiation Exposure of the Population of the United States

(a) NCRP Report 160 table expressed doses in mSv/yr (1 mSv/yr equals 100 mrem/yr).

(b) Occupational dose is regulated separately from public dose and is provided here for informational purposes.

(c) Estimated using 153 person-Sv/yr from Table 6.1 of NCRP 160 and a 2006 US population of 300 million.

13 Based on the analyses presented above, the NRC staff concludes that the environmental
 14 impacts of radioactive effluents from the uranium fuel cycle are SMALL.

15 **6.1.6 Radiological Wastes**

16 The quantities of buried radioactive waste material (low-level, high-level, and transuranic
 17 wastes) are specified in Table S-3 (Table 6-1).

18 For low-level waste disposal at land burial facilities, the Commission notes in Table S-3 that
 19 there would be no significant radioactive releases to the environment. CPNPP Units 1 and 2

1 can no longer dispose of Class B and C LLW at the Energy Solutions site in Barnwell, South
2 Carolina. Proposed Units 3 and 4, if in operation, would also not be able to dispose of these
3 wastes at Barnwell. However, Class A LLW can be shipped to the Energy Solutions site in
4 Clive, Utah. Other disposal sites may be available by the time the two new units would become
5 operational. For example, on September 10, 2009, the Texas Commission on Environmental
6 Quality (TCEQ) (TCEQ 2009e) issued a Radioactive Material License R04100 to Waste Control
7 Specialists, LLC (WCS) for the construction of a low-level waste facility in Andrews County,
8 Texas. The facility will be capable of disposal of Class A, B, and C LLW. Construction will
9 begin after WCS demonstrates that it has adequately addressed the conditions identified in its
10 license. Once WCS completes construction and satisfies any operational-related conditions
11 imposed by the TCEQ, the facility may begin to receive and dispose of LLW (TCEQ 2009e).
12 Disposal activities are estimated to begin in late 2010 (Valhi 2010). Thus, it is likely that this
13 facility would be available to the CPNPP for disposal of LLW. In addition, the industry is
14 investigating alternate disposal pathways for Class B and C LLW to include (1) compaction and
15 storage at offsite vendor locations until disposal is secured, and (2) blending of waste types with
16 subsequent disposal at available disposal sites.

17 The NRC staff anticipates that licensees would temporarily store Class B and C LLW onsite until
18 offsite storage locations are available. Several operating nuclear power plants have
19 successfully increased onsite storage capacity in the past in accordance with existing NRC
20 regulations. This extended waste storage onsite resulted in no significant increase in dose to
21 the public. In addition, the NRC issued considerations for extended onsite interim storage of
22 LLW in Regulatory Issue Summary 2008-12 (NRC 2008). Examples of considerations included
23 storing waste in a manner that minimizes potential exposure to workers which may require
24 adding shielding and storing waste in packaging compatible with the waste composition
25 (e.g., chemical and thermal properties).

26 The NRC staff concluded in NUREG-1437 (NRC 1996) that the radiological impacts from LLW
27 storage would be small and fall within current regulatory requirements. Although NUREG-1437
28 is for license renewal activities, the staff concludes the evaluation can be applied to new
29 reactors because radwaste technology and operations would be similar to existing operating
30 reactors. In NUREG-1437 (Section 6.4.4.2), the NRC staff concluded that there should be no
31 significant issues or environmental impacts associated with interim storage of LLW generated
32 by nuclear power plants. Interim storage facilities would be used until these wastes could be
33 safely shipped to licensed disposal facilities. Luminant's resolution of LLW disposal issues
34 for the existing CPNPP Units 1 and 2 could also be implemented for the proposed Units 3
35 and 4.

36 The Commission notes that high-level and transuranic wastes are to be buried at a repository,
37 such as the candidate repository at Yucca Mountain, Nevada. The Commission also notes that
38 no release to the environment is expected to be associated with such disposal because it has
39 been assumed that all of the gaseous and volatile radionuclides contained in the spent fuel are
40 released to the atmosphere before the disposal of the waste. In NUREG-0116 (NRC 1976),
41 which provides background and context for the high-level and transuranic Table S-3 values
42 established by the Commission, the NRC staff indicates that these high-level and transuranic
43 wastes will be buried and will not be released to the environment.

44 As a part of the Table S-3 rulemaking the NRC staff evaluated, along with more conservative
45 assumptions, the zero release assumption associated with waste burial in a repository, and the
46 NRC reached an overall generic determination that fuel cycle impacts would not be significant.
47 In 1983, the Supreme Court affirmed the NRC's position that the zero release assumption was
48 reasonable in the context of the Table S-3 rulemaking to address generically the impacts of the

1 uranium fuel cycle in individual reactor licensing proceedings (Baltimore Gas & Electric v.
2 Natural Resources Defense Council, 462 U.S. 87 (1983)).

3 Furthermore, in the Commission's Waste Confidence Decision, 10 CFR 51.23, the Commission
4 has made the generic determination that "if necessary, spent fuel generated in any reactor can
5 be stored safely and without significant environmental impacts for at least 30 years beyond the
6 licensed life for operation of that reactor at its spent fuel storage basin or at either onsite or
7 offsite independent spent fuel storage installations." That regulation also states that "the
8 Commission believes there is reasonable assurance that at least one mined geologic repository
9 will be available within the first quarter of the twenty-first century, and sufficient repository
10 capacity will be available within 30 years beyond the licensed life for operation of any reactor to
11 dispose of the commercial high-level waste and spent fuel originating in such reactor and
12 generated up to that time." The regulation provides that, accordingly, no discussion of any
13 environmental impact of spent fuel storage for the period following the term of a reactor
14 combined license is required in any EIS prepared in connection with the issuance of that
15 combined license.

16 In October 2008, the Commission proposed a rulemaking to update and revise the Waste
17 Confidence Decision (73 FR 59551). Public comments were received on the rulemaking and
18 the public comment period for the rule was extended through February 2009 (73 FR 72370). At
19 this time, however, the Commission has not approved publication of the final rule. If a revised
20 rule concerning the waste confidence determination is ultimately issued by the Commission, the
21 staff will be required to follow that determination. Absent further developments with respect to
22 the Waste Confidence rulemaking, Table S-3 and the existing Waste Confidence Decision
23 indicate that any environmental impacts associated with the high-level waste that would be
24 generated by Units 3 and 4 would be SMALL.

25 In the context of operating license renewal, Sections 6.2 and 6.4 of NUREG-1437 (NRC 1996)
26 provide additional description of the generation, storage, and ultimate disposal of LLW, mixed
27 waste, and spent fuel from power reactors, concluding that environmental impacts from these
28 activities are small. For the reasons stated above, the NRC staff concludes that the
29 environmental impacts of radioactive waste storage and disposal associated with Units 3 and 4
30 are SMALL.

31 **6.1.7 Occupational Dose**

32 The annual occupational dose attributable to all phases of the uranium fuel cycle for the
33 1000-MW(e) LWR-scaled model is about 2400 person-rem. This quantity is based on a 600
34 person-rem occupational dose estimate attributable to all phases of the uranium fuel cycle for
35 the model 1000-MW(e) LWR (NRC 1996). (Most of the dose arises from reprocessing and
36 waste management.) The NRC staff concludes that the environmental impact from this
37 occupational dose would be SMALL because the dose to any individual worker is maintained
38 within the limits of 10 CFR Part 20, which is 5 rem/yr.

39 **6.1.8 Transportation**

40 The transportation dose to workers and the public totals about 2.5 person-rem annually for the
41 reference 1000-MW(e) LWR per Table S-3 (Table 6-1). This quantity corresponds to a dose of
42 10 person-rem for the 1000-MW(e) LWR-scaled model. The NRC staff concludes that
43 environmental impacts of uranium fuel cycle transportation would be SMALL.

1 **6.1.9 Conclusions**

2 The NRC staff evaluated the environmental impacts of the uranium fuel cycle, as given in Table
 3 S-3 from 10 CFR 51.51(b) (Table 6.1), considered the effects of radon-222 and technicium-99,
 4 and appropriately scaled the impacts for the proposed CPNPP 3040-MWe (net) system (total for
 5 Units 3 and 4) from the Table S-3 model, which is for a single 1000-MW(e) unit. The NRC staff
 6 also evaluated the environmental impacts of greenhouse gas emissions from the uranium fuel
 7 cycle and appropriately scaled the impacts for the 1000-MW(e) LWR-scaled model. Based on
 8 that evaluation, the NRC staff concludes that the impacts would be SMALL.

9 **6.2 Transportation Impacts**

10 This section addresses both the radiological and nonradiological environmental impacts from
 11 normal operating and accident conditions resulting from (1) shipment of unirradiated fuel to the
 12 CPNPP site and alternative sites, (2) shipment of spent fuel to a monitored retrievable storage
 13 facility or a permanent repository, and (3) shipment of LLW and mixed waste to offsite disposal
 14 facilities. The sites evaluated in this EIS include the existing CPNPP site (preferred) near Glen
 15 Rose, Texas, and alternative sites identified in Luminant's ER as the Coastal site (Site A, near
 16 Victoria, Texas), the Pineland site (Site B, near Lufkin, Texas), and the Tradinghouse site (Site
 17 C, near Waco, Texas) (Luminant 2009a). Additional details, including the location of these three
 18 alternative sites, can be found in Section 9.3 of this EIS.

19 The NRC performed a generic analysis of the environmental effects of transportation of fuel and
 20 waste to and from LWRs in the Environmental Survey of Transportation of Radioactive Materials
 21 To and From Nuclear Power Plants, WASH-1238 (AEC 1972) and in a supplement to WASH-
 22 1238, NUREG-75/038 (NRC 1975) and found the impact to be minimal. These documents
 23 provided the basis for Table S-4 in 10 CFR 51.52, which summarizes the environmental impacts
 24 of transportation of fuel and waste to and from one LWR of 3000 to 5000 MW(t) [1000 to 1500
 25 MW(e)]. Impacts are provided for normal conditions of transport and accidents in transport for a
 26 reference 1100-MW(e) LWR. ^(b)Dose to transportation workers during normal transportation
 27 operations was estimated to result in a collective dose of 4 person-rem per reference
 28 reactor year. The combined dose to the public along the route and dose to onlookers were
 29 estimated to result in a collective dose of 3 person-rem per reference reactor year.

30 Environmental risks of radiological effects during accident conditions, as stated in Table S-4, are
 31 minimal. Nonradiological impacts from postulated accidents were estimated as one fatal injury
 32 in 100 reactor years and one nonfatal injury in 10 reference reactor years. Subsequent reviews
 33 of transportation impacts in NUREG-0170 (NRC 1977a) and NUREG/CR-6672 (Sprung et al.
 34 2000) concluded that impacts were bounded by Table S-4 in 10 CFR 51.52.

35 In accordance with 10 CFR 51.52(a), a full description and detailed analysis of transportation
 36 impacts are not required when licensing an LWR (i.e., impacts are bounded by Table S-4) if the
 37 reactor meets the following criteria.

- 38 • The reactor has a core thermal power level not exceeding 3800 MW(t).
- 39 • Fuel is in the form of sintered UO₂ pellets having a uranium-235 enrichment not exceeding
 40 4 percent by weight, and the pellets are encapsulated in zircalloy-clad fuel rods.

(b) The transportation impacts associated with the CPNPP site were normalized for a reference 1100-MW(e) LWR at an 80 percent capacity factor for comparisons to Table S-4. Note that the basis for Table S-4 is an 1100 MW(e) LWR at an 80% capacity factor (AEC, 1972, NRC 1975). The basis for Table S-3 in 10 CFR 51.51(b) that was discussed in Section 6.1 of this EIS is a 1000 MW(e) LWR with an 80% capacity factor (NRC 1976). However, since the fuel cycle and transportation impacts are evaluated separately, this difference does not affect the results and conclusions in this EIS.

- 1 • Average level of irradiation of the fuel from the reactor does not exceed 33,000 MWd/MTU,
2 and no irradiated fuel assembly is shipped until at least 90 days after it is discharged from
3 the reactor.
- 4 • With the exception of irradiated fuel, all radioactive waste shipped from the reactor is
5 packaged and in solid form.
- 6 • Unirradiated fuel is shipped to the reactor by truck; irradiated (spent) fuel is shipped from the
7 reactor by truck, rail, or barge; and radioactive waste other than irradiated fuel is shipped
8 from the reactor by truck or rail.

9 The environmental impacts of the transportation of fuel and radioactive wastes to and from
10 nuclear power facilities were resolved generically in 10 CFR 51.52, provided that the specific
11 conditions in the rule (i.e., in Table S-4) are met; if not, then a full description and detailed
12 analysis is required for initial licensing. The NRC may consider requests for licensed plants to
13 operate at conditions above those in the facility's licensing basis; for example, higher burnups
14 (above 33,000 MWd/MTU), enrichments (above 4 percent uranium-235), or thermal power
15 levels (above 3800 MW(t)). Departures from the conditions itemized in 10 CFR 51.52(a) must
16 be supported by a full description and detailed analysis of the environmental effects, as
17 specified in 10 CFR 51.52(b). Departures found to be acceptable for licensed facilities cannot
18 serve as the basis for initial licensing of new reactors.

19 In its application, Luminant requested COLs for two additional reactors at its CPNPP site in
20 Somervell and Hood Counties, Texas. The design of the proposed new reactor would be an
21 US-APWR. Each US-APWR reactor has a thermal power rating of 4451 MW(t) and a design
22 net electrical output of 1600 MW(e). The thermal power rating exceeds the 3800 MW(t)
23 condition given in 10 CFR 51.52(a). The US-APWR reactors are expected to operate with a 93
24 percent capacity factor, so the net electrical output (annualized) is about 1488 MW(e)(Luminant
25 2009a). Fuel for the plants would be enriched up to about 4.55 weight-percent uranium-235,
26 which exceeds the 10 CFR 51.52(a) condition. In addition, the expected irradiation level of
27 about 46,200 MWd/MTU exceeds the 10 CFR 51.52(a) condition. Therefore, a full description
28 and detailed analysis of transportation impacts is required.

29 In its ER (Luminant 2009a), Luminant provided a full description and detailed analyses of
30 transportation impacts. In these analyses, radiological impacts of transporting fuel and waste
31 to/from the CPNPP site were calculated using the RADTRAN 5.6 computer code (Weiner et al.
32 2008). RADTRAN 5.6 was used in this EIS and is the most commonly used transportation
33 impact analysis software in the nuclear industry.

34 **6.2.1 Transportation of Unirradiated Fuel**

35 The NRC staff performed an independent analysis of the environmental impacts of transporting
36 unirradiated (i.e., fresh) fuel to the CPNPP site and to the alternative sites. Radiological impacts
37 of normal operating conditions and transportation accidents as well as nonradiological impacts
38 are discussed in this section. Radiological impacts to populations and maximally exposed
39 individuals (MEIs) are presented. Because the specific fuel fabrication plant for CPNPP Units 3
40 and 4 are not known at this time, the NRC staff's analysis assumes a "representative" route
41 between the fuel fabrication facility and CPNPP site and the alternative sites. This means that
42 the route characteristics (distance and population distribution) are the same and that there
43 are no differences between the impacts calculated for transporting unirradiated fuel to the
44 CPNPP site or to one of the three alternative sites. However, site-specific differences would be
45 small because the radiation doses from unirradiated fuel transport and shipping distances
46 between potential fuel fabrication plants and the CPNPP site and alternative sites are minimal.

1 **6.2.1.1 Normal Conditions**

2 Normal conditions, sometimes referred to as “incident-free” transportation, are transportation
 3 activities in which shipments reach their destination without releasing any radioactive material to
 4 the environment. Impacts from these shipments would be from the low levels of radiation that
 5 penetrate the unirradiated-fuel shipping containers. Radiation exposures at some level would
 6 occur to (1) persons residing along the transportation corridors between the fuel fabrication
 7 facility and the CPNPP site or the alternative sites; (2) persons in vehicles traveling on the same
 8 route as an unirradiated fuel shipment; (3) persons at vehicle stops for refueling, rest, and
 9 vehicle inspections; and (4) transportation crew workers.

10 **Truck Shipments**

11 Table 6-3 provides an estimate of the number of truck shipments of unirradiated fuel for the US-
 12 APWR design compared with those for the reference 1100-MW(e) reactor specified in WASH-
 13 1238 (AEC 1972) operating at 80 percent capacity [880 MW(e)]. After normalization, the
 14 number of truck shipments of unirradiated fuel to the proposed CPNPP site and alternative sites
 15 would be fewer than the number of truck shipments of unirradiated fuel estimated for the
 16 reference LWR in WASH-1238.

Table 6-3. Numbers of Truck Shipments of Unirradiated Fuel for the Reference LWR and the US-APWR

Reactor Type	Number of Shipments per Reactor Total ^(a)	Unit Electric Generation, MW(e) ^(b)	Capacity Factor ^(b)	Normalized, Shipments per 1100 MW(e) ^(c)
Reference LWR (WASH-1238)	252	1100	0.8	252
CPNPP US-APWR	100	1600	0.93	60

- (a) Total shipments of unirradiated fuel over a 40-year plant lifetime (i.e., initial core load plus 39 years of average annual reload quantities).
- (b) Unit capacities and capacity factors were taken from WASH-1238 (AEC 1972) for the reference LWR and the ER (Luminant 2009a) for the US-APWR reactor.
- (c) Normalized to net electric output for WASH-1238 reference LWR (i.e., 1100-MW(e) plant at 80 percent or net electrical output of 880 MW(e) (AEC 1972).

17 **Shipping Mode and Weight Limits**

18 In 10 CFR 51.52 (a)(5), a condition is identified that states all unirradiated fuel is shipped to the
 19 reactor by truck. Luminant specifies that unirradiated fuel would be shipped to the reactor site
 20 by truck (Luminant 2009a). Table S-4 in 10 CFR 51.52 includes a condition that the truck
 21 shipments not exceed 73,000 lb as governed by Federal or State gross vehicle weight
 22 restrictions. Luminant states in its ER (Luminant 2009a) that the unirradiated fuel shipments to
 23 the proposed CPNPP site would comply with applicable weight restrictions.

24 **Radiological Doses to Transport Workers and the Public**

25 Table S-4 in 10 CFR 51.52, Table S-4, includes conditions related to radiological dose to
 26 transport workers and members of the public along transport routes. The doses are a function
 27 of many variables, including the radiation dose rate emitted from the unirradiated fuel
 28 shipments, the number of exposed individuals and their locations relative to the shipment, the

1 time in transit (including travel and stop times), and number of shipments to which the
2 individuals are exposed. For this EIS, the NRC staff calculated the radiological dose impacts of
3 the transportation of unirradiated fuel for the worker and the public using the RADTRAN 5.6
4 computer code (Weiner et al.2008).

5 One of the key assumptions in WASH-1238 (AEC 1972) for the reference LWR unirradiated fuel
6 shipments is that the radiation dose rate at 3.3 feet (ft) from the transport vehicle is about
7 0.1 mrem/hr. This assumption was also used in the NRC staff's analysis of the US-APWR
8 reactor unirradiated fuel shipments. This assumption is reasonable because the US-APWR
9 reactor fuel materials would be low-dose-rate uranium radionuclides and would be packaged
10 similarly to that described in WASH-1238 (i.e., inside a metal container that provides little
11 radiation shielding). The numbers of shipments per year were obtained by dividing the
12 normalized shipments in Table 6-3 by 40 years of operation. Other key input parameters (listed
13 in metric units) used in the radiation dose analysis for unirradiated fuel are shown in Table 6-4.

14 The RADTRAN 5.6 results for this "generic" unirradiated fuel shipment are as follows:

- 15 • Worker dose: 1.85×10^{-3} person-rem/shipment;
- 16 • General public dose (onlookers/persons at stops and sharing the highway):
17 3.79×10^{-3} person-rem/shipment); and
- 18 • General public dose (along route/persons living near a highway or truck stop): 5.02×10^{-5}
19 person-rem/shipment.

20 These values were combined with the average annual shipments of unirradiated fuel for the US-
21 APWR reactor to calculate annual doses to the public and workers. Table 6-5 presents the
22 annual radiological impacts to workers, public onlookers (persons at stops and sharing the
23 road), and members of the public along the route (i.e., residents within 0.5 mi of the highway) for
24 transporting unirradiated fuel to the CPNPP site. The cumulative annual dose estimates in
25 Table 6-5 were normalized to 1100 MW(e) [880 MW(e) net electrical output]. The NRC staff
26 performed an independent review and determined that all dose estimates calculated by the staff
27 are bounded by the Table S-4 conditions of 4 person-rem/yr to transportation workers, 3 person-
28 rem/yr to onlookers, and 3 person-rem/yr to members of the public along the route.

Table 6-4. RADTRAN 5.6 input parameters for unirradiated fuel shipments

Parameter	RADTRAN 5 Input Value	Source
Shipping distance, km	3200	AEC 1972 ^(a)
Travel fraction—rural	0.90	
Travel fraction—suburban	0.05	NRC 1977a
Travel fraction—urban	0.05	
Population density—rural, persons/km ²	10	
Population density—suburban, persons/km ²	349	DOE 2002a
Population density—urban, persons/km ²	2260	
Vehicle speed—km/hr	88.49	Conservative in transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count—rural, vehicles/hr	530	
Traffic count—suburban, vehicles/hr	760	DOE 2002a
Traffic count—urban, vehicles/hr	2400	
Dose rate at 1 m from vehicle, mrem/hr	0.1	AEC 1972
Packaging length, m	9.1	Approximate length of two US-APWR fuel assemblies placed on end (INEEL 2003)
Number of truck crew	2	AEC 1972, NRC 1977a, and DOE 2002a
Stop time, hr/trip	4	Based on 1 30-minute stop per 400 km (Johnson and Michelhaugh 2003)
Population density at stops, persons/km ²	See Table 6-8 for truck stop parameters	

(a) WASH 1238 (AEC 1972) provides a range of shipping distances between 40 km (25 mi) and 4800 km (3000 mi) for fresh fuel shipments. A 3200-km (2000-mi) “representative” shipping distance was assumed here.

2 Radiation protection experts assume that any amount of radiation may pose some risk of
 3 causing cancer or a severe hereditary effect and that the risk is higher for higher radiation
 4 exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the
 5 relationship between radiation dose and detriments such as cancer induction. A recent report
 6 by the National Research Council (2006), the Biological BEIR VII report, uses the linear, no-
 7 threshold model as a basis for estimating the risks from low doses. This approach is accepted
 8 by the NRC as a conservative method for estimating health risks from radiation exposure,
 9 recognizing that the model may overestimate those risks. Based on the method, the NRC staff
 10 estimated the risk to the public from radiation exposure using the nominal probability coefficient
 11 for total detriment. The coefficient has the value of 570 fatal cancers, nonfatal cancers, and
 12 severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv), equal to 0.00057

1 effects per person-rem. The coefficient is taken from Publication 103 of the International
 2 Commission of Radiological Protection (ICRP 2007).

Table 6-5 Radiological impacts under normal conditions of transporting unirradiated fuel to the CPNPP site and alternative sites

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose; person-rem/yr per 1100 MW(e) ^(a) [880 MW(e) net]		
		Workers	Public - Onlookers	Public - Along Route
Reference LWR [WASH-1238 (AEC 1972)]	6.3	1.1×10^{-2}	2.3×10^{-2}	3.2×10^{-4}
US-APWR, CPNPP and Alternative Sites	1.5	4.1×10^{-3}	7.1×10^{-3}	4.3×10^{-5}
10 CFR 51.52, Table S-4 Condition	< 1 per day	4	3	3

(a) Multiply person-rem/yr times 0.01 to obtain doses in person-Sv/yr.

3 Both National Council on Radiation Protection (NCRP) and ICRP suggest that when the
 4 collective effective dose is smaller than the reciprocal of the relevant risk detriment (in other
 5 words, less than 1/0.00057, which is less than 1754 person-rem), the risk assessment should
 6 note that the most likely number of excess health effects is zero (NCRP 1995, ICRP 2007). The
 7 largest annual collective dose estimate for transporting unirradiated fuel to the CPNPP site and
 8 alternative sites was 1.7×10^{-2} person-rem, which is less than the 1754 person-rem value that
 9 ICRP and NCRP suggest would most likely result in zero excess health effects.

10 To place these impacts in perspective, the average U.S. resident receives about 311 mrem/yr
 11 effective dose equivalent from natural background radiation (i.e., exposures from cosmic
 12 radiation, naturally occurring radioactive materials such as radon, and global fallout from testing
 13 of nuclear explosive devices) (NCRP 2009). Using this average effective dose, the collective
 14 population dose from natural background radiation to the population along this representative
 15 route would be about 2.2×10^5 person-rem. Therefore, the radiation doses from transporting
 16 unirradiated fuel to the CPNPP and alternative sites are small compared to the collective
 17 population dose to the same population from exposure to natural sources of radiation.

18 **MEIs under Normal Transport Conditions**

19 A scenario-based analysis was conducted by the NRC staff to develop estimates of incident-
 20 free radiation doses to MEIs for fuel and waste shipments to and from the CPNPP site and
 21 alternative sites. The following discussion applies to unirradiated fuel shipments to, and spent
 22 fuel and radioactive shipments from, any of the alternative sites. The analysis is based on
 23 information from DOE (DOE 2002b) and incorporates data about exposure times, dose rates,
 24 and the number of times an individual may be exposed to an offsite shipment. Adjustments
 25 were made where necessary to reflect the normalized fuel and waste shipments addressed in
 26 this EIS. In all cases, the NRC staff assumed that the dose rate emitted from the shipping
 27 containers is 10 mrem/hr at 2 m (6.6 ft) from the side of the transport vehicle. This assumption
 28 is conservative, in that the assumed dose rate is the maximum dose rate allowed by U.S.
 29 Department of Transportation (DOT) regulations (49 CFR 173.441). Most unirradiated fuel and
 30 radioactive waste shipments would have much lower dose rates than the regulations allow

1 (AEC 1972, DOE 2002a). An MEI is a person who may receive the highest radiation dose from
2 a shipment to and/or from the CPNPP site and alternative sites. The analysis is described
3 below.

4 **Truck crew member.** Truck crew members would receive the highest radiation doses during
5 incident-free transport because of their proximity to the loaded shipping container for an
6 extended period of time. The analysis assumed that crew member doses are limited to 2 rem
7 per year, which is the DOE administrative control level presented in Chapter 2, Article 211, of
8 *DOE Standard, Radiological Control*, DOE-STD-1098-99 (DOE 2005). This limit is anticipated
9 to apply to spent nuclear fuel shipments to a disposal facility because DOE would take title to
10 the spent fuel at the reactor site. There will be more shipments of spent nuclear fuel from the
11 CPNPP site and alternative sites than there will be shipments of unirradiated fuel and
12 radioactive waste other than spent fuel from these sites. This is because the capacities of spent
13 fuel shipping casks are limited due to their substantial radiation shielding and accident
14 resistance requirements. Spent fuel shipments also have significantly higher radiation dose
15 rates than unirradiated fuel and radioactive waste (DOE 2002b). As a result, crew doses from
16 unirradiated fuel and radioactive waste shipments would be lower than the doses from the spent
17 nuclear fuel shipments. The DOE administrative limit of 2 rem/yr (see DOE 2005) is less than
18 the NRC limit for occupational exposures of 5 rem/yr (see 10 CFR Part 20).

19 The DOT does not regulate annual occupational exposures. It does recognize that air crews
20 are exposed to elevated cosmic radiation levels and recommends dose limits to air crew
21 members from cosmic radiation (DOT 2003). Air passengers are less of a concern because
22 passengers do not fly as frequently as air crew members. The recommended limits are a 5-year
23 effective dose of 2 rem/yr with no more than 5 rem in a single year (DOT 2003). As a result, a 2
24 rem/yr MEI dose to truck crews is a reasonable estimate to apply to shipments of spent fuel and
25 waste from the CPNPP site and alternative sites.

26 **Inspectors.** Radioactive shipments are inspected by Federal or State vehicle inspectors, for
27 example, at State ports of entry. The Yucca Mountain Final EIS (DOE 2002b) assumed that
28 inspectors would be exposed for 1 hr at a distance of 1 m (3.3 ft) from the shipping containers.
29 The dose rate at 1 m (3.3 ft) is about 14 mrem/hr; therefore, the dose per shipment is about
30 14 mrem. This is independent of the location of the reactor site. Based on this conservative
31 value and the assumption that the same person inspects all shipments of fuel and waste to and
32 from the CPNPP site and the alternative sites, the annual doses to vehicle inspectors were
33 calculated by the staff to be about 0.8 rem/yr, based on a combined total of all shipments of
34 unirradiated fuel, spent fuel and radioactive waste to and from the CPNPP site and alternative
35 sites. This value is less than the DOE administrative control level (DOE 2005) on individual
36 doses and is also less than the 5 rem/yr NRC occupational dose limit.

37 **Resident.** The NRC staff's analysis assumed that a resident lives adjacent to a highway where
38 a shipment would pass and that the resident would be exposed to all shipments along a
39 particular route. Exposures to residents on a per-shipment basis were obtained from the NRC
40 staff's RADTRAN 5.6 output files. These dose estimates are based on an individual located 100
41 ft from the shipments that are traveling 15 mph. The potential radiation dose to the maximally
42 exposed resident is about 0.3 mrem/yr for shipments of fuel and waste to/from the CPNPP site
43 and alternative sites.

44 **Individual stuck in traffic.** This scenario addresses potential traffic interruptions that could
45 lead to a person being exposed to a loaded shipment for 1 hr at a distance of 4 ft. The NRC
46 staff's analysis assumed this exposure scenario would occur only one time to any individual and
47 that the dose rate was at the regulatory limit of 10 mrem/hr at 2m (6.6 ft) from the shipment, so

1 the dose will be higher at the assumed exposed distance of 4 ft. The dose to the MEI was
2 calculated to be 16 mrem in DOE's Yucca Mountain Final EIS (DOE 2002b).

3 **Person at a truck service station.** This scenario estimates doses to an employee at a service
4 station where all truck shipments to and from the CPNPP site and alternative sites are assumed
5 to stop. It is assumed that this person is exposed for 49 min at a distance of 52 ft from the
6 loaded shipping container (DOE 2002b). The exposure time and distance were based on the
7 observations discussed by Griego et al. (1996). This results in a dose of about
8 0.55 mrem/shipment and an annual dose of about 48 mrem/yr for the CPNPP site and
9 alternative sites, assuming that a single individual services all unirradiated fuel, spent fuel, and
10 radioactive waste shipments to and from the CPNPP site and alternative sites.

11 **6.2.1.2 Radiological Impacts of Transportation Accidents**

12 Accident risks are a combination of accident frequency and consequence. Accident frequencies
13 for transportation of unirradiated fuel to the CPNPP site or any of the alternative sites are
14 expected to be lower than those used in the analysis in WASH-1238 (AEC 1972), which forms
15 the basis for Table S-4 in 10 CFR 51.52, because of improvements in highway safety and
16 security, and an overall reduction in traffic accident, injury, and fatality rates since WASH-1238
17 was published. There is no significant difference in consequences of transportation accidents
18 severe enough to result in a release of unirradiated fuel particles to the environment between
19 the US-APWR and current-generation LWRs because the fuel form, cladding, and packaging
20 are similar to those analyzed in WASH-1238. Consequently, consistent with the conclusions of
21 WASH-1238 (AEC 1972), the impacts of accidents during transport of unirradiated fuel for the
22 US-APWR at the CPNPP site and alternative sites are expected to be negligible.

23 **6.2.1.3 Nonradiological Impacts of Transportation Accidents**

24 Nonradiological impacts are the human health impacts projected to result from traffic accidents
25 involving shipments of unirradiated fuel to the CPNPP site and alternative sites (that is, the
26 analysis does not consider radiological or hazardous characteristics of the cargo).

27 Nonradiological impacts include the projected number of traffic accidents, injuries, and fatalities
28 that could result from shipments of unirradiated fuel to the site and return shipments of empty
29 containers from the site.

30 Nonradiological impacts are calculated using accident, injury, and fatality rates from published
31 sources. The rates (i.e., impacts per vehicle-km traveled) are then multiplied by estimated
32 travel distances for workers and materials. The general formula for calculating nonradiological
33 impacts is as follows:

$$34 \quad \text{Impacts} = (\text{unit rate}) \times (\text{round-trip shipping distance}) \times (\text{annual number of shipments})$$

35 In this formula, impacts are presented in units of the number of accidents, number of injuries,
36 and number of fatalities per year. Corresponding unit rates (i.e., impacts per vehicle-km
37 traveled) are used in the calculations.

38 Accident, injury, and fatality rates were taken from Table 4 in ANL/ESD/TM-150 *State-Level*
39 *Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins
40 1999). Nation-wide median rates were used for shipments of unirradiated fuel to the site. The
41 data are representative of traffic accident, injury, and fatality rates for heavy truck shipments
42 similar to those to be used to transport unirradiated fuel to the CPNPP site and alternative sites.
43 In addition, the U.S. Department of Transportation Federal Motor Carrier Safety Administration
44 evaluated the data underlying the Saricks and Tompkins (1999) rates, which were taken from
45 the Motor Carrier Management Information System (MCMIS 2009), and determined that the
46 rates were under-reported. Therefore, the accident, injury, and fatality rates in Saricks and

1 Tompkins (1999) were adjusted using factors derived from data provided by the University of
2 Michigan Transportation Research Institute (UMTRI 2003). The University of Michigan
3 Transportation Research Institute data indicate that accident rates for 1994 to 1996, the same
4 data used by Saricks and Tompkins (1999), were under-reported by about 39 percent. Injury
5 and fatality rates were under-reported by 16 and 36 percent, respectively. As a result, the
6 accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57,
7 respectively, to account for the under-reporting.

8 The nonradiological accident impacts for transporting unirradiated fuel to (and empty shipping
9 containers from) the CPNPP site and alternative sites are shown in Table 6-6. The
10 nonradiological impacts associated with the WASH-1238 reference LWR (AEC 1972) are also
11 shown for comparison purposes. Note that there are only small differences between the
12 impacts calculated for an US-APWR at the CPNPP site and alternative sites and the reference
13 LWR in WASH-1238 due entirely to the estimated annual number of shipments

14 **6.2.2 Transportation of Spent Fuel**

15 The NRC staff performed an independent analysis of the environmental impacts of transporting
16 spent fuel from the proposed CPNPP site and alternative sites to a spent fuel disposal
17 repository. For the purposes of those analyses, the staff considered the proposed Yucca
18 Mountain, Nevada, site as a surrogate destination. Currently, NRC has not made a decision on
19 the proposed geologic repository at Yucca Mountain. However, the NRC staff considers that an
20 estimate of the impacts of the transportation of spent fuel to a possible repository in Nevada to
21 be a reasonable bounding estimate of the transportation impacts to a storage or disposal facility
22 because of the distances involved and the representativeness of the distribution of members of
23 the public in urban, suburban, and rural areas (i.e., population distributions) along the shipping
24 routes. Radiological environmental impacts of normal operating conditions and transportation
25 accidents, as well as nonradiological impacts, are discussed in this section.

26 The NRC's staff analysis is based on shipment of spent fuel by legal-weight trucks in shipping
27 casks with characteristics similar to currently available casks (i.e., massive, heavily shielded,
28 cylindrical metal pressure vessels). Due to the large size and weight of spent fuel shipping
29 casks, each shipment is assumed to consist of a single shipping cask loaded on a modified
30 trailer. These assumptions are consistent with those made in the evaluation of the
31 environmental impacts of transportation of spent fuel in Addendum 1 to NUREG-1437
32 (NRC 1999). Because the alternative transportation methods involve rail transportation or
33 heavy-haul trucks, which would reduce the overall number of spent fuel shipments (NRC 1999),
34 thereby reducing impacts, these assumptions are conservative. Also, the use of current
35 shipping cask designs for this analysis results in conservative impact estimates because the
36 current designs are based on transporting short-cooled spent fuel (approximately 120 days out
37 of the reactor). Future shipping casks would be designed to transport longer-cooled fuel
38 (greater than 5 years out of the reactor) and would require much less shielding to meet external
39 dose limitations. Therefore, future shipping casks are expected to have higher cargo capacities,
40 thus reducing the numbers of shipments and associated impacts.

Table 6-6. Nonradiological impacts of transporting unirradiated fuel to the CPNPP site and alternative sites, normalized to reference LWR^(a)

Plant Type	Annual Shipments Normalized to Reference LWR	One-Way Shipping Distance, km	Round-trip Distance, km per Year	Annual Impacts		
				Accidents per Year	Injuries per Year	Fatalities per Year
Reference LWR (WASH-1238)	6.3	3200	4.0×10^4	1.8×10^{-2}	9.3×10^{-3}	6.1×10^{-4}
CPNPP and Alternative Sites US-APWR	1.5	3200	5.8×10^3	2.6×10^{-3}	1.3×10^{-3}	8.7×10^{-5}

(a) The WASH-1238 reference LWR (AEC 1972).

1 Radiological impacts of transportation of spent fuel were calculated using the RADTRAN 5.6
 2 computer code (Weiner et al. 2008). Routing and population data used in RADTRAN 5.6 for
 3 truck shipments were obtained from the TRAGIS routing code (Johnson and
 4 Michelhaugh 2003). The population data in the TRAGIS code are based on the 2000 census.
 5 Nonradiological impacts were calculated using published traffic accident, injury, and fatality data
 6 (Saricks and Tompkins 1999) in addition to route information from TRAGIS (Johnson and
 7 Michelhaugh 2003). Traffic accident rates input to RADTRAN 5.6 and nonradiological impact
 8 calculation were adjusted to account for under-reporting, as discussed in Section 6.2.1.3

9 **6.2.2.1 Normal Conditions**

10 Normal conditions, sometimes referred to as “incident-free” conditions, are transportation
 11 activities in which shipments reach their destination without an accident occurring en route.
 12 Impacts from these shipments would be from the low levels of radiation that penetrate the
 13 heavily shielded spent fuel shipping cask. Radiation exposures would occur to the following
 14 populations: (1) persons residing along the transportation corridors between the CPNPP site or
 15 any of the alternative sites and the proposed repository location; (2) persons in vehicles
 16 traveling on the same route as a spent fuel shipment; (3) persons at vehicle stops for refueling,
 17 rest, and vehicle inspections; and (4) transportation crew workers (drivers). For the purposes of
 18 this analysis, it was assumed that the destination for the spent fuel shipments would be the
 19 proposed Yucca Mountain disposal facility in Nevada. This assumption is conservative because
 20 it tends to maximize the shipping distance from the CPNPP site and alternative sites.

21 Shipping casks have not been designed for the spent fuel from advanced reactor designs such
 22 as the US-APWR. Information in Early Site Permit Environmental Report Sections and
 23 Supporting Documentation (INEEL 2003) indicated that advanced LWR fuel designs would not
 24 be significantly different from existing LWR fuel designs; therefore, current shipping cask
 25 designs were used for the analysis of US-APWR spent fuel shipments. The NRC staff assumed
 26 that the capacity of a truck shipment of US-APWR spent fuel was 0.5 MTU/shipment, the same
 27 capacity as that used in WASH-1238 (AEC 1972). This assumption results in conservative

1 estimates for future shipments because shipping casks designed for 10-year-cooled fuel would
 2 have three or more times this capacity, resulting in fewer shipments and lower impacts.

3 Input to RADTRAN 5.6 includes the total shipping distance between the origin and destination
 4 sites and the population distributions along the routes. This information was obtained by
 5 running the TRAGIS computer code (Johnson and Michelhaugh 2003) for highway routes from
 6 the proposed CPNPP site and alternative sites to Yucca Mountain. The resulting route
 7 characteristics information is shown in Table 6-7. Note that for truck shipments, all the spent
 8 fuel is assumed to be shipped to the Yucca Mountain site over designated highway-route
 9 controlled-quantity routes. In addition, TRAGIS data was loaded into RADTRAN 5.6 on a state-
 10 by-state basis. This increases precision and could allow the results to be presented for each
 11 state along the route between the CPNPP site and alternative sites and Yucca Mountain.

Table 6-7. Transportation Route Information for Shipments from the CPNPP Site and Alternative Sites to the Proposed Geologic Repository at Yucca Mountain, Nevada (Johnson and Michelhaugh 2003) Spent Fuel Disposal Facility

Advance Reactor Site	One-way Shipping Distance, km				Population Density, persons/km ²			Stop time per trip, hr
	Total	Rural	Suburban	Urban	Rural	Suburban	Urban	
CPNPP Site	2568	2198	317	53	8.1	344.6	2268	4
Site A (Coastal)	2848	2480	316	53	7.3	346.5	2363	4
Site B (Pineland)	3095	2501	489	105	8.5	380.3	2393	5
Site C (Tradinghouse)	2605	2227	324	54	8.1	341.7	2242	4

Note: This table presents aggregated route characteristics provided by TRAGIS (Johnson and Michelhaugh 2003), including estimated distances from the alternative sites to the nearest TRAGIS highway node. Input to the RADTRAN 5.6 computer code was disaggregated to a state-by-state level.

12 Radiation doses are a function of many parameters, including vehicle speed, traffic count, dose
 13 rate, packaging dimensions, the number in the truck crew, stop time, and population density at
 14 stops. A listing of the values for these and other parameters and the sources of the information
 15 is provided in Table 6-8.

16 For purposes of this analysis, the transportation crew for spent fuel shipments delivered by truck
 17 is assumed to consist of two drivers. Escort vehicles and drivers were considered, but they
 18 were not included because their distance from the shipping cask would reduce the dose rates to
 19 levels well below the dose rates experienced by the drivers and would be negligible. Stop times
 20 for refueling and rest were assumed to accrue at the rate of 30 min per 4 hr driving time.
 21 TRAGIS outputs were used to estimate the number of stops (Johnson and Michelhaugh 2003).
 22 Doses to the public at truck stops have been significant contributors to the doses calculated in
 23 previous RADTRAN 5.6 analyses. For this analysis, doses to the public at refueling and rest
 24 stops (“stop doses”) are the sum of the doses to individuals located in two annular rings
 25 centered at the stopped vehicle, as illustrated in Figure 6-2. The inner ring represents persons
 26 who may be at the truck stop at the same time as a spent fuel shipment and extends 1 to 10 m
 27 from the edge of the vehicle. The outer ring represents persons who reside near a truck stop
 28 and extends from 10 to 800 m from the vehicle. This scheme is similar to that used by Sprung

1 et al. (2000). Population densities and shielding factors were also taken from Sprung et al.
 2 (2000), which were based on the observations of Griego et al. (1996).

3 The results of these normal (incident-free)
 4 exposure calculations are shown in Table 6-9
 5 for the proposed CPNPP site and alternative
 6 sites. Population dose estimates are given for
 7 workers (i.e., truck crew members), onlookers
 8 (doses to persons at stops and persons on
 9 highways exposed to the spent fuel shipment),
 10 and persons along the route (persons living
 11 near the highway). Shipping schedules for
 12 spent fuel generated by the proposed new unit
 13 have not been determined. It was judged by
 14 the NRC staff to be reasonable to calculate the
 15 annual doses assuming the annual number of
 16 spent fuel shipments is equivalent to the
 17 annual refueling requirements. Population
 18 doses were normalized to the reference LWR
 19 in WASH-1238 (880 net MW[e]) (AEC 1972).
 20 This corresponds to an 1100-MW(e) LWR
 21 operating at 80 percent capacity.

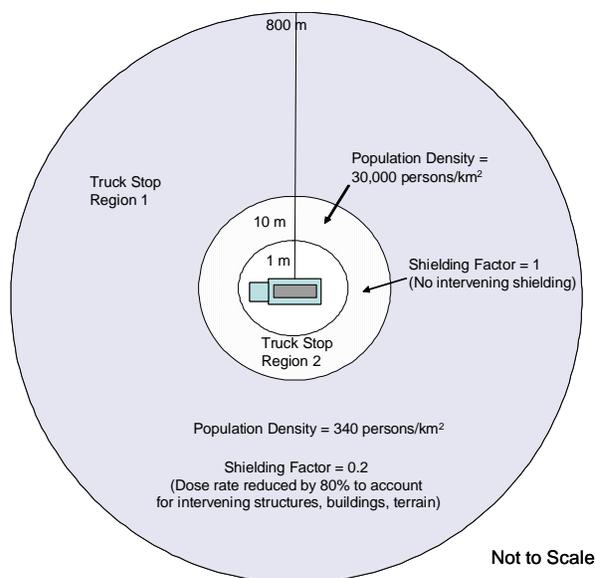


Figure 6-2. Illustration of Truck Stop Model

22 There are only small differences in
 23 transportation impacts among the four sites
 24 evaluated. In general, the CPNPP site and the
 25 Alternate Site C have slightly lower impacts
 26 than the Alternate Site A and Alternate Site B
 27 because of the shorter shipping distance to
 28 Yucca Mountain. However, the differences among sites are relatively minor and all less than
 29 the uncertainty in the analytical results.

30 The bounding cumulative doses to the exposed population given in Table S-4 (10 CFR 51.52)
 31 are as follows:

- 32 • 4 person-rem/yr to transport workers
- 33 • 3 person-rem/yr to general public (onlookers), and members of the public along the route.

34 The calculated population doses to the crew and onlookers for the reference LWR and the
 35 CPNPP site and alternative site shipments exceed Table S-4 values (10 CFR 51.52). A key
 36 reason for the higher population doses relative to Table S-4 is the longer shipping distances
 37 assumed for this COL analysis (i.e., to a possible repository in Nevada) than were used in
 38 WASH-1238. WASH-1238 assumed that each spent fuel shipment would travel a distance of
 39 1000 mi, whereas the shipping distances used in this assessment were about 1500 to 1900 mi
 40 (AEC 1972). Other important differences are the model related to vehicle stops described
 41 above and the additional precision that results from incorporating state-specific route
 42 characteristics and vehicle densities (vehicles per hour).

Table 6-8. RADTRAN 5.6 normal (incident-free) exposure parameters

Parameter	RADTRAN 5.6 Input Value	Source
Vehicle speed, km/hr	88.49	Based on average speed in rural areas given in DOE (2002a). Conservative in-transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count—Rural, vehicles/hr		
Traffic count—Suburban, vehicles/hr	State-specific	Weiner et al. (2008)
Traffic count—Urban, vehicles/hr		
Vehicle occupancy, persons/vehicle	1.5	DOE (2002a)
Dose rate at 1 m from vehicle, mrem/hr	14	DOE (2002a, 2002b)—approximate dose rate at 1 m that is equivalent to maximum dose rate allowed by Federal regulations (i.e., 10 mrem/hr at 2 m from the side of a transport vehicle).
Packaging dimensions, m	Length—5.2 Diameter—1.0	DOE (2002b)
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a, 2002b)
Stop time, hr/trip	4	See Table 6-5
Population Density at Stops, persons/km ²	30,000	Sprung et al. (2000). Nine persons within 10 m of vehicle. See Figure 6-2.
Min/Max Radii of Annular Area Around Vehicle at Stops, m	1 to 10	Sprung et al. (2000)
Dimensionless Shielding Factor Applied to Annular Area Surrounding Vehicle at Stops	1 (no shielding)	Sprung et al. (2000)
Population Density Surrounding Truck Stops, persons/km ²	340	Sprung et al. (2000)
Min/Max Radius of Annular Area Surrounding Truck Stop, m	10 to 800	Sprung et al. (2000)
Dimensionless Shielding Factor Applied to Annular Area Surrounding Truck Stop	0.2	Sprung et al. (2000)

Table 6-9. Normal (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from the CPNPP Site and Alternative Sites to the Proposed High-Level Waste Repository at Yucca Mountain

	Worker (Crew)	Along Route	Onlookers
Reference LWR, ^(a) Person-rem/yr ^(b)	1.3×10^1	7.1×10^{-1}	2.5×10^1
CPNPP COLs Normalized Impacts, person-rem/yr	2.0×10^0	1.1×10^{-1}	3.7×10^{-1}
Alternate Site A (Coastal)	2.4×10^0	9.1×10^{-2}	3.9×10^{-1}
Alternate Site B (Pineland)	2.5×10^0	9.5×10^{-2}	3.9×10^{-1}
Alternate Site C (Tradinghouse)	2.0×10^0	1.1×10^{-1}	3.7×10^{-1}
Table S-4 Condition	4×10^0	3×10^0	3×10^0

(a) WASH-1238 reference reactor (AEC 1972).

(b) To convert person-rem to person-Sv, divide by 100.

1 Where necessary, the NRC staff made conservative assumptions to calculate impacts. Some of
 2 the key conservative assumptions are:

3 • Use of the Regulatory Maximum Dose Rate (10 mrem/hr at 2 m) in the RADTRAN 5.6
 4 Calculations.

5 The shipping casks assumed in the EIS prepared by DOE in support of the application for
 6 the proposed geologic repository at Yucca Mountain (DOE 2002b) were designed to
 7 transport spent fuel that has cooled for 5 years (see 10 CFR 961, Subpart B). Most spent
 8 fuel would have cooled for much longer than 5 years before it would be shipped to a
 9 possible geologic repository. Based on this assumption, shipments from the CPNPP site or
 10 from any of the alternative sites are also expected to be cooled for longer than 5 years.
 11 Consequently, the estimated population doses in Table 6-9 could be further reduced if more
 12 realistic dose rate projections and shipping cask capacities are used.

13 • Use of 30 Min as the Average Time at a Truck Stop in the Calculations.

14 Many stops made for spent fuel shipments, for example, for brief visual inspections of the
 15 cargo (e.g., checking the cask tie-downs), are of short duration (i.e., 10 min). These stops
 16 typically occur in minimally populated areas, such as an overpass or freeway ramp in an
 17 unpopulated area. Furthermore, empirical data provided in Griego et al. (1996) indicate that
 18 a 30-min duration is toward the high end of the stop time distribution. Average stop times
 19 observed by Griego et al (1996) are on the order of 18 min.

20 A sensitivity study was performed to demonstrate the effects of using more realistic dose rates
 21 and stop times on the incident-free population doses. For the study, the dose rate was reduced
 22 to 5 mrem/hr, the approximate 50 percent confidence interval of the dose rate distribution
 23 estimated by Sprung et al. (2000) for future spent fuel shipments. The stop time was reduced to
 24 18 min per stop. All other RADTRAN 5.6 input values were unchanged. The result is that the
 25 annual crew doses were reduced to about 35 percent of the annual dose shown in Table 6-9,
 26 about 0.7 person-rem/yr. The annual onlooker doses were reduced to 1.1 person-rem/yr
 27 (28 percent) and the annual doses to persons along the route were reduced to
 28 0.04 person-rem/yr (36 percent).

1 In its ER (Luminant 2009a) Luminant described the results of a RADTRAN 5.6 analysis of the
2 impacts of incident-free transport of spent fuel to Yucca Mountain. Although the overall
3 approaches are the same (e.g., use of TRAGIS and RADTRAN 5.6), there are some differences
4 in the modeling details. For example, the NRC staff's analysis used state-by-state route
5 characteristics and a shipment capacity of 0.5 MTU whereas Luminant elected to use
6 aggregated route information. The NRC staff concluded that the results produced by Luminant
7 are similar to those calculated by the NRC staff in this EIS.

8 Using the linear no-threshold dose response relationship discussed in Section 6.2.1.1, the staff
9 estimated the annual collective public dose impacts for transporting spent fuel from the CPNPP
10 site and alternative sites to Yucca Mountain to be about 18 person-rem/yr, which is less than the
11 1754 person-rem value that ICRP (ICRP 2007) and NCRP (NCRP 1995) suggest would most
12 likely result in zero excess health effects. This dose is very small compared to the estimated
13 2.8×10^5 person-rem that the same population along the route from the proposed CPNPP site
14 to Yucca Mountain would incur annually from exposure to natural sources of radiation. Note
15 that the estimated population doses along the Comanche Peak-to-Yucca Mountain route from
16 natural background radiation are different than the natural background dose calculated by the
17 NRC staff for unirradiated fuel shipments in Section 6.2.1.1 of this EIS because the route
18 characteristics are different. A generic route was used in Section 6.2.1.1 for unirradiated fuel
19 shipments and the actual highway route was used in this section for spent fuel shipments.

20 Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and wastes under
21 normal conditions are presented in Section 6.2.1.1.

22 **6.2.2.2 Radiological Impacts of Accidents**

23 As discussed previously, the NRC staff used the RADTRAN 5.6 computer code to estimate
24 impacts of transportation accidents involving spent fuel shipments. RADTRAN 5.6 considers a
25 spectrum of postulated transportation accidents, ranging from those with high frequencies and
26 low consequences (e.g., "fender benders") to those with low frequencies and high
27 consequences (i.e., accidents in which the shipping container is exposed to severe mechanical
28 and thermal conditions).

29 Radionuclide inventories are important parameters in the calculation of accident risks. The
30 radionuclide inventories used in this analysis were taken from the applicant's ER (Luminant
31 2009a). Spent fuel inventories used in the NRC staff's analysis are presented in Table 6-10.
32 Table 6-10 lists all of the radionuclides that were included in the analysis conducted by Sprung
33 et al. (2000). The NRC staff's analysis also included the estimated inventory of crud
34 (radioactive material deposited on the external surfaces of LWR spent fuel rods). Because crud
35 is deposited from corrosion products generated elsewhere in the reactor cooling system and the
36 complete reactor design and operating parameters are uncertain, the quantities and
37 characteristics of crud deposited on US-APWR reactor spent fuel are not available at this time.
38 The CPNPP US-APWR spent fuel transportation accident impacts were calculated in this EIS
39 and in Luminant's ER (Luminant 2009a), assuming the cobalt-60 inventory in the form of crud is
40 76 Ci/MTU, based on information in Sprung et al. (2000).

41 Robust shipping casks are used to transport spent fuel because of the radiation shielding and
42 accident resistance required by 10 CFR Part 71. Spent fuel shipping casks must be certified

1

Table 6-10. Radionuclide inventories used in transportation accident risk calculations for the US-APWR^{(a)(b)}

Radionuclide	Ci/MTU	Bq/MTU	Physical-Chemical Group
Am-241	2.12E+03	7.9E+13	Particulate
Am-242m	2.39E+01	8.8E+11	Particulate
Am-243	8.74E+01	3.2E+12	Particulate
Ce-144	1.63E+04	6.0E+14	Particulate
Cm-242	7.13E+01	2.6E+12	Particulate
Cm-243	6.76E+01	2.5E+12	Particulate
Cm-244	1.47E+03	5.4E+14	Particulate
Co-60	1.01E+02	3.7E+12	Crud
Cs-134	7.52E+04	2.8E+15	Cesium
Cs-137	2.07E+05	7.6E+15	Cesium
Eu-154	1.21E+04	4.5E+14	Particulate
Eu-155	3.22E+03	1.2E+14	Particulate
Kr-85	1.28E+04	4.7E+14	Gas
Pm-147	6.07E+04	2.2E+15	Particulate
Pu-238	1.12E+03	4.1E+14	Particulate
Pu-239	4.78E+02	1.8E+13	Particulate
Pu-240	8.17E+02	3.0E+13	Particulate
Pu-241	1.97E+05	7.3E+15	Particulate
Ru-106	2.89E+04	1.1E+15	Ruthenium
Sb-125	3.98E+03	1.5E+14	Particulate
Sr-90	1.40E+05	5.2E+15	Particulate
Y-90	1.40E+05	5.2E+15	Particulate

(a) Divide Becquerel per Metric Ton Uranium (Bq/MTU) by 3.7×10^{10} to obtain curies per MTU (Ci/MTU).

(b) The source of the spent fuel inventories is Table 7.4-1 in the Comanche Peak ER (Luminant 2009a).

2

1 Type B packaging systems, meaning they must withstand a series of severe postulated
2 hypothetical accident conditions with essentially no loss of containment or shielding capability.

3 These casks are also designed with fissile material controls to ensure that the spent fuel
4 remains subcritical under normal and accident conditions. According to Sprung et al. (2000),
5 the probability of encountering accident conditions during transport that would lead to shipping
6 cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents would result
7 in no release of radioactive material from the shipping cask). The NRC staff assumed that
8 shipping casks approved for transportation of spent fuel from a US-APWR would provide
9 equivalent mechanical and thermal protection of the spent fuel cargo.

10 Accident frequencies are calculated in RADTRAN 5.6 using user-specified accident rates and
11 conditional shipping cask failure probabilities. State-specific accident rates were taken from
12 Saricks and Tompkins (1999) and used in the RADTRAN 5.6 calculations. The State-specific
13 accident rates were then adjusted to account for underreporting, as described in
14 Section 6.2.1.3. Conditional shipping cask failure probabilities (i.e., the probability of cask
15 failure as a function of the mechanical and thermal conditions applied in an accident) were
16 taken from Sprung et al. (2000).

17 The RADTRAN 5.6 accident risk calculations were performed using the radionuclide inventories
18 given in Table 6-10. The resulting risk estimates were then multiplied by assumed annual spent
19 fuel shipments to derive estimates of the annual accident risks associated with spent fuel
20 shipments from the CPNPP site and alternative sites to the proposed geologic repository at
21 Yucca Mountain in Nevada. As was done for normal transport exposures, the NRC staff
22 assumed that the numbers of shipments of spent fuel per year are equivalent to the annual
23 discharge quantities.

24 For this assessment, release fractions for current-generation LWR fuel designs (Sprung et al.
25 2000) were used to approximate the impacts from the US-APWR spent fuel shipments. This
26 assumes that the fuel materials and containment systems (i.e., cladding, fuel coatings) behave
27 similarly to current LWR fuel under applied mechanical and thermal conditions.

28 The NRC staff used RADTRAN 5.6 to calculate the population dose from the released
29 radioactive material from four of five possible exposure pathways. The fifth pathway, ingestion
30 of contaminated food, was not considered because the staff assumed evacuation and
31 subsequent interdiction of foodstuffs following a postulated transportation accident. The four
32 pathways are as follows.

- 33 • External dose from exposure to the passing cloud of radioactive material (cloudshine).
- 34 • External dose from the radionuclides deposited on the ground by the passing plume
35 (groundshine). The NRC staff's analysis included the radiation exposure from this pathway
36 even though the area surrounding a potential accidental release would be evacuated and
37 decontaminated, thus preventing long-term exposures from this pathway.
- 38 • Internal dose from inhalation of airborne radioactive contaminants (inhalation).
- 39 • Internal dose from resuspension of radioactive materials that were deposited on the ground
40 (resuspension). The NRC staff's analysis included the radiation exposures from this
41 pathway even though evacuation and decontamination of the area surrounding a potential
42 accidental release would prevent long-term exposures.

43 Table 6-11 presents the environmental consequences of transportation accidents when shipping
44 spent fuel from the CPNPP site and the alternative sites to the proposed Yucca Mountain
45 repository. The shipping distances and population distribution information for the routes were
46 the same as those used for the normal "incident-free" conditions (see Section 6.2.2.1). The

1 results are normalized to the WASH-1238 reference reactor (880-MW(e) net electrical
 2 generation, 1100-MW(e) reactor operating at 80-percent capacity) (AEC 1972) to provide a
 3 common basis for comparison to the impacts listed in Table S-4. Although there are slight
 4 differences in impacts among the alternative sites, none of the alternative sites would be clearly
 5 favored over the CPNPP site

6 Using the linear no-threshold dose response relationship discussed in Section 6.2.1.1, the
 7 annual collective public dose estimate for transporting unirradiated fuel to the CPNPP site or
 8 any of the alternative sites to Yucca Mountain is about 1×10^{-4} person-rem/yr, which is less
 9 than the 1754 person-rem value that ICRP (ICRP 2007) and NCRP (NCRP 1995) suggest
 10 would most likely result in zero excess health effects. This risk is very small compared with the
 11 estimated 2.8×10^5 person-rem that the same population along the route from the proposed
 12 CPNPP site to Yucca Mountain would incur from exposure to natural sources of radiation.

13 The NRC staff performed a confirmatory evaluation of the applicant's spent fuel transportation
 14 accident risk analysis. The applicant used a different, though valid, methodology for the ER
 15 calculations (Luminant 2009a). The primary difference was that the applicant assumed
 16 aggregated route parameters whereas this EIS used state-by-state shipping distances and
 17 population densities. The NRC staff concluded that the applicant's analysis was reasonable
 18 and comprehensive and thus was considered to meet the intent of 10 CFR 51.52(b).

Table 6-11. Annual spent fuel transportation accident impacts for an US-APWR reactor at the CPNPP Site and alternative sites normalized to reference 1100-MW(e) LWR Net electrical generation

	Normalized Population Impacts, Person-rem/yr^(a)
Reference LWR, Person-rem/yr (AEC 1972)	3.8×10^{-4}
CPNPP Site Normalized Impacts, person-rem/yr	5.9×10^{-5}
Alternate Site A (Coastal)	5.2×10^{-5}
Alternate Site B (Pineland)	5.3×10^{-5}
Alternate Site C (Tradinghouse)	6.3×10^{-5}

(a) Divide person-rem/yr by 100 to obtain person-Sv/yr.

19 **6.2.2.3 Nonradiological Impact of Spent Fuel Shipments**

20 The general approach used to calculate nonradiological impacts of spent fuel shipments is the
 21 same as that used for unirradiated fuel shipments. The main difference is that the spent fuel
 22 shipping route characteristics are better defined, so the state-level accident statistics in Saricks
 23 and Tompkins (1999) may be used. State-by-state shipping distances were obtained from the
 24 TRAGIS output file (Johnson and Michelhaugh 2003) and were combined with the annual
 25 number of shipments and accident, injury, and fatality rates by state from Saricks and Tompkins
 26 (1999) to calculate nonradiological impacts. In addition, the accident, injury, and fatality rates
 27 from Saricks and Tompkins (1999) were adjusted to account for under-reporting (see Section
 28 6.2.1.3). The results are shown in Table 6-12.

Table 6-12. Nonradiological impacts of transporting spent fuel from the CPNPP site and alternative sites to Yucca Mountain, normalized to reference LWR

Site	One-way Shipping Distance, km	Nonradiological Impacts, per year		
		Accidents/yr	Injuries/yr	Fatalities/yr
CPNPP (preferred site)	2568	1.1×10^{-2}	6.2×10^{-2}	4.2×10^{-3}
Alternate Site A (Coastal)	2848	1.3×10^{-2}	6.3×10^{-2}	4.3×10^{-3}
Alternate Site B (Pineland)	3095	1.3×10^{-2}	6.3×10^{-2}	4.3×10^{-3}
Alternate Site C (Tradinghouse)	2605	1.1×10^{-2}	6.2×10^{-2}	4.2×10^{-3}

Note: The number of shipments of spent fuel assumed in the calculations is 9.5 shipments/yr after normalizing to the reference LWR (AEC 1972).

1 **6.2.3 Transportation of Radioactive Waste**

2 This section discusses the environmental effects of transporting radioactive waste other than
 3 spent fuel from the CPNPP site and alternative sites. The environmental conditions listed in 10
 4 CFR 51.52 that apply to shipments of radioactive waste are as follows.

- 5 • Radioactive waste (except spent fuel) would be packaged and in solid form.
- 6 • Radioactive waste (except spent fuel) would be shipped from the reactor by truck or rail.
- 7 • The weight limitation of 73,000 lb per truck and 100 tons per cask per railcar would be met.
- 8 • Traffic density would be less than the one truck shipment per day or three railcars per month
 9 condition.

10 Radioactive waste other than spent fuel from the US-APWR reactor is expected to be capable
 11 of being shipped in compliance with Federal or State weight restrictions. Table 6-13 presents
 12 estimates of annual waste volumes and annual waste shipment numbers for a US-APWR
 13 reactor normalized to the reference 1100-MW(e) LWR defined in WASH-1238 (AEC 1972). The
 14 expected annual waste volume for the US-APWR reactor is estimated at 15,278 ft³/yr, and the
 15 annual number of waste shipments is estimated at 109 shipments per year (Luminant 2009a)
 16 after normalization to the reference LWR in WASH-1238. The annual waste volume exceeds
 17 that for the 1100-MW(e) reference reactor that was the basis for Table S-4 in 10 CFR 51.52.
 18 However, the number of radioactive waste shipments for the US-APWR is somewhat larger than
 19 the number that was assumed in WASH-1238 for the reference LWR. The staff reviewed the
 20 shipment capacities assumed by Luminant (Luminant 2009a) and concluded that the
 21 assumptions are reasonable, based on current LWR operating experience. Therefore, the
 22 estimated annual waste volumes for the US-APWR exceed those for the reference LWR, and
 23 the number of shipments of radioactive waste to disposal facilities is anticipated to be roughly
 24 double those for the reference LWR in WASH-1238.

25 The sum of the daily shipments of unirradiated fuel, spent fuel, and radioactive waste for a US-
 26 APWR reactor located at the CPNPP site and alternative sites is well below the one-truck-
 27 shipment-per-day condition given in 10 CFR 51.52, Table S-4.

28 Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and waste under
 29 normal conditions are presented in Section 6.2.1.1.

30 Nonradiological impacts of radioactive waste shipments were calculated using the same general
 31 approach as unirradiated and spent fuel shipments. For this EIS, the shipping distance was

1 assumed to be 500 mi one way (AEC 1972). Because the actual destination is uncertain,
 2 national median accident, injury, and fatality rates were used in the calculations (Saricks and
 3 Tompkins 1999). These rates were adjusted to account for under-reporting, as described in
 4 Section 6.2.1.3. The results are presented in Table 6-14. As shown, the calculated non-
 5 radiological impacts for transportation of radioactive waste other than spent fuel from the
 6 CPNPP site and alternative sites to waste disposal facilities are roughly double the impacts
 7 calculated for the reference LWR in WASH-1238.

8 6.2.4 Conclusions

9 The NRC staff conducted independent confirmatory analyses of potential impacts under normal
 10 operating and accident conditions of transporting fuel and wastes to and from an US-APWR
 11 reactor proposed to be located at the proposed CPNPP site and alternative sites. To make
 12 comparisons to Table S-4 in 10 CFR 51.52, the environmental impacts were adjusted (that is,
 13 were normalized) to the environmental impacts associated with the reference LWR in WASH-
 14 1238 (AEC 1972) by multiplying the normalized impacts by the ratio of the total electric output
 15 for the reference reactor to electrical output for the proposed US-APWR reactor at the CPNPP
 16 site and alternative sites.

Table 6-13. Summary of radioactive waste shipments from the CPNPP site and alternative sites

Reactor Type	Waste Generation Information	Annual Waste Volume, m ³ /yr per Unit	Electrical Output, MW(e) per Unit	Normalized Rate, m ³ /1100 MW(e) Unit (880 MW(e) Net) ^(a)	Shipments/1100 MW(e) (880 MW(e) Net) Electrical Output ^(b)
Reference LWR (WASH-1238)	3800 ft ³ /yr per unit	108	1100	108	46 ^(b)
CPNPP US-APWR	15,278 ft ³ /yr per unit ^(c)	433	1600 ^(c)	256	109 ^(d)

Conversions: 1 m³ = 35.31 ft³. Drum volume = 210 liters (0.21 m³).

(a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are 80 percent for the reference LWR (AEC 1972) and 93 percent for the US-APWR (Luminant 2009a). Waste generation for the US-APWR is normalized to 880 MW(e) net electrical output (1100-MW(e) unit with an 80 percent capacity factor).

(b) The number of shipments per 1100 MW(e) was calculated assuming the WASH-1238 average waste shipment capacity of 2.34 m³ per shipment (AEC 1972).

(c) These values were taken from the ER (Luminant 2009a).

(d) This value was obtained from the Luminant (Luminant 2009a) estimate (109 shipments/yr) to the reference LWR electrical generation output. If the WASH-1238 shipment capacity is used (2.34 m³ per shipment) in lieu of the Luminant (Luminant 2009a) annual shipment estimate, the normalized shipments from the US-APWR would be about 109 shipments per year.

17

Table 6-14. Nonradiological impacts of radioactive waste shipments from the CPNPP site

	Normalized Shipments per Year	One-Way Distance, km	Accidents per Year	Injuries per Year	Fatalities per Year
WASH-1238 (AEC 1972)	46	800	3.3×10^{-2}	1.7×10^{-2}	1.1×10^{-3}
CCNPP US-APWR	109	800	7.7×10^{-2}	4.0×10^{-2}	2.6×10^{-3}

Note: The shipments and impacts have been normalized to the reference LWR; the expected waste volumes and shipments from the Luminant ER were used (Luminant 2009a).

1 Because of the conservative approaches and data used to calculate impacts, the actual
 2 environmental effects are not likely to exceed those calculated in this EIS. Thus the NRC staff
 3 concludes that the environmental impacts of transportation of fuel and radioactive wastes to and
 4 from the CPNPP site and alternative sites would be SMALL and that they would be consistent
 5 with the environmental impacts associated with transportation of fuel and radioactive wastes
 6 from the current-generation reactors presented in Table S-4 of 10 CFR 51.52.

7 The NRC staff notes on March 3, 2010 (DOE 2010) DOE submitted a motion to the Atomic
 8 Safety and Licensing Board to withdraw with prejudice its application for a permanent geologic
 9 repository at Yucca, Mountain, Nevada. Regardless of the outcome of this motion, the NRC
 10 staff concludes that transportation impacts are roughly proportional to the distance from the
 11 reactor site to the repository site, in this case Texas to Nevada. The distance from the CPNPP
 12 site or any of the alternative sites to any new planned repository in the contiguous United States
 13 would be no more than double the distance from the CPNPP site to Yucca Mountain. Doubling
 14 the environmental impact estimates from the transportation of spent fuel, as presented in this
 15 section, would provide a reasonable bounding estimate of the impacts for National
 16 Environmental Policy Act (NEPA 1969) purposes. The NRC staff concludes that the
 17 environmental impacts of these doubled estimates would still be SMALL.

18 **6.3 Decommissioning Impacts**

19 At the end of the operating life of a power reactor, NRC regulations require that the facility
 20 undergo decommissioning. Decommissioning is the safe removal of a facility from service and
 21 the reduction of residual radioactivity to a level that permits termination of the NRC license. The
 22 regulations governing decommissioning of power reactors are found in 10 CFR 50.75.

23 An applicant for a COL is required to certify that sufficient funds will be available to ensure
 24 radiological decommissioning at the end of power operations. Luminant included a
 25 Decommissioning Funding Assurance Report as Attachment 9 to Part 1 of its COL application
 26 for the proposed CPNPP Units 3 and 4 on the CPNPP site near Glen Rose, Texas (Luminant
 27 2009b). Luminant will establish an external sinking funds account to accumulate funds for
 28 decommissioning.

29 Environmental impacts from the activities associated with the decommissioning of any reactor
 30 before or at the end of an initial or renewed license are evaluated in NUREG-0586, the *Generic
 31 Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1*
 32 (GEIS-DECOM) (NRC 2002). Environmental impacts of the DECON, SAFSTOR, and ENTOMB
 33 decommissioning methods are evaluated in the NUREG-0586, Supplement 1. A COL applicant

1 is not required to identify a decommissioning method at the time of the COL application. The
2 NRC staff's evaluation of the environmental impacts of decommissioning presented in NUREG-
3 0586, Supplement 1, identifies a range of impacts for each environmental issue for a range of
4 different reactor designs. The NRC staff concludes that the construction methods that would be
5 used for the US-APWR are not sufficiently different from the construction methods used for the
6 current plants to significantly affect the impacts evaluated in the GEIS-DECOM. Therefore, the
7 NRC staff concludes that the impacts discussed in the GEIS-DECOM remain bounding for
8 reactors deployed after 2002, including the US-APWR.

9 The GEIS-DECOM does not specifically address the carbon footprint of decommissioning
10 activities. However, it does list the decommissioning activities and states that the
11 decommissioning workforce would be expected to be smaller than the operational workforce
12 and that the decontamination and demolition activities could take up to 10 years to complete.
13 Finally, it discusses SAFSTOR, in which decontamination and dismantlement are delayed for a
14 number of years. Given this information, the NRC staff estimated the CO₂ footprint of
15 decommissioning to be of the order of 6.3×10^4 metric tons without SAFSTOR. This footprint is
16 about equally split between decommissioning workforce transportation and equipment usage.
17 The details of the NRC staff's estimate are presented in Appendix I. A 40-yr SAFSTOR period
18 would increase the footprint of decommissioning by about 40 percent. These CO₂ footprints are
19 roughly three orders of magnitude lower than the CO₂ footprint presented in Section 6.1.3 for
20 the uranium fuel cycle.

21 The NRC staff relies upon the bases established in the GEIS-DECOM and concludes the
22 following:

- 23 • Doses to the public would be well below applicable regulatory standards regardless of which
24 decommissioning method considered in NUREG-0586, Supplement 1, is used.
- 25 • Occupational doses would be well below applicable regulatory standards during the license
26 term.
- 27 • The quantities of Class C or greater than Class C wastes generated would be comparable
28 or less than the amounts of solid waste generated by reactors licensed before 2002.
- 29 • Air quality impacts of decommissioning are expected to be negligible at the end of the
30 operating term.
- 31 • Measures are readily available to avoid potential significant water quality impacts from
32 erosion or spills. The liquid radioactive waste system design includes features to limit
33 release of radioactive material to the environment, such as pipe chases and tank collection
34 basins. These features will minimize the amount of radioactive material in spills and leakage
35 that would have to be addressed at decommissioning.
- 36 • Ecological impacts of decommissioning are expected to be negligible.
- 37 • Socioeconomic impacts would be short-term and could be offset by decreases in population
38 and economic diversification.

39 On the basis of the GEIS-DECOM and the evaluation of air quality impacts from greenhouse
40 gas emissions above, the NRC staff concludes that, as long as the regulatory requirements on
41 decommissioning activities to limit the impacts of decommissioning are met, the
42 decommissioning activities would result in a SMALL impact.

43

1 **6.4 References**

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7.0 Cumulative Impacts

1 The National Environmental Policy Act of 1969, as amended (NEPA), requires a Federal agency
2 to consider the cumulative impacts of proposals under its review. Cumulative impacts may
3 result when the environmental effects associated with the proposed action are overlaid or added
4 to temporary or permanent effects associated with past, present, and reasonably foreseeable
5 future projects. Cumulative impacts can result from individually minor, but collectively significant
6 actions taking place over a period of time.

7 Luminant Generation Company (Luminant or Applicant) submitted an application for combined
8 licenses (COLs), which included an Environmental Report (ER) (Luminant ER 2009), to
9 construct and operate two Mitsubishi Heavy Industries, Inc., (MHI) U.S. Advanced Pressurized
10 Water Reactor (US-APWR) reactors at the Comanche Peak Nuclear Power Plant (CPNPP) site.
11 When evaluating the potential of building and operating two new units, the NRC and U.S. Army
12 Corps of Engineers (Corps or USACE) (collectively, review team) considered potential
13 cumulative impacts to resources that could be affected by the construction, preconstruction,
14 operation, and decommissioning of two Mitsubishi Heavy Industries, Inc., US-APWR reactors at
15 the CPNPP site. Cumulative impacts result when the effects of an action are added to or
16 interact with other past, present, and reasonably foreseeable future effects on the same
17 resources. For purposes of this analysis, past actions are those prior to the receipt of the COL
18 application. Present actions are those related to resources from the time of the COL application
19 until the start of NRC-authorized construction of the proposed new units. Future actions are
20 those that are reasonably foreseeable through building and operating the proposed Units 3 and
21 4, including decommissioning. The geographic area over which past, present, and reasonably
22 foreseeable future actions could contribute to cumulative impacts is dependent on the type of
23 resource considered and is described below for each resource area. The review team
24 considered, among other things, cumulative effects of the proposed Units 3 and 4 with current
25 operations at the existing CPNPP Units 1 and 2.

26 The approach for this environmental impact statement (EIS) is outlined in the following
27 discussion. To guide its assessment of environmental impacts of a proposed action or
28 alternative actions, the NRC has established a standard of significance for impacts based on
29 guidance developed by the Council on Environmental Quality (CEQ) [Title 40 of the Code of
30 Federal Regulations (CFR) 1508.27]. The three significance levels established by the NRC –
31 SMALL, MODERATE, or LARGE – are defined as follows:

32 SMALL – Environmental effects are not detectable or are so minor that they will neither
33 destabilize nor noticeably alter any important attribute of the resource.

34 MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize,
35 important attributes of the resource.

36 LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize
37 important attributes of the resource.

38 The impacts of the proposed action, as described in Chapters 4 and 5, are combined with other
39 past, present, and reasonably foreseeable future actions in the general area surrounding the
40 CPNPP site that would affect the same resources impacted by the proposed new units,
41 regardless of what agency (Federal or non-Federal) or person undertakes such actions. These
42 combined impacts are defined as “cumulative” in 40 CFR 1508.7 and include individually minor
43 but collectively potentially significant actions taking place over a period of time. It is possible
44 that an impact that may be SMALL by itself could result in a MODERATE or LARGE cumulative
45 impact when considered in combination with the impacts of other actions on the affected

1 resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual
2 impact could be important if it contributes to or accelerates the overall resource decline.

3 The description of the affected environment in Chapter 2 serves as the baseline for the
4 cumulative impacts analysis, including the effects of past actions. The incremental impacts
5 related to the construction activities requiring NRC authorization [10 CFR 50.10(a)] are
6 described and characterized in Chapter 4, and those related to operations are described and
7 characterized in Chapter 5. These impacts are summarized for each resource area in the
8 sections that follow. The level of detail is commensurate with the significance of the impact for
9 each resource area.

10 This chapter includes an overall cumulative impact assessment for each resource area. The
11 specific resources and components that could be affected by the incremental effects of the
12 proposed action and other actions in the same geographic area were assessed. This
13 assessment includes the impacts of construction and operations for the proposed new units as
14 described in Chapters 4 and 5; impacts of preconstruction activities as described in Chapter 4;
15 impacts of fuel cycle, transportation, and decommissioning impacts described in Chapter 6; and
16 impacts of past, present, and reasonably foreseeable Federal, non-Federal, and private actions
17 that could affect the same resources affected by the proposed actions.

18 The review team visited the CPNPP site in February 2009. The team then used the information
19 provided in the ER, Luminant's responses to Requests for Additional Information (RAIs) issued
20 by the NRC and Corps staff, information from other Federal and State agencies, and information
21 gathered at the CPNPP site visit to evaluate the cumulative impacts of building and operating
22 two new nuclear power plants at the site. To inform the cumulative analysis, the review team
23 researched U.S. Environmental Protection Agency (EPA) databases for recent EISs within
24 Texas, used databases for permits for water discharges in the geographic area, and used the
25 www.recovery.gov website to identify projects in the geographic area funded by the American
26 Recovery and Reinvestment Act of 2009 (Public Law 111-5). Other actions and projects that
27 were identified during this review and considered in the review team's independent analysis of
28 the cumulative effects are described in Table 7-1.

29 **7.1 Land Use**

30 The description of the affected environment in Section 2.2 serves as the baseline for the
31 cumulative impact assessment for land use. As described in Section 4.1, the NRC staff
32 concludes that the impacts of NRC-authorized construction on land use would be SMALL and
33 no further mitigation would be warranted. The combined impacts from construction and
34 preconstruction are also described in Section 4.1 and have been determined by the review team
35 to be SMALL to MODERATE. As described in Section 5.1, the review team concludes that the
36 impacts of operations on land use would be SMALL to MODERATE and mitigation would be
37 warranted.

38 In addition to the impacts from construction, preconstruction, and operations, the cumulative
39 analysis also considers past, present, and reasonably foreseeable future actions that could
40 impact land use. For this cumulative analysis, the geographic area of interest is defined as
41 Somervell, Hood, and Bosque Counties. Direct and indirect impacts on land use due to
42 construction and operation of CPNPP Units 3 and 4 would be confined to this three-county area.
43 The anticipated routes for development of transmission lines, pipelines, and other offsite
44 ancillary facilities are also confined to these three counties. In addition, impacts due to
45 interactions between the proposed project and other foreseeable activities would not be
46 expected to extend beyond this three-county area.

Table 7-1. Projects and Other Actions Considered in the Cumulative Analysis at the CPNPP Site

Project Name	Summary of Project/Activity	Location	Status
Energy Projects			
Operation of CPNPP Units 1 and 2	The CPNPP consists of two existing nuclear generating units (i.e., Units 1 and 2), which began commercial operation in 1991 and 1993, respectively.	About 0.5 mi southeast	Operational. ^(a)
License renewal for CPNPP Units 1 and 2	Extend the operating license of CPNPP Units 1 and 2 for up to an additional 40 years	About 0.5 mi southeast	The operating licenses for existing Units 1 and 2 expire in 2030 and 2033, respectively. ^(a)
DeCordova Steam Electric Station	A four-turbine, 1084-MW conventional steam generating plant	3.6 mi northeast	Operational. ^(a)
Wolf Hollow 1	A gas-fired, 730-MW power plant	4.9 mi northeast	Operational. ^(a)
Transportation Projects			
Highway 121 construction	Highway construction, I-30 to Farm-to-Market Road 1187	35 mi northeast	Proposed. ^(b)
Southwest to Northeast Rail Corridor	Transportation improvements via light rail to the cities of Fort Worth, Haltom City, North Richland Hills, Colleyville and Grapevine	50 mi northeast	Proposed. ^(c)
River and Watershed Projects			
Lake Granbury Surface Water and Treatment System (SWATS)	Supplies water to the City of Granbury and the Acton Municipal Utility district. Treatment capacity is 10.5 million gallons per day.	10 mi northeast	Operational. ^(a)
Somervell County Water Supply Project	Construction and operation of two dams (concrete channel dam on the Paluxy River and earthen dam on Wheeler Branch), pump station and pipeline from Paluxy River to Wheeler Branch reservoir, water treatment plant, and water supply distribution systems. ^(d)	Potentially within 5 mi	Dams, reservoir, pumping station and pipeline are complete. Development of water treatment and distribution systems is ongoing as of 2010. Additional expansion of distribution systems is planned in the future. ^(e)

Table 7-1. (contd)

Project Name	Summary of Project/Activity	Location	Status
New water treatment facility for City of Granbury	New 1.5 million gallon per day water treatment plant	12 mi north	Proposed. ^(a)
Mining Projects and Oil/Gas Industry			
DeCordova Compressor Station	Compressor for the oil and gas industry	3.1 mi northeast	Operational. ^(a)
Various oil and gas exploration and extraction operations	Numerous oil and gas exploration and extraction operations throughout a 50-mi radius of CPNPP Unit 3 and 4 site	Throughout the region	Facilities are in operation but more could be developed as demand increases. ^(a)
Parks			
Dinosaur Valley State Park	Scenic 1500-ac state park that straddles the Paluxy River	About 3 mi southwest	Operational. ^(f)
Squaw Creek Reservoir	Currently closed to public access; however, reopening for limited public access for recreational opportunities is being considered.	Immediately adjacent to and east of site	Reopening the reservoir is proposed. ^(g)
Other parks, forests, and reserves	Numerous state and national parks, forests, reserves, and other recreational areas are located within a 50-mi region	Throughout 50-mi region	Parks are currently being managed by national, state, and/or local agencies

Table 7-1. (contd)

Project Name	Summary of Project/Activity	Location	Status
Other Actions/Projects			
Naval Air Station Forth Worth Joint Reserve Base	Provides training to reservists in preparation for mobilization readiness. Trains and equips air crews and aviation ground support personnel in preparation for deployment.	About 35 mi northwest, in Carswell, Texas	Operational. ^(h)
Various hospitals and industries that use radioactive materials	Medical and other isotopes	Within 50 mi	Operational in nearby cities and towns.
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents	Throughout the region	Construction would occur in the future, as described in state and local land use planning documents.
<p>(a) Source: Luminant 2009a. (b) Source: TxDOT 2010. (c) Source: FWTA 2010. (d) Source: Freese and Nichols 2001. (e) Source: SCWD 2008. (f) Source: TPWD 2009. (g) Source: Luminant 2010a. (h) Source: U.S. Navy 2010.</p>			

1 Historically, land in the three-county area of interest has been used predominantly for ranching
2 and agricultural purposes since the first European settlers arrived in the early- to mid-1800s,
3 with cattle ranches and farms dominating the landscape. Increases in population and urban
4 development began after World War II and accelerated in the period between 1960 and 1980
5 due partly to the completion of Lake Granbury and CPNPP Units 1 and 2. Even with this
6 increase in urban development, most land in the three counties is still devoted to ranching and
7 farming, with pastureland being the prevalent land use, followed by cropland (TSHA 2010).

8 Table 7-1 lists projects that, in combination with the proposed development and operation of
9 CPNPP Units 3 and 4, could contribute to cumulative impacts in the region. None of these other
10 projects or actions would contribute to fogging, icing, or salt drift.

11 Cumulative land-use impacts on the CPNPP site would consist of the additional commitment of
12 land for the proposed Units 3 and 4 to the land already used for Units 1 and 2. Units 1 and 2
13 together with their supporting facilities presently occupy approximately 203 ac, and it is not
14 anticipated that any additional land would be dedicated to their operation, even if their licenses
15 were renewed. Following post-development revegetation and landscaping, Units 3 and 4 plus
16 their supporting facilities [e.g., cooling towers and blowdown treatment facility (BDTF)] would
17 permanently occupy approximately an additional 550 ac. The result would be a combined total
18 of 753 ac of land dedicated to energy production use on the 7950 ac site, occupying
19 approximately 9 percent of the site. The remainder of the site would continue to be occupied by
20 Squaw Creek Reservoir (SCR) and naturally vegetated buffer lands. Construction,
21 preconstruction, and operational impacts of the new units and associated transmission line and
22 pipeline rights-of-way are addressed in Sections 4.1 and 5.1 of this EIS.

23 In June 2010, Luminant opened the SCR for limited public use. Outside a security area
24 established around CPNPP (including the existing and proposed units and associated support
25 facilities), members of the public are able to engage in activities such as fishing, boating, and
26 shoreline activities. Development and operation of Units 3 and 4 should not interfere with the
27 recreational opportunities on SCR or otherwise result in adverse effects on recreational land
28 use, since the Applicant would control access to the new and existing reactor support facilities
29 and would not allow uses incompatible with the site's primary function for energy production.
30 Cumulatively, the opening of SCR could have the beneficial effect of increasing the amount of
31 recreational land in the area of interest.

32 Other recent and ongoing development actions in the three-county geographic area of interest
33 include the development of Wheeler Branch Reservoir (WBR), located approximately 1 mi south
34 of the site, and Ham Creek Park (HCP), approximately 18 mi southeast. Major development
35 was recently completed at WBR, with installation of the associated water distribution system
36 scheduled to begin in 2010 (SCWD 2010). Before development began, the WBR site was
37 covered by grassland and evergreen and deciduous forest, including a stream valley, all of
38 which are characteristic of the region and the CPNPP site. Construction at HCP is largely
39 complete, with final trail construction scheduled for 2010. This park occupies vacant wooded
40 and open land that had been previously used as a public recreation area until the 1970s. No
41 other major Federal, State, or local actions are foreseen in the area.

42 Expanded natural gas exploration and extraction activities by private parties could occupy more
43 land and therefore could affect availability of land near the CPNPP site. Natural gas wells are
44 scattered throughout the region, especially in Hood County. Drilling permits are concentrated in
45 eastern Hood County but are also found in other parts of the county and in Somervell County.
46 Following a decade of decline, natural gas production in the area of interest has increased
47 dramatically since 2004. In 2008 wells in Hood County produced approximately 65,411,773
48 million cubic feet (mcf) of natural gas, more than 83 times the county's production in 2004.

1 Somervell County wells produced approximately 4,915,171 mcf in 2008, or 395 times as much
2 as in 2004. On a smaller scale, production has also increased in Bosque County, rising from 0
3 mcf in 2004 to 230,463 mcf in 2008 (Railroad Commission of Texas 2010). Although there are
4 a number of the wells in the region, each one occupies only a small area on the land surface,
5 resulting in a limited impact on land use. Natural gas exploration and production wells generally
6 can be operated in a manner compatible with concurrent agricultural use of land, and land
7 supporting wells can typically be used for most other land uses once the wells are removed from
8 service.

9 New workers would be attracted both by the construction and operation of CPNPP Units 3 and 4
10 and by the exploration and extraction of natural gas. However, in both cases, workers would be
11 drawn from a region substantially larger than Somervell, Hood, and Bosque Counties. Thus, the
12 impacts of induced land use changes (such as new residential areas and retail and service
13 developments) would be dispersed over that wider region.

14 Texas State Data Center (TSDC) projects that the population in a six-county area surrounding
15 the CPNPP site (including Bosque, Erath, Hood, Johnson, Somervell, and Tarrant Counties) will
16 increase by 41.5 percent by the year 2040 (TSDC 2009). The highest growth in the six-county
17 area is projected to occur in areas close to Fort Worth; however, the more outlying counties are
18 still expected to experience substantial growth. Even with the anticipated growth, the area
19 around the CPNPP site is likely to continue to be predominantly rural in character with the
20 majority of land continuing to be covered by grassland and evergreen and deciduous forest.
21 Recent urbanization in this area has occurred primarily in and around the cities of Granbury and
22 Glen Rose. This trend is likely to continue, with most of the growth occurring in Hood County
23 around and northeast of Lake Granbury, due primarily to recreation home development and
24 commuting patterns associated with Fort Worth. The construction and operations workforce for
25 CPNPP Units 3 and 4 would make a minor contribution to this increase in the urban growth of
26 the region. The cumulative urbanization in the geographic area of interest could alter attributes
27 of land use by reducing natural vegetation and open space in localized areas. However, this
28 would not be expected to substantially affect the overall availability of land for various uses or
29 substantially alter the extent and connectivity of wetlands, forests, and wildlife habitat near the
30 CPNPP site.

31 The report on Global Climate Change Impacts in the United States, provided by the U.S. Global
32 Change Research Program, summarizes the projected impacts of future climate changes in the
33 U.S. (Karl et al. 2009). The report divides the U.S. into nine regions. The CPNPP site is
34 located in the Great Plains region. The GCRP climate models for this region project continued
35 warming in all seasons and an increase of as much as 12°F from 2000 to 2090. Additionally,
36 climate models project that there will tend to be less rainfall in this area. The GCRP states that
37 the precipitation decrease projected for the Great Plains could result in a potential reduction in
38 crop yields and livestock productivity, which may change distribution of agricultural and ranching
39 land, as well as reductions in forests and wetlands.

40 Based on its evaluation, the review team concludes that the cumulative land-use impacts
41 associated with proposed Units 3 and 4 and other projects in the three-county area of interest
42 would be MODERATE. The land-use impacts from development of the transmission lines and
43 pipelines serving CPNPP Units 3 and 4, combined with other ongoing and anticipated offsite
44 land uses in the three-county geographic area of interest, would be sufficient to alter noticeably,
45 but not destabilize, important attributes of land use. The NRC staff concludes that the
46 incremental impacts of NRC-authorized activities (which includes NRC-authorized construction
47 and operations activities but not preconstruction) would be SMALL, and would not contribute
48 substantially to the MODERATE impact characterization. The incremental contribution of the

1 overall CPNPP Units 3 and 4 project, including preconstruction, however, would substantially
2 contribute to the MODERATE impact characterization.

3 **7.2 Water Use and Quality**

4 This section analyzes the cumulative impacts of the proposed new units, the existing CPNPP
5 Units 1 and 2, and other past, present, and reasonably foreseeable projects on water use and
6 water quality.

7 **7.2.1 Water-Use Impacts**

8 This section describes cumulative water use impacts resulting from construction and operation
9 of the proposed CPNPP Units 3 and 4, and their interactions with the surrounding environment.
10 The geographic area of interest for this cumulative analysis of water use and quality is the
11 Brazos G Regional Water Planning Area. This is the region of interest because it encompasses
12 the water resources potentially affected by the proposed project.

13 The description of the affected environment in Chapter 2 serves as the baseline for the
14 cumulative impact assessments in this resource area. As described in Section 4.2, the review
15 team concludes that the impacts of NRC-authorized construction activities on water use
16 (including both surface water and groundwater) would be SMALL and that no further mitigation
17 would be warranted. Section 5.2 provides the review team conclusion that the impacts of
18 operations on surface water use would be MODERATE, but no further potential mitigation has
19 been identified. Additionally, in Section 5.2, the review team concluded that the operational
20 effects of the proposed new nuclear units would have a SMALL to MODERATE impact on water
21 quality, but no further potential mitigation has been identified. Also as described in Section 5.2,
22 the review team concludes that impacts to groundwater quantity and quality from operations
23 would be SMALL, and no further mitigation would be warranted.

24 Other past, present, and reasonably foreseeable future actions in the region of interest with a
25 potential to affect water use include the construction of WBR and associated expansion of the
26 Somervell County Water District (SCWD) water supply system, the continued operation of
27 reservoirs (Lake Granbury, SCR, Lake Palo Pinto, Possum Kingdom Lake, and Lake Whitney),
28 consumptive use by existing steam electric power plants (CPNPP Units 1 and 2 and the
29 DeCordova Power Company LLC natural gas-fired steam electric plant), the future operation of
30 WBR, and ongoing and future water use by population growth in the region. Anticipated
31 changes in the Brazos River Authority's (BRA) policies for Brazos River System water
32 management under the pending System Operation Permit (SOP) are intended to accommodate
33 these existing and future uses of Brazos River water. The continuing buildup of sediment in
34 Brazos River System reservoirs may affect future water supply as well.

35 **Climate Change**

36 On a larger spatial and longer time scale, global climate change (GCC) is a subject of national
37 and international interest. The recent compilation of the state of knowledge by the U.S. Global
38 Change Research Program (GCRP), a Federal Advisory Committee, has been considered in
39 preparation of this EIS (Karl et al. 2009).

40 **7.2.1.1 Surface-Water-Use Impacts**

41 The water availability model (WAM) sanctioned by the Texas Commission on Environmental
42 Quality (TCEQ) to assess the feasibility of new water rights and deliveries is discussed in
43 Section 5.2. Additional WAM results provided by the Applicant in support of the BRA SOP are
44 based on water demand growth assumptions defined in the 2060 Brazos Region G Water Plan.

1 Thus, the modeling includes the effects of the past, present, and reasonable foreseeable future
2 actions that may contribute to cumulative impacts. In the Brazos G Region as a whole, water
3 demand is projected to increase 38 percent between 2010 and 2060, from 835,691 ac-ft/yr to
4 1,150,973 ac-ft/yr (TWDB 2007). Due almost entirely to projected increases in population
5 resulting in increased municipal water use, local water demand from Possum Kingdom Lake is
6 projected to grow from 12,867 ac-ft/yr in 2020 to 17,283 ac-ft/yr in 2060, and local water
7 demand from Lake Granbury (exclusive of CPNPP Units 3 and 4) is projected to grow from
8 85,138 ac-ft/yr in 2020 to 107,302 ac-ft/yr in 2060. The model also estimates that reservoir
9 sedimentation will continue to reduce the surface area and capacity of both reservoirs, so that
10 by 2060 Possum Kingdom Lake holds 79 percent of the volume it held in 2020 (73 percent of its
11 volume in 2005) and Lake Granbury holds only 75 percent of the volume it held in 2020 (68
12 percent of its volume in 2003) (Freese and Nichols 2008).

13 These increased water demands and other cumulative changes are expected to result in more
14 frequent occurrence of low water levels in Lakes Granbury and Possum Kingdom, lower
15 average streamflows in the Brazos River, and additional reduction in seasonal variation in
16 streamflow. Water management under the SOP and other TWDB-approved strategies would,
17 however, minimize adverse impact on water availability for users with valid water rights under
18 the Texas Water Code.

19 If global climate change results in decreased precipitation and increased temperatures in the
20 Brazos River Basin as many predictions suggest, the resulting reduction in surface runoff and
21 increase in evapotranspiration would contribute to cumulative impacts on surface water quantity
22 by reducing streamflows.

23 Based on this analysis, the review team concludes that cumulative impacts on surface-water
24 quantity would be MODERATE because there would be noticeable alterations in the Brazos
25 River System. Additionally, because CPNPP Unit 3 and 4 withdrawals would be a major new
26 determinant of Brazos River System water management policy, the review team concludes that
27 the incremental impacts from NRC-authorized activities at proposed CPNPP Units 3 and 4
28 would be MODERATE.

29 **7.2.1.2 Groundwater-Use Impacts**

30 Construction of the WBR and resulting expansion of surface water supplies in the SCWD
31 service area can be expected to result in some reversal of the groundwater level declines that
32 have occurred historically in the local area, resulting in a positive cumulative impact on
33 groundwater quantity. The planned use of WBR water for potable supply at the CPNPP site
34 would contribute to this positive impact. Additionally, the Applicant has indicated that no
35 groundwater would be used during construction or operation of Units 3 and 4. Thus, the review
36 team concludes that the cumulative impact on groundwater quantity would be SMALL.

37 **7.2.2 Water-Quality Impacts**

38 This section describes cumulative water-quality impacts from construction, preconstruction, and
39 operations of proposed Units 3 and 4, and other past, present, and reasonably foreseeable
40 projects. Other actions and activities in the region of interest that have a potential to affect
41 water quality include future urbanization, permitted discharges of effluents to the Brazos River
42 and its tributaries, oil and gas exploration and extraction in the region, residential development
43 near the reservoirs, and various construction projects, including the construction of WBR and
44 associated expansion of the SCWD's water supply system and the construction of Ham Creek
45 Park (HCP; a campground at Whitney Lake, about 40 river mi downstream from Lake
46 Granbury). Changes in water quantity, as discussed in Section 7.2.1, also can indirectly affect

1 water quality. Reductions in surface water quantity can affect surface water quality by changing
2 the volume of water available to assimilate contaminants delivered to streams from natural
3 sources and effluent discharges. Changes in groundwater use that affect groundwater levels in
4 an aquifer can affect groundwater quality by increasing or reducing the aquifer's vulnerability to
5 vertical contaminant migration.

6 **7.2.2.1 Surface-Water Quality Impacts**

7 When multiple construction projects occur in a watershed during the same time period, they can
8 have cumulative impacts on surface-water quality that are much larger than the impacts of any
9 one project. Besides WBR and the HCP, the review team has identified no other existing or
10 planned water resources development or control projects that would impact Lake Granbury or
11 the Brazos River downstream. HCP is an existing public park that was closed 20 years ago, but
12 it will be renovated and reopened. HCP is located 18 mi to the south of Lake Granbury (40
13 Brazos river miles). The construction of the WBR project is likely to be completed before major
14 construction of CPNPP Units 3 and 4 would begin. These activities will all employ best
15 management practices (BMPs) to reduce the impacts of construction on water quality. Because
16 of planned mitigation measures and the separation in distance (HCP) or time (WBR) from the
17 construction of the proposed CPNPP Units 3 and 4, the cumulative impacts to water quality
18 resulting from construction of all three of these projects would be minor.

19 The review team evaluated information on other sources that could contribute water pollutants
20 to the same surface water bodies that would receive discharges from CPNPP Units 3 and 4.
21 Thirteen sanitary wastewater treatment facilities (including the facility that serves CPNPP Units
22 1 and 2) discharge effluent to Lake Granbury, Squaw Creek, the Paluxy River, or the Brazos
23 River between Lake Granbury and Lake Whitney (Mitsubishi and Enercon 2009 and Luminant
24 2010a). These types of discharges can adversely affect water quality by introducing nutrients
25 into the receiving waters and contributing to depletion of dissolved oxygen. Future urbanization
26 would add to these types of impacts. Most of the existing wastewater treatment facilities are
27 small; based on their permit limits, the combined discharge from these facilities could average
28 more than 4.3 MGD, but their combined total discharge in 2008 was well below 3 MGD, or less
29 than 10% of the volume that Units 3 and 4 would discharge to Lake Granbury. The potential
30 from cumulative impact of these sources is limited by their small size and their geographic
31 dispersal. Because the contaminants they introduce are different in kind from those that would
32 be introduced by the principal discharges from proposed Units 3 and 4, there is little potential for
33 operation of these units to add to their effects on water quality.

34 Four existing effluent discharges in the area are similar in kind to the effluents from proposed
35 Units 3 and 4, and thus could combine with those effluents to cumulatively affect the water
36 quality of affected surface waters:

- 37 • The Luminant DeCordova Power Plant is a substantial source of thermal impacts to
38 Lake Granbury. It is permitted to discharge heated effluent at a rate of 1041.8 MGD
39 at a location about 7 miles upstream from the proposed discharge location for Units 3
40 and 4. This discharge permit for this source allows a maximum permitted effluent
41 temperature of 110°F and a maximum chlorine concentration of 0.2 mg/L. Discharge
42 at the permitted volume and concentration can create a substantial thermal plume,
43 while introducing 3 tons/day of chlorine into the lake. During 2008, this facility
44 discharged effluent during only six months of the year, at a maximum flow of 612
45 MGD, peak temperature of 103°F, and maximum chlorine concentration of just half
46 of its permit limit Luminant 2010a). The steam-electric unit of the DeCordova Power
47 Plant that is responsible for this heated effluent was reportedly mothballed in 2009,

1 while four natural gas-fired combustion turbine units are still operating (Luminant
2 2010b).

- 3 • The Lake Granbury Surface Water and Treatment Systems (SWATS) facility
4 discharges water with high concentrations of dissolved solids (similar to the
5 proposed BDTF effluent) to Lake Granbury under a permit that allows discharge of
6 up to 2.5 MGD and daily average concentrations of sulfate and chloride of 4700 and
7 9900 mg/L, respectively. The permitted concentration of chloride in the SWATS
8 effluent is well above the 1000-mg/L water-quality criterion for the lake. Operating at
9 its permit limits, the SWATS facility could return almost 950 tons/day of chloride to
10 Lake Granbury. However, during 2008 this plant consistently discharged at levels
11 well below its permit limits. At the peak daily flow (710,000 gpd) and the highest
12 daily chloride concentration (1612 mg/L) reported in 2008, this plant would discharge
13 18 tons/day of chloride to the lake (Luminant 2010a).
- 14 • Wolf Hollow Power Plant, which withdraws water from Lake Granbury, discharges its
15 effluent to the Brazos River several miles downstream from DeCordova Dam. This
16 plant is permitted to discharge at an average rate of 1.1 MGD and a maximum of
17 1.65 MGD, but discharged no more than 517,000 gpd in 2008. The discharge is
18 monitored for parameters typically associated with sanitary wastewater (such as
19 BOD and nitrogen) as well as parameters associated with power plant cooling (such
20 as temperature, dissolved solids concentrations, and chlorine). During 2008, Wolf
21 Hollow discharges had TDS concentrations as high as 6670 mg/L, chloride as high
22 as 2280 mg/L, sulfate as high as 2450. At the peak flow rate and chloride
23 concentration reported in 2008, the plant would discharge 18 tons/day of chloride to
24 the river. Monthly average discharge temperatures ranged from 68 to 88°F, with
25 monthly maximums of 90°F and above year-round (Luminant 2010a).
- 26 • CPNPP Units 1 and 2 discharge cooling water, sanitary wastewater treatment
27 effluent, site runoff, and other plant wastewaters to SCR. The cooling water
28 discharge has the most potential for cumulative impacts. Discharge occurred at the
29 full permitted rate of 3168 MGD during most of 2008, and monthly average
30 discharge temperatures ranged from 83 to 110°F, with monthly maximums of 86 to
31 111°F (Luminant 2010a).

32 Releases of cooling water from DeCordova Power Plant, Wolf Hollow Power Plant, and the
33 existing CPNPP units cumulatively affect the thermal condition of the Brazos River system by
34 the addition of heat. Effluent from operation of the proposed CPNPP Units 3 and 4 would not
35 increase the temperature of Lake Granbury or releases from Lake Granbury significantly. The
36 proposed operation of Units 3 and 4 would not add significant cumulative impact to the
37 temperature of Lake Granbury.

38 Under low flow conditions, the proposed operation of Units 3 and 4 would result in effluent
39 discharges with TDS and chloride concentrations greater than ambient concentrations (see
40 Section 5.2.3.2). Such effluent would combine with the impact of the Lake Granbury SWATS
41 and Wolf Hollow Power Plant, also contributors to higher salt concentrations in Lake Granbury,
42 to increase TDS and chloride concentrations in Lake Granbury and the Brazos River
43 downstream.

44 If global climate change results in decreased precipitation and increased temperatures in the
45 Brazos River Basin, as many predictions suggest, the resulting reduction in surface runoff and
46 increase in evapotranspiration would contribute to cumulative impacts on surface water quality.
47 By reducing streamflows, these changes could reduce the ability of Lake Granbury and the

1 Brazos River downstream to dilute natural salt concentrations and waste heat and other
2 constituents in the effluent from Units 3 and 4.

3 These changes would increase salt concentrations in Lake Granbury and downstream during
4 reduced streamflow conditions, but would not significantly change the existing thermal and
5 chemical profiles of Lake Granbury. Additionally, because operation of the proposed CPNPP
6 Units 3 and 4 would be among the larger contributors to cumulative impacts, the staff concludes
7 that cumulative impacts to surface-water quality resulting from the operation of the proposed
8 CPNPP Units 3 and 4 would be SMALL to MODERATE. The MODERATE level is based on the
9 potential impacts to ambient water conditions and downstream users from increased dissolved
10 solids, particularly during low flow conditions. Current and future water users would still be
11 required to implement water treatment mechanisms to address salinity regardless of the
12 increase in salt concentrations attributable to CPNPP Units 3 and 4.

13 **7.2.2.2 Groundwater-Quality Impacts**

14 Oil and gas exploration and extraction in the region are a potential source of cumulative adverse
15 impacts to groundwater quality throughout the region. The significant vertical separation
16 between the main oil and gas production target (the Barnett Shale) at depth and the water
17 supply aquifer (the Twin Mountains Formation) nearer the land surface (Figure 2-21) limits the
18 potential for impact, but if leakage occurs along inadequately cased drillholes and wells, the
19 aquifer could be contaminated by drilling fluids and naturally occurring salts and other
20 contaminants from the hydrocarbon production zone. Any such impact would typically be
21 localized to the immediate vicinity of the affected drillhole or well.

22 At the CPNPP site, groundwater quality may be affected by spills and leaks during construction
23 and operation and by salt drift from cooling towers and the BDTF. Similarly, there is a potential
24 for contamination due to spills and leaks at other construction and industrial sites in the region.
25 Effects of all of these activities would generally be localized, and (as discussed in Section
26 5.2.3.2) any contaminant releases at the CPNPP site would be limited to the shallow
27 groundwater on site and would not impact offsite users.

28 Over time, the past, present, and future discharge to SCR of effluents from CPNPP operations
29 could adversely affect groundwater quality in the Twin Mountains Formation aquifer if SCR
30 water migrates downward through the Glen Rose Formation to the Twin Mountains Formation.
31 The low vertical permeability of the Glen Rose Formation impedes such fluid migration in spite
32 of the downward hydraulic gradient between SCR and the Twin Mountains Formation, but
33 vertical migration is possible, particularly in fractures or other preferential flow paths that may be
34 present but undetected in the Glen Rose Formation. Any migration would be slow, however,
35 and radioactive decay would likely reduce tritium concentrations to background levels before the
36 water reached the Twin Mountains Formation. The reversal of past groundwater level declines
37 noted in Section 7.2.1.2 could slightly reduce the potential for downward migration of
38 contaminants from SCR and other surface sources, but would not eliminate the potential for
39 impact.

40 In summary, there are several potential sources of cumulative adverse impacts to groundwater
41 quality in the region. However, all potential impacts would be localized, and implementation of
42 good engineering practices could avoid or reduce the potential impacts. Accordingly, the review
43 team concludes that cumulative impacts to groundwater quality would be SMALL.

44 **7.3 Ecology**

45 This section addresses the cumulative impacts on terrestrial resources, and aquatic and
46 wetlands resources. It considers activities associated with the proposed new units at the

1 CPNPP site combined with other past, present, and reasonably foreseeable future activities
2 within a geographic area of interest defined for each resource.

3 **7.3.1 Terrestrial Ecology**

4 The description of the affected environment in Section 2.4.1 provides the baseline for the
5 cumulative impacts assessments for terrestrial ecological resources. As described in Section
6 4.3.1, the review team concluded that the impacts from NRC-authorized construction on
7 terrestrial resources would be SMALL, and no further mitigation would be warranted. However,
8 the combined impacts of construction and preconstruction were described in Section 4.3.1 and
9 determined to be SMALL to MODERATE. As described in Section 5.3.1, the review team
10 concluded that the impacts of operations on terrestrial ecology would be MODERATE, and
11 further monitoring and mitigation may be warranted.

12 In addition to impacts from construction, preconstruction, and operation, the following
13 cumulative analysis also considers other past, present, and reasonably foreseeable projects
14 that could affect the same terrestrial ecological resources affected by the CPNPP Units 3 and 4
15 project. For purposes of this cumulative analysis, the geographic area of interest is defined as
16 Somervell, Hood, and Bosque Counties. These counties encompass the CPNPP site,
17 anticipated transmission line and pipeline rights-of-way, and the surrounding ecological
18 landscape. These counties lie almost completely in the Limestone Cut Plain of the Western
19 Cross Timbers ecoregion (Griffith et al. 2004). These counties are expected to encompass
20 those other projects capable of interacting with the CPNPP Units 3 and 4 project to affect
21 terrestrial ecological resources.

22 **7.3.1.1 Wildlife and Plant Communities**

23 As described in Section 2.4.1, most of the region existed prior to European settlement as
24 grassland or open live oak savanna that supported herds of bison (*Bison bison*) and other
25 herbivores. The introduction of domestic livestock, farming, and wildfire control in the nineteenth
26 century dramatically altered the landscape. At the time CPNPP Units 1 and 2 were developed,
27 the geographic area of interest consisted primarily of a mosaic of forest, woodland, savanna,
28 and prairie. The transitional natural vegetation of little bluestem grassland with scattered
29 blackjack oak and post oak trees was used mostly for rangeland and pastureland, with some
30 areas of woody plant invasion and closed forest.

31 Since establishment of Units 1 and 2, development in the three counties has continued and
32 additional acreage of terrestrial habitat has been lost or modified by farming, ranching,
33 residential development, river and watershed projects, and transportation projects (see
34 Table 7-1). Oil production has been a major activity in the three counties for over eighty years
35 (Griffith et al. 2004), and oil and natural gas exploration and production continue throughout the
36 region. These trends will likely continue over the operating life of proposed Units 3 and 4.
37 Indeed, the power produced by these units would contribute to this further development.

38 As noted in Section 2.4.1, building of the proposed Units 3 and 4 at CPNPP would affect several
39 areas of habitat types and associated wildlife including the permanent or temporary loss of
40 approximately 675 ac, consisting mostly of mostly Ashe juniper woodland - savanna habitat,
41 with some grassland and mixed hardwood forest, as well as some land previously disturbed
42 during development and operation of Units 1 and 2. Overall, 675 ac would be disturbed during
43 preconstruction and construction, which represents about 9 percent of the total site. Expansion
44 of power transmission and cooling water pipeline rights-of-way required for CPNPP Units 3 and
45 4 would occupy additional offsite acreage of similar wildlife habitat types. No old growth timber,
46 unique or sensitive plants, or unique or sensitive plant communities would be affected by work

1 on the site. Surveys for threatened and endangered species would be conducted on
2 transmission and pipeline rights-of-way once the final routes are determined. Impacts on
3 terrestrial resources from expansion of the rights-of-way could be minimized by placement of
4 structures to avoid sensitive resources such as wetlands and habitats favorable for threatened
5 and endangered species.

6 Proposed future and other current actions within the geographic area of interest that could
7 adversely affect terrestrial resources in a similar way to development of the CPNPP Units 3 and
8 4 project include the proposed development and building of transportation projects, future
9 urbanization, and continued oil and gas exploration and development (Table 7-1). Other future
10 actions or conditions that would contribute to cumulative effects on terrestrial resources would
11 include creation and/or upgrading transmission lines independent of Units 3 and 4, new road
12 development and expansion, continued industrial and urban development throughout the
13 geographic region of interest, increased outdoor recreation, and continued nonpoint source
14 runoff from activities such as agriculture and ranching.

15 Texas State Data Center (TSDC) projects that the population in a six-county area surrounding
16 the CPNPP site (including Bosque, Erath, Hood, Johnson, Somervell, and Tarrant Counties) will
17 increase by 41.5 percent by the year 2040 (TSDC 2009). The highest growth in the six-county
18 area is projected to occur in areas close to Fort Worth; however, the more outlying counties are
19 still expected to experience substantial growth. Even with the anticipated growth, the area
20 around the CPNPP site is likely to continue to be predominantly rural in character with the
21 majority of land covered by grassland and evergreen and deciduous forest. Recent
22 urbanization in this area has occurred primarily in and around the cities of Granbury and Glen
23 Rose. This trend is likely to continue, with most of the growth occurring in Hood County around
24 and northeast of Lake Granbury, due primarily to recreation home development and commuting
25 patterns associated with Fort Worth. The preconstruction, construction, and operations
26 workforce for CPNPP Units 3 and 4 would make only a minor contribution to this increase in the
27 urban growth of the region. The cumulative urbanization in the geographic area of interest
28 could alter attributes of land use by reducing wildlife habitat in localized areas. However, this
29 would not be expected to substantially affect the overall availability of wildlife habitat or wildlife
30 migration corridors near the CPNPP site or the general extent of forests or other specific habitat
31 types near the CPNPP site.

32 Continued development of other projects is expected to further contribute to the loss of wildlife
33 habitat. Activities associated with highway projects and continued urban and industrial
34 development that would cumulatively affect terrestrial ecological resources include land clearing
35 and grading (temporary and permanent), residential growth due to building and operation, heavy
36 equipment operation, traffic, noise, avian collisions, and fugitive dust. Site preparation and
37 building activities for proposed projects would likely displace or destroy wildlife that inhabits
38 areas where activities take place. Some wildlife, including some important species, would
39 perish or be displaced during land clearing as a consequence of direct mortality, habitat loss,
40 habitat fragmentation, and competition for remaining resources. Less mobile animals, such as
41 reptiles, amphibians, and small mammals, would be at greater risk of incurring mortality than
42 more mobile animals such as birds, many of which would be displaced to adjacent communities.
43 Undisturbed land adjacent to areas of activity could provide habitat to support displaced wildlife,
44 but increased competition for available space and resources could affect population levels.
45 Such land disturbing activities are not expected to destabilize terrestrial resources; however,
46 site preparation and building activities for other projects could alter key attributes of terrestrial
47 resources. Wildlife would also be subjected to impacts from increased noise and traffic, and
48 birds could be injured or suffer mortality through collisions with tall structures or equipment.

1 Expansion of the areas of existing power transmission line and cooling water pipeline rights-of-
2 way required for CPNPP Units 3 and 4, as well as other right-of-way development expected as
3 the geographic area continues to develop, would impact additional land areas and may increase
4 the fragmentation of remaining forested areas. This trend could be beneficial for some species,
5 including those that inhabit early successional habitat or use edge environments. However, the
6 increased fragmentation would adversely affect species that require continuous expanses of
7 uninterrupted forested habitat, including many neotropical migratory birds. New transmission
8 lines are not anticipated to cause any increases in bird collisions and electrocutions, if proper
9 mitigation were employed, and thus, would not be expected to increase and contribute to
10 cumulative effects.

11 As described in Section 5.3.1, impacts to terrestrial ecosystems associated with salt deposition
12 stemming from mechanical draft cooling tower deposition for Units 3 and 4 would be below
13 levels expected to adversely affect terrestrial habitats. Salt drift from the BDTF as described in
14 Section 5.3.1, however, could affect adjoining terrestrial habitats both on and off of the CPNPP
15 site. The review team concluded that the effects of salt drift from the BDTF could be enough to
16 injure vegetation. No noticeable impacts to vegetation associated with fogging, precipitation
17 and icing from cooling tower and BDTF operation are expected. No other projects anticipated in
18 the geographic area of interest have the potential for fogging or salt drift impacts. Any impacts
19 to birds from collisions with power lines over the BDTF might be successfully mitigated with
20 appropriate bird deterrents.

21 Additionally, Section 5.3.1 describes impacts to shoreline habitat as a result of operations of the
22 proposed new nuclear units. The increased drawdown from operations of Units 3 and 4 would
23 constitute an added fluctuation that may noticeably further stress plant communities by
24 lessening availability of water to vegetation on the existing shoreline. The review team
25 concluded, the increased drawdown of Lake Granbury and Possum Kingdom Lake would
26 noticeably alter shoreline habitat, however it would not destabilize the important attributes of the
27 resource. No other projects identified in the geographic area of interest have the potential affect
28 shoreline habitat in a similar manner.

29 The habitats that would be disturbed at the 7950 ac CPNPP site, and additional acreage for new
30 transmission and pipeline rights-of-way, are common in the area of geographical interest. The
31 majority of the Limestone Cut Plain of the Western Cross Timbers ecoregion has been subject
32 to continued and additional loss of acreage of terrestrial habitat due to farming, ranching, gas
33 exploration, residential development, river and watershed projects, and transportation projects.
34 This project, in addition to future development and other proposed actions would likely further
35 reduce these types of habitats. These impacts may be sufficient to alter noticeably important
36 attributes of wildlife habitat

37 The report on Global Climate Change Impacts in the United States, provided by the U.S. Global
38 Change Research Program, summarizes the projected impacts of future climate changes in the
39 U.S. (Karl et al. 2009). The report divides the U.S. into nine regions. The CPNPP site is
40 located in the Great Plains region. The GCRP climate models for this region project continued
41 warming in all seasons and an increase of as much as 12°F from 2000 to 2090. Additionally,
42 climate models project that there will tend to be less rainfall in this area. The GCRP states that
43 the precipitation could possibly alter the character of terrestrial habitats. This could further
44 stress terrestrial resources affected by the activities described above.

45 **7.3.1.2 Important Species**

46 The discussion of important species, as defined by the NRC in NUREG 1555, for the CPNPP
47 site and vicinity in Section 2.4.1.3 is applicable to the geographic area of interest defined for

1 cumulative impact assessment. Future urban and industrial development, new transmission
2 corridors, and the effects of other projects may potentially affect important species in the
3 geographic area of interest primarily by decreasing or degrading the available habitat for these
4 species. Impacts from development, new transmission corridors, and potential effects of other
5 projects would noticeably alter, but not destabilize, important species in the geographic area of
6 interest.

7 Populations of two bird species listed under the Endangered Species Act (ESA) occur in the
8 geographic area of interest for cumulative effects. These are the Federally endangered black-
9 capped vireo (*Vireo atricapillus*) and golden-cheeked warbler (*Dendroica chrysoparia*). Both are
10 also listed as endangered by the State of Texas. The major threats to these species are habitat
11 modification, habitat loss, and habitat fragmentation due to range management practices and
12 continued development in the region. Depending on the final route ultimately selected, the
13 Whitney transmission line right-of-way might pass through habitat occupied by one or both of
14 these species. In addition, habitat potentially suitable for the golden-cheeked warbler (but not
15 black-capped vireo) could be altered by salt drift from the BDTF. Habitat loss and alteration due
16 to other projects, including non-Federal projects, in the geographical area of interest could be
17 sufficient to alter noticeably populations of both species. Because both species are covered
18 under consultation requirements with the U.S. Fish and Wildlife Service (USFWS) under Section
19 7 of the ESA, compliance with FWS recommendations would likely prevent impacts which could
20 destabilize affected populations.

21 Three additional species are listed as threatened or endangered by the State of Texas that
22 could be cumulatively affected by the CPNPP Units 3 and 4 and other projects in the geographic
23 area of interest. These consist of one bird, the bald eagle (*Haliaeetus leucocephalus*); and two
24 reptiles: Texas horned lizard (*Phrynosoma cornutum*), and timber (canebreak) rattlesnake
25 (*Crotalus horridus*). In addition, three species listed by the State of Texas as rare, but with no
26 official regulatory status, could be cumulatively affected. These consist of one reptile, the Texas
27 garter snake (*Thamnophis sirtalis annectens*); and two plants: Comanche Peak prairie clover
28 (*Dalea reverchonii*), and Glen Rose yucca (*Yucca necopina*). All of these species are
29 potentially affected by habitat loss from projects in the geographic area of interest and direct
30 mortality from clearing and grading associated with those projects. Where distributions of these
31 species overlap areas required for CPNPP Units 3 and 4 and associated structures,
32 development and operation of the project could contribute to locally noticeable environmental
33 effects. Other important species in Somervell, Hood, and Bosque Counties, such as the
34 recreationally important white-tailed deer and wild turkey, are sufficiently abundant and have
35 sufficient favorable habitat that environmental effects should be minimal.

36 **Summary**

37 Cumulative impacts to terrestrial ecological resources are estimated based on the information
38 provided by Luminant and the review team's independent evaluation. Past, present, and
39 reasonably foreseeable future activities exist in the geographic area of interest that could affect
40 terrestrial ecological resources. Development of new transmission corridors and infrastructure to
41 support future projects, when combined with this project, could adversely affect wildlife and may
42 be detrimental to surrounding terrestrial habitats. Loss of vegetation, wildlife habitat, and
43 increased habitat fragmentation from continued development and global climate change are
44 unavoidable and would continue to occur. The extents of available habitats are ultimately
45 limited, and direct loss of habitat through continuing development, as well as habitat
46 modifications caused by increasing scarcity of water could noticeably contribute to cumulative
47 impacts. Based on this analysis, the review team concludes that cumulative impacts from past,
48 present, and reasonably foreseeable future actions on important species and habitat wildlife

1 habitat in Somervell, Hood, and Bosque Counties near the CPNPP site and associated
2 structures would be noticeable. The review team concludes that the cumulative impacts to
3 terrestrial resources from construction, preconstruction, and operations of Units 3 and 4—when
4 combined with other present and reasonably foreseeable future actions and viewed in the
5 context of past impacts—would be MODERATE. The MODERATE level of impact is associated
6 with the operation of the cooling system on shoreline vegetation on Lake Granbury and Possum
7 Kingdom Lake as well as the operations of the BDTF, NRC authorized construction and
8 operation activities would be a substantial contributor to this conclusion.

9 **7.3.2 Aquatic Ecosystem and Wetlands Impacts**

10 The review team evaluated other projects and activities in addition to the construction and
11 operation of the proposed CPNPP Units 3 and 4 to determine whether past, present, and future
12 actions would contribute to adverse cumulative impacts on aquatic and wetlands resources. For
13 this cumulative analysis of aquatic ecosystems and wetlands, the geographic area of interest
14 includes the following: (1) the area immediately surrounding (within approximately one mile of)
15 the site of Units 3 and 4 near SCR; (2) the portion of the Brazos River watershed from Possum
16 Kingdom Lake to the upper end of Lake Whitney, including Lake Granbury; (3) Squaw Creek
17 below and including SCR; and (4) the Paluxy River from the low dam in the City of Glen Rose to
18 the river's confluence with the Brazos River.

19 Anthropogenic activities potentially contributing to cumulative aquatic and wetlands impacts
20 include the construction and operation of the proposed CPNPP Units 3 and 4; continued
21 operation of the existing CPNPP Units 1 and 2; and impacts not directly related to CPNPP, such
22 as the operation of other industrial facilities, residential and agricultural water use, and water-
23 based recreational activities such as fishing and boating. Natural environmental stressors
24 contributing to cumulative aquatic impacts include short-term and long-term changes in
25 precipitation or temperature and the spread of invasive aquatic organisms.

26 Activities related to construction of the intake and discharge structures, as well as other
27 structures to be built in conjunction with the proposed CPNPP Units 3 and 4 would have minimal
28 and mostly temporary impacts on the aquatic ecosystems of Lake Granbury and the small
29 streams and wetlands in the vicinity of the project site and proposed new rights-of-way (ROWs).
30 The greatest potential for cumulative aquatic impacts from construction activities in the area of
31 interest would result from degraded water quality due to stormwater runoff from development
32 sites (primarily residential with some commercial, as discussed in Section 7.1.1) along
33 shorelines and elsewhere in watersheds, as well as sediment disturbance by inwater
34 construction activities. TCEQ requires stormwater permits for construction sites of 1 ac or more,
35 and obtaining a permit requires development and implementation of a stormwater pollution
36 prevention plan specifying the BMPs to be used in protecting water bodies (TCEQ 2008).
37 Enforcement of permitting requirements and associated use of BMPs to minimize or prevent
38 stormwater impacts are expected to ensure that the cumulative effects on aquatic resources
39 from construction of CPNPP Units 3 and 4 and other construction projects in the area of interest
40 would be minimal.

41 As discussed in Section 5.3.2, impacts due to the operation of CPNPP Units 3 and 4 would
42 include minor chemical, thermal, and physical effects in Lake Granbury and the Brazos River
43 downstream due to the withdrawal of cooling water from the lake and the discharge of
44 blowdown to the lake. Other existing water intakes on Lake Granbury (described in Section
45 7.2.1), including intakes for CPNPP Units 1 and 2, the Wolf Creek power facility, and the
46 SWATS water supply facility, potentially would withdraw water in the future concurrently with
47 Units 3 and 4; additional intakes have not been proposed. Other discharges to Lake Granbury
48 and the Brazos River could cumulatively affect surface water quality, as discussed in Section

1 7.2.2.1. Many of these discharges are from sanitary wastewater treatment facilities, which have
2 different effluent constituents than would CPNPP Units 3 and 4 and, thus, minimal cumulative
3 effects. However, the Lake Granbury SWATS facility discharges effluent with elevated
4 concentrations of TDS, chloride, and sulfate that would cumulatively contribute to the levels of
5 these constituents in Lake Granbury. The De Cordova power facility discharges thermal effluent
6 to Lake Granbury, and the Wolf Creek power facility discharges heated effluent with TDS and
7 other constituents above ambient concentrations into the Brazos River downstream of Lake
8 Granbury. Constituent concentrations and temperatures in these discharges are regulated by
9 TCEQ to ensure concentrations and temperatures in the receiving water body do not exceed
10 levels that would pose risk to aquatic life. Given the additional dilution and attenuation that
11 occur after discharge and mixing, adverse impacts on the aquatic communities of Lake
12 Granbury and the Brazos River from the operation of the existing intakes and discharges would
13 be unlikely to be noticeable.

14 As discussed in Section 7.2.1, hydrological changes in the Brazos River, PKL, and Lake
15 Granbury associated with increased water consumption by CPNPP Units 3 and 4 in combination
16 with other future users of BRA water allocations would be noticeable and would have substantial
17 cumulative impacts on the quantity of surface water in this system. The types of effects that
18 these potentially substantial changes in hydrology would have on the aquatic biota of PKL, Lake
19 Granbury, and the river segments between these lakes and downstream to Lake Whitney are
20 described in Section 5.3.2 and would range from negligible to noticeable but not destabilizing.
21 The withdrawals by Units 3 and 4 would be a major component of the increased withdrawals
22 planned for under BRA water management policy. However, these increases are likely to occur
23 even without the operation of CPNPP Units 3 and 4 because the 2060 Brazos G Water Plan
24 calls for full utilization of the yield from the Brazos River system between now and 2060. This
25 would require increased releases from PKL, which would be allocated to Units 3 and 4 and/or
26 other water users, or would be allocated entirely to other users eventually if Units 3 and 4 were
27 not built. Water allocated to CPNPP Units 3 and 4 also would be withdrawn from Wheeler
28 Branch Reservoir (WBR) to supply potable water and some process water to CPNPP as well as
29 other water users supplied by the SCWD. The water in WBR is pumped from the Paluxy River,
30 so the incremental use of water from this reservoir by CPNPP in conjunction with other users
31 would have a cumulative effect on downstream flows in the 2.5-mi reach of the Paluxy River
32 above its mouth, and in the Brazos River below the mouth of the Paluxy River. However, the
33 planning and management of water supply allocations from WBR by the SCWD and regulations
34 to prevent low-flow withdrawals from the Paluxy River would ensure that adverse effects on
35 aquatic communities of WBR, the Paluxy River, and the Brazos River from the cumulative
36 effects of water supply withdrawals from WBR would be negligible. Thus, the cumulative effects
37 on aquatic biota from the hydrological changes in these water bodies ultimately would be similar
38 to those described for Units 3 and 4 and likely would range from minimal to noticeable. The
39 NRC-authorized activity is a substantial contributor to those effects.

40 The review team also considered potential cumulative impacts from the blowdown discharge for
41 CPNPP Units 3 and 4 in conjunction with other sources of chemical and thermal releases to
42 water bodies in the area of interest. Section 7.2.2 describes other activities in the area of
43 interest that have the potential to affect water quality and, as a result, aquatic biota. Principal
44 sources of chemical inputs are effluent discharges, including discharges from wastewater
45 treatment facilities and existing power facilities. These effluents potentially could have
46 cumulative effects on the concentrations of chemical constituents that they contain in common,
47 such as TDS, chloride, and other inorganics. Such discharges are regulated and permitted by
48 the TCEQ for compliance with TPDES permit requirements regarding chemical releases, and
49 such monitoring is expected to continue in the future. TCEQ would take into consideration the
50 cumulative chemical releases from existing and proposed discharges to Lake Granbury and the

1 Brazos River before approving a TPDES permit for the proposed CPNPP Units 3 and 4. As a
2 result, the permitted discharge limits would ensure that the potential for cumulative toxicity
3 effects on aquatic life would be minimal. Similarly, thermal characteristics of discharges from
4 existing power facilities and proposed CPNPP Units 3 and 4 would be required to comply with
5 TPDES permit requirements. Cumulative thermal effects would be considered in the TCEQ
6 permitting process to help ensure that, although these facilities contribute incrementally to a
7 cumulative increase in heat added to Lake Granbury and the Brazos River, the increase in
8 water temperatures beyond the mixing zones near the discharges would be negligible. Thus,
9 the cumulative impacts on aquatic biota from the limited changes in water chemistry and
10 temperature in the area of interest would be minimal.

11 As stated above, the cumulative ecological impacts of hydrological and water quality changes in
12 the Brazos River below Lake Granbury would range from negligible to noticeable. These
13 impacts would be further moderated as the water is impounded in Lake Whitney. Lake Whitney
14 covers 2.7 times the area of Lake Granbury and is managed for flood control, water
15 conservation, and hydroelectric power. Given the size of Lake Whitney and the management of
16 water within the reservoir, the limited alterations in flow and minor changes in water quality
17 constituents in the Brazos River upstream of Lake Whitney would not be expected to be
18 detectable in the Brazos River below Lake Whitney downstream to the Gulf of Mexico.
19 Consequently, the potential for fisheries and other aquatic resources in the lower Brazos River
20 and the Gulf of Mexico to be adversely affected by the cumulative impacts that could occur
21 upstream in the geographic area of interest is negligible.

22 Anthropogenic impacts not directly associated with the operation of CPNPP Units 3 and 4 also
23 may contribute to cumulative impacts on the aquatic biota of Lake Granbury, the Brazos River,
24 and other aquatic habitats in the area of interest. These impacts include habitat loss due to
25 development along shorelines; nonpoint source pollution related to increased development
26 within the watersheds of Lake Granbury, PKL, and the Brazos River; and hydrological and water
27 quality alterations resulting from changes in stormwater runoff and infiltration as a result of
28 development in watersheds. Such impacts could result from increased urbanization in the
29 geographic area of interest. Recent urbanization in the area has occurred primarily around the
30 cities of Granbury and Glen Rose, with most of the growth occurring in Hood County around and
31 northeast of Lake Granbury. This trend is likely to continue, and future urbanization in these
32 areas could contribute to additional demand for water, increased need for wastewater
33 assimilation, and reduced water quality. Other parts of the area, including the area around the
34 CPNPP site, are likely to continue to be predominantly rural in character and covered by
35 grassland and forest. Reductions in natural vegetation and open space due to increased
36 urbanization or agricultural land uses likely would result in increased stormwater runoff and
37 associated increases in nonpoint source pollutants such as nutrients, pesticides, and petroleum
38 compounds. The cumulative effects of development in combination with CPNPP operations are
39 not expected to result in substantial adverse impacts on aquatic biota in the area of interest.

40 Other activities that may contribute to cumulative impacts on the aquatic biota of Lake
41 Granbury, PKL, the Brazos River, SCR, WBR, and other aquatic habitats in the area of interest
42 involve recreational uses of these water bodies for fishing and boating. As discussed in
43 Sections 2.4.2.1, 2.4.2.4, and 5.3.2.8, Lake Granbury and PKL are popular for recreational
44 fishing and are stocked with several species of game fish by the Texas Parks and Wildlife
45 Department (TPWD) to compensate for losses from their populations due to fishing and toxic
46 blooms of golden alga (*Prymnesium parvum*). As the human population of the region increases
47 in the future, there may be a similar increase in recreational fishing and boating on these lakes.
48 Game fish populations could be reduced by the cumulative effects of fishing pressure and the
49 other factors discussed above, including hydrological changes, reduced water quality, and other

1 chemical, thermal, and physical effects from water withdrawals and discharges to the lakes.
2 TPWD stocking programs likely would be continued for Lake Granbury and PKL to mitigate for
3 game fish population losses. The use of small, gasoline-fueled watercraft on the lakes for
4 fishing and other recreational purposes may increase in the future with increasing regional
5 population and could contribute to cumulative effects on water quality mainly through spillage of
6 fuel and oil. The Brazos River in the geographical area of interest also is likely to continue to be
7 used for some recreational fishing, SCR was reopened to the public for fishing and boating, and
8 WBR has been stocked with game fish and is expected to be used for these activities.
9 Increased fishing pressure and pollution from boats may contribute to cumulative impacts on
10 fish populations in conjunction with the incremental effects from CPNPP Units 3 and 4 and other
11 activities affecting water use and the water quality of these water bodies. The occurrence of
12 natural environmental stressors, including extremes of temperature or precipitation occurring
13 over the short term or long term (such as changes associated with global climate change) could
14 contribute to cumulative impacts on the aquatic biota of water bodies in the area of interest.
15 The report *Global Climate Change Impacts in the United States* (Karl et al. 2009) summarizes
16 the projected impacts of future climate changes in the U.S. The report divides the U.S. into nine
17 regions, and the CPNPP site is in the Great Plains region. The GCRP climate models for this
18 region projecting out to 2090 predict continued warming in all seasons and less rainfall. If global
19 climate change results in decreased precipitation and increased temperatures in the Brazos
20 River Basin, the resulting reduction in surface runoff and increase in evaporation would
21 contribute to reductions in wetlands and stream flows. Reductions in stream flows could reduce
22 the dilution of natural salt concentrations from the Brazos River watershed, as well as other
23 constituents in the effluents from Units 3 and 4 and other discharges, in Lake Granbury and the
24 Brazos River downstream. Higher air temperatures also could slow the dissipation of waste
25 heat from these water bodies. These climate-driven changes in conjunction with anthropogenic
26 changes affecting water quantity and quality in the area of interest would have cumulative
27 effects on aquatic biota. Such effects may include loss of native species due to altering of
28 breeding patterns, water quality, food supply, and habitat availability; increasing vulnerability of
29 natural communities to invasive species; and resulting changes in the composition and diversity
30 of aquatic communities (Karl et al. 2009). Thus, under extreme climatic conditions, the operation
31 of CPNPP Units 3 and 4 could contribute incrementally to cumulative adverse impacts on
32 aquatic biota in this area of the Brazos River watershed. The cumulative effects of water
33 consumption and effluent discharge by CPNPP Units 3 and 4 and other water users would likely
34 contribute to these effects and increase the potential for natural stressors to adversely affect
35 aquatic biota.

36 Only small areas of functionally impaired wetlands would be affected at the CPNPP Units 3 and
37 4 site, and the potential wetland areas within ROWs also would be small. Because the wetlands
38 potentially affected by the proposed action are small and isolated, the incremental contribution
39 to cumulative effects on wetland functions and values throughout the area of interest would be
40 minimal. In addition, mitigation likely would be required by the USACE in conjunction with
41 permitting under CWA Section 404 of the development activities affecting wetlands and
42 streams. Consequently, cumulative impacts to wetlands would be minimal, and mitigation
43 beyond that required through the USACE permitting process would not be warranted.

44 Cumulative impacts on aquatic ecology and wetlands resources were assessed based on the
45 information provided by Luminant and the review team's independent evaluation. This
46 assessment considered impacts on aquatic communities and wetlands from factors such as
47 direct effects of construction and operation of the facility, consumptive water loss, regulation of
48 water levels by dams, operation of other industrial facilities on Lake Granbury, and other natural
49 and anthropogenic stressors. Based on this assessment, the review team concludes that
50 cumulative impacts from past, present, and future actions on aquatic and wetlands resources in

1 the geographic area of interest would range from SMALL to MODERATE. The incremental
 2 contribution of the proposed action to impacts on aquatic resources of the water bodies and
 3 wetlands in the area of interest would be SMALL for most impacts. However, the incremental
 4 contribution to impacts on the aquatic resources of Lake Granbury, PKL, and the Brazos River
 5 from PKL to Lake Whitney that would result from reduced flows and extreme low flows during
 6 drought conditions potentially would range from SMALL to MODERATE.

7 7.4 Socioeconomics and Environmental Justice

8 The following sections describe the evaluation of cumulative impacts on socioeconomics and
 9 environmental justice.

10 7.4.1 Socioeconomics

11 The description of the affected environment in Section 2.5 serves as a baseline for the
 12 cumulative impacts assessment for socioeconomics. As described in Section 4.4, the impacts
 13 of NRC-authorized construction activities on socioeconomic resources would be SMALL with
 14 the following exceptions. First, NRC-authorized construction would result in LARGE beneficial
 15 economic and tax revenue impacts for Somervell County, and to a lesser extent Hood County.
 16 Second, NRC-authorized construction would result in MODERATE adverse impacts on traffic
 17 flow and level of service (LOS) on Farm to Market Road (FM) 56 during the project building
 18 peak. Third, NRC-authorized construction would result in MODERATE adverse impacts on
 19 wastewater treatment facilities in Somervell and Bosque counties during the building peak. As
 20 described in Section 5.4, the adverse socioeconomic impacts of operating Units 3 and 4 would
 21 be SMALL.

22 The combined impacts from construction and preconstruction were described in Section 4.4 and
 23 were determined to be the same as described above for NRC-authorized construction. In
 24 addition to the impacts from construction, preconstruction, and operations, the cumulative
 25 analysis also considers other past, present, and reasonably foreseeable projects that could
 26 affect socioeconomic resources. For this analysis, the geographic area of interest is the 50-mi
 27 region around the CPNPP site. This geographic area of interest includes the primary
 28 communities that would be affected by building and operating CPNPP Units 3 and 4.

29 Historically, the geographic area of interest had an agricultural based economy initially centered
 30 on cattle, corn, and cotton. By the late 20th Century, the area's demographic and economic
 31 growth had been affected by the building and operation of CPNPP Units 1 and 2 (including large
 32 refueling outages), natural gas exploration and extraction in the Barnett Shale region (Sections
 33 2.5.2.1 and 7.1), and USACE's development of HCP on Whitney Lake (Section 7.1). The area's
 34 socioeconomic profile is now being affected by Somervell County Water District's development
 35 of WBR (Section 7.1).

36 The socioeconomic impact analyses in Chapters 4 and 5 are cumulative by nature and depend
 37 largely on the rate of change from existing conditions, for example, the increase in the rate of
 38 population growth. Past and current economic impacts associated with the activities listed in
 39 Table 7-1 already have been considered as part of the socioeconomic baseline presented in
 40 Section 2.5. For example, the economic impacts of existing enterprises such as CPNPP Units 1
 41 and 2, mining, other electric utilities, etc., are part of the base used for establishing the Regional
 42 Input-Output Model System (RIMS) II multipliers. Regional planning efforts and associated
 43 demographic projections formed the basis for the review team's assessment of foreseeable
 44 future impacts. State and county plans along with modeled demographic projections like those
 45 used in Sections 2.5, 4.4, and 5.4 include forecasts of future development and population
 46 increases. Thus, cumulative impacts associated with general growth in the geographic area of

1 interest and construction, preconstruction, and operation of proposed Units 3 and 4 are
2 evaluated in Chapters 4 and 5.

3 As discussed in Section 4.4, the existing operations work force at CPNPP Units 1 and 2 is 977
4 workers. At various times during the building period for Units 3 and 4, there would be 800 to
5 1200 additional workers on site for refueling outages at CPNPP Unit 1 and 2. Once operations
6 begin at Units 3 and 4, at various times there would be 800 to 1200 additional workers on site
7 for refueling outages at CPNPP Unit 1, 2, 3, or 4. The presence of the Units 1 and 2 operations
8 workers and the Units 1, 2, 3, and 4 refueling outage workers during the building and operation
9 of CPNPP Units 3 and 4 would contribute to cumulative socioeconomic impacts in the region.

10 For socioeconomic, the largest adverse cumulative impact would be the increase in vehicular
11 traffic during the peak building period (Section 4.4.4.1). Given the relatively large traffic
12 increases that would occur, especially when combined with the existing traffic related to gas
13 exploration and extraction in the Barnett Shale region, it is likely that building CPNPP Units 3
14 and 4 would contribute to noticeable cumulative impacts on traffic flow and LOS on FM 56
15 (particularly north of the CPNPP entrance). These traffic impacts would likely require mitigation,
16 as discussed in Section 4.4.5. It is likely that operation of CPNPP Units 3 and 4 would
17 contribute to minor cumulative impacts on traffic flow and LOS on FM 56.

18 Population growth resulting from the in-migration of CPNPP Units 3 and 4 construction and
19 operations workers would combine with continued operations at CPNPP Units 1 and 2; refueling
20 outages at CPNPP Units 1, 2, 3, and 4; continued gas exploration and extraction in the Barnett
21 Shale; and the other actions in the region to create additional demand for recreation, housing,
22 public services, and education. However, the cumulative impacts of this increased demand
23 would be minimal in most cases, given existing and planned resources and facilities.

24 Cumulative impacts to socioeconomic resources from preconstruction, construction, and
25 operation of CPNPP Units 3 and 4 and other projects are estimated based on the information
26 provided by Luminant and the review team's independent review. The review team concludes
27 that cumulative impacts on socioeconomic resources would be SMALL and no further mitigation
28 would be warranted, except for three areas. First, the review team concludes that the economic
29 and tax revenue impacts for Somervell County, and to a lesser extent Hood County, would be
30 LARGE and beneficial. Second, the review team concludes that impacts on traffic flow and LOS
31 on FM 56 (i.e., both the physical impacts and the impacts to infrastructure and community
32 services) would be MODERATE during the project building peak and would require additional
33 mitigation. Third, the review team concludes that impacts on wastewater treatment facilities in
34 Somervell and Bosque counties (i.e., impacts to infrastructure and community services) would
35 be MODERATE during the building peak. Based on Luminant's estimate that 98 percent of
36 socioeconomic impacts would be attributable to NRC-authorized construction (Luminant 2009a),
37 NRC staff also concludes that cumulative impacts on socioeconomic resources would be
38 SMALL except for the three areas discussed above. The review team concludes that the
39 cumulative impacts of operations on socioeconomic resources would be SMALL and no further
40 mitigation would be warranted.

41 **7.4.2 Environmental Justice**

42 The description of the affected environment in Section 2.6 serves as a baseline for the
43 cumulative impacts assessment for environmental justice. As described in Section 4.5, the
44 environmental justice impacts of NRC-authorized construction activities would be SMALL. As
45 described in Section 5.5, the environmental justice impacts of operations would be SMALL and
46 no further mitigation would be warranted.

1 The combined impacts from construction and preconstruction are described in Section 4.5 and
2 determined to be SMALL. In addition to the impacts from construction, preconstruction, and
3 operations, the cumulative analysis also considers past, present, and reasonably foreseeable
4 future actions that could cause environmental justice impacts on minority and low-income
5 populations. For this cumulative analysis, the geographic area of interest is the 50-mi region
6 around the CPNPP site. This geographic area of interest includes the minority and low-income
7 populations that would be affected by developing and operating CPNPP Units 3 and 4.

8 The environmental justice analyses in Chapters 4 and 5 are cumulative by nature. Past or
9 current environmental justice impacts associated with the activities listed in Table 7-1 already
10 have been considered as part of the environmental justice baseline presented in Section 2.6
11 and there were no unique characteristics or practices, including subsistence, noted for any of
12 the minority populations in the region that would make them vulnerable to environmental
13 impacts from CPNPP.

14 As discussed in Sections 4.5 and 5.5, the review team concludes that the building and operating
15 CPNPP Units 3 and 4 would not have any disproportionately high and adverse human health or
16 environmental effects on minority or low-income populations through the pathways of soil,
17 water, or air. Similarly, the cumulative impacts of building and operating CPNPP Units 3 and 4
18 and the other actions in the region on socioeconomic resources would not have
19 disproportionately high and adverse effects on minority or low-income populations. NRC staff
20 concludes that the environmental justice impacts of developing CPNPP Units 3 and 4 would be
21 minimal and no further mitigation would be warranted. As described in Section 5.5, the review
22 team concludes that the environmental justice impacts of operating Units 3 and 4 would be
23 minimal and no further mitigation would be warranted.

24 Cumulative impacts to minority and low-income populations from preconstruction, construction,
25 and operation of CPNPP Units 3 and 4 and other projects are estimated based on the
26 information provided by Luminant and the review team's independent review. The review team
27 concludes that cumulative environmental justice impacts would be SMALL and no further
28 mitigation would be warranted. Based on Luminant's estimate that 98 percent of environmental
29 justice impacts would be attributable to NRC-authorized construction (Luminant 2009a), NRC
30 staff also concludes that the cumulative environmental justice impacts of NRC-authorized
31 construction would be SMALL. The review team concludes that the cumulative environmental
32 impacts of operations would be SMALL and no further mitigation would be warranted.

33 **7.5 Historic and Cultural Resources**

34 The description of the affected environment in Chapter 2.7 serves as the baseline for the
35 cumulative impact assessment of historic and cultural resources. As described in Section 4.6,
36 the NRC staff concludes that the impacts of NRC-authorized construction activities on historic
37 and cultural resources would be SMALL. As described in Section 5.6, the review team
38 concludes that the impacts of operations on historic and cultural resources would also be
39 SMALL. Mitigative actions may be warranted only in the event of an unanticipated discovery
40 during any ground disturbing activities associated with building and maintaining the facility.
41 Mitigation procedures would be determined by Luminant in consultation with the Texas State
42 Historic Preservation Office (SHPO).

43 The combined impacts from construction and preconstruction were described in Section 4.6 of
44 this EIS and determined to be SMALL. In addition to the impacts from construction,
45 preconstruction, operations, the fuel cycle, transportation, and decommissioning, the cumulative
46 analysis also considered past, present, and reasonably foreseeable future actions that could
47 affect the historic and cultural resources, including other Federal and non-Federal projects in the

1 geographic area of interest. For the cumulative analysis of potential impacts of construction and
2 preconstruction on historic and cultural resources, the geographic area of interest is considered
3 to be the CPNPP site and nearby portions of Hood and Somervell Counties.

4 Projects identified in Table 7-1 that may impact historic and cultural resources include operation
5 of CPNPP Units 1 and 2, renewal of licenses for CPNPP Units 1 and 2, Somervell County Water
6 Supply Project, and various oil and gas exploration and extraction operations. Additionally, the
7 average population growth rate for the six counties surrounding the CPNPP site is predicted to
8 be 41.5 percent from 2010 to 2040 (TSDC 2009). These six counties include Bosque, Erath,
9 Hood, Johnson, Somervell, and Tarrant. Increased urbanization is expected to occur as a result
10 of the predicted increase in population. Building and operating two additional units at the
11 CPNPP site, in addition to the other projects identified above and urbanization could have a
12 cumulative impact on historic and cultural resources within the geographic area of interest. Only
13 other Federal undertakings would require a Section 106 review.

14 Cultural resources are nonrenewable; therefore, the impact of destruction of cultural and historic
15 resources within the APE is cumulative. Based on its evaluation, the review team concludes
16 that the cumulative historic and cultural resources impact from construction, preconstruction,
17 operations, other federal and non-federal projects, and urbanization would be SMALL. Because
18 impacts to important resources from building and operating the proposed CPNPP Units 3 and 4
19 are not expected, the incremental impacts associated with NRC-authorized activities would not
20 contribute significantly to the cumulative impacts.

21 **7.6 Air Quality**

22 The description of the affected environment in Chapter 2 serves as the baseline for the
23 cumulative impact assessment in this resource area. As described in Section 4.7, the review
24 team concludes that the impacts on air quality from construction would be SMALL and that no
25 further mitigation would be warranted. As described in Section 5.7, the review team concludes
26 that the impacts on air quality from operations would be SMALL and that no further mitigation
27 would be warranted.

28 **7.6.1 Criteria Pollutants**

29 The combined impacts from construction and preconstruction were described in Section 4.7 and
30 determined to be SMALL. In addition to the impacts from construction, preconstruction, and
31 operations, the cumulative analysis also considers other past, present, and reasonably
32 foreseeable future actions that could contribute to cumulative impacts to air quality. For this
33 cumulative analysis of criteria pollutants, the geographic area of interest is Somervell County,
34 which is in the Metropolitan Dallas-Fort Worth Intrastate Air Quality Control Region (40 CFR
35 81.39). Air quality attainment status for Somervell County as set forth in 40 CFR 81.344 reflects
36 the effects of past and present emissions from all pollutant sources in the region. Somervell
37 County is in attainment for all criteria pollutants for which National Ambient Air Quality
38 Standards (NAAQS) have been established (40 CFR 81.344).

39 The air quality impact of site development for proposed Units 3 and 4 would be local and
40 temporary. The distance from building activities to the site boundary would be sufficient to
41 generally avoid significant air quality impacts. There are no land uses or projects that would
42 have emissions during site development that would, in combination with emissions from
43 CPNPP, result in degradation of air quality in the region.

44 The only permitted air emission sources near the location of the newly proposed units are diesel
45 generator sources associated with the two existing reactor units at the CPNPP site. Although

1 those sources operate under a TCEQ air quality permit (Number 19225), their emissions do not
2 exceed the 100 tons per year that would qualify the site as a major emissions source, and
3 therefore the CPNPP site is not currently required to have a TCEQ Title V Air Permit. The
4 addition of additional generators associated with the two new units would include the potential
5 for the facility exceeding the standard (100 ton/yr) and therefore would result in requiring a Title
6 V Permit.

7 There are no other facilities that are considered major emissions sources within Somervell
8 County (TCEQ 2009). Other new industrial projects listed in Table 7-1 would have de minimis
9 impacts. Given that these other projects would be subject to institutional controls, it is unlikely
10 that the air quality in the region would degrade to the extent that the geographic area of interest
11 is in nonattainment of National Ambient Air Quality Standards.

12 **7.6.2 Greenhouse Gas Emissions**

13 As discussed in the state of the science report issued by the GCRP, it is the "... production and
14 use of energy that is the primary cause of global warming, and in turn, climate change will
15 eventually affect our production and use of energy. The vast majority of U.S. greenhouse gas
16 emissions, about 87 percent, come from energy production and use..." Approximately one third
17 of the greenhouse gas emissions are the result of generating electricity and heat (Karl et al.
18 2009). This assessment is focused on greenhouse gas emissions.

19 Greenhouse gas emissions associated with building, operating, and decommissioning a nuclear
20 power plant are addressed in Sections 4.7, 5.7, 6.1.3, and 6.3. The review team concluded that
21 the atmospheric impacts of the emissions associated with each aspect of building, operating,
22 and decommissioning a single plant are minimal. The review team also concludes that the
23 impacts of the combined emissions for the full plant life cycle are minimal.

24 The cumulative impacts of a single source or combination of greenhouse gas emission sources
25 must be placed in geographic context:

- 26 • The environmental impact is global rather than local or regional
- 27 • The effect is not particularly sensitive to the location of the release point
- 28 • The magnitude of individual greenhouse gas sources related to human activity, no matter
29 how large compared to other sources, are small when compared to the total mass of
30 greenhouse gases resident in the atmosphere, and
- 31 • The total number and variety of greenhouse gas emission sources is extremely large and
32 are ubiquitous.

33 These points are illustrated in Table 7-2.
34

1

Table 7-2. Comparison of Annual Carbon Dioxide Emission Rates

Source	Metric Tons per Year
Global Emissions	28,000,000,000 ^(a)
United States	6,000,000,000 ^(a)
1000 MW Nuclear Power Plant (including fuel cycle, 90 percent capacity factor)	400,000 ^(b)
1000 MW Nuclear Power Plant (operations only, 90 percent capacity factor)	5000 ^(b)
Average U.S. Passenger Vehicle ^(c)	5

(a) Source: EPA 2010a.
(b) Source: Appendix J.
(c) Source: EPA 2010b.

2 Evaluation of cumulative impacts of greenhouse gas emissions requires the use of a global
3 climate model. The GCRP report referenced above provides a synthesis of the results of
4 numerous climate modeling studies. The review team concludes that the cumulative impacts of
5 greenhouse emissions around the world as presented in the report are the appropriate basis for
6 its evaluation of cumulative impacts. Based on the impacts set forth in the GCRP report, the
7 review team concludes that the national and worldwide cumulative impacts of greenhouse gas
8 emissions are noticeable but not destabilizing. The review team further concludes that the
9 cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse
10 gas emissions of the proposed project.

11 Consequently, the review team recognizes that greenhouse gas emissions, including carbon
12 dioxide, from individual stationary sources and, cumulatively, from multiple sources, can
13 contribute to climate change and that the carbon footprint is a relevant factor in evaluating
14 energy alternatives. This factor is considered in the analysis of energy alternatives in Section
15 9.2.

16 **7.6.3 Summary**

17 Cumulative impacts to air quality resources are estimated based on the information provided by
18 Luminant and the review team's independent evaluation. Other past, present and reasonably
19 foreseeable activities exist in the geographic areas of interest (local for criteria pollutants and
20 global for greenhouse gas emissions) that could affect air quality resources. The cumulative
21 impacts on criteria pollutants from emissions of effluents from the CPNPP site and other
22 projects would be noticeable but not destabilizing. CPNPP and other projects listed in Table 7-1
23 would have de minimis impacts. The national and worldwide cumulative impacts of greenhouse
24 gas emissions are noticeable but not destabilizing. The review team concludes that the
25 cumulative impacts would be noticeable but not destabilizing, with or without the greenhouse
26 gas emissions from the CPNPP site. The review team concludes that cumulative impacts from
27 other past, present, and reasonably foreseeable future actions on air quality resources in the
28 geographic areas of interest would be MODERATE. The incremental contribution of impacts on
29 air quality resources from building and operating proposed Units 3 and 4 would be SMALL. The
30 incremental contribution of impacts on air quality resources from the NRC-authorized activities
31 would also be SMALL.

1 **7.7 Nonradiological Health**

2 The description of the affected environment in Section 2.10 serves as the baseline for the
3 cumulative impacts in this resource area. As described in Section 4.8, the NRC concludes that
4 the nonradiological health impacts from construction would be SMALL and that no further
5 mitigation would be warranted. As described in Section 5.8, the review team concludes that the
6 nonradiological health impacts on from operations would be SMALL to MODERATE. The
7 MODERATE level of impact is associated with the potential for an increase level of noise as a
8 result of operating pumps and mitigation measures could include low-noise-producing pump
9 motors, mounting the motors on sound-dampening material, relocating the motors away from
10 water, or enclose the pumps in a sound-absorbing structure.

11 As described in Section 4.8, the combined nonradiological health impacts from construction and
12 preconstruction would be SMALL, and no further mitigation would be warranted other than that
13 described in the Comanche Peak ER. In addition to the impacts from construction,
14 preconstruction, and operations, the cumulative analysis also considers other past, present, and
15 reasonably foreseeable future actions that could contribute to cumulative impacts to
16 nonradiological health. Based on the localized nature of nonradiological health impacts, the
17 geographic area of interest for this cumulative impacts analysis includes projects within a 50-mi
18 radius around the CPNPP site; and for cumulative impacts associated with transmission lines,
19 the geographic area of interest is the transmission system associated with the proposed Units 3
20 and 4 (as described in Section 2.2.2). These geographic areas are expected to encompass the
21 areas where public and worker health could be influenced by the proposed project in
22 combination with any other past, present or reasonably foreseeable future actions.

23 Current projects within the geographic areas of interest that could contribute to cumulative
24 impacts for nonradiological health include the operation of CPNPP Units 1 and 2, existing
25 transmission lines and gas pipelines, and existing urbanization. Reasonably foreseeable future
26 projects in the geographic areas of interest that could contribute to cumulative impacts for
27 nonradiological health include potential future transmission line development and urbanization.

28 Preconstruction, construction, and operation activities that have the potential to impact the
29 nonradiological health of the public and workers include the following: exposure to fugitive dust
30 and vehicle emissions, occupational injuries, noise from construction and operation, exposure to
31 etiological agents, exposure to electromagnetic fields (EMFs), and the transportation of
32 construction materials and personnel to and from the CPNPP site. There are no existing or
33 future projects that could contribute to cumulative nonradiological health impacts of occupational
34 injuries. Existing and potential development of new transmission lines could increase
35 nonradiological health impacts from exposure to acute EMFs; however, as stated in Section
36 5.8.3, adherence to Federal criteria and State utility codes would create minimal cumulative
37 nonradiological health impacts. With regard to chronic effects of EMFs, the scientific evidence
38 on human health does not conclusively link extremely low frequency EMFs to adverse health
39 impacts. Noise and vehicle emissions associated with current urbanization and current
40 operations of CPNPP Units 1 and 2, could contribute to public nonradiological health impacts.
41 However, as discussed in Sections 4.8 and 5.8, the proposed Units 3 and 4 contribution to
42 these impacts would be temporary and minimal, and existing and future facilities would likely
43 comply with local, State, and Federal regulations governing noise and emissions. Section
44 7.10.2 discusses cumulative nonradiological health impacts related to additional traffic on the
45 regional and local highway networks leading to and from the CPNPP site, and the NRC staff
46 determines that these impacts would also be minimal.

47 In Section 5.8.1, the review team evaluated the health impacts of operating the existing CPNPP
48 Units 1 and 2 and two new proposed units at the CPNPP site with regard to the ambient

1 temperature of Lake Granbury, and the potential enhancement of thermophilic microorganisms,
2 including those that can cause diseases (i.e., etiological agents). The evaluation indicated that
3 operation of Units 3 and 4 would not likely increase the presence of etiological agents in Lake
4 Granbury. This is because the discharge temperature of effluent from Units 3 and 4 is expected
5 to result in a temperature increase of 1°C or less in the Lake Granbury receiving waters.

6 The review team is also aware of the potential climate changes that could affect human health—
7 a recent compilation of the state of knowledge in this area (Karl et al. 2009) has been
8 considered in the preparation of this EIS. Projected changes in the climate for the region during
9 the life of proposed Units 3 and 4 include an increase in average temperature and a decrease in
10 precipitation. Potential changes in water temperature and frequency of downpours could alter
11 the presence of thermophilic microorganisms: however, the NRC staff did not identify anything
12 that would alter its conclusion regarding the presence of etiological agents or change in the
13 incidence of water-borne diseases.

14 Cumulative impacts to nonradiological health are based on information provided by Luminant
15 and the review team's independent evaluation of impacts resulting from the building and
16 operation of proposed Units 3 and 4, along with a review of potential impacts from other past,
17 present, and reasonably foreseeable projects and urbanization located in the geographic area of
18 interest. The review team concludes that cumulative impacts on public and worker
19 nonradiological health would be SMALL to MODERATE. The MODERATE level of impact is
20 associated with the potential for an increase level of noise as a result of operating pumps and
21 mitigation measures could include low-noise-producing pump motors, mounting the motors on
22 sound-dampening material, relocating the motors away from water, or enclose the pumps in a
23 sound-absorbing structure. The review team does acknowledge that there is no conclusive link
24 between EMF exposure and human health impacts.

25 **7.8 Radiological Impacts of Normal Operation**

26 The description of the affected environment in Section 2.10 serves as a baseline for the
27 cumulative impacts assessment in this resource area. As described in Section 4.9, the NRC
28 staff concludes that the radiological impacts from NRC-authorized construction would be
29 SMALL, and no further mitigation would be warranted. As described in Section 5.9, the NRC
30 staff concludes that the radiological impacts from normal operations would be SMALL, and no
31 further mitigation would be warranted.

32 The combined impacts from construction and preconstruction were described in Section 4.9 and
33 determined to be SMALL. In addition to impacts from construction, preconstruction, and
34 operations, the cumulative analysis also considers other past, present, and reasonably
35 foreseeable future actions that could contribute to cumulative radiological impacts. For this
36 analysis, the geographic area of interest is the area within a 50-mi radius of the proposed Units
37 3 and 4. Historically, the NRC has used the 50-mi radius as a standard bounding geographic
38 area to evaluate population doses from routine releases from nuclear power plants. The
39 geographic area of interest includes the existing operating CPNPP Units 1 and 2. Also, within
40 the 50-mi radius of the site, there are likely to be hospitals and industrial facilities that use
41 radioactive materials.

42 As stated in Section 2.11, Luminant has conducted a radiological environmental monitoring
43 program (REMP) around the CPNPP site since 1981. The REMP measures radiation and
44 radioactive materials from all sources, including the existing CPNPP Units 1 and 2, hospitals,
45 and industrial facilities. The year 2008 monitoring data for the waters of the SCR show that the
46 tritium concentration ranged from 11,800 to 14,300 picocuries per liter (pCi/L) (Luminant 2009c).
47 The annual average release of tritium into SCR due to CPNPP Units 1 and 2 operations during

1 the period 2003 to 2008 (TXU Power 2004, TXU Power 2005, TXU Power 2006, TXU Power
2 2007, Luminant 2008, Luminant 2009b) was 1410 Ci; the annual release ranged from a low of
3 532 Ci to a high of 2430 Ci. The trend in the SCR tritium levels indicates that SCR is in
4 equilibrium with the tritium release rate of the existing CPNPP Units 1 and 2. The equilibrium
5 value is less than Luminant's administrative action level of 30,000 pCi/L. The tritium content of
6 SCR is the only consistent detectable indicator of CPNPP operations found in the site
7 environment.

8 As described in Section 4.9, the estimate of doses to construction workers during building of the
9 proposed Units 3 and 4 are well within NRC annual exposure limits (i.e., 100 millirem) designed
10 to protect the public health. This estimate includes exposure from existing Units 1 and 2 and
11 the planned Independent Spent Fuel Storage Installation (SFSI). The estimate does not include
12 doses from the operation of Unit 3 to workers constructing Unit 4 because the construction and
13 fueling of Unit 4 would be completed before Unit 3 began operation. As described in Section
14 5.9, the public and occupational doses predicted from the proposed operation of two new units
15 at the CPNPP site are well below NRC regulatory limits and standards. In addition, the dose to
16 the maximally exposed individual (MEI) from the existing Units and the proposed Units 3 and 4
17 at the CPNPP site would be well within the EPA regulatory standard of 40 CFR Part 190. Also,
18 based on results of the REMP and the estimates of doses from proposed Units 3 and 4 to biota
19 given in Chapter 5.9, the NRC staff concludes that the cumulative radiological impact on biota
20 would not be significant. The results of the REMP indicate that effluents and direct radiation
21 from area hospitals and industrial facilities that use radioactive materials do not contribute
22 measurably to the cumulative dose.

23 Currently, there are no other nuclear facilities planned within 50 mi of the CPNPP site. The
24 NRC, the U.S. Department of Energy, and the State of Texas would regulate or control any
25 reasonably foreseeable future actions in the region that could contribute to cumulative
26 radiological impacts. Therefore, the NRC staff concludes that the cumulative radiological
27 impacts of operating two new units, along with the existing units at CPNPP and the influence of
28 other man-made sources of radiation nearby would be SMALL, and no further mitigation would
29 be warranted.

30 **7.9 Postulated Accidents**

31 As described in Section 5.11.4, the NRC staff concludes that the potential environmental
32 impacts (risk) from a postulated accident from the operation of proposed CPNPP Units 3 and 4
33 would be SMALL. Section 5.11 considers both design basis accidents (DBAs) and severe
34 accidents.

35 The COL application references a steam electric system of the US-APWR design. As described
36 in Section 5.11.1, the NRC staff concludes that the environmental consequences of design
37 basis accidents (DBAs) at the Comanche Peak site would be SMALL for an US-APWR reactor.
38 DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet
39 NRC safety criteria. The consequences of DBAs are bounded by the consequences of severe
40 accidents.

41 As described in Section 5.11.2, the NRC staff concludes that the severe-accident probability-
42 weighted consequences (i.e., risk) of an US-APWR reactor at the Comanche Peak site are
43 SMALL compared to risks to which the population is generally exposed, and no further
44 mitigation would be warranted.

45 The cumulative analysis considers risk from potential severe accidents at all other existing and
46 proposed nuclear power plants that have the potential to increase risks at any location within 50

1 mi of the proposed Units 3 and 4. The 50-mi radius was selected to cover any potential risk
2 overlaps from 2 or more nuclear facilities. The only existing reactors within geographic area of
3 interest are CPNPP Units 1 and 2.

4 Tables 5-24 and 5-25 in Section 5.11 provide comparisons of estimated risk for the proposed
5 US-APWR units at the Comanche Peak site and current-generation reactors. The estimated
6 population dose risk for the proposed US-APWR units at the Comanche Peak site is well below
7 the median value for current-generation reactors. In addition, estimates of average individual
8 early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR
9 30028). For existing plants within the geographic area of interest (CPNPP Units 1 and 2), the
10 Commission has determined that the probability-weighted consequences of severe accidents
11 are small (10 CFR 51, Appendix B, Table B-1). The severe accident risk due to any particular
12 nuclear power plant gets smaller as the distance from that plant increases. However, the
13 combined risk at any location within 50 mi of the Comanche Peak site would be bounded by the
14 sum of risks for all operating and proposed nuclear power plants. Even though there would be
15 potentially several plants included in the combination, this combined risk would still be low. On
16 this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location
17 within 50 mi of the Comanche Peak site likely would be SMALL and no further mitigation would
18 be warranted.

19 **7.10 Fuel Cycle, Transportation, and Decommissioning**

20 The cumulative impacts related to the fuel cycle, radiological and nonradiological aspects of
21 transportation, and facility decommissioning for the proposed site are described below.

22 **7.10.1 Fuel Cycle**

23 As described in Section 6.1, the NRC staff concludes that the impacts of the fuel cycle due to
24 operation of proposed Units 3 and 4 would be SMALL. Fuel-cycle impacts would occur not only
25 at the CPNPP site but would also be scattered through other locations in the United States or, in
26 the case of foreign-purchased uranium, in other countries.

27 In addition to fuel-cycle impacts from proposed Units 3 and 4, this cumulative analysis also
28 considers fuel-cycle impacts from existing Units 1 and 2. There are no other nuclear power
29 plants within 50 mi of the CPNPP site. The fuel-cycle impacts of Units 1 and 2 would be similar
30 to that of proposed Units 3 and 4. Per 10 CFR 51.51(a), the NRC staff concludes that impacts
31 would be acceptable for the 1000-MW(e) reference reactor. The impacts of producing and
32 disposing of nuclear fuel include mining the uranium ore, milling of the ore, conversion of the
33 uranium oxide to uranium hexafluoride, enrichment of the uranium hexafluoride, fuel fabrication
34 (where the uranium hexafluoride is converted into uranium oxide fuel pellets), and disposition of
35 the spent fuel in a proposed Federal waste repository. As discussed in Section 6.1, advances in
36 reactors since the development of Table S-3 in 10 CFR 51.51 would reduce environmental
37 impacts relative to the operating reference reactor. For example, a number of fuel management
38 improvements have been adopted by nuclear power plants to achieve higher performance and
39 to reduce fuel and separative work (enrichment) requirements. In Section 6.1, the NRC staff
40 multiplied the values in Table S-3 by a factor of approximately four, to scale the impacts up
41 from the 1000-MW(e) light-water reactor (LWR) model to address the fuel cycle impacts of
42 proposed Units 3 and 4. Adding the fuel cycle impacts from Units 1 and 2 would increase the
43 scaling to no more than a factor of six. Therefore, the NRC staff considers the cumulative fuel-
44 cycle impacts of operating CPNPP Units 3 and 4 to be SMALL.

1 **7.10.2 Transportation**

2 The description of the affected environment in Section 2.5.2 serves as a baseline for the
3 cumulative impacts assessment in this resource area. As described in Sections 4.8.3 and 5.8.6,
4 the review team concludes that impacts of transporting personnel and nonradiological materials
5 to and from the CPNPP site would be SMALL. In addition to impacts from preconstruction,
6 construction, and operations, the cumulative analysis also considers other past, and present,
7 and reasonably foreseeable future actions that could contribute to cumulative transportation
8 impacts. For this analysis the geographic area of interest is the 50-mi region surrounding the
9 CPNPP site.

10 Nonradiological transportation impacts are related to the additional traffic on the regional and
11 local highway networks leading to and from the CPNPP site. Additional traffic would result from
12 shipments of construction materials and movements of construction personnel to and from the
13 site. The additional traffic would increase the risk of traffic accidents, injuries, and fatalities.
14 Other projects in the region could potentially increase nonradiological impacts if traffic to and
15 from the CPNPP site interacts with traffic traveling to and from these other projects. Cumulative
16 impacts could result from major construction projects, such as the Highway 121 construction
17 project listed in Table 7-1; however, it is unlikely that the construction schedules for all of the
18 foreseeable projects in the region would overlap to result in a significant cumulative impact.

19 In Sections 4.8.3 and 5.8.6, the review team concluded that the impacts of transporting
20 construction material, and construction and operations personnel to and from the CPNPP site is
21 a small fraction of the existing nonradiological impacts in the area. Luminant has identified
22 mitigation measures designed to improve traffic flow at the CPNPP site (see Section 4.4.5).
23 Based on the magnitude of nuclear power plant construction relative to the other industrial
24 construction activities in the region, the review team concludes the cumulative nonradiological
25 transportation impacts of constructing and operating the proposed new reactor at the CPNPP
26 site would be SMALL and no further mitigation is warranted.

27 As described in Section 6.2, the NRC staff concludes that impacts transporting unirradiated fuel
28 to the CPNPP site and irradiated fuel and radioactive waste from the CPNPP site would be
29 SMALL. Historically, the radiological impacts to the public and environment associated with
30 transportation of radioactive materials in the 50-mi region surrounding the CPNPP site have
31 been primarily associated with shipments of fuel and waste to and from the existing CPNPP
32 Units 1 and 2. Radiological impacts of transporting radioactive materials would occur along the
33 routes leading to and from the CPNPP site, fuel fabrication facilities, and waste disposal sites
34 located in other parts of the United States. No other major activities with the potential for
35 cumulative radiological impacts were identified in the geographic region of interest. Radiological
36 transportation impacts have been shown to be a small fraction of the impacts from natural
37 background radiation.

38 The addition of the proposed new CPNPP Units 3 and 4 would result in additional shipments of
39 unirradiated fuel to the site and additional shipments of spent fuel and waste from the site.
40 Cumulative impacts would be just over twice those of the existing two operating units (Units 1
41 and 2). The environmental impacts from transportation of unirradiated fuel, spent fuel, and
42 waste found in Section 6.2 of this EIS are based on the US-APWR design. Regarding
43 transportation of waste shipments, the NRC staff concludes that the normalized number of
44 waste shipments would be within the value specified in Table S-4 for the 1000-MW(e) reference
45 reactor. Advances in reactor technology and operations since the development of Table S-4
46 would reduce environmental impacts relative to the values in Table S-4. For example, fuel
47 management improvements have been adopted by nuclear power plants to achieve higher
48 performance and to reduce fuel requirements. This leads to fewer unirradiated and spent fuel

1 shipments than the 1000 MW(e) reference reactor discussed in 10 CFR 51.52. In addition,
2 advances in shipping cask designs to increase their capabilities would result in fewer shipments
3 of spent fuel to offsite storage or disposal facilities.
4 Therefore, the NRC staff concludes the cumulative nonradiological and radiological
5 transportation impacts of operating the proposed new reactors at the CPNPP site would be
6 SMALL and no further mitigation would be warranted.

7 **7.10.3 Decommissioning**

8 As discussed in Section 6.3, the environmental impacts from decommissioning the proposed
9 Units 3 and 4 are expected to be SMALL because the licensee would have to comply with
10 decommissioning regulatory requirements.

11 In this cumulative analysis, the geographic area of interest is within a 50-mi radius of the
12 CPNPP site. In addition to the proposed Units 3 and 4, the only other nuclear power plants
13 within this geographic area of interest are the existing CPNPP Units 1 and 2. The impacts of
14 decommissioning nuclear power plants are bounded by the assessment in Supplement 1 to
15 NUREG-0586, *Generic Environmental Impact Statement on Decommissioning of Nuclear*
16 *Facilities*. In that document, the NRC found the impacts on radiation dose to workers and the
17 public, waste management, water quality, air quality, ecological resources, and socioeconomics
18 to be SMALL (NRC 2002). In addition, in Section 6.3 the review team concluded that the impact
19 of greenhouse gas emissions on air quality during decommissioning would be SMALL.
20 Therefore, the cumulative impacts for the CPNPP site would be SMALL, and further mitigation
21 would not be warranted.

22 **7.11 Conclusions and Recommendations**

23 The review team considered the potential cumulative impacts resulting from construction,
24 preconstruction, and operations of two additional nuclear units at the CPNPP site together with
25 past, present and reasonable foreseeable future actions. The specific resources that could be
26 affected by the proposed action and other past, present, and reasonable foreseeable actions, in
27 the same geographic area, were assessed. This assessment included the impacts of
28 construction and operations for the proposed new units as described in Chapters 4 and 5;
29 impacts of preconstruction activities as described in Chapter 4; impacts of fuel cycle,
30 transportation, and decommissioning impacts described in Chapter 6; impacts of past, present,
31 and reasonably foreseeable Federal and non-Federal actions that could affect the same
32 resources affected by the proposed action, as described in Table 7-1.

33 Table 7-3 summarizes the cumulative impacts by resource area. The cumulative impacts for
34 the majority of resource areas would be SMALL, although there could be MODERATE or
35 LARGE impacts for some resources, as described below.

36 Cumulative land-use impacts in the geographic area of interest would be MODERATE, primarily
37 due to construction and preconstruction activities that include (1) the commitment of land for the
38 new Units 3 and 4 and their associated cooling towers, for the BDTF, and for new transmission
39 lines, (2) future urbanization, and (3) land use impacts from GCC. The incremental impacts
40 from NRC-authorized activities on land use would be SMALL because the effects to land use
41 from building and operating Units 3 and 4 would be minimal.

42

1

Table 7-3. Cumulative Impacts on Environmental Resources, Including the Impacts of the Proposed CPNPP Units 3 and 4

Resource Category	Impact level
Land-Use	MODERATE
Water-Related	
Water Use-Surface Water	MODERATE
Water Use-Groundwater	SMALL
Water Quality-Surface Water	SMALL to MODERATE
Water Quality-Groundwater	SMALL
Ecology	
Terrestrial Ecosystems	MODERATE
Aquatic Ecosystems and Wetlands	SMALL to MODERATE
Socioeconomic Resources	
Physical Impacts	SMALL to MODERATE
Demography	SMALL
Taxes and Economy	LARGE (beneficial)
Infrastructure and Community Services	SMALL to MODERATE
Environmental Justice	SMALL
Historic and Cultural Resources	SMALL
Air Quality	MODERATE
Nonradiological Health	SMALL to MODERATE
Radiological Health	SMALL
Severe Accidents	SMALL
Fuel Cycle, Transportation, and Decommissioning	SMALL

2 The cumulative surface water use impacts would be MODERATE, primarily because there
 3 would be noticeable alterations in the Brazos River system. The incremental impacts to water
 4 use from the NRC-authorized activities would also be MODERATE. The review team concludes
 5 that the cumulative surface water quality impacts in the geographic area of interest would be
 6 SMALL to MODERATE. The NRC staff concludes that the incremental impacts on water quality
 7 from NRC-authorized activities would also be SMALL to MODERATE.

8 Cumulative terrestrial ecology impacts in the geographic area of interest would be MODERATE.
 9 The development of new transmission corridors and infrastructure to support future projects,
 10 when combined with this project, could affect wildlife and may be detrimental to surrounding

1 terrestrial habitats. Loss of vegetation, wildlife habitat, and increased habitat fragmentation from
2 continued development and GCC are unavoidable and would continue to occur. The extents of
3 available habitats are ultimately limited, and direct loss of habitat through continuing
4 development, as well as habitat modifications caused by increasing scarcity of water in the
5 region would contribute to cumulative impacts. The incremental impacts from NRC-authorized
6 activities on terrestrial ecology would be substantial contributors to the overall MODERATE
7 impact level.

8 The review team concludes that cumulative impacts from past, present, and reasonably
9 foreseeable actions to aquatic resources and wetlands in the geographic area of interest would
10 be SMALL to MODERATE. Future development of industries that compete for water along the
11 Brazos River, as well as management of water budgets across the State of Texas would likely
12 affect aquatic resources in the Brazos River. The cumulative effects on aquatic biota from the
13 hydrological changes in the Brazos River, PKL, and Lake Granbury associated with increased
14 water consumption by the proposed CPNPP Units 3 and 4 in combination with other future
15 users of BRA water allocations would be noticeable; however, cumulative impacts to wetlands
16 would be minimal. Direct and indirect anthropogenic stressors, including GCC, in the
17 geographic area of interest would cumulatively lead to effects on the aquatic communities that
18 would be noticeable. The incremental contribution of the proposed action to impacts on aquatic
19 resources in water bodies and wetlands in the area of interest would be SMALL for most
20 impacts; however, the incremental contribution to impacts on the aquatic resources of Lake
21 Granbury, PKL and the stretch of the Brazos River from PKL to Lake Whitney that would result
22 from the reduced flows and extreme low flows during drought conditions would potentially range
23 from SMALL to MODERATE. The incremental impact from NRC-authorized activities on
24 aquatic resources would also be SMALL to MODERATE.

25 For socioeconomic resources, the review team concludes that cumulative physical impacts
26 would be SMALL, except for MODERATE physical impacts on FM 56 due to increased traffic
27 associated with CPNPP Units 3 and 4. The review team concludes that cumulative impacts on
28 demography would be SMALL. The review team concludes that cumulative impacts on the
29 economy and taxes would be LARGE and beneficial in Somervell County, but SMALL and
30 beneficial in the rest of the six-county study area. For infrastructure and community services,
31 the review team concludes that cumulative impacts would be SMALL with two exceptions. First,
32 cumulative impacts on traffic on FM 56 would be MODERATE because there would be
33 noticeable impacts on traffic flow and LOS during peak employment. Second, cumulative
34 impacts on wastewater treatment facilities in Somervell and Bosque counties would be
35 MODERATE because of population growth associated with peak employment at CPNPP Units 3
36 and 4. Based on Luminant's estimate that 98 percent of socioeconomic impacts would be
37 attributable to NRC-authorized construction (Luminant 2009a), the NRC staff concludes that the
38 incremental cumulative impacts of NRC-authorized activities on socioeconomic resources would
39 be the same as those discussed for the review team.

40 In regard to the potential cumulative impacts to air quality from the proposed Units 3 and 4, the
41 review team concludes that the cumulative impacts on criteria pollutants from emissions of
42 effluents from the CPNPP site and from other past, present and reasonably foreseeable future
43 actions—as well as the cumulative impacts of GCC—would be noticeable, but not destabilizing.
44 The cumulative impacts to air quality resources in the geographic areas of interest would be
45 MODERATE; however, the incremental contribution of impacts on air quality resources from
46 building and operating proposed Units 3 and 4 would be SMALL. The incremental contribution
47 of impacts on air quality resources from the NRC-authorized activities would also be SMALL.

48 The review team concludes that cumulative impacts on public and worker nonradiological health
49 would be SMALL to MODERATE. NRC-authorized activities associate with the operation and

1 construction of the proposed new units would be contributor the SMALL to MODERATE level of
 2 impact. The MODERATE level of impact is associated with the potential for an increase level of
 3 noise as a result of operating pumps and mitigation measures could include low-noise-
 4 producing pump motors, mounting the motors on sound-dampening material, relocating the
 5 motors away from water, or enclose the pumps in a sound-absorbing structure.

6 **7.12 References**

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8.0 Need for Power

1 Luminant Generation Company LLC (Luminant) is the Applicant for Comanche Peak Nuclear
2 Power Plant (CPNPP) Units 3 and 4. Luminant is a merchant energy company that provides
3 electricity and related services to wholesale customers in the Electric Reliability Council of
4 Texas (ERCOT) region (TXU Corp. 2006; CPNPP 2007). The ERCOT wholesale power market
5 has been competitive since 1995, and the ERCOT retail power market, as shown in Figure 8-1,
6 has been competitive since 2002 (ERCOT 2010a). ERCOT lies wholly within the State of
7 Texas, and while not a formal member of the North American Energy Reliability Corporation
8 (NERC), follows NERC rules. It is isolated from the rest of the power grid by a lack of
9 alternating current (AC) compatibility and limited direct current (DC) connections. ERCOT is
10 part of the Public Utility Commission of Texas (PUCT). ERCOT is responsible for the reliability
11 of the electric grid and for ensuring nondiscriminatory access to transmission services by all
12 market participants. To meet its responsibilities, ERCOT undertakes frequent assessments of
13 long-term power needs and ensures nondiscriminatory access to transmission services by
14 power market participants. These analyses and forecasts have supplied much of the data
15 contained in the Applicant's need for power analysis. ERCOT also approves transmission
16 upgrades necessary to maintain grid reliability and acts as an independent system operator
17 (ISO) for wholesale power markets.

18 Luminant currently owns a mix of nuclear, coal, and gas generating plants that supply wholesale
19 power to the ERCOT grid. Luminant's parent company is Luminant Holding Company LLC,
20 which is a wholly owned subsidiary of Energy Future Holdings Corporation (EFH), a Dallas-
21 based energy company that manages a portfolio of competitive and regulated energy
22 businesses, primarily in the ERCOT market. The Luminant business segment includes
23 merchant electric generation, a business development group, a construction group, and a
24 wholesale market group. Luminant is also the largest purchaser of wind-generated power in
25 Texas and the fifth-largest wind purchaser in the United States (Luminant 2009b).

26 Luminant proposes to construct and operate two U.S. Advanced Pressurized Water Reactor
27 units (designed by Mitsubishi Heavy Industries, Inc.) at its CPNPP site located in North-Central
28 Texas. Luminant currently owns and operates two Westinghouse four-loop pressurized-water
29 reactors, designated Units 1 and 2, as well as supporting infrastructures at the same location.
30 Units 1 and 2 have been in commercial operation since 1990 and 1993, respectively.
31 Supporting infrastructure will be expanded to meet the requirements of proposed Units 3 and 4.
32 Expansion of the existing transmission infrastructure will be required (Luminant 2009a).

33 This need for power analysis is guided by Chapter 8 of NRC's *Standard Review Plans for*
34 *Environmental Reviews for Nuclear Power Plants* (NRC 2000). NRC staff has followed these
35 guidelines while attempting to also capture unique aspects of Luminant's application for
36 combined operating licenses (COLs). This review recognizes that Luminant is a merchant
37 power vendor that must compete in electricity markets with other suppliers. As a merchant
38 power vendor, Luminant must bear market-related risks that differ from those of regulated power
39 vendors. In particular, Luminant receives no negotiated profit margins that sometimes
40 characterize the rate-of-return for regulated power markets. For this reason, the acceptance
41 criteria in this need for power analysis consider whether relevant service region supply and
42 demand conditions are consistent with market entry by a vendor with additional capacity as is
43 proposed by Luminant. The NRC staff's determination is that market conditions justify
44 Luminant's proposal.

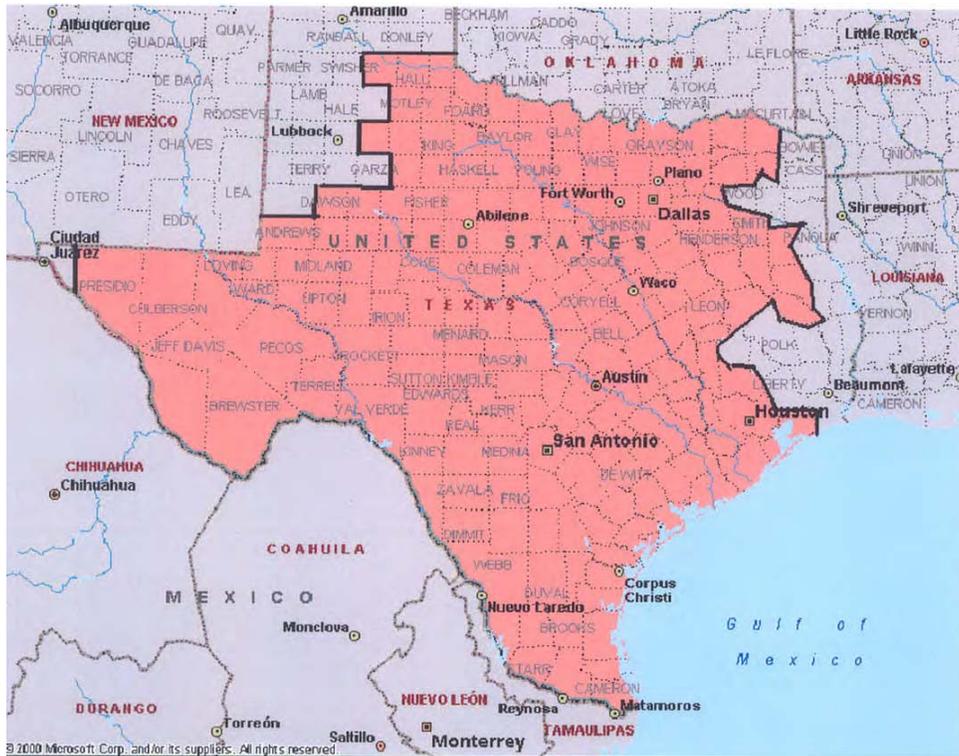


Figure 8-1. Electric Reliability Council of Texas region. (TXU Corp. 2006; CPNPP 2007)

1 In preparing the need for power analysis contained in its application, Luminant has relied heavily
 2 on analyses prepared by ERCOT as part of its assignments from the PUCT (ERCOT 2010b).
 3 The NRC staff has taken Luminant's analysis as a point of departure and conducted an updated
 4 analysis using newer data from ERCOT than was found in Luminant's application, also based
 5 on ERCOT data. In determining the validity of ERCOT analyses, NRC follows guidance in
 6 Chapter 8 of NUREG-1555 (NRC 2000), which states that if the NRC finds an analysis to be
 7 (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting
 8 uncertainty, then this analysis is acceptable and need not be subject to further review by NRC.
 9 The NRC staff has determined that the ERCOT data and forecasts meet these criteria.
 10 However, the NRC staff also notes that updates by ERCOT have replaced those reported by
 11 Luminant in its application. For this reason the NRC staff has included the new data in the need
 12 for power analysis and has compared them to those in Luminant's application.

13 This chapter is presented in four subsections as follows:

- 14 • Section 8.1, Description of Power System, presents an overview of the ERCOT region and a
 15 brief summary of EFH's subsidiaries in the ERCOT power system, as well as a regional
 16 demand assessment based on ERCOT reports, assessments, and analyses. This section
 17 also provides a detailed discussion describing why the NRC staff finds the ERCOT analysis
 18 to meet the four criteria.
- 19 • Section 8.2, Power Demand, presents the load forecasts submitted by Luminant in its
 20 application, the revised forecasts prepared by the NRC staff based on more recent ERCOT
 21 data, and the differences that arise between the two forecast sets.

- 1 • Section 8.3, Power Supply, presents a regional supply assessment based on ERCOT
2 reports, assessments, and analyses.
- 3 • Section 8.4, Assessment of Need for Power, provides the NRC staff's determination
4 regarding the need for power based on the material presented in Sections 8.1, 8.2, and 8.3,
5 drawing heavily on the ERCOT reports and also on additional material describing the
6 evolution of the ERCOT region.

7 **8.1 Description of Power System**

8 This section provides a brief overview of the Applicant's company and then focuses on the
9 history, structure, and operation of ERCOT.

10 **8.1.1 The Applicant**

11 EFH, TXU Corporation, is a holding company that conducts its operations principally through the
12 following wholly owned subsidiaries:

- 13 • Oncor Electric Delivery Company LLC, (Oncor) a regulated company;
14 • Luminant, a competitive wholesale power company; and
15 • TXU Energy Company LLC (TXU Energy), a competitive retail power company.

16 EFH's service territory is the entire ERCOT region (Figure 8-1). Prior to deregulation, the
17 traditional service territory in North Texas had an estimated population in excess of 7 million,
18 which is about one-third of the population of Texas.

19 Oncor, EFH's regulated company, operates the largest transmission and distribution (T&D)
20 system in Texas, providing power to more than 117,000 mi of T&D lines (Oncor 2010). The
21 distribution grid system and transmission interties are discussed in Final Safety Analysis Report
22 Sections 8.1 and 8.2 (Luminant 2009b).

23 Luminant, as a wholesale merchant generator, owns or leases 18,365 MW of thermal
24 generation capacity, including 2300 MW of nuclear-fueled capacity (CPNPP Units 1 and 2),
25 5837 MW of lignite/coal-fueled capacity, and 10,228 MW of natural gas-fueled capacity.
26 Luminant also purchased wind energy equivalent to about 900 MW capacity in 2009.

27 As of December 31, 2007, TXU Energy, the retail sales company, estimated that its shares of
28 the ERCOT retail residential and small business markets were 36 percent and 25 percent,
29 respectively (TCEH 2007). Approximately 1.9 million of TXU Energy's approximately 2.1 million
30 retail electricity customers are in its traditional service territory. The remaining retail electricity
31 service customers are in other areas now open to competition, including Houston, Corpus
32 Christi, and lower Rio Grande Valley areas of Texas (TXU Corp. 2006). In North Texas, the
33 remaining customers are served by other competitive retailers.

34 **8.1.2 The Restructured Texas Utility Industry**

35 Legislation enacted by the Texas Legislature in 1995 and 1999 changed the traditional
36 regulation of electric utilities in Texas by creating a comprehensive electric wholesale market
37 and provided for the restructuring of the retail and T&D markets. The PUCT has principal
38 responsibility for the Texas power industry under the Public Utilities Regulatory Act (PURA),
39 § 39.151 (PURA 1999). The restructured power industry corresponds geographically to the
40 current ERCOT boundaries, and ERCOT was assigned major power system operating
41 responsibilities under the oversight of the PUCT.

1 In 1999, the Texas Legislature enacted Senate Bill 7 (SB 7 1999) providing for retail electric
2 competition. SB 7 required the state's vertically integrated investor-owned utilities to separate
3 their business activities into three components, which included competitive power generating
4 companies, competitive retail electric providers, and regulated T&D utilities. This business
5 separation, known as unbundling, was accomplished by establishing separate affiliated
6 companies owned by a common holding company or by sale of assets or stock to third parties.
7 SB 7 also mandated that each state power region create and maintain an ISO to monitor the
8 T&D system, ensure nondiscriminatory access to T&D, and settle wholesale energy
9 transactions (SB 7 1999). ERCOT functions as the ISO within its boundaries.

10 The ERCOT region is distinguished by its lack of synchronous interconnectivity with other power
11 regions in the United States, although it can exchange a small amount of DC power with the
12 Southwest Power Pool (SPP) and with Mexico. Because of this lack of interconnectivity, almost
13 all of the power consumed within the ERCOT region must be generated within the region. Also,
14 for ERCOT operations contained wholly within Texas, ERCOT is not subject to the Federal
15 Energy Regulatory Commission (FERC). The exception is the DC lines, which, because they
16 cross state boundaries, are subject to FERC regulation (FERC 2007, ERCOT 2005).

17 ERCOT manages the flow of electric power to approximately 20 million Texas customers,
18 representing 85 percent of the state's electric load and 75 percent of the state's land area.
19 ERCOT, functioning as the ISO for the region, schedules power on an electric grid that connects
20 38,000 mi of high-voltage transmission lines and more than 500 generation units. ERCOT is a
21 membership-based, not-for-profit corporation [501(c)6] governed by a board of directors and
22 subject to oversight by the state PUCT and the Texas Legislature. ERCOT has roughly 250
23 members, including retail customers, investor-owned utilities, rural electric cooperatives, river
24 authorities, independent generators, and power marketers (ERCOT 2010a). ERCOT has a
25 Board of Directors consisting of independent members, consumers, and representatives from
26 the current seven power markets. This Board of Directors appoints ERCOT's officers.
27 Representatives from all segments of ERCOT's market participants collaboratively created
28 ERCOT's governing documents, referred to as ERCOT's protocols (ERCOT 2010c). In
29 addition, ERCOT has a variety of advisory committees and other stakeholder interaction
30 mechanisms.

31 ERCOT performs a number of roles in managing the electric power grid and marketplace
32 (ERCOT 2010b), including

- 33 • monitoring schedules submitted by wholesale buyers and sellers for the next day's electricity
34 supply for purposes of load following to supplement bilateral power sales;
- 35 • managing financial settlements for wholesale sales;
- 36 • ensuring electricity transmission reliability by managing the incoming and outgoing supply of
37 electricity over the grid, conducting a day-ahead market for ancillary services and a real-time
38 balancing market, and issuing instructions to generation and transmission companies to
39 maintain balance;
- 40 • serving as a central hub for retail customer registration and switching; and
- 41 • forecasting loads and analyzing transmission and related system needs.

42 In practice, most power sales take place through bilateral arrangements between power
43 producers and power consumers, and ERCOT must plan for transmission capacity to facilitate
44 power transfers between seller and buyer.

45 A major aspect of ERCOT's ISO role is to manage congestion across the zones that make up
46 the current management structure for power delivery and reliability functions while facilitating
47 the completion of contracted power deliveries. Within the current system, power consumption

1 and transfer is modeled and managed as a ten-zone system with some restrictions on inter-
2 zonal power transfers (ERCOT 2010c). This results in inefficiencies as system management
3 does not account fully for the real costs of congestion. ERCOT is now planning to switch from
4 this zonal system to a nodal system that will highlight the costs of congestion and assign
5 congestion costs based on differences between nodal prices at point of injection and point of
6 withdrawal (ERCOT 2010c). The new management system generally mimics the physical
7 power system, provides greater information on the marginal costs of power at each node, and
8 provides incentives for more efficient behavior.

9 **8.1.3 The Role of Market Forces in the Restructured System**

10 Under the restructured system, responsibilities for planning have seen significant reassignment.
11 ERCOT has planning responsibilities for power system performance and is concerned with its
12 specific functions within the context of system reliability. By law, ERCOT must perform
13 extensive annual and semiannual studies, issue reports, make recommendations for
14 transmission system needs and adequacy, and make legislative recommendations to further
15 these objectives. Beyond enforcing compliance with its operational procedures, ERCOT does
16 not participate in the planning functions of individual power sellers and buyers within the system.
17 Instead, individual power suppliers assess the market forces affecting the overall demand and
18 supply for power and make individual decisions to add new capacity or to retire old capacity.
19 ERCOT analyzes the region within the context of a competitive market using load growth
20 projections, regional transmission topology, specialized studies, and new generation
21 characteristics. These reports are subject to market participants' input and review. However,
22 ERCOT is concerned primarily with overall system performance and, apart from minor concerns
23 with ancillary services for reliability requirements, does not participate in the decisions of
24 individual market players to increase or decrease their operating capacities.

25 This environment constitutes a significant departure from traditional rate-of-return regulation
26 under which state regulators participate in many operating decisions by system players. In
27 particular, they assess the efficiency of choices over how system assets are operated and over
28 choices to add or retire system assets. Regulators also approve or disapprove pricing (tariff)
29 decisions, usually within the context of an equitable rate of return on capital investments used in
30 power operations. In the restructured system, ERCOT and the PUCT have limited influence
31 over choices to invest in new assets, by power generators, such as Luminant, but they also do
32 not ratify power prices to ensure equitable rates of return. In short, market forces are the
33 principal drivers behind power prices and vendor prices.

34 **8.1.4 ERCOT Load Forecasting Process**

35 In addition to its other responsibilities, the ERCOT organization has the responsibility to study
36 the need for increased transmission and generation capacity within its boundaries, pursuant to
37 PURA § 39.151 (PURA 1999). Key inputs to this process are the preparation of multiyear
38 forecasts of peak electricity loads and total energy consumption, generation capacity and
39 resources, and transmission capacity and constraints. In carrying out these responsibilities,
40 ERCOT develops detailed load forecasts and forecasts of the generation capacity and
41 transmission capacity changes needed to meet the load. These reports are subject to
42 stakeholder input and review and are filed with the state legislature. The load forecasting
43 report, *2009 ERCOT Planning Long-Term Hourly Peak Demand and Energy Forecast*, was filed
44 on May 28, 2009 (ERCOT 2009a). The report provides a historical perspective of the load
45 growth in ERCOT's territory, the ERCOT forecasting process, a summary of the forecast results,
46 and a description of differences between the current year's forecast and the previous year's
47 forecast.

1 The ERCOT planning process requires detailed information to study transmission system loads
2 and potential locations of congestion with the goal of ensuring system reliability. In contrast, this
3 need for power analysis assumes that ERCOT will provide needed access to its grid and
4 considers only system-level loads. ERCOT also is interested in understanding how changes to
5 the power system affect the ability of the system to follow variations in peak load. While the
6 proposed CPNPP Units 3 and 4 are designed to meet base load needs and to have limited load-
7 following capability they are evaluated in this need for power analysis relative to the overall
8 power system. The NRC staff includes both energy consumption and peak load in this section
9 to consider the impact of load and other anticipated changes on the ERCOT reserve margin, but
10 follows a traditional capacity planning analysis based on system peaks for analyzing the impacts
11 of the proposed units on the ERCOT reserve margin. Power loads are observed by measuring
12 the instantaneous demands placed on the power system. Total loads can be integrated over
13 any chosen interval, for example, an hour or a year. ERCOT peak load forecasts refer to hourly
14 peak loads and are a measure of the highest hourly load occurring within a year. Total energy
15 consumption is the sum of total loads supplied over a period of time, for example, total watts
16 served for an hour or for a year. Energy consumption is typically reported as load served for an
17 hour (watt hours, kilowatt hours, megawatt hours, etc.). ERCOT reports average load as total
18 watt hours served divided by the number of hours in a year. Capacity planning is typically
19 carried out by considering the various aspects of capacity and capacity management options
20 that can be employed to meet peak loads, taking into account a measure of safety or cushion
21 referred to as the reserve margin. These management options are discussed in detail below in
22 table 8.2 and in Section 8.4. Throughout this chapter the NRC staff follow the traditional
23 approach to capacity planning to establish a need for power that takes into account observed
24 peak system loads. Whereas the nuclear generating units proposed by this application are
25 “baseload” units, that is, units with relatively low average costs, but limited load following
26 capacity, base power loads are not observed independently from total loads. Generation
27 capacity dispatch in ERCOT is determined by long term contracts between power buyers and
28 sellers, supplemented by power auctions. This means that any source of generating capacity
29 could engage in long term contracts or bid in the auctions and compete with the nuclear units,
30 regardless of fuel and generation type. The Applicant relied heavily on the ERCOT analyses in
31 its application, and the NRC staff has used updated ERCOT forecasts and analyses in
32 preparing this environmental impact statement (EIS) and has compared them to the Applicant’s
33 data.

34 **8.1.4.1 Historical and Forecasted Peak Demand and Average Load**

35 Figure 8-2 compares ERCOT’s peak loads and average hourly loads between 1998 and 2008.
36 The average hourly load corresponds roughly to the base load of the system, the load that is
37 relatively predictable and that tends to grow at a relatively constant rate. In addition, there are
38 also a number of cyclical changes in load that follow patterns determined by time of day, day of
39 the week, month of the year, and so on. ERCOT conducts planning exercises to ensure that
40 peak loads can be met with a relatively high degree of confidence and plans for the availability
41 of a variety of system assets to ensure against brownouts or blackouts.

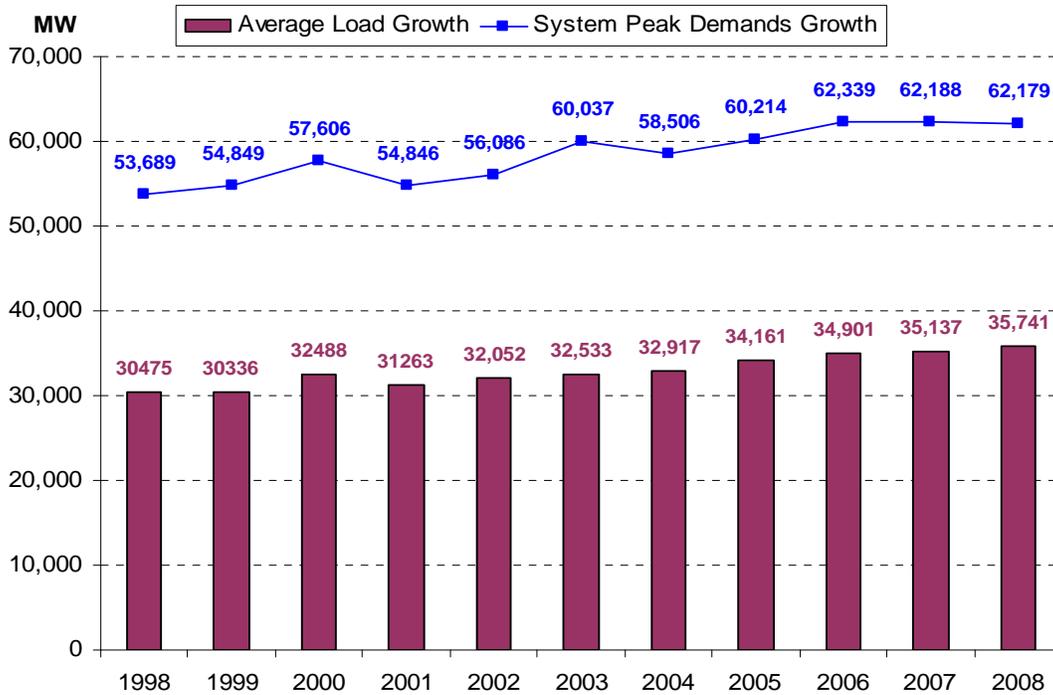


Figure 8-2. ERCOT historical load versus system peak growth (ERCOT 2009a).

1 Between 1998 and 2008, ERCOT reported average hourly load growth of 17.3 percent, (from
 2 30,475 to 35,741 MW) and system peak growth of 15.8 percent, (from 53,689 to 62,179 MW)
 3 (ERCOT 2009a). Between 1997 and 2007, however, ERCOT reported average load growth of
 4 21.3 percent and peak loads growth of 24.0 percent (ERCOT 2008a). ERCOT describes the
 5 variation in the following way: The actual system peak demand from 1997 to 2007 experienced
 6 a high growth rate that can be attributed to abnormal weather conditions, which ERCOT does
 7 not expect to reoccur in the future. Because 1997 was a mild weather year, it anchored the
 8 1997–2007 period to a lower initial point than was representative of the longer term. In
 9 describing this period as unusual, ERCOT was arguing that arbitrary periods of peak demand
 10 and average load provide an inadequate basis for forecasting (ERCOT 2008a). Forecasting
 11 must take into account underlying causes, the use to which the forecasts will be put, and
 12 differences between transient causes and long-term ones.

13 Subsequently, ERCOT forecasted the average load and peak demands for the future period
 14 2009–2019 obtaining the data shown in Figure 8-3 (ERCOT 2009a). Data in this figure indicate
 15 that over the 2009–2019 period, average load is forecasted to grow at 22.3 percent and peak
 16 load is forecasted to grow at 21.9 percent. The following sections consider the ERCOT
 17 forecasting process, the results it produces, and the steps taken by ERCOT to reflect
 18 uncertainties.

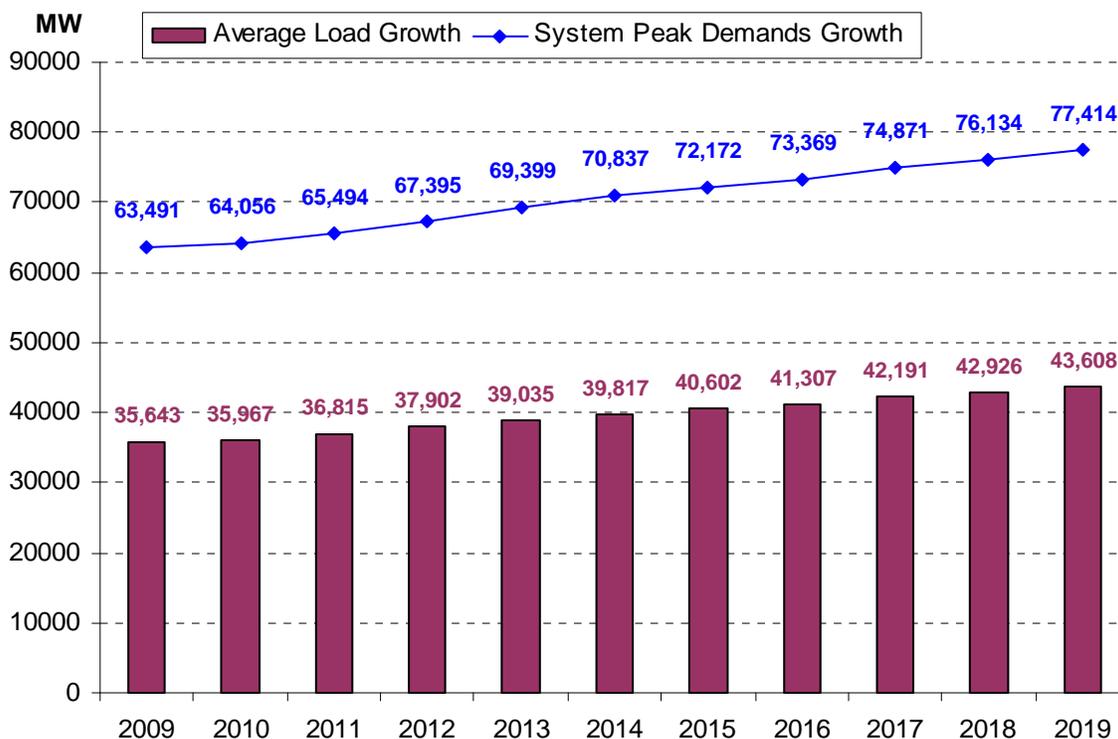


Figure 8-3. ERCOT forecasted average load versus system peak growth (ERCOT 2009a).

1 **8.1.4.2 Development of Peak Demand and Energy Consumption Forecasts**

2 Appendix A of the *2009 ERCOT Planning Long-Term Hourly Peak Demand and Energy*
 3 *Forecast* (ERCOT 2009a) provides a general description of ERCOT's forecasting methodology.
 4 The basic ERCOT forecasting model consists of two components: (1) a monthly energy
 5 consumption model; and (2) an hourly load shape model. The monthly model is used to
 6 forecast energy consumption by eight weather zones throughout the ERCOT market area.
 7 These zones are shown in Figure 8-4. The hourly load shape model is an annual model that
 8 reshapes the total energy consumption into hourly components. These components change
 9 from hour to hour, day to day, and month to month, depending on such factors as average
 10 temperature, weekly work cycles, daily lifestyle cycles, and the like. The same load shape
 11 model is used for each forecast year and supplies forecasts of cyclical variation whereas the
 12 monthly model provides forecasts of electricity demand by months over the forecast period.
 13 When combined, the models forecast the hourly peak load by year on the ERCOT system by
 14 regions and the monthly total load by regions.

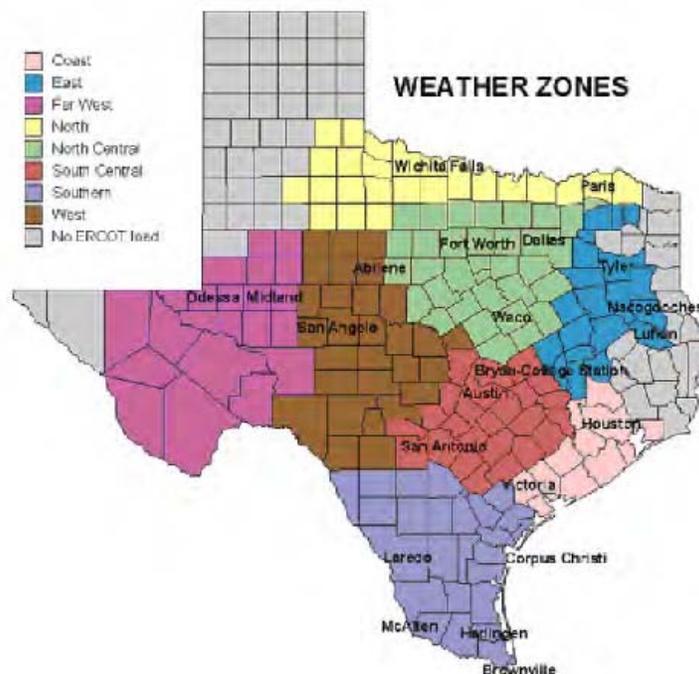


Figure 8-4. Weather zones. (ERCOT 2007a)

- 1 The monthly model is a linear econometric model that combines historical levels of several
- 2 independent variables to predict future load values. Independent variables include income,
- 3 population, and employment. Typically, electricity use increases (decreases) as income,
- 4 population, and employment increase (decrease). This analysis is carried out by year and
- 5 region and yields electricity consumption forecasts for each region and each year. System-wide
- 6 forecasts are obtained by summing over the regions for each year. The modeling process is
- 7 described in Figure 8-5.

- 8 Several types of error can occur when forecasting. First, historical data may not apply perfectly
- 9 to the future. For example, behavior may change over time, as when electricity users purchase
- 10 energy-using products not available during the historical period. These are sampling errors and
- 11 can often be prevented. Errors also occur when the model makes predictions because
- 12 forecasts of independent variables are typically smooth while actual observed data tend to be
- 13 less regular, as when a recession or a major weather event occurs. This type of error is a
- 14 forecasting error, and while it cannot be removed entirely, if the model is correctly designed, a
- 15 forecasting error will not introduce any bias or net positive or negative change in the
- 16 independent variable predicted. Forecasting is less accurate the farther into the future the
- 17 model tries to predict because sampling and forecasting errors tend to magnify over time.
- 18 ERCOT analyses appear to be well structured and consider these types of errors.

Weather Zone Forecasting Process

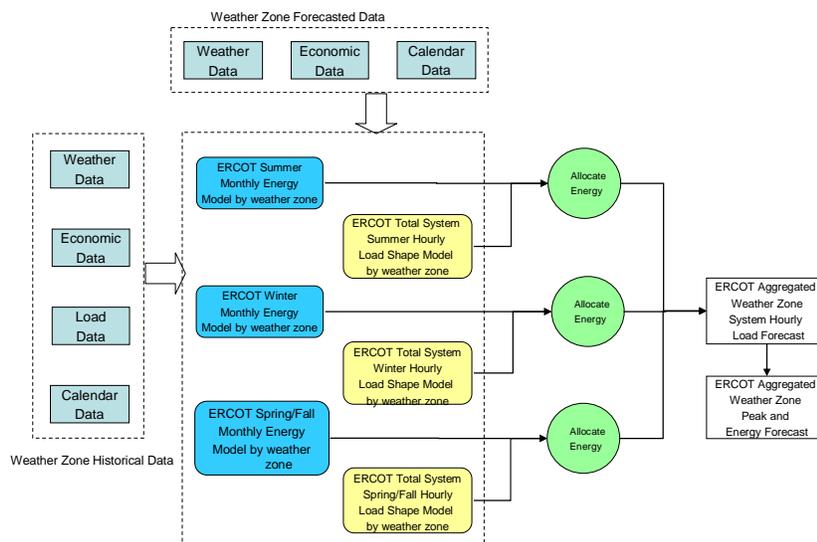


Figure 8-5. The forecasting process (ERCOT 2009a).

1 8.1.4.3 Historical Trends and Long-Term Forecasts

2 ERCOT's annual historical and peak demand forecasts, produced in 2009, are shown on
 3 Figure 8-6. Historical peak loads are variable and depend on the many factors that ERCOT
 4 seeks to capture in preparing its updated annual forecasting series. In Figure 8.6, a baseline
 5 (mid) forecast is presented and cool temperature (10-90) and high temperature (90-10)
 6 scenarios are shown. The 90-10 scenario is a "high temperature" scenario formed by assuming
 7 temperatures that exceed 90 percent of the historical temperatures experienced over the last
 8 fourteen years. The 10-90 scenario is a "low temperature" scenario formed by assuming
 9 temperatures that exceed ten percent of the historical temperatures experienced over the past
 10 fourteen years. While falling short of providing confidence intervals, this practice accounts for
 11 temperature variation and illustrates how electricity loads are influenced by temperature
 12 extremes. This underscores that the goal of forecasting is not to provide perfect predictions of
 13 future loads, but rather to provide a sound foundation for system planning that can be updated
 14 over time. To ensure that tradeoffs are captured in the planning process, the system
 15 establishes a target reserve margin (i.e., extra capacity) that will accommodate peaking
 16 requirements for most foreseeable circumstances. This is discussed below. In this specific
 17 case, optimal system management is based on meeting peak loads efficiently.

18 Figure 8-7 shows historical and forecasted energy consumption for 2009. Energy consumption
 19 is a measurement of the energy inputs required to meet a load over a period of time, so, a
 20 10-MW load that was constant for an hour would require 10 MWh of energy. The sum of a
 21 year's worth of average hourly loads yields the annual energy consumption in megawatt hours.
 22 The total increases in peak load and energy demand over 1998–2008 were 15.8 percent and
 23 17.3 percent, respectively. For 2009–2019 the percentages will increase to 21.9 percent and
 24 22.3 percent, respectively.

25 Owing to the national economic downturn, the observed 2008 energy consumption was less
 26 than that forecast for 2008 in early 2008. Further, the 2009 forecasts show energy consumption

- 1 to be lower in the years 2009–2012 than the 2008 forecasts, before the return to the longer term
- 2 trend. To capture any related effects in the need for power analysis in Section 8.4, we compare
- 3 the forecasts submitted by Luminant (based on 2007 ERCOT forecasts, with 2009 ERCOT
- 4 forecasts examined by the NRC staff.

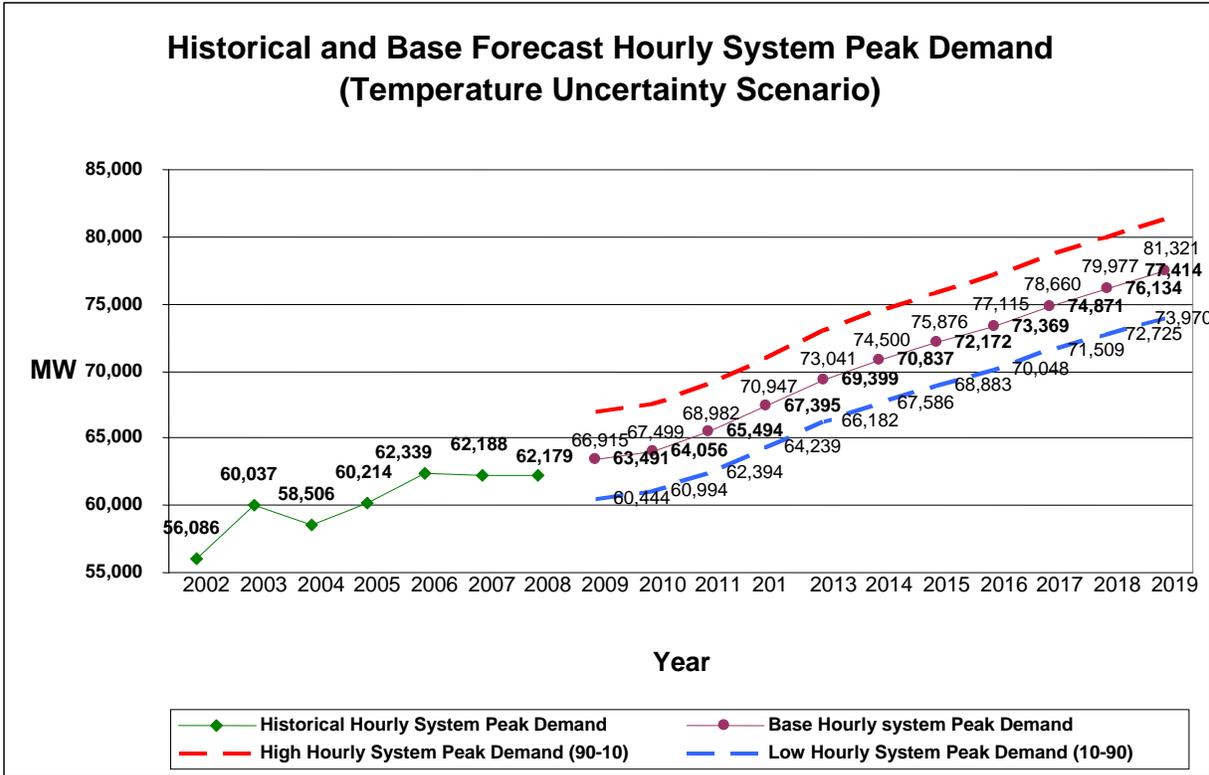


Figure 8-6. Historical and base forecast hourly peak demand (ERCOT 2009a).

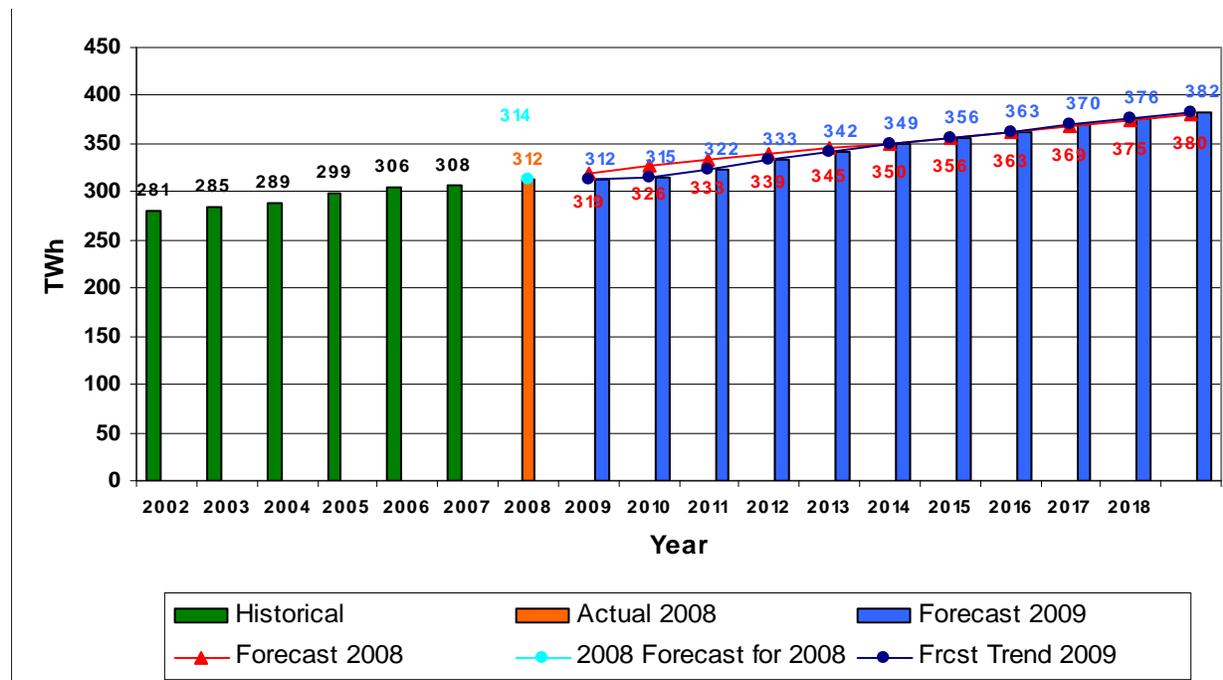


Figure 8-7. Comparison of 2008 and 2009 long-term energy forecasts (ERCOT 2009a).

1 8.1.4.4 Load Participation Programs

2 The ERCOT Demand Side Working Group (DSWG) was created in 2001 as a task force by a
 3 directive of the PUCT and was converted to a permanent working group in 2002. A broad range
 4 of commercial and industrial consumers, load-serving entities and retail power providers, T&D
 5 service providers, and power generation companies participate in the DSWG meetings and
 6 initiatives. ERCOT market rules allow demand-side participation under three general classes of
 7 service: (1) voluntary load response, (2) qualified Balancing up Load (BUL), and (3) Load
 8 Acting as a Resource (LaaR) (ERCOT 2007b).

9 Voluntary load response refers to a customer's independent decision to reduce consumption
 10 from its scheduled or anticipated level, in response to a price signal. This practice has also
 11 been known as "passive load response" and "self-directed load response." Participants gain
 12 financially by postponing consumption when prices are high and consuming the energy when
 13 prices are lower. BULs refer to loads that provide energy balancing by reducing their energy
 14 use. Customers with interruptible loads that can meet certain performance requirements may
 15 be qualified to provide operating reserves under the LaaR program. In eligible ancillary services
 16 markets, the value of the LaaR load reduction is equal to that of an increase in generation.

17 8.1.4.5 Conclusion: Adequacy of ERCOT Assessments as per NUREG-1555 Criteria

18 As discussed in Section 8.0, NUREG-1555 (NRC 2000) acknowledges that data and planning
 19 forecasts by independent bodies, including NERC reliability councils, such as ERCOT, are an
 20 appropriate basis for establishing the need for power in an environmental review for nuclear
 21 power plants licensing, provided the data and forecasts are systematic, comprehensive, subject
 22 to confirmation, and responsive to forecasting uncertainty. These ERCOT data and forecasting
 23 systems have been examined in some detail. The following sections summarize how the
 24 ERCOT data and forecasts fulfill these requirements.

1 Criterion 1 – Systematic

2 ERCOT takes a systems perspective. That is, ERCOT uses information for power producers,
3 power consumers, capital assets linking them (including T&D systems), and the various markets
4 in the ERCOT power system to ensure system reliability. As part of this process ERCOT also
5 links its analyses to systems outside the power sector. As discussed in 8.1.4.2, demand
6 forecasts take into account economic and demographic drivers and weather conditions.
7 ERCOT uses a two-component modeling system consisting of a monthly energy consumption
8 model and an hourly load shape model. The monthly model is used to forecast energy
9 consumption by eight weather zones, and the hourly load shape model reshapes monthly power
10 consumption into cyclical components by hour. The monthly model is a linear econometric
11 model that takes into account historical levels and trends of a number of independent variables,
12 including income, population and employment. The hourly load shape model is a time series
13 model that uses time series analysis to convert historical cyclical trends into parameters that
14 can reshape the monthly forecasts. Taken together, the models forecast cyclical energy
15 consumption over the forecast horizon. In preparing its reports and analyses, ERCOT
16 evaluates individual resources from the perspective of the system, for example, to evaluate
17 reserve margins. Further, ERCOT systematically updates and evaluates its data collection and
18 forecasts and in doing so promotes transparency in its forecasting and planning processes. It
19 therefore provides a continuous data base and conclusions that signal to participants throughout
20 its service area when opportunities are available (see Sections 8.1.4.1, 8.1.4.2, and 8.1.4.3).

21 Criterion 2 – Comprehensive

22 As discussed in the preceding portions of this section, the ERCOT data and forecasting system
23 are comprehensive in that they are inclusive of all relevant parts of the power system within its
24 boundaries. This means that ERCOT planning resources are available from a single source
25 and are produced under a unified operating philosophy in support of ERCOT's legal
26 responsibilities. Separate analyses are carried out by regions to establish system demands,
27 attributes of generating capacity, transmission system capacities, and power auction
28 characteristics. These separate pieces are brought together to study the adequacy of
29 generation capacity, the adequacy of various substitutes for generation capacity, transmission
30 system stability and adequacy, and the role of ERCOT as an Independent System Operator
31 (ISO). ERCOT is not charged with advocating or promoting specific technologies but
32 encourages public debate by publishing its findings, holding open meetings, and encouraging
33 stakeholder participation (See Sections 8.1.4.2 and 8.1.4.3).

34 Criterion 3 – Subject to Confirmation

35 ERCOT data and forecasting systems are subject to confirmation in the sense that they are
36 subject to processes that require support by evidence, i.e., they are subject to corroboration and
37 validation. All data and methodologies are available to interested parties and they can be
38 compared to analyses performed by a variety of alternative sources, such as the federal Energy
39 Information Administration. They are also submitted to the NERC, which publishes them in
40 volumes that are inclusive of data and forecasts from other NERC regions. As noted, ERCOT
41 analysis and conclusions are subject to extensive stakeholder review processes in which
42 promoters and advocates of various activities and technologies relevant to the ERCOT power
43 system have an opportunity to review and comment on the data and forecasts. As an agent of
44 the PUCT, ERCOT reports through PUCT to the Texas State Legislature. Finally, ERCOT
45 maintains an extensive website through which members of the general public can gain access
46 to all non-proprietary information contained in ERCOT's analyses and other affairs.

1 **Criterion 4 – Responsive to Forecasting Uncertainty**

2 Forecasting uncertainty recognizes that many aspects of the demand and supply of power
3 production and consumption cannot be fully anticipated. Weather events can have significant
4 impacts on the demand for power, as when Hurricane Ike negatively impacted economic activity
5 on the Texas gulf coast, and weather events can contribute to unusual peak power demands, as
6 when heat and humidity lead to higher loads for air conditioning. Economic conditions, such as
7 housing markets and recessions can affect household incomes and business-sector levels of
8 activity. Prices of fuels can change, affecting electricity production costs. ERCOT carries out
9 sensitivity analysis, for example for weather, through the 90-10/10-90 scenarios, to provide
10 rough bounds on its baseline forecasts. ERCOT also studies and makes annual modifications to
11 trends in behavioral variables, such as income, population, and employment that influence its
12 energy load and consumption forecasts. All of these forces and others must be recognized in
13 the forecasting process, which in turn must be updated with sufficient regularity to account for
14 significant changes that affect loads. Moreover, ERCOT does not “manage” power production
15 in its service area, but rather functions to link demands and resources. This means that the
16 important decisions regarding increasing capacity, changing generation fuel mixes and
17 technologies, choices over heating and cooling technologies and steps taken to promote energy
18 efficiency are made by decentralized decision makers in the private sector, rather than by
19 system regulators. Finally, responsiveness to uncertainty does not imply that forecasts must be
20 accurate for distant time periods. Rather, the forecasting process must inform the user about
21 the sensitivities that forecasts have to input variables and assumptions, how accurate the
22 forecasts have proved in the past, and what options the system has to accommodate
23 forecasting uncertainty. This allows members of the private sector participating in the power
24 system to make informed choices as they write contracts, plan expansions, and carry out other
25 activities.

26 **8.2 Power Demand: Comparison of Applicant Demand**
27 **Estimates and NRC Staff Estimates Updated with 2009**
28 **ERCOT Data**

29 Table 8-1 compares the Luminant peak load forecasts, based on 2007 ERCOT data contained
30 in its application, with the NRC staff’s peak load forecasts updated using 2009 ERCOT data.
31 This comparison was undertaken because, as discussed in Section 8.1, exogenous factors can
32 cause short term shocks to forecasts, though over time, the forecasts tend to return to the long
33 term trend. In this case the exogenous factors included the cumulative impacts of the national
34 economic downturn and from Hurricane Ike, which occurred in 2008.

35 For this comparison, we calculate peak loads using the definition discussed below for reserve
36 margin calculation. As indicated below, the reserve margin provides a margin of safety to
37 ensure capacity will be adequate to meet unusual load circumstances. By reducing the peak
38 forecast by loads acting as resources and demand side management programs, a value termed
39 the corrected peak load for reserve margin is obtained. For the purposes of generation capacity
40 planning, demand side management impacts are principally those savings associated with
41 Texas House Bill 3693 (OEECB 2007). Other trends in energy efficiency increases are
42 captured through the monthly load forecasting model.

Table 8-1 Comparison of peak load forecasts, loads acting as reserves, and demand-side management energy saving for 2014, 2019, and 2024

	2014		2019		2024	
	Luminant	ERCOT	Luminant	ERCOT	Luminant	ERCOT
Peak Load, MW	73,998	70,837	81,662	77,414	88,160	82,778
Minus Loads Acting as Resources, MW	1,115	1,115	1,115	1,115	1,115	1,115
Demand-Side Management, MW	110	242	242	242	242	242
Corrected Peak Load for Reserve Margin, MW	72,773	69,480	80,305	76,057	86,803	81,421

Source: ERCOT 2009a

1 The Luminant forecast for the corrected peak load exceeded the NRC staff forecasts, by 4.7,
2 5.6, and 6.6 percent in 2014, 2019 and 2024, respectively. In the need for power analysis
3 below, the NRC staff will use this lower figure to reflect changes in economic activity that have
4 led to somewhat lower growth in peak loads.

5 **8.3 Power Supply**

6 This section presents an electricity supply assessment for the ERCOT region based on ERCOT
7 reports, assessments, and analyses. ERCOT studies are wholly in the public domain and not
8 subject to proprietary considerations. Although NRC staff has drawn upon recent ERCOT
9 documents to update data contained in the Applicant's ER, the NRC staff has not speculated on
10 new generation capacity or retirements of old generation capacity beyond that justified by
11 ERCOT data.

12 **8.3.1 Generating Capacity Analysis and Planning**

13 Table 8-2 compares peak summer loads (discussed in Section 8.2) to resources available to
14 meet those loads. For capacity planning analysis, forecasted peak demands are reduced by
15 portions of peak load that will or could be avoided. For example, loads serving as reserves can
16 be dropped. Energy efficiency programs are also subtracted from peak load to be served.

17 Resource availabilities are typically calculated for summers owing to ERCOT's annual summer
18 peak loads. Installed generating capacity, the largest single resource in the ERCOT region, was
19 estimated at 63,492 MW in 2009 and is forecast to decrease to 61,800 MW in 2014. This
20 excludes available mothballed natural gas-fired generation capacity, which ranges from 0 MW in
21 2009 to 479 MW in 2014 (ERCOT 2009b). Mothballed capacity consists of units that have not
22 been run for 6 months. ERCOT uses probabilities supplied by utilities that the plants could be
23 returned to service to determine the availability of mothballed plants. Other operational
24 resources include capacity from private networks (estimated at 5318 MW over the period), wind
25 (708 MW), and reliability must-run (RMR) units (under contract of 115 MW in 2009). In sum,
26 operational generation capacity of 69,628 MW was available in 2009, and it is forecast to
27 decrease to 67,826 MW in 2014 and remain at that level through 2024.

Table 8-2. 2009 report on the capacity, demand, and reserves in the ERCOT region

Load Forecast:	2009	2010	2011	2014	2019	2024
Total Summer Peak Demand, MW	63,491	64,056	65,494	70,837	77,414	82,778
Less Loads Acting as Resources (LaaRs) Serving as Responsive Reserve, MW	1,115	1,115	1,115	1,115	1,115	1,115
Less LaaRs Serving as Non-Spinning Reserve, MW	0	0	0	0	0	0
Less Balancing-up Loads, MW	0	0	0	0	0	0
Less Energy Efficiency Programs (OEECB 2007)	110	242	242	242	242	242
Firm Load Forecast, MW	62,266	62,699	64,137	69,480	76,057	81,421
Resources:	2009	2010	2011	2014	2019	2024
Installed Capacity, MW	63,492	61,800	61,800	61,800	61,800	61,800
Capacity from Private Networks, MW	5,313	5,318	5,318	5,318	5,318	5,318
Effective Load-Carrying Capability (ELCC) of Wind Generation, MW	708	708	708	708	708	708
Reliability-Must-Run Units to Be under Contract, MW	115	0	0	0	0	0
Operational Generation, MW	69,628	67,826	67,826	67,826	67,826	67,826
50% of Nonsynchronous Ties, MW	553	553	553	553	553	553
Switchable Units, MW	2,848	2,848	2,848	2,848	2,848	2,848
Available Mothballed Generation , MW	0	401	479	479	479	479
Planned Units (Not Wind) with Signed Interconnection Agreement (IA) and Air Permit, MW	0	3,769	4,389	7,206	7,206	7,206
ELCC of Planned Wind Units with Signed IA, MW	0	76	121	211	211	211

1

Table 8-2. (contd)

Load Forecast:	2009	2010	2011	2014	2019	2024
Total Resources, MW	73,029	75,472	76,215	79,123	79,123	79,123
Less Switchable Units Unavailable to ERCOT, MW	317	158	0	0	0	0
Less Retiring Units, MW	0	0	0	0	0	0
Resources, MW	72,712	75,314	76,215	79,123	79,123	79,123
Reserve Margin	16.8%	20.1%	18.8%	13.90%	4.0%	-2.8%
(Resources - Firm Load Forecast)/Firm Load Forecast						
Other Potential Resources						
Total Potential Resources:	553	13,889	23,094	33,141	33,141	33,141
Mothballed Capacity , MW	0	5,478	7,125	7,125	7,125	7,125
50% of Nonsynchronous Ties, MW	553	553	553	553	553	553
Planned Units in Full Interconnection Study Phase, MW	0	7,858	15,417	25,463	25,463	25,463

Source: ERCOT 2009b

2 Seventy-one percent of installed capacity in 2009 is from natural gas, 18.7 percent from coal,
3 6.7 percent nuclear, other and hydro 2.9 percent, and wind 1.0 percent (ERCOT 2009b). Based
4 on its recent analysis, ERCOT values wind capacity at 8.7 percent of nameplate capacity for
5 reliability analyses (GE 2008). Nearly all new generation capacity added in the ERCOT system
6 since 2000 is fueled by natural gas. Baseload units (coal and nuclear) typically have much
7 higher capacity factors than peaking or variable units, such as wind (ERCOT 2008b).

8 Other resources that are available to meet peak loads include 50 percent of nonsynchronous
9 (DC) ties (553 MW); switchable units (2848 MW) available mothballed generation (479 MW in
10 2014); planned units, not wind (7206 MW in 2014); and planned units, wind (211 MW in 2014).
11 A planned unit is defined as a unit with an interconnection agreement and an air permit. In sum,
12 resources are estimated at 72,712 MW in 2009 and 79,123 MW in 2014, 2019, and 2024.
13 These increases are mostly due to the new capacity forecast to come online.

14 For completeness we include resources that could potentially be used to meet peak loads. The
15 major element of these resources is planned units in applications stage but without signed
16 agreements or air permits. Capacity at this level of planning is sufficiently far away from a utility
17 commitment as to be disregarded in reliability planning.

18 Although ERCOT does not forecast additional units retiring between 2009 and 2014, additional
19 retirements will likely occur. Since 1999, a total of 117 units have been decommissioned. One
20 reason ERCOT does not project plant closings is that ERCOT carries out systematic
21 assessments of the impacts of plant closings on reliability before decommissioning older plants.
22 According to PUCT rules, ERCOT can maintain certain necessary units under RMR contracts,
23 which provide voltage support and stability, or management of localized transmission

1 constraints under first contingency criteria and maintain the option for any transmission
2 alternatives to these RMR sources (ERCOT 2008b).

3 At present there are 51 units with 8014 MW capacity that are between 40 and 49 yr of age and
4 63 units with 2927 MW capacity that are over 50 yr old in the installed capacity portfolio
5 (ERCOT 2008a). Age is one indication of the efficiency and maintenance costs of a generating
6 unit, which are major factors in a decision to decommission. However, current air quality
7 regulations provide some incentives for retaining older plants with less stringent emissions
8 requirements. In contrast, changes in this legislation that increased penalties for carbon
9 emissions might increase decommissioning. Because it is difficult to forecast regulatory
10 changes and the retirement process, NRC staff does not attempt to weigh the probabilities of
11 decommissioning, new legislation, and incentives to continue operation. For the analysis in
12 Section 8.4, the NRC staff assumes that capacity remains constant from 2014 to 2024.

13 8.3.2 ERCOT Future Generation

14 As shown in Table 8-2, ERCOT includes a limited amount of planned generation capacity in its
15 capacity and reserve calculation for 2014. This is a portion of the larger amount of proposed
16 future generation that is being evaluated by ERCOT. To illustrate categories of planned
17 capacity, Table 8-3 shows the interconnection request activity that took place in 2008.
18 Table 8-3 shows proposed capacity by fuel type and separates them into three categories:
19 Screening Studies; Interconnection Studies; and Interconnection Agreements. In total 102,149
20 MW of capacity are being studied by ERCOT, but only a small portion of the interconnection
21 agreements are included in ERCOT's capacity and reserve calculation. This is because there is
22 no firm commitment from the owner of the proposed plant until an interconnection agreement is
23 signed. The first two categories are only studies and require minimal expense and commitment
24 on the part of the owner of the proposed capacity. Additional information regarding future
25 generation is provided in ERCOT's *Report on Existing and Potential Electric System Constraints
26 and Needs* (ERCOT 2008b).

Table 8-3. Generation interconnection information

Generation interconnection request activity in 2008						
Fuel	Screening studies requested		Interconnection studies requested		Interconnection agreements signed	
	Number	MW	Number	MW	Number	MW
Coal	6	3467	5	2412	0	0
Gas-CC	11	8154	14	13,080	5	1802
Gas-CT	6	998	3	98	1	178
Wind	68	19,797	36	13,315	6	1066
Solar	7	863	0	0	0	0
Other	1	1200	1	1200	0	0
Total	99	34,479	59	30,105	12	3046

Projects may appear in more than one category.

Source: ERCOT 2008b.

1 **8.3.3 Reserve Margin**

2 The reserve margin is the percentage by which the resources available to meet a peak load
 3 exceed the anticipated/forecasted peak load. This margin leads to an available capacity greater
 4 than forecasted needs and provides a cushion or margin of safety in protecting against an
 5 inability to follow load. The reserve margin is therefore a planning tool that helps ERCOT meet
 6 its reliability responsibilities and signals to the market if capacity is likely to be inadequate
 7 (ERCOT 2007a). The reserve margin, however, is a rule of thumb rather than a threshold
 8 because many system resources that contribute to the reserve margin may be old, inefficient, or
 9 otherwise less desirable than new, modern generators. The reserve margin also does not take
 10 the cost of producing electricity into account. On the other hand, ERCOT must approve plant
 11 decommissioning and will not do so if the plants under consideration for decommissioning are
 12 required to meet reserve margins. As a result, the reserve margin is a tool rather than a
 13 decision metric.

14 In 2005, the ERCOT Board approved a new methodology for calculating the reserve margin and
 15 based on that methodology, adopted a 12.5 percent target. The details that underlie the
 16 calculation of ERCOT's new reserve margin are shown in ERCOT 2007a. This target was
 17 based on a reliability study that concluded that the margin should provide about a 1-day-in-10-
 18 years loss of load expectation (GE 2008). This reserve margin should be sufficient to cover,
 19 among other uncertainties, the potentially 5.4 percent higher demand peak associated with the
 20 90-10 temperature scenario employed in the peak demand forecasts. The new method was
 21 used to calculate the margin from 2006 to 2014 (ERCOT 2007a). The new methodology
 22 considered switchable capacity, mothballed capacity, and wind capacity as they apply to the
 23 ERCOT electric market. Short-term variations in forecasted economic activity, owing to Gulf
 24 storms and declines in the national economy, have caused peak load forecasts to lie
 25 significantly below previously forecast levels and reserve margins to be higher than those based
 26 on older peak load forecasts. In its application, Luminant used the 2007 reserve margin
 27 forecasts.

28 **8.3.3.1 Calculating the Reserve Margin**

29 The ERCOT reserve margin is defined as

$$30 \quad \text{RM} = \frac{\text{RA} - \text{FLF}}{\text{FLF}} \quad \text{or} \quad \text{RM} = (\text{RA} - \text{FLF}) / \text{FLF}$$

31

32 There is uncertainty associated with a number of the inputs to the ERCOT reserve margin
 33 calculation. The methodology considers these uncertainties to the extent possible in a formulaic
 34 approach while attempting to produce an equation to calculate an ERCOT reserve margin
 35 forecast that produces a reasonable estimate of such reserve margins while not being overly
 36 cumbersome or complex. For example, to calculate the electric load carrying capacity of wind,
 37 ERCOT selected Global Energy Decisions, Inc., (GE 2008) to complete a new target reserve
 38 margin study. GE used their unit commitment and dispatch software (MarketSym) to analyze
 39 the impact of load volatility, wind generation, unit maintenance, and forced unit outages on
 40 expected unserved energy, loss of load probability, and loss of load events. GE ran the model
 41 with the base set of generating units and a generic thermal generator (550 MW) and determined
 42 the expected unserved load. GE removed the generic generator and added new wind capacity
 43 until the same expected unserved energy was achieved. The amount of new wind generation
 44 will have the same ELCC as the 550 MW thermal generator. It was found that 6300 MW of wind
 45 had the same load carrying capacity as the 550 MW thermal generator. Thus, the ELCC of
 46 wind is 8.7 percent

1 Nevertheless, it is not possible to create a forecasting process that totally eliminates uncertainty
 2 from the ERCOT planning process. However, the ERCOT Board believes that the approved
 3 methodology provides a reasonable approximation to the reserve margin and over time supplies
 4 a body of information that supports long-term decision making (GATF 2007). The elements
 5 included in the reserve margin calculation are those contained in Table 8.2. Examples of
 6 elements excluded from the reserve margin calculation are characterized as potential other
 7 resources. Further details on the reserve margin can be found in ERCOT 2007a.

8 **8.3.4 Comparison of Applicant Reserve Margins and NRC Staff Estimates**

9 Table 8-4 compares the generating capacity forecasts and reserve margins obtained by
 10 comparing Luminant forecasts and NRC staff forecasts. In its application, Luminant provides
 11 three scenarios that assume that capacity is retired as it reaches 30, 40, and 50 yr of age. For
 12 the year 2022, an assumption that capacity would be retired at 30, 40, and 50 yr of age leads to
 13 available generation capacity of 25,930 MW 37,357 MW, and 57,188 MW, respectively. The
 14 NRC staff d could not sufficiently support using these scenarios for purposes of this EIS, and
 15 instead substituted the updated ERCOT capacity estimates. The NRC staff notes that the
 16 capacity reduction scenarios are supplied by ERCOT and are fully appropriate for Luminant and
 17 other market participants to use in their own planning. Luminant is a major market player and
 18 understands its own proprietary plans for retiring capacity. It also understands its own contracts
 19 for wholesale power supply and the growth the holders of these contracts are likely to
 20 experience. Moreover, the NRC staff has used a very strict definition of planned capacity
 21 additions, and have not factored in, for example, the new capacity represented by requests for
 22 screening studies, as shown on Table 8-4. These two assumptions allow the analysis to be
 23 grounded in the most firm data publicly available, and have reduced reliance on scenario driven
 24 analysis to calculate future reserve margins.

Table 8-4 Summary of generating capacity and simple reserve margins based on ERCOT and Luminant forecasts

	2014		2019		2024	
	Luminant	ERCOT	Luminant	ERCOT	Luminant	ERCOT
Capacity (from 2014), MW	79,113	79,113	79,113	79,113	79,113	79,113
Simple Reserve Margin, %	8.7	13.9	-1.5	4.0	-8.9	-2.8

Sources: ERCOT 2009b and Luminant 2009a.

25 **8.4 Assessment of Need for Power**

26 This section assesses the need for power within the ERCOT region. The summer peak demand
 27 and energy forecasts used in this assessment are discussed in more detail in Section 8.2.
 28 Installed capacity, planned additions, and calculation of reserve margins are discussed in
 29 Section 8.3. As described in Section 8.2, the basis for the use of ERCOT forecasts in this
 30 chapter is that the ERCOT forecasts are (1) systematic, (2) comprehensive, (3) subject to
 31 confirmation, and (4) responsive to forecasting uncertainty. Finally, the data presented in this
 32 section, drawn from Sections 8.2 and 8.3, update the information contained in the Applicant's
 33 original submission. The section describes the circumstances under which there is a need for
 34 additional generating capacity over the time frame proposed by the Applicant.

1 8.4.1 Analysis

2 Table 8-5 summarizes the need for power analysis. First, the peak loads and adjustments
 3 contained in Luminant's ER and the NRC staff's updated forecasts from Table 1 are shown on
 4 the first line of table 5 for 2014, 2019, and 2024. They are reduced by loads serving as
 5 reserves, demand-side management savings, and other appropriate demand-side measures.
 6 We have not attempted to forecast these. Netting these adjustments out leaves a series of
 7 entries in the table that we refer to as "corrected peak loads."

Table 8-5. Summary of need for power

	2014		2019		2024	
	Luminant	ERCOT	Luminant	ERCOT	Luminant	ERCOT
Peak Load	73,998	70,837	81,662	77,414	88,160	82,778
Minus Loads Acting as Resources	1,115	1,115	1,115	1,115	1,115	1,115
Demand-Side Management	110	242	242	242	242	242
Corrected Peak Load for Reserve Margin	72,773	69,480	80,305	76,057	86,803	81,421
Capacity (from 2014)	79,113	79,113	79,113	79,113	79,113	79,113
Simple Reserve Margin	8.7	13.9	-1.5	4.0	-8.9	-2.8
Capacity with Units 3 & 4 Added (Assumes 92% Cap Factor)	82,056	82,056	82,056	82,056	82,056	82,056
Reserve Margin with Units 3 & 4	12.8	18.1	2.2	7.9	-5.5	.08

Sources: ERCOT 2009b and Luminant 2009a.

8 Next, the ERCOT's generation capacity, as shown on Table 8-2, is included as total resources.
 9 Table 8-2 shows the adjustments that were made to total installed capacity to obtain a corrected
 10 capacity. New units have not been added beyond those included in ERCOT's own analysis.
 11 The capacity for wind is entered as a relatively small amount, because, based on its own
 12 analysis, ERCOT has chosen to value wind at 8.7 percent of face plate capacity for reliability
 13 planning purposes.

14 To summarize, these calculations reveal that the ERCOT region is not reaching a circumstance
 15 wherein load will be unserved in the near future. Using Luminant's numbers, a reserve margin
 16 of 8.7 for 2014 is calculated, and using ERCOT's recent numbers, the reserve margin is
 17 estimated to be 13.9 for 2014. For 2019, the respective margins are -1.5 and 4.0 and for 2024,
 18 -8.9 and -2.8.

19 Finally, the NRC staff calculated a scenario in which the CPNPP Units 3 and 4 come online with
 20 a 92 percent capacity factor in 2014. Were this to occur, reserve margins would be 12.8 for
 21 Luminant's assumption in 2014 and 18.1 for the ERCOT-based calculations. In 2019 these
 22 respective numbers would be 2.2 and 7.9 and in 2024, -5.5 and 0.8 percent, respectively.

1 **8.4.2 Summary and Conclusions**

2 The NRC staff has conducted a thorough and conservative analysis of the need for power in
3 ERCOT for the future periods 2014, 2019, and 2024. The NRC staff has reviewed the
4 Applicant's ER and has concluded that while appropriate, it contained data that failed to reflect
5 current economic and other conditions fully. The NRC staff has updated that analysis using the
6 newest data available to the analysis. In both cases, the basis for analysis has been the body
7 of integrated ERCOT analyses, which staff finds to be appropriate for this analysis by virtue of
8 fulfilling the criteria of being systematic, comprehensive, subject to confirmation, and responsive
9 to forecasting uncertainty.

10 The NRC staff carried out an analysis using the best available data from ERCOT, but the NRC
11 staff did not speculate on capacity retirements or additions. The results of this analysis show
12 that the ERCOT region is currently in a sound position when evaluated from the perspective of
13 the reserve margin and will remain so through the 2014 period. Beyond 2014, reserve margins
14 will grow smaller over time until 2024, when margins turn negative. This suggests that over time
15 additional resources will be required to meet forecasted load expectations. Other
16 considerations, such as demand-side management or aggressive conservation could influence
17 this conclusion.

18 Finally, the last two lines of Table 8-5 show the time path for reserve margins assuming that
19 Units 3 and 4 come online with 92 percent capacity factors. In this case, capacity factors do not
20 fall as rapidly and for the NRC staff's analysis based on recent ERCOT data remain positive but
21 below targets through 2024.

22 Based on the information provided by Luminant and from the reports available from ERCOT, it
23 is the judgment of NRC staff that it is reasonable for a merchant power vendor, such as
24 Luminant, to expand its baseload power capacity, starting construction in the relatively near
25 term.

26 **8.5 NRC Staff Conclusions**

27 Based on its review of the documents discussed in this chapter of the EIS, the NRC staff
28 determined that, in aggregate, the documents and the Luminant decision are sufficiently
29 (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting
30 uncertainty to serve the needs of the NRC in complying with Section 102 of the National
31 Environmental Policy Act. In keeping with the Chapter 8 ESRPs (NRC 2000) and the
32 Commission's statements at 68 FR 55905, the NRC staff gave particular credence to the
33 (1) ERCOT's analysis for reasonably foreseeable need for increased transmission and
34 generation capacity within its boundaries and (2) the applicant's need for power assessment,
35 supplemented with updates and analyses prepared by the NRC staff.

36 The NRC staff concludes (1) there could become a shortage of power in the ERCOT region that
37 could be at least partially addressed by construction of proposed Units 3 and 4 at the CPNPP
38 site; (2) construction of Units 3 and 4 would reduce the likelihood of an electricity supply
39 reliability crisis in Texas; and (3) construction of Units 3 and 4 would contribute to the new
40 generation needed in the ERCOT region by 2019 to meet reserve targets. Based on its
41 analysis, the NRC staff concludes there is a justified need for new baseload generating capacity
42 in Texas in excess of the planned output of proposed Units 3 and 4.

8.6 References

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9.0 Environmental Impacts of Alternatives

1 This chapter describes alternatives to the proposed U.S. Nuclear Regulatory Commission
 2 (NRC) action for combined licenses (COLs) for the construction and operation of two US-APWR
 3 (Advanced Pressurized Water Reactor) units at the Comanche Peak Nuclear Power Plant
 4 (CPNPP) site, and the U.S. Army Corps of Engineers (Corps or USACE) action for permits, and
 5 discusses the environmental impacts of those alternatives. The reasonable range of
 6 alternatives is limited to those that can achieve the stated purpose and need for the actions; in
 7 addition, the no-action alternative is to be discussed even if it does not meet the purpose and
 8 need. The purpose and need for the proposed actions, which is discussed in Section 1.3 of this
 9 environmental impact statement (EIS), is to provide 3200 MW(e) of additional baseload
 10 electrical power for use in current markets and/or for potential sale on the wholesale market in
 11 the Electric Reliability Council of Texas (ERCOT) region, to meet the demand projected for 2016
 12 and to maintain the reserve margin that is needed to maintain system reliability (Luminant
 13 2009a). The region of interest (ROI), as defined by Luminant's purpose and need, is ERCOT's
 14 relative service area. The need for additional baseload power in the ERCOT region is
 15 discussed in Chapter 8 of this EIS. A discussion of the baseload of the power system, which is
 16 relatively predictable and tends to grow at a relatively constant rate, and how it differs from peak
 17 load, which involves cyclical changes in load that follow patterns determined by time of day, day
 18 of the week, month of the year, and so on, is provided in Section 8.1.4 of this EIS. Section 9.1
 19 discusses the no-action alternative. Section 9.2 addresses alternative energy sources. Section
 20 9.3 is the evaluation of the Luminant Generation Company LLC's (Luminant's) region of interest
 21 (ROI), its site-selection process, and a summary and comparison of the environmental impacts
 22 for the proposed and alternative sites. Section 9.4 examines plant design alternatives. Section
 23 9.5 lists the references cited in this chapter.

24 The need to compare the proposed action with alternatives arises from the requirement in
 25 Section 102(2)(c)(iii) of the National Environmental Policy Act of 1969, as amended (NEPA)
 26 (42 USC 4321), that environmental impact statements (EISs) include an analysis of alternatives
 27 to the proposed action. The NRC implements this comparison through its regulations in Title 10
 28 of the Code of Federal Regulations (CFR) Part 51 and its Environmental Standard Review Plan
 29 (ESRP) (NRC 2000).

30 The environmental impacts of the alternatives are evaluated using the NRC's three-level
 31 standard of significance—SMALL, MODERATE, or LARGE—developed using Council on
 32 Environmental Quality (CEQ) guidelines (40 CFR 1508.27) and set forth in the footnotes to
 33 Table B-1 of 10 CFR 51, Subpart A, Appendix B. The issues evaluated in this chapter are the
 34 same as those addressed in the *Generic Environmental Impact Statement for License Renewal
 35 of Nuclear Plants* (GEIS), NUREG-1437^a with the additional issue of environmental justice.
 36 Although NUREG-1437 was developed for NRC's review of renewal of nuclear power plant
 37 operating licenses, it provides useful information for this review and is referenced throughout
 38 this chapter.

39 As part of the evaluation of permit applications subject to Section 404 of the Federal Water
 40 Pollution Control Act (Clean Water Act), the Corps is required by regulation to apply the criteria
 41 set forth in the 404(b)(1) guidelines (33 USC 1251 et seq.; 40 CFR Part 230). These guidelines
 42 establish criteria that must be met for the proposed activities to be permitted pursuant to
 43 Section 404.

^a NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999 (NRC 1999). Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

1 Section 230.10(a) of the Guidelines [40 CFR 230.10(a)] requires that “no discharge of dredged
2 or fill material shall be permitted if there is a practicable alternative to the proposed discharge
3 which would have less adverse impact on the aquatic ecosystem, so long as the alternative
4 does not have other significant adverse environmental consequences.” Section 230.10(a)(2) of
5 the Guidelines states that “[A]n alternative is practicable if it is available and capable of being
6 done after taking into consideration cost, existing technology, and logistics in light of overall
7 project purposes. If it is otherwise a practicable alternative, an area not presently owned by the
8 Applicant which could reasonably be obtained, used, expanded, or managed in order to fulfill
9 the basic purpose of the proposed activity may be considered.” Thus, this analysis is necessary
10 to determine which alternative is the Least Environmentally Damaging Practicable Alternative
11 (LEDPA) that meets the project purpose and need.

12 Where the activity associated with a discharge is proposed for a special aquatic site (as defined
13 in 40 CFR Part 230, Subpart E), and does not require access or proximity to or siting within
14 these types of areas to fulfill its basic project purpose (i.e., the project is not “water dependent”),
15 practicable alternatives that avoid special aquatic sites are presumed to be available, unless
16 clearly demonstrated otherwise [40 CFR 230.10(a)(3)].

17 **9.1 No-Action Alternative**

18 For purposes of a COL application, the no-action alternative refers to a scenario in which the
19 NRC would deny Luminant’s request for authorization to build and operate two new units. Upon
20 such a denial, the construction and operation of CPNPP Units 3 and 4 in accordance with 10
21 CFR Part 52 would not occur and the predicted environmental impacts associated with the
22 project would not occur. Pre-construction impacts associated with activities not within the
23 definition of construction in 10 CFR 50.10(a) and 51.4 may occur nonetheless. If no power
24 plants were to be built in lieu of the proposed project or other strategy implemented in its place,
25 then the benefits of the additional electrical capacity and electricity generation to be provided by
26 the project would not occur. If no additional measures (e.g., conservation, importing power,
27 restarting retired power plants, and/or extending the life of existing power plants) were
28 implemented to realize the amount of electrical capacity that would otherwise be required for
29 power in Luminant’s ROI (see Section 9.3.1), then the need for baseload power supply to meet
30 the projected demand and to maintain reserve margin, discussed in Chapter 8, would not be
31 met. Therefore, the purpose and need of this project would not be satisfied if the no-action
32 alternative was selected and the need for power was not met by other means.

33 For purposes of a Department of the Army permit for the project, the no-action alternative refers
34 to a scenario in which the USACE would deny Luminant’s application request. Upon such a
35 denial, the results and impacts would be the same as discussed above.

36 If Luminant were to do nothing in response to the denial of a COL or Corps permit, the Electric
37 Reliability Council of Texas’ (ERCOT) forecasts indicate that its ability to maintain an adequate
38 reserve margin would be impaired and it could fail to meet its public service obligations to
39 provide sufficient power within its service territory (see Section 8.3.4). ERCOT is the entity that
40 operates the electric grid and manages the deregulated market for 75 percent of Texas. To
41 address growing power demands, it would be ERCOT’s obligation to pursue alternative options
42 in power generation or demand reduction by implementing one or some combination of the
43 following actions (Luminant 2009a):

- 44 • Demand-Side Management (DSM): In addition to the existing and planned DSM programs
45 (see Section 9.2.1.3), it would be the responsibility of ERCOT to implement more aggressive
46 programs as conditions necessitate. As a merchant power producer, Luminant has no
47 authority to implement DSM programs.

- 1 • Purchase Power: As discussed in Section 9.2.1, ERCOT could attempt to purchase power
2 from other suppliers of electricity within ERCOT's service area to fill short-term needs.
3 However, ERCOT's restricted existing interconnections with neighboring reliability regions
4 limit its ability to purchase significant power from other sources.
- 5 • Construct Other Baseload Power Options: ERCOT could look to one or more of the
6 baseload power-generation alternatives which could include Luminant pursuing construction
7 of a nuclear power station at one of the alternative sites discussed in Sections 9.2 and 9.3 of
8 this EIS.

9 All of the alternatives listed above could have environmental impacts. In some cases, these
10 impacts would be realized in another location or at different times. These impacts are
11 discussed in more detail in Section 9.2.1.1 (purchased power), Section 9.2.2.1 (coal-fired
12 alternative), Section 9.2.2.2 (gas-fired alternative), Section 9.2.2.3 (wind generation), Section
13 9.2.3 (other alternatives), and Section 9.3 (alternative sites).

14 **9.2 Energy Alternatives**

15 Luminant's objective in seeking COLs for CPNPP Units 3 and 4 is to identify a site where it can
16 provide 3200-MW(e) baseload power generation for sale to ERCOT. This section examines the
17 potential environmental impacts associated with alternatives to building a new baseload nuclear
18 power-generating facility. Section 9.2.1 discusses energy alternatives not requiring new
19 generating capacity. Section 9.2.2 discusses energy alternatives requiring new generating
20 capacity. Other alternatives are discussed in Section 9.2.3. A combination of alternatives is
21 discussed in Section 9.2.4. Section 9.2.5 compares the environmental impacts from new
22 nuclear, coal-fired, and natural-gas-fired generating units at the CPNPP site and a combination
23 of energy sources.

24 For analysis of energy alternatives, Luminant assumed a bounding electrical output target value
25 of 3200-MW(e) (Luminant 2009a). The NRC staff and Corps staff (review team) also used this
26 level of output in analyzing energy alternatives.

27 **9.2.1 Alternatives Not Requiring New Generation Capacity**

28 Four alternatives to the proposed action that do not require the ERCOT to pursue the
29 construction of new generating capacity include

- 30 • purchasing the needed electric power from other suppliers,
- 31 • reactivating retired power plants,
- 32 • extending the operating life of existing power plants, and
- 33 • implementing DSM programs, including conservation.

34 **9.2.1.1 Purchased Power**

35 Texas produces and consumes more electricity than any other state. Despite large net
36 interstate electricity imports in some areas, the Texas interconnect power grid is largely isolated
37 from the integrated power systems serving the eastern and western United States. In addition,
38 most areas of Texas have little ability to export or import electricity to and from other states
39 (DOE/EIA 2009a). As described in Section 9.1 of this EIS, the ROI, as defined by Luminant's
40 purpose and need, is ERCOT's relevant service area (Luminant 2009a). The option of
41 purchasing electricity from neighboring utilities or resources outside of ERCOT's relevant
42 service area is limited by ERCOT's limited synchronous interconnections across state lines
43 (Luminant 2009a). The ERCOT region has no synchronous connections with any area of the
44 United States or Mexico. Although there are some asynchronous connections in the ERCOT

1 region, these connections only service the Southwest Power Pool and Mexico. Therefore,
2 system reliability is dependent upon maintaining a constant balance of energy produced and
3 used in the region (ERCOT 2009a). These limitations restrict the import and export of power.
4 As such, nearly all of the power used within the ERCOT region must be generated within the
5 region.

6 If interconnections with other regional power suppliers outside the ERCOT region did exist or
7 were developed such that ERCOT could import enough power to replace the capacity of
8 CPNNP Units 3 and 4, then the source for this power would most likely be one of those
9 described in NUREG-1437 (e.g., existing or new coal, natural-gas, or nuclear power facilities)
10 (NRC 1996). Under the purchased-power alternative, the environmental impacts of imported
11 power production would be located outside of the ERCOT region but would still occur. The
12 environmental impacts of baseload coal-fired and natural-gas-fired plants are discussed in
13 Section 9.2.2.

14 New interconnections for purchased power would require new transmission lines. Construction
15 and operation of new transmission lines could have environmental consequences. Such
16 impacts are discussed in Sections 4.4.1 and 5.4.1.

17 Under the current limited interconnections with other power regions, purchased power is not a
18 viable option for the replacement of the power that would be generated by CPNPP Units 3 and
19 4. Furthermore, ERCOT identified no additional interconnections for power purchases in its
20 long-term system assessment (ERCOT 2008b).

21 Based on the preceding discussion, the review team concludes that the option of purchasing
22 electric power from other suppliers is not a reasonable alternative to providing new baseload
23 power generation capacity. However, should interconnections be expanded to allow for the
24 import of more power, then environmental impacts of power generation would depend on the
25 generation technology and location of the power plant. The construction of new transmission
26 lines could have environmental consequences, particularly if new transmission line corridors
27 were needed. The review team concludes that the local environmental impacts from purchased
28 power would be SMALL when existing transmission line corridors are used and could range
29 from SMALL to LARGE if acquisition of new corridors is required. The overall environmental
30 impacts of power generation would depend on the generation technology and location of the
31 generation site and, therefore, are unknown. However, as discussed in Section 9.2.5, the
32 review team concluded that the reasonable and viable energy alternatives would not be
33 environmentally preferable to construction of a new baseload nuclear power generation plant
34 located within Luminant's ROI.

35 **9.2.1.2 Reactivating Retired Power Plants or Extending Operating Life**

36 Many factors, including fuel cost, operation and maintenance costs, efficiency, environmental
37 requirements, and revenue influence whether a generating unit will remain in service or be
38 decommissioned. Age, as an indication of the relative efficiency and maintenance cost of a
39 generating unit, has been used to provide some limited insight into the factors that are
40 considered in the decommissioning of units.

41 Since 1999 a total of 108 power production units have been decommissioned within the ERCOT
42 service area. Decommissioning older plants near metropolitan areas due to economics or
43 environmental restrictions requires ERCOT to undertake a careful assessment of the reliability
44 needs to propose maintaining certain units under Reliability Must-Run (RMR) contracts and any
45 transmission alternatives to these RMR sources (ERCOT 2008c).

1 Currently, ERCOT identifies *available* generation facilities no longer intended to produce power,
2 i.e., “mothballed” facilities, totaling 848 MW(e) by the year 2014 in its system planning document
3 (ERCOT 2009a. ERCOT defines *available* mothballed generation as “the probability that a
4 mothballed unit will return to service, as provided by its owner, multiplied by the capacity of the
5 unit.” Return probabilities are proprietary information and are not included in planning
6 documents. ERCOT predicts a mothballed capacity of 4314 MW(e) by 2014 (ERCOT 2008c).
7 In general, there is about a 20 percent likelihood of the mothballed facilities returning to service
8 at their original capacities and a similar probability of mothballed facilities replacing the 3200
9 MW(e) that would be generated from the proposed project.

10 Currently there is almost 11,000 MW of generation capability within ERCOT that is over 40
11 years in age with about 3000 MW of generation more than 50 years old (ERCOT 2008c).
12 Fossil-fueled plants slated for extensive refurbishment, predominately coal-fired and natural
13 gas-fired plants, tend to be old enough to have economic difficulty meeting the current and more
14 restrictive environmental standards. It is unlikely that these older plants will remain cost
15 effective compared to new power generation facilities leading up to and during the operating
16 period of CPNPP Units 3 and 4.

17 Luminant currently operates or maintains 19 fossil-fueled plants within the ERCOT service area.
18 Of the operating plants, most began operations in the 1960s or 1970s and one facility, Trinidad,
19 was commissioned into service in 1926 (Luminant 2009a). The Trinidad plant was the first
20 major power station in the world to be fueled by lignite, a soft brown fuel with characteristics that
21 place it between coal and peat. In 1942, the Trinidad plant was converted from lignite to natural
22 gas.

23 As discussed in Section 9.2.2.1, fossil-fueled power plants are not environmentally preferable to
24 CPNPP Units 3 and 4. Furthermore, environmental restrictions are becoming increasingly more
25 stringent making reactivating old plants more difficult. Therefore, the review team concludes
26 that (1) extending the operation of Luminant’s fossil fuel plants, many of which are more than 40
27 years old, beyond the lifetime expected in the ERCOT projections or (2) restarting mothballed
28 Luminant plants are not reasonable alternatives to new power generation to meet the capacity
29 needs of the service area.

30 The 40-yr operating licenses for CPNPP Units 1 and 2 are scheduled to expire in 2030 and
31 2033, respectively. Luminant has not yet applied for 20-yr license extension for these units;
32 similar to most of the U.S. reactor fleet, it is not unlikely that Luminant would apply for the
33 license renewals in the future. The environmental impacts of continued operation of a nuclear
34 power plant are less than building and operating a new plant. The expected generating capacity
35 of CPNPP Units 1 and 2 is included in the need-for-power assessment included in Chapter 8 of
36 this EIS. Therefore, continued operation of CPNPP Units 1 and 2 would not provide additional
37 generating capacity.

38 Based on the preceding discussion, the review team concludes that the options of reactivating
39 retired power plants and extending the operating life of existing power plants beyond that
40 already accounted for in long-term energy forecasts are not reasonable alternatives to providing
41 new baseload power generation capacity.

42 **9.2.1.3 Demand Side Management**

43 Demand-Side Management (DSM) programs consist of planning, implementing, and monitoring
44 activities that enable and encourage consumers to reduce and/or modify their levels and
45 patterns of electricity usage. By reducing customers’ demand for energy through energy-
46 efficiency, conservation, and load management, the need for additional generation capacity can
47 be reduced, postponed, or even eliminated. However, these programs are not within the

1 responsibility of a merchant power supplier such as Luminant. As previously determined by the
2 NRC (NRC 2005) and described in NUREG-1555 (NRC 2000), a DSM analysis is not required
3 for an Applicant seeking to build a merchant plant.

4 Furthermore, while DSM programs could play an important role in reducing peak load power in
5 the ERCOT region, they are not generally expected to significantly reduce baseload
6 consumption, and would not be a reasonable alternative for the 3200-MW additional baseload
7 capacity expected with CPNPP Units 3 and 4.

8 Nevertheless, some cities in the region are taken actions to reduce and/or modify their levels
9 and patterns of electricity usage. In March 2008, the City of Dallas adopted Ordinance No.
10 27109 to the Dallas Energy Conservation Code (City of Dallas 2008), an amended version of
11 the 2006 International Energy Conservation Code. The code applies to any additions,
12 alterations, renovations or repairs to existing building or residences including any changes in
13 occupancy that would result in an increase in demand for either fossil fuel or electrical energy.
14 Resource management programs have been implemented in Fort Worth in response to Texas
15 Senate Bill 5 (SB 5). The goal of SB 5 is to improve environmental air quality through demand-
16 side energy conservation (City of Fort Worth 2010).

17 **9.2.1.4 Conclusions**

18 The review team finds that it would be unreasonable for an applicant to request COLs if (1) the
19 power could be purchased from other electricity suppliers at a reasonable cost, (2) the power
20 could be obtained by reactivating one or more mothballed generating plants or by extending the
21 life of one or more existing generating plants beyond the lifetime expected in the ERCOT
22 projections, or (3) conservation or DSM programs could make the additional power from new
23 power generating units unnecessary.

24 As discussed in Chapter 8 of this EIS, ERCOT took account of conservation and demand-side
25 management programs in preparing its report, 2009 ERCOT Planning Long-Term Hourly Peak
26 Demand and Energy Forecast (ERCOT 2009b). In this report, ERCOT determined that there
27 was a need for additional baseload power in Luminant's ROI, even taking into account
28 conservation and demand side management programs. Based on the preceding discussion, the
29 review team concludes that the options of purchasing electric power from other suppliers,
30 reactivating mothballed power plants, extending the operating life of existing power plants
31 beyond the lifetime expected in the ERCOT projections, or any combination of these are already
32 fully utilized in the capacity projections for the ERCOT service area (ERCOT 2008b) and that
33 additional efforts do not present reasonable alternatives to providing new baseload power-
34 generation capacity.

35 **9.2.2 Alternatives Requiring New Generation Capacity**

36 Consistent with the NRC's evaluation of alternatives to the renewal of operating licenses, a
37 reasonable set of energy alternatives to the construction and operation of one or more new
38 nuclear units at the CPNPP site should be limited to analysis of discrete power-generation
39 sources, a combination of sources, and those power-generation technologies that are
40 technically reasonable and commercially viable (NRC 1996). The current mix of baseload
41 power generation options in the ERCOT region is one indicator of the feasible choices for power
42 generation technology within the region. As of 2009, the generation profile in the ERCOT region
43 (ERCOT 2009a) was approximately as follows: natural gas (43 percent), coal (37.1 percent),
44 nuclear (13.2 percent), wind (4.9 percent), hydroelectric (0.2 percent), and other sources (1.6
45 percent).

1 Furthermore, in accordance with NUREG-1555, the basic criteria for a viable alternative energy
 2 source include (1) use of the energy source is consistent with national energy policy goals for
 3 energy use, and (2) Federal, State, and local regulations do not prohibit or restrict the use of the
 4 energy source. This section discusses the environmental impacts of energy alternatives to the
 5 proposed action that would require construction of new facilities to meet the demand for power-
 6 generating capacity.

7 Additional criteria listed in NUREG-1555 include the following:

- 8 • The energy technology should be developed, proven, and available in the relevant region;
- 9 • The energy source should provide power generation equivalent to power level output of the
 10 Applicant's proposed project [3200 MW(e) baseload power with a capacity factor of 93
 11 percent^a];
- 12 • The power should be available within the time frame needed for the proposed project; and
- 13 • No unusual environmental impacts or exceptional costs are associated with the energy
 14 source that would make it impractical.

15 Each year, the Energy Information Administration (EIA), a component of the U.S. Department of
 16 Energy (DOE), issues an annual energy outlook. In its *Annual Energy Outlook 2010*
 17 (DOE/EIA 2010), the EIA's reference case projects that the total electrical energy demand in
 18 2008 [3873 TW(e)] will increase by 30 percent by 2035 reference case [5021 TW(e)]; the coal-
 19 fired capacity is projected to decrease from 48 percent in 2008 to 44 percent in 2035. Previous
 20 projections relied heavily on the construction of new coal-fired plants with the coal-fired portion
 21 accounting for about 50 percent of the power industry, followed by smaller amounts of
 22 renewable, gas, and nuclear capacity. These projections align with the current ERCOT energy
 23 production mix with natural gas (combined cycle) the more likely baseload alternative.

24 The discussion in Sections 9.2.2.1 through 9.2.2.2 is limited to the individual alternatives that
 25 meet the criteria provided in the previous paragraphs and that appear to the review team to be
 26 viable baseload generation sources: coal-fired and natural gas combined cycle-fired power
 27 generation. The impacts discussed in this section are estimates based on present technology.
 28 For the purpose of assessing the environmental impacts of each of these alternatives, the
 29 review team assumed that (1) the new power generation facilities would be located at the
 30 CPNPP site for the coal-fired and natural-gas-fired alternatives; (2) a mechanical draft cooling
 31 tower of the type proposed by Luminant for Units 3 and 4, would be used for plant cooling; and
 32 (3) no new offsite transmission line rights-of-way (ROWs) would be needed, which is consistent
 33 with Luminant's COL application for Units 3 and 4. Section 9.2.3 addresses alternative
 34 generation technologies that have demonstrated commercial acceptance but may be limited in
 35 application, total capacity, or technical feasibility when analyzed based on the need to supply
 36 reliable, baseload capacity. Section 9.2.4 discusses combinations of alternatives that could be
 37 used to generate 3200 MW(e) of baseload power. For the purpose of assessing the
 38 environmental impacts of the combination of energy sources alternative, the review team
 39 assumed that (1) the new power generation facilities would be located at the CPNPP site for the
 40 natural-gas-fired contribution to the alternative; (2) a mechanical draft cooling tower of the type
 41 proposed by Luminant for Units 3 and 4, would be used for plant cooling; and (3) new offsite
 42 transmission line rights-of-way (ROWs) would be needed only for that portion of the alternative
 43 involving wind or solar technologies..

^{a a} The capacity factor is the ratio of the net electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period.

1 **9.2.2.1 Coal-Fired Power Generation**

2 For the coal-fired power generation alternative, the review team assumed construction and
3 operation of supercritical pulverized coal-fired units with a closed-cycle cooling system and
4 cooling towers at the CPNPP site. The site is assumed to contain six units with a power level
5 rated at 530-MW(e) each, having a total rated power level of 3180 MW(e). Although this
6 alternative assumes slightly less power than the proposed 3200 MW(e) from the two US-APWR
7 units, it approximates Luminant's purpose and the slight variance in the total rated power level
8 need for the project and has little impact on the assessment of environmental impacts. The
9 review team assumes that the coal-fired alternative would use existing transmission lines and
10 ROWs to the CPNPP site.

11 Supercritical pulverized coal-fired plants are similar to conventional pulverized coal-fired plants
12 except that the facilities would operate at slightly higher temperatures and higher pressures,
13 which results in greater thermal efficiency. Supercritical coal-fired plants are commercially
14 proven and represent an increasing proportion of new coal-fired power plants. The coal-fired
15 plant is assumed to have an operating life of 30 years. The coal-fired plant is assumed to have
16 a capacity factor of 85 percent; the capacity factor discounts for that portion of the time that a
17 power generation facility is not producing boilerplate, nameplate, or the maximum rated power
18 level.

19 The review team also considered an integrated gasification combined cycle (IGCC) coal-fired
20 plant. IGCC is an emerging technology for generating electricity with coal that combines
21 modern coal gasification technology with both gas turbine and steam turbine power generation.
22 The IGCC technology is less polluting than conventional pulverized coal plants because major
23 pollutants can be removed from the gas stream before combustion. The IGCC alternative also
24 generates less solid waste than the pulverized coal-fired alternative. The largest solid waste
25 stream produced by IGCC installations is slag, a black, glassy, sand-like material that may be a
26 marketable by-product. The other large-volume by-product produced by IGCC plants is sulfur,
27 which is extracted during the gasification process and can also be marketed rather than placed
28 in a landfill. IGCC units do not produce ash or scrubber wastes.

29 In spite of the preceding advantages, the review team concludes that, at present, a new IGCC
30 plant is not a reasonable alternative to a 3200-MW(e) nuclear power generation facility for the
31 following reasons: (1) IGCC plants are more expensive than comparable pulverized coal plants
32 (NETL 2007), (2) existing IGCC plants have considerably smaller rated power levels than the
33 proposed 3200-MW(e) nuclear plant, (3) system reliability of existing IGCC plants has been
34 lower than pulverized coal plants, (4) the existing IGCC plants have required an extended
35 (though ultimately successful) start up period (NWPCC 2005), and (5) a lack of overall plant
36 performance warranties for IGCC plants has hindered commercial financing (NWPCC 2005).
37 While Luminant is currently developing two commercial IGCC demonstration projects in Texas
38 (Luminant 2009a), for the reasons stated above IGCC plants are not considered further in this
39 EIS.

40 The review team estimates that a 3180 MW(e) coal-fired power generation plant at the CPNPP
41 site would consume approximately 15,000,000 tons of Powder River Basin subbituminous coal
42 per year. Coal and lime (calcium carbonate) for a pulverized coal-fired plant could be delivered
43 to the CPNPP site by train. Lime or limestone, used in the scrubbing process for control of
44 sulfur dioxide (SO₂) emissions, is injected as a slurry into the hot effluent combustion gases to
45 remove entrained sulfur dioxide. The lime-based scrubbing solution reacts with SO₂ to form
46 calcium sulfite, which precipitates and is removed from the process as sludge. The review team
47 estimates that approximately 900,000 tons/yr of limestone would be used for flue gas
48 desulfurization (NETL 2007).

1 **Air Quality**

2 The impacts on air quality from coal-fired power generation would vary considerably from those
3 of nuclear generation because of emissions of sulfur dioxide, nitrogen oxides (NO_x), carbon
4 monoxide (CO), and particulate matter (PM), and hazardous air pollutants such as mercury (Hg)
5 and lead. In its environmental report (ER), Luminant assumed a coal-fired plant design that
6 would minimize air emissions through a combination of boiler technology and post-combustion
7 pollutant removal. Luminant estimates that the coal-fired alternative emissions for SO₂, NO_x,
8 CO, and PM would be approximately as follows (Luminant 2009a):

- 9 • SO₂ = 4270 tons/yr
- 10 • NO_x = 3625 tons/yr
- 11 • CO = 3625 tons/yr
- 12 • PM₁₀ = 87 tons/yr

13 In addition, the review team estimates the total PM_{2.5} emissions would be of the order of 22
14 tons/yr and mercury emissions would be less than 1 ton/yr.

15 PM₁₀ is particulate matter with a diameter equal to or less than 10 microns (40 CFR 50.6). PM_{2.5}
16 is particulate matter with a diameter equal to or less than 2.5 microns (40 CFR 50.7).

17 Based on data from previous NRC EIS documents, the review team determined that the
18 preceding emission estimates are not unreasonable. A new coal-fired plant at the CPNPP site
19 would also have approximately 35,000,000 tons/yr of unregulated carbon dioxide (CO₂)
20 emissions (Luminant 2009a) that could affect climate.

21 The acid rain requirements of the Clean Air Act (CAA) capped the nation's sulfur dioxide
22 emissions from power plants. Luminant would need to obtain sufficient pollution credits either
23 from a set-aside pool or from purchases on the open market to cover annual emissions from the
24 plant. The market-based allowance system, such as that used for sulfur dioxide emissions is
25 not used for nitrogen oxides emissions.

26 A new coal-fired power generation plant at the CPNPP site would likely need a prevention of
27 significant deterioration (PSD) permit and an operating permit under the CAA Amendments of
28 1990 and an operating permit from the Texas Commission on Environmental Quality (TCEQ).
29 The plant would need to comply with the new source performance standards (NSPS) for such
30 plants in 40 CFR 60, Subpart Da. The standards establish emission limits for particulate matter
31 and opacity (40 CFR 60.42Da), sulfur dioxide (40 CFR 60.43Da), nitrogen oxides
32 (40 CFR 60.44Da), and mercury (40 CFR 60.45Da).

33 The Dallas–Fort Worth (DFW) Attainment Demonstration (AD) State Implementation Plan (SIP)
34 Revision for the 1997 Eight-Hour Ozone Standard was adopted by the TCEQ in May 2007 and
35 submitted to the U.S. Environmental Protection Agency (EPA) in June 2007. The May 2007
36 DFW AD SIP Revision introduced control strategies for nitrogen oxides (NO_x) and volatile
37 organic compounds (VOC), and it demonstrates attainment of the 1997 8-hr ozone National
38 Ambient Air Quality Standard (NAAQS) in the nine-county DFW 8-hr ozone nonattainment area
39 (DFW area) by June 15, 2010. The attainment demonstration is based on photochemical
40 modeling that included new control strategies as well as an evaluation of corroborative
41 evidence. The Dallas–Fort Worth area is classified as a moderate nonattainment area for the
42 8-hr ozone standard with an attainment date of June 15, 2010. The DFW Reasonable Further
43 Progress (RFP) SIP was not required or intended to demonstrate attainment of the ozone
44 NAAQS, but rather is intended to demonstrate that emissions will be reduced by 15 percent for
45 the period 2002 through 2008. This SIP revision demonstrates that the RFP 15 percent
46 reduction requirement would be met for the analysis period 2002 to 2008. Demonstration of
47 RFP is based on the guidelines set forth in the EPA Phase II Eight-Hour Ozone Implementation

1 Rule (70 FR 71612) specifying how the 8-hr ozone nonattainment areas must demonstrate
2 RFP.

3 The nearest nonattainment area to Comanche Peak is the nine-county Dallas–Fort Worth
4 metropolitan area which is classified a “moderate” ozone nonattainment area under the 8-hr
5 ozone standard (TCEQ 2007). The Dallas–Fort Worth nonattainment area is located north and
6 east of the CPNPP site and borders Hood County to the north and east, and Somervell County
7 to the east.

8 The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P,
9 including a specific requirement for review of any new major stationary source in an area
10 designated as in attainment or unclassified for criteria pollutants under the CAA [40 CFR
11 51.307(a)]. Criteria pollutants under the CAA are lead, ozone, particulates, carbon monoxide,
12 nitrogen dioxide, and sulfur dioxide. Ambient air-quality standards for criteria pollutants are in
13 40 CFR 50. The CPNPP site is in an area designated as in attainment or unclassified for all
14 criteria pollutants (40 CFR 81.344).

15 The fugitive dust emissions from construction activities would be mitigated using best
16 management practices (BMPs) (Luminant 2009a). Such emissions would be temporary.

17 A new coal-fired plant at the CPNPP site would also have unregulated greenhouse gas (GHG)
18 emissions, primarily in the form of approximately 35,000,000 tons/yr of carbon dioxide that could
19 contribute to global warming (Luminant 2009a). The GHG emissions with respect to the
20 construction of the coal plants compared to the two new nuclear units are considered to be
21 similar; however, the GHG emissions with respect to the operation of coal plants compared to
22 the two new nuclear units are considerably greater. Texas currently does not have GHG
23 emissions reduction targets.

24 Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing
25 future impairment of visibility and remedying existing impairment in mandatory Class I Federal
26 areas when impairment is from air pollution caused by human activities. In addition, the EPA
27 regulations provide that for each mandatory Class I Federal area located within a State, the
28 State must establish goals that provide for reasonable progress toward achieving natural
29 visibility conditions. The reasonable progress goals must provide for an improvement in visibility
30 for the most impaired days over the period of the implementation plan and confirm no
31 degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)].
32 If a new coal-fired power plant were located close to a mandatory Class I area, additional air
33 pollution control requirements could be imposed. No mandatory Class I Federal areas are
34 within 50 mi of the CPNPP site.

35 In NUREG-1437 (NRC 1996) the NRC staff did not quantify emissions from coal-fired power
36 plants, but suggested that air impacts would be substantial. The GEIS for license renewal
37 identified global warming from unregulated carbon dioxide emissions and acid rain from sulfur
38 oxides and nitrogen oxides emissions as a potential impact (NRC 1996). Any new coal-fired
39 power facility would need to comply with the suite of Federal and State permitting requirements
40 described above. Overall, the review team concludes that air quality impacts from new coal-
41 fired generation at the CPNPP site would be MODERATE. The impacts would be noticeable,
42 but would not destabilize air quality.

43 ***Waste Management***

44 NUREG-1437 (NRC 1996) and the NRC’s experience from operating license renewal analyses
45 indicate that coal combustion generates waste in the form of ash, and equipment for controlling
46 air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and

1 scrubber sludge. Luminant estimates the coal would have a 5.21 percent ash content, and 75
2 percent of the ash would be recycled, resulting in approximately 188,000 tons of ash per year
3 requiring disposal in a land fill (Luminant 2007).

4 Luminant also estimated that SO₂ control scrubbers would require approximately 1,049,400
5 tons/yr of lime (Luminant 2009a). Combined with the ash waste, the NRC estimates that the
6 total 30-yr ash and scrubber waste would be approximately 37 million tons requiring some 653
7 ac of landfill area based on assumed densities and spreading the waste in a 30-ft-thick layer.

8 In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes from the
9 Combustion of Fossil Fuels" (65 FR 32214). The EPA concluded that some form of national
10 regulation is warranted to address coal combustion waste products because of health concerns.
11 Accordingly, the EPA announced its intention to issue regulations for disposal of coal-
12 combustion waste under Subtitle D of the Resource Conservation and Recovery Act of 1976, as
13 amended. The EPA anticipates submitting a proposed rule for public comment in 2010 (EPA
14 2009b).

15 Waste impacts on groundwater and surface water could extend beyond the operating life of the
16 plant if leachate or runoff from the waste storage area occurs. Disposal of the waste could
17 noticeably affect land use and groundwater quality, but with appropriate management and
18 monitoring, it would not destabilize any resources. After closure of the waste site and
19 revegetation, the land could be available for other uses. Construction-related debris would be
20 generated during plant construction activities.

21 Any new coal-fired power facility would need to comply with the suite of Federal and State
22 permitting requirements described above. For the reasons stated above, the review team
23 concludes that the impacts from waste generated at a coal-fired plant would be MODERATE.
24 The impacts would be noticeable but would not destabilize any important attribute of the
25 affected resources.

26 ***Human Health***

27 In NUREG-1437, the NRC staff identified cancer and emphysema as a potential health risk from
28 coal-fired plants (NRC 1996). The risk may be attributable to nitrogen oxides emissions that
29 contribute to ozone formation, which in turn contribute to health risk. Air emissions from a coal-
30 fired power generation plant located at the CPNPP site would be regulated by the TCEQ. Coal-
31 fired power generation also introduces worker risks from coal and limestone mining, worker and
32 public risk from coal and lime/limestone transportation, worker and public risk from disposal of
33 coal-combustion waste, and public risk from inhalation of stack emissions. In addition, natural
34 uranium and thorium contained in routine air emissions from coal-fired power plants could result
35 in radiological doses that could be in excess of those from nuclear power plant operations
36 (Gabbard 1993).

37 Regulatory agencies, including the EPA and State agencies, base air emission standards and
38 requirements on human health impacts. These agencies also impose site-specific emission
39 limits as needed to protect human health. Given the regulatory oversight exercised by the EPA
40 and State agencies, the review team concludes that the human health impacts from radiological
41 doses, inhaled toxins, and criteria pollutants (including particulates and nitrogen oxides)
42 generated from coal-fired generation would be SMALL.

43 ***Other Impacts***

44 Approximately 150 ac would need to be converted to industrial use for the powerblock,
45 infrastructure and support facilities, coal and limestone storage, and handling sludge based on a
46 47 ac per 1000 MW average for the Luminant plants listed in Table 9-1. The total acreage of

1 the CPNPP site is 7950 ac; however, approximately 3500 ac of the site include the Squaw
 2 Creek Reservoir (3125 ac), developed areas (439 ac), and shoreline buffer areas. No additional
 3 land would be needed to accommodate the operations of a coal-fired plant. The total acreage
 4 required to operate a coal-fired power plant is more than the nuclear power plant; thus, the
 5 ecological disruption due to permanent loss of wetlands and forest acreage would be greater.
 6 In addition, land-use changes would occur offsite in an undetermined coal mining area to supply
 7 coal for the plant and for landfill disposal of ash and scrubber sludge. Overall, the review team
 8 concludes that land-use impacts would be MODERATE primarily because of the impacts
 9 associated with disposal of ash and the large area of offsite land affected by mining activities.

Table 9-1. Land areas of Luminant lignite coal plants

Plant Site Name	Total Site MW(e)	Total Site Acreage (ac)	Location
Martin Lake	2400	95	Rusk County, TX
Shadow 5	590	30	Milam County, TX
Oak Grove	1800	100	Robertson County, TX
Totals	4790	225	
Average ac per 1000 MW(e)		47	

10 The impacts on water use and quality from constructing and operating a coal-fired plant at the
 11 CPNPP site would be comparable to the impacts associated with a new nuclear plant. Cooling
 12 water would likely be withdrawn directly from Lake Granbury. Plant discharges would consist
 13 mostly of cooling tower blowdown, characterized primarily by an increase in temperature and
 14 concentration of dissolved solids in the receiving waterbody and intermittent low concentrations
 15 of biocides. Discharges would be regulated by the TCEQ through a Texas Pollutant Discharge
 16 Elimination System (TPDES) permit. Indirectly, water quality could be affected by acids and
 17 mercury from air emissions. In NUREG-1437, the NRC staff determined that some erosion and
 18 sedimentation would likely occur during construction of new facilities (NRC 1996). Construction
 19 activities would also require a TPDES permit. The amount of water that would be used for a
 20 coal-fired power plant would be comparable to that for a nuclear facility assuming similar power
 21 levels and cooling water systems. Any new coal-fired power facility would need to comply with
 22 the suite of Federal and State permitting requirements for water use and quality described
 23 above. Overall, the review team concludes that the water-use and water-quality impacts would
 24 be MODERATE.

25 The coal-fired generation alternative would introduce ecological impacts from construction and
 26 new incremental impacts from operations. The impacts would be similar to those of the
 27 proposed action at the CPNPP site along the transmission corridors. The impacts could include
 28 wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological
 29 diversity. The impacts could occur at the CPNPP site and at the sites used for coal and
 30 limestone mining. Some of the impacts at the CPNPP site would occur in areas that were
 31 previously disturbed during the construction of Units 1 and 2. Extraction of cooling makeup
 32 water could have adverse impacts on aquatic resources, which would be similar to impacts from
 33 a new nuclear facility at the CPNPP site. Cooling tower drift would have minimal impact on
 34 terrestrial ecology. Disposal of waste products ash could affect water quality and the aquatic
 35 environment. Impacts on threatened and endangered species would likely be similar to the
 36 impacts from a new nuclear facility located at the CPNPP site. Overall, the review team
 37 concludes that the ecological impacts would be MODERATE primarily because of the impacts
 38 associated with disposal of ash and the large area of offsite land affected by mining activities.

1 Socioeconomic impacts would result from the approximately 3000 temporary workers needed to
2 construct the facility and an additional 382 employees to operate the plant (Luminant 2007).
3 These workers would impact the demands on housing and public services during construction,
4 and the loss of jobs would have a counter impact after construction. Overall, because the scale
5 of activity for coal-fired power generation would be smaller than that for CPNPP Units 3 and 4
6 but still significant, the review team concludes that these impacts would be SMALL to
7 MODERATE. Luminant would pay taxes based on the improvements made to the property to
8 Somervell County. Considering the population and economic condition of the county, the review
9 team concludes that the taxes would have a LARGE beneficial impact to the tax recipients.

10 The CPNPP site is currently an industrial site located in a rural area. The coal-fired powerblock
11 units would be as much as 200 ft tall and would be visible offsite during daylight hours. The six
12 exhaust stacks would be as much as 600 ft high. The stacks and associated emissions would
13 likely be visible in daylight hours for distances greater than 10 mi. Even accounting for
14 downward lighting, the powerblock units and associated stacks would also be visible at night
15 because of outside lighting. The Federal Aviation Administration (FAA) generally requires that
16 structures exceeding an overall height of 200 ft above ground level have markings and/or
17 lighting so as not to impair aviation safety (FAA 2007). The visual impacts of a new coal-fired
18 plant could be mitigated by landscaping and color selection for buildings that is consistent with
19 the environment. Visual impacts at night could be further mitigated by reduced use of lighting,
20 down-facing lighting, and alternate lighting equipment provided the lighting meets FAA
21 requirements, and appropriate use of shielding. Overall, the review team concludes that the
22 aesthetic impacts associated with new coal-fired power generation at the CPNPP site would be
23 MODERATE.

24 Coal-fired power generation would introduce mechanical sources of noise that would be audible
25 offsite. Sources contributing to the noise produced by plant operation are classified as
26 continuous or intermittent. Continuous sources include the mechanical equipment associated
27 with normal plant operations. Intermittent sources include the equipment related to coal
28 handling, solid-waste disposal, transportation related to coal and limestone delivery, use of
29 outside loudspeakers, and the commuting of plant employees. Noise and light from the plant
30 would be detectable offsite. Noise impacts associated with rail delivery of coal and
31 lime/limestone would be most significant for residents living in the vicinity of the facility and
32 along the delivery route. The Federal Railroad Administration (FRA) provides information on the
33 noise levels of railroad operations. According to the FRA, at a distance of 100 ft, a railroad horn
34 ranges between about 95 and 115 dBA, a locomotive operates between 90 and 95 dBA, and
35 passing railcars at 50 mph are at about 75 to 85 dBA (FRA 2009). Daytime rural sound levels
36 are between 40 and 50 dBA. The six-unit coal-fired facility would require 15 to 16 million tons of
37 coal and limestone to be delivered each year. Assuming a 100-car train at 100 tons per car, this
38 translates to about 25 to 30 rail deliveries per week. An equal number of empty rail cars would
39 have to leave the site as well. The review team concludes that the impacts of noise on
40 residents in the vicinity of the facility, including the communities of Tular and Granbury, would
41 be LARGE. These impacts could be reduced to MODERATE if the units were built in remote
42 locations away from residential communities allowing for greater attenuation of noise generated
43 by plant activities.

44 Historic and cultural resource impacts for a new coal-fired plant located at the CPNPP site
45 would be similar to the impacts for a new nuclear plant, as discussed in Sections 4.6 and 5.6 of
46 this EIS. However, because a greater amount of land would be disturbed on a permanent
47 basis, the likelihood of impacting cultural resources would be greater. A cultural resources
48 inventory would likely be needed for any onsite property that has not been previously surveyed.
49 Other lands that are acquired to support the plant would also likely need an inventory of field

1 cultural resources, identification and recording of existing historic and archaeological resources,
2 and possible mitigation of the adverse effect from ground-disturbing actions. The studies would
3 likely be needed for areas of potential disturbance at the plant site, any offsite affected areas,
4 such as mining and waste-disposal sites, and along associated corridors where new
5 construction would occur such as roads. Presently no resources eligible for the National
6 Register of Historic Places (NRHP) are in the vicinity of the plant. The review team concludes
7 that the historic and cultural resource impacts would likely be SMALL.

8 As discussed in Section 2.6 of this EIS, there are few minority populations (2 of 32 census
9 blocks within a 2-mi radius) and no low-income populations near the CPNPP site.
10 Environmental impacts on minority and low income populations associated with a new coal-fired
11 plant located at the CPNPP site would be similar to those for a new nuclear plant, which the
12 review team has concluded are SMALL.

13 Other construction and operation impacts are likely to be SMALL. In most cases, the impacts
14 would be detectable, but they would not destabilize any important attribute of the resource
15 involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not
16 be warranted.

17 The construction and operation impacts of coal-fired power generation at the CPNPP site are
18 summarized in Table 9-2.

19 **9.2.2.2 Natural Gas-Fired Power Generation**

20 For the natural gas-fired power generation alternative, the review team assumed construction
21 and operation of a natural gas-fired plant with a closed-cycle cooling system and cooling towers
22 located at the CPNPP site. The review team assumed that the plant would use combined-cycle
23 combustion turbines, which is consistent with the application. The site is assumed to contain six
24 units with a power level rated at of 530-MW(e) each, having a total rated power level of 3180
25 MW(e). Although this alternative assumes slightly less power than the proposed 3200 MW(e)
26 from the two US-APWR units, it approximates Luminant's purpose and need for the project and
27 the slight variance in the total rated power level has little impact on the assessment of
28 environmental impacts. The review team assumes that the gas-fired alternative would use
29 existing transmission lines and ROWs to the CPNPP site.

30 ***Air Quality***

31 Natural gas is a relatively clean burning fuel. When compared to a coal-fired plant, a natural
32 gas-fired plant would release similar types of emissions but in lower quantities.

33 The impacts on air quality from natural gas-fired power generation would vary considerably from
34 those of nuclear generation because of emissions of sulfur dioxide, nitrogen oxides, carbon
35 monoxide, and particulate matter. Luminant estimates that the gas-fired alternative emissions
36 for sulfur dioxide, nitrogen oxides, carbon monoxide, and particulate matter would be
37 approximately as follows (Luminant 2009a):

- 38 • SO₂= 253 tons/yr
- 39 • NO_x= 2676 tons/yr
- 40 • CO= 1115 tons/yr
- 41 • PM_{2.5} = 142 tons/yr

1

Table 9-2. Summary of environmental impacts of coal-fired power generation

Resource Area	Impact Category Level	Comment
Land use	MODERATE	Uses approximately 800 ac for the powerblock, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. Mining activities would have additional offsite impacts.
Water use and quality	MODERATE	Impacts would be comparable to the impacts for a new nuclear power plant located at the CPNPP site.
Ecology	MODERATE	Some impacts could occur from onsite construction, but major impacts would occur offsite ash disposal and mining. These impacts could include wildlife habitat loss and fragmentations, reduced productivity, and a local reduction in biological diversity.
Socioeconomics	LARGE beneficial to LARGE adverse	Construction-related impacts on housing would be noticeable. Local property tax base would likely have beneficial impacts mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Impacts of noise on residents in the CPNPP vicinity would be destabilizing. The stacks would be visible offsite for distances greater than 10 mi.
Waste management	MODERATE	Approximately 1,049,400 tons/yr limestone waste and 188,000 tons/yr coal ash waste would be generated.
Environmental justice	SMALL	There are few minority populations and no low-income populations near the site; impacts to such populations would likely be minimal.
Historic and cultural resources	SMALL	Adverse effects are unlikely as there are no NRHP-eligible resources in the vicinity of the site.
Air quality	MODERATE	SO ₂ = 4270 tons/yr NO _x = 3625 tons/yr CO = 3625 tons/yr PM ₁₀ = 87 tons/yr PM _{2.5} = 22 tons/yr CO ₂ = 35 million tons/yr Hg = < 1 ton/yr
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.

2

1 A new natural gas-fired plant at the CPNPP site would also have unregulated carbon dioxide
2 emissions of approximately 8,200,000tons/yr (Luminant 2009a).

3 The acid rain requirements of the Clean Air Act (CAA) capped the nation's sulfur dioxide
4 emissions from power plants. Prior to operating a natural gas-fired plant at the CPNPP site,
5 Luminant would need to obtain sufficient pollution credits either from a set-aside pool or from
6 purchases on the open market to cover annual emissions from the plant.

7 A new natural gas-fired power generation plant at the CPNPP site would likely need a
8 prevention of significant deterioration (PSD) permit from the Texas Commission on
9 Environmental Quality (TCEQ) and an operating permit from TCEQ under the CAA Amendments
10 of 1990. The plant would need to comply with the new source performance standards (NSPS)
11 for such plants in 40 CFR 60, Subpart Da. The standards establish emission limits for
12 particulate matter and opacity (40 CFR 60.42Da), SO₂ (40 CFR 60.43Da), NO_x (40 CFR
13 60.44Da), and Hg (40 CFR 60.45Da).

14 The Dallas-Fort Worth (DFW) AD SIP Revision for the 1997 Eight-Hour Ozone Standard was
15 adopted by the TCEQ in May 2007 and submitted to the EPA in June 2007. The May 2007
16 DFW AD SIP Revision introduced control strategies for NO_x and VOC, and it demonstrates
17 attainment of the 1997 8-hr ozone NAAQS in the nine-county DFW 8-hr ozone nonattainment
18 area (DFW area) by June 15, 2010. The attainment demonstration is based on photochemical
19 modeling that included new control strategies as well as an evaluation of corroborative
20 evidence. The Dallas-Fort Worth area is classified as a moderate nonattainment area for the 8-
21 hr ozone standard with an attainment date of June 15, 2010. The DFW RFP SIP was not
22 required or intended to demonstrate attainment of the ozone NAAQS, but rather is intended to
23 demonstrate that emissions would be reduced by 15 percent for the period 2002 through 2008.
24 This SIP revision demonstrates that the RFP 15 percent reduction requirement will be met for
25 the analysis period 2002 to 2008. Demonstration of RFP is based on the guidelines set forth in
26 the EPA Phase II Eight-Hour Ozone Implementation Rule (70 FR 71612) specifying how the 8-
27 hr ozone nonattainment areas must demonstrate RFP.

28 The nearest nonattainment area to Comanche Peak is the nine-county Dallas-Fort Worth
29 metropolitan area which is classified a "moderate" ozone nonattainment area under the 8-hr
30 ozone standard (TCEQ 2007). The Dallas-Fort Worth nonattainment area is located north and
31 east of the CPNPP site and borders Hood County to the north and east, and Somervell County
32 to the east.

33 The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P,
34 including a specific requirement for review of any new major stationary source in areas
35 designated as in attainment or unclassified under the CAA. The CPNPP site is in an area
36 designated as in attainment or unclassified for all criteria pollutants (40 CFR 81.344).

37 Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future and
38 remedying existing impairment of visibility in mandatory Class I Federal areas when impairment
39 occurs because of air pollution resulting from human activities. In addition, EPA regulations
40 provide that for each mandatory Class I Federal area located within a State, the State must
41 establish goals that provide for reasonable progress toward achieving natural visibility
42 conditions. The reasonable progress goals must provide for an improvement in visibility for
43 those days on which visibility is most impaired over the period of the implementation plan and
44 ensure no degradation in visibility for the least visibility-impaired days over the same period
45 [40 CFR 51.308(d)(1)]. If a new natural gas-fired power generation station were located close to
46 a mandatory Class I area, additional air pollution control requirements could be imposed. There

1 are two mandatory Class I Federal areas in Texas, Big Bend National Park and Guadalupe
2 Mountains National Park (EPA 2009a). Neither of these is within 50 mi of the CPNPP site.

3 The combustion turbine portion of the combined-cycle plant would be subject to EPA's National
4 Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR
5 63, Subpart YYYYY) if the site is a major source of hazardous air pollutants. Major sources have
6 the potential to emit 10 tons/yr or more of any single hazardous air pollutant or 25 tons/yr or
7 more of any combination of hazardous air pollutants [40 CFR 63.6085(b)].

8 The review team assumes that fugitive dust emissions from construction activities would be
9 mitigated through the implementation of BMPs (Luminant 2009a). Such emissions would be
10 temporary.

11 In NUREG-1437 (NRC 1996) the NRC staff did not quantify emissions from natural gas-fired
12 power plants, but expected that the impacts would be generally less than for other fossil
13 technologies because fewer pollutants are emitted and there would not be an appreciable
14 impact related to acid rain from SO₂ emissions. Air quality impacts result from emissions of
15 criteria pollutants as well as carbon dioxide. The impacts of emissions from a natural gas-fired
16 power generation plant would be noticeable, but would not be sufficient to destabilize air
17 resources. Overall, the review team concludes that air quality impacts resulting from
18 construction and operation of new natural gas-fired power generation at the CPNPP site would
19 be SMALL to MODERATE.

20 ***Waste Management***

21 In NUREG-1437, the NRC staff concluded that waste generation from natural gas-fired
22 technology would be minimal (NRC 1996). The only significant waste generated at a natural
23 gas-fired power plant would be spent SCR catalyst, which is used to control nitrogen oxide
24 emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent
25 SCR catalyst, waste generation at an operating natural gas-fired plant would be largely limited
26 to typical operations and maintenance waste. Construction-related debris would be generated
27 during construction activities. Overall, the review team concludes that waste impacts from
28 natural gas-fired power generation would be SMALL.

29 ***Human Health***

30 In NUREG-1437, the NRC staff identified cancer and emphysema as a potential health risk from
31 natural gas-fired plants (NRC 1996). The risk may be attributable to nitrogen oxides emissions
32 that contribute to ozone formation, which in turn contribute to health risk. Air emissions from a
33 natural gas-fired power generation plant located at the CPNPP site would be regulated by the
34 TCEQ. Nevertheless, the human health effect is expected to be either undetectable or
35 sufficiently minor. Overall, the review team concludes that the impacts on human health from
36 natural gas-fired power generation would be SMALL.

37 ***Other Impacts***

38 A natural gas-fired generating plant would require approximately 350 ac for the powerblock and
39 support facilities based on an estimated 0.11 ac/MW (Luminant 2009a). Construction of a
40 natural gas pipeline would be needed from the CPNPP site to a supply point where a firm
41 supply of gas is available. An additional pipeline would need to be constructed from an existing
42 36-in transmission pipeline traversing the Comanche Peak Exclusion Area approximately 2.4 mi
43 north of the plant location. Construction of the new pipeline would require approximately 3 ac.
44 In the GEIS for license renewal (NRC 1996), the NRC staff estimated that approximately 3600
45 ac would be needed per 1000 MW(e) plant for natural gas wells and collection stations.

1 Overall, the review team concludes that the land-use impacts from new natural gas-fired power
2 generation at the CPNPP site would be SMALL to MODERATE.

3 The impacts on water use and quality from constructing and operating a natural gas-fired plant
4 at the CPNPP site would be comparable to the impacts associated with a new nuclear plant.
5 Cooling water would likely be withdrawn directly from Lake Granbury. Plant discharges would
6 consist mostly of cooling tower blowdown, characterized primarily by an increased temperature
7 and concentration of dissolved solids relative to the receiving waterbody and intermittent low
8 concentrations of biocides. Discharges would be regulated by the TCEQ through a TPDES
9 permit. Indirectly, water quality could be affected by acids and mercury from air emissions. In
10 the GEIS for license renewal, the NRC staff determined that some erosion and sedimentation
11 would likely occur during construction of new facilities (NRC 1996). Construction activities
12 would also require a TPDES permit. Overall, the review team concludes that the water-use and
13 water-quality impacts would be similar to those of constructing and operating the proposed new
14 reactors at the site and would be MODERATE.

15 The natural gas-fired generation alternative would introduce ecological impacts from
16 construction and new incremental impacts from operations comparable to the impacts
17 associated with a new nuclear plant. The impacts could include wildlife habitat loss and
18 fragmentation, reduced productivity, and a local reduction in biological diversity. Constructing a
19 new underground gas pipeline to the site of the new plant would cause temporary ecological
20 impacts. Some of the ecological impacts at the CPNPP site would occur in areas that were
21 previously disturbed during the construction of Units 1 and 2. Extraction of cooling makeup
22 water could have adverse impacts on aquatic resources. Cooling tower drift would have
23 minimal impact on terrestrial ecology. Overall, types of impacts, including those on threatened
24 and endangered species, would likely be similar to the impacts from a new nuclear facility
25 located at the CPNPP site. Therefore, the review team concludes that the ecological impacts
26 would be MODERATE.

27 Socioeconomic impacts would result from the approximate 800 temporary workers needed to
28 construct plant and an additional 150 permanent employees to operate the plant
29 (Luminant 2009a). These impacts would include demands on housing and public services
30 during construction, and the loss of jobs after construction. Overall, the review team concludes
31 that these impacts would be SMALL. Luminant would pay significant property taxes for the
32 plant to Somervell County. Considering the population and economic condition of the county,
33 the review team concludes that the taxes would have a MODERATE beneficial impact to the tax
34 recipients.

35 The CPNPP site is currently an industrial site located in a rural area. The turbine buildings, six
36 exhaust stacks (approximately 200 ft tall) and associated emissions, cooling towers,
37 condensation plumes from the cooling towers, and the gas pipeline compressors would be
38 visible during daylight hours from offsite. Noise and light from the plant would be detectable
39 offsite. Overall, the review team concludes that the aesthetic impacts associated with new
40 natural gas-fired power generation at the CPNPP site would be SMALL.

41 Historic and cultural resource impacts for a new natural gas-fired plant located at the CPNPP
42 site would be similar to the impacts for a new nuclear plant, as discussed in Sections 4.6 and
43 5.6 of this EIS. A cultural resources inventory would likely be needed for any onsite property
44 that has not been previously surveyed. Other lands that are acquired to support the plant would
45 also likely need an inventory of field cultural resources, identification and recording of existing
46 historic and archaeological resources, and possible mitigation of the adverse effect from
47 ground-disturbing actions. The studies would likely be needed for areas of potential disturbance
48 at the plant site, any offsite affected areas, such as mining and waste-disposal sites, and along

1 associated corridors where new construction would occur such as roads. Presently there are no
2 NRHP-eligible resources in the vicinity of the plant. The review team concludes that the historic
3 and cultural resource impacts would likely be SMALL.

4 As discussed in Section 2.6, there are few minority populations (2 of 32 census blocks within a
5 2-mi radius) and no low-income populations near the CPNPP site. Environmental impacts on
6 minority and low income populations associated with a new gas-fired plant located at the
7 CPNPP site would be similar to those for a new nuclear plant, which the review team has
8 concluded would be SMALL.

9 Other construction and operation impacts are likely to be SMALL. In most cases, the impacts
10 would be detectable, but they would not destabilize any important attribute of the resource
11 involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not
12 be warranted.

13 The construction and operation impacts of natural gas-fired power generation at the CPNPP site
14 are summarized in Table 9-3.

15 **9.2.3 Other Alternatives**

16 This section discusses energy alternatives that Luminant determined are not reasonable power
17 generation options to provide power equal to that generated by the proposed CPNPP Units 3
18 and 4. The review team's conclusions about the overall environmental impacts of each
19 alternative and the review team's basis for the conclusions are provided. A feasible alternative
20 to the new nuclear units must meet the purpose and need of the project, which is to generate
21 3200 MW(e) of baseload power. In performing its initial evaluation in its ER, Luminant relied on
22 NUREG-1437 for license renewal (NRC 1996). The review team reviewed the information
23 submitted by Luminant and conducted an independent evaluation and finds that Luminant's
24 conclusion, that these individual generation options are not reasonable alternatives to one or
25 more new nuclear units, is appropriate.

26 The review team has not assigned significance levels to the environmental impacts associated
27 with the alternatives discussed in this section because, in general, the generation alternatives
28 would have to be installed at a location other than the CPNPP site. While the review team
29 followed CEQ's guidance not to speculate on future land utilization and locations, it was able to
30 describe the types of effects that could be realized under the other energy alternatives.

Table 9-3. Summary of environmental impacts of natural gas-fired power generation

Resource Area	Impact Category Level	Comment
Land use	SMALL to MODERATE	Uses approximately 350 ac for the powerblock, infrastructure and support facilities. Drilling and collection activities would have additional offsite impacts.
Water use and quality	MODERATE	Impacts would be comparable to the impacts for a new nuclear power plant located at the CPNPP site.
Ecology	MODERATE	Impacts could occur both onsite and offsite and could include wildlife habitat loss and fragmentations, reduced productivity, and a local reduction in biological diversity similar to the impacts associated with a new nuclear plant.
Socioeconomics	MODERATE beneficial to SMALL adverse	Construction-related impacts would be noticeable. Local property tax base would be beneficial mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. The plant would have only minor aesthetic impacts.
Waste management	SMALL	Spent catalyst would be regenerated or disposed of offsite.
Environmental justice	SMALL	There are few minority populations and no low-income populations near the site; impacts to such populations would likely be minimal.
Historic and cultural resources	SMALL	Adverse effects are unlikely as there are no NRHP-eligible resources in the vicinity of the plant.
Air quality	SMALL to MODERATE	Sulfur oxides = 253 tons/yr Nitrogen oxides = 2676 tons/yr Carbon monoxide = 1115 tons/yr PM _{2.5} = 142 tons/yr CO ₂ = 8.2 million tons/yr
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.

2 9.2.3.1 Wind Power Generation

3 Luminant is the top wind power purchaser in the State and the fifth largest in the United States
4 according to a recent American Wind Energy Association (AWEA) with more than 900 MW(e) of
5 the State's 7906 MW(e) of installed capacity (AWEA 2009a). In 2008, 2671 MW(e) of wind
6 capacity was installed in Texas, an amount that, by comparison, is more than that produced by
7 any country other than China (AWEA 2009b). Texas is also home to the four largest wind farms
8 in the United States, the largest being Horse Hollow at 735 MW(e) (AWEA 2009b). Horse
9 Hollow consists of 291 1.5-MW wind turbines and 130 2.3-MW wind turbines spread over more
10 than 19,020 ha (47,000 ac) or 190 km² (about 73 mi²) of land in Taylor and Nolan Counties. As

1 of April 2009, an additional 1102 MW(e) is under construction (AWEA 2009a). This includes the
2 recently completed 457.5 MW Panther Creek Wind Farm in West Texas (MacDonald 2010).

3 While Texas leads the nation in wind energy production, Luminant concluded that wind power
4 generation is not yet a reasonable alternative to baseload power (Luminant 2009a). Luminant
5 also concluded that more than 10,000 MW(e) of wind generating capacity, which is more than
6 the entire State's current installed capacity, would be needed to replace the baseload power
7 that would be provided by the proposed CPNPP Units 3 and 4 based on a 25 to 45 percent
8 capacity factor. The capacity factor is the ratio of the net electricity generated, for the time
9 considered, to the energy that could have been generated at continuous full-power operation
10 during the same period (Luminant 2009a). Newer wind turbines typically operate at
11 approximately a 36 percent capacity factor (DOE 2008a). By comparison, the average capacity
12 factor for a nuclear generation plant in 2008 in the United States was 91.5 percent (NEI 2009).
13 As of September 2008, ERCOT was tracking interest in an additional 51,000 MW(e) of wind
14 generation projects in Texas (ERCOT 2008c). Therefore, based on the significant wind
15 resources in Texas and the existing and anticipated amount of ERCOT interconnection
16 requests, the review team determined that consideration of wind power generation warranted a
17 more detailed analysis before determining if it is a reasonable alternative.

18 In ERCOT's December 2008 long-term system assessment, which reports the need for
19 increased transmission and generation capacity throughout the state of Texas, it analyzed a
20 highwind generation case (ERCOT 2008c). The review team concludes that this case
21 presented by ERCOT as an alternative to the construction and operation of CPNPP Units 3 and
22 4 warranted additional evaluation. To achieve the target reserve power margin of 12.5 percent
23 for ERCOT, the high-wind generation case did not include CPNPP Units 3 and 4. The ERCOT
24 high-wind generation case includes 24,622 MW(e) of installed new wind capacity in 10 years,
25 two new nuclear units at the South Texas Project totaling 2724 MW(e) (which have not been
26 approved yet), and 3295 MW(e) of new combustion natural gas turbines across the system
27 (ERCOT 2008c).

28 To improve the availability of energy from wind for the purpose of baseload supply, ERCOT
29 considers Compressed Air Energy Storage (CAES) to store and distribute energy from wind
30 (ERCOT 2008c). A CAES plant consists of motor-driven air compressors that consume low
31 cost off peak electricity to compress air into an underground storage medium. During high
32 electricity demand periods, the stored energy is recovered by releasing the compressed air
33 through a combustion turbine to generate electricity (NWPPCC 2009). Two CAES plants are
34 currently in operation worldwide. A 290-MW plant near Bremen, Germany, began operating in
35 1978, and a 110-MW plant located in McIntosh, Alabama, has been operating since 1991. Both
36 facilities use salt caverns for compressed air storage (Succar and Williams 2008). A CAES
37 plant requires suitable geology such as an underground cavern for energy storage. A 268-MW
38 CAES plant coupled to a wind farm, the Iowa Stored Energy Park, has been proposed for
39 construction near Des Moines, Iowa. The Iowa facility would use a porous rock storage
40 reservoir for the compressed air (Succar and Williams 2008). The review team is not aware of
41 any known, proposed, or operational projects in Texas for wind generation with storage project
42 that exceed 10 percent of the power level to be generated by the proposed CPNPP Units 3 and
43 4 project. Pilot, demonstration, prototype, and research projects are increasing in numbers,
44 including projects in California, New York and Texas. In addition, projects such as the Conoco-
45 Phillips General Compression venture may use compressed air storage directly, without the
46 combustion of fuel such as natural gas, thus increasing the efficiency of wind power above the
47 25 to 45 percent capacity factor. Furthermore, the review team is not aware of any other
48 proposed project for wind power generation with storage that approaches the scale of 3200
49 MW(e) that has yet been contemplated in the United States.

1 In one of ERCOT's power supply scenarios analyzed for determining potential needs for
2 increased transmission capacity, two scenarios were evaluated with CAES units located in West
3 Texas near Texas' significant wind resources; one scenario considered two 250-MW CAES
4 units and the other four 500-MW CAES units. These scenarios were evaluated using both the
5 recent Competitive Renewable Energy Zones ruling by the Public Utilities Commission of Texas
6 predicted wind capacity of 18,456 MW(e) and the high-wind generation case of 24,622 MW(e)
7 (ERCOT 2008c).

8 Additional wind energy storage can be achieved using batteries. Recent advances in sodium-
9 sulfur batteries provide storage of excess energy supply during periods of low demand for
10 usage during peak demand. According to American Electric Power (AEP 2009), AEP has
11 entered into a joint venture with MidAmerican Energy Holding Company to build a 4-MW
12 sodium-sulfur battery system in Presidio, Texas. The cost of the batteries, about \$2500 per
13 kilowatt (about 10 percent more than a new coal plant), has discouraged independent wind farm
14 developers from utilizing these batteries because it would necessarily increase wholesale
15 electricity prices that they would charge (Davidson 2007).

16 The review team considered that the wind power alternative would require new transmission
17 lines and ROWs from West Texas, where wind is most plentiful as a resource, to the east,
18 where the electric load growth rate is highest. The ERCOT high-wind generating case [24,622
19 MW(e)] was used by the review team as a surrogate to predict transmission needs.

20 In NUREG-1437, the NRC staff stated that wind energy is expected to require the use of
21 approximately 61,000 ha (150,000 ac) or 610 km² (about 235 mi²) of land to generate 1000
22 MW(e) of power (NRC 1996) or about 6100 ha per 100 MW(e). The Horse Hollow wind farm,
23 the Nation's largest, covers about 2600 ha per 100 MW(e). The Panther Creek Wind Farm
24 covers some 26,300 ha (65,000 ac) of contiguous ranch land, about 5750 ha per 100 MW(e)
25 (MacDonald 2010). Recently, the DOE estimate the land needed to be about 2000 ha per 100
26 MW(e) (DOE 2008a). The DOE also estimated that actual land use of constructed wind
27 turbines ranges from two percent to five percent of the total amount of land needed the turbines
28 and related infrastructure (DOE 2008a). Each wind turbine requires an access road. For the
29 Kenedy Ranch wind project near Corpus Christi, Texas, 59 mi of access roads were required to
30 support 118 wind turbines (Mettler 2009). The remaining land can be used for other activities
31 such as agriculture. For the high-wind generation case, which includes about 25,000 MW(e) of
32 wind generating capacity, ERCOT predicts the need for as many 230 mi of additional
33 transmission lines. The CPNPP site is not large enough to host the needed wind generating
34 capacity and most of the wind turbines would have to be located off site, most likely in high wind
35 regions.

36 Concern regarding greenhouse gas (GHG) emissions is fueling interest in wind power as an
37 option for new power generation. U.S. electricity demand is growing rapidly and some power
38 sources such as renewables and nuclear could help meet much of the new demand while
39 reducing GHG emissions. In 2008, the U.S. wind energy industry brought over 8500 MW(e) of
40 new wind power capacity online, increasing the Nation's cumulative total by 50 percent to over
41 25,300 MW (AWEA 2009b). Wind energy that displaces fossil-fueled power generation can also
42 help meet existing regulations for emissions of conventional pollutants, including sulfur dioxide,
43 nitrogen oxides, and mercury. Neglecting the impacts from the manufacturing, installation, and
44 maintenance operations, electricity produced directly from installed wind energy capacity will
45 result in no GHG emissions. However, as described in ERCOT's high-wind generation scenario
46 in its long-term system assessment (ERCOT 2008c), such a scenario that does not include
47 CPNPP Units 3 and 4 does includes additional new nuclear and fossil fuel capacity within the
48 ERCOT region. Beyond the small amount of localized short-term traffic associated with the

1 installation and maintenance of wind turbines and new transmission lines, the impacts to air
2 quality resource from operation would be minor.

3 Wind turbines typically have a service life of at least 20 yr (DOE 2008a). As such, waste
4 generation from wind power technology would be minimal. Some construction-related debris
5 could be generated during construction activities.

6 The DOE predicts that there will be substantial water savings, especially in the west, as wind
7 power production increases (DOE 2008a). While there are no water discharges for wind
8 turbines, erosion and sedimentation, which could be managed, could occur and affect land and
9 water resources.

10 In NUREG-1437, the NRC staff stated that birds are likely to collide with the turbines, and wind
11 energy developers should consider migration areas and nesting locations when sites for wind
12 energy facilities are selected (NRC 1996). However, relative to other human causes of avian
13 mortality, wind energy's impacts are minimal. The DOE shows, bird fatalities from
14 anthropogenic causes range from 100 million to 1 billion annually, and currently, it is estimated
15 that for every 10,000 birds killed by human activity, less than one death is caused by wind
16 turbines (DOE 2008a). A recent National Research Council study concluded that current wind
17 energy generation is responsible for 0.003 percent of human-caused avian mortality (National
18 Research Council 2007). Estimates of temporary construction impacts from turbines, service
19 roads, and other infrastructure range from 0.2 to 1.0 ha per turbine; estimates of permanent
20 habitat spatial displacement range from 0.3 to 0.4 ha per turbine (Strickland and Johnson 2006).
21 Indirect impacts can include trees being removed around turbines, edges in a forest being
22 detrimental to some species, and the presence of turbines causing wildlife habitat loss and
23 fragmentations, reduced productivity, and a local reduction in biological diversity. For example,
24 a grassland songbird study on Buffalo Ridge in Minnesota found species displacement of 180 m
25 to 250 m from the wind turbines (Strickland and Johnson 2006). Also, depending on the amount
26 of water and wetland crossings, aquatic resources could also be affected.

27 The workforce needed to install and maintain wind turbines at a wind farm is a small fraction of
28 that for fossil fuel or nuclear power options. Transporting the large wind turbine components
29 can result in temporary local traffic disruptions. Individuals with turbines on their properties
30 might actually see an increase in their property values because of the lease payments paid by
31 the wind project owner. Lease payments tend to be \$2000 to \$5000 per turbine per year, either
32 through fixed payments or as a small share of the revenue (DOE 2008a).

33 Turbine noise might be considered obtrusive in some instances. However, to reasonably
34 ensure that sound levels are acceptable and nonintrusive, standard setbacks from residences
35 and other buildings are used (DOE 2008a). While the optimal areas for siting wind turbines tend
36 to be those with lower population densities, less populated areas are also often prized for their
37 natural beauty unimpaired by human activity.

38 Wind turbines can be highly visible because of their height and locations (e.g., ridgelines and
39 open plains). The Horse Hollow wind farm has 421 wind turbines on 19,020 ha (47,000 ac).
40 The land area for 10,000 MW(e) of wind generating capacity for about 5700 wind turbines would
41 be 260,000 ha (643,000 ac), an area about the size of Rhode Island. The aesthetic impacts
42 based on the large number of wind turbines would be significant.

43 There are few minority or low-income populations in the West Texas high wind regions where
44 many of the existing wind farms are located. These include Borden, Scurry, Howard, Mitchell,
45 Nolan, Taylor, Glasscock, and Coke Counties.

46 Historic and cultural resource impacts for wind farms would be dependent on the amount of land
47 disturbed for wind turbines, access roads, and transmission line corridors. Lands that are

1 acquired to support wind power generation would also likely need an inventory of field cultural
2 resources, identification and recording of existing historic and archaeological resources, and
3 possible mitigation of the adverse effect from ground-disturbing actions.

4 For the preceding reasons the review team concluded that wind power (with or without CAES)
5 generation would not be a reasonable alternative to building a 3200 MW(e) nuclear power plant
6 that would be operated as a baseload plant within Luminant's ROI.

7 **9.2.3.2 Oil-Fired Power Generation**

8 In its *Annual Energy Outlook 2010*, the EIA's reference case projects that electricity production
9 using crude oil and lease condensate increase less than 1 percent of through the year 2035
10 (DOE/EIA 2010). Oil-fired generation is more expensive than nuclear, natural-gas-fired, or coal-
11 fired power generation options. In addition, future increases in oil prices are expected to make
12 oil-fired generation increasingly more expensive. The high cost of oil has resulted in a decline in
13 its use for electricity generation. In Section 8.3.11 of the GEIS for license renewal, the NRC
14 staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 120 ac of
15 land (NRC 1996). The review team estimates that a petroleum-fired power plant with a net
16 output of 3200 MW would require approximately 384 ac to construct, which would be
17 comparable to the land requirements for a gas-fired plant. Operation of an oil-fired power plant
18 would have environmental impacts that would be similar to those of a comparably sized coal
19 fired plant (NRC 1996).

20 For the preceding reasons, the review team concludes that an oil-fired power plant at or in the
21 vicinity of the proposed site would not be a reasonable alternative to building a 3200-MW(e)
22 nuclear power plant that would be operated as a baseload plant within Luminant's ROI.

23 **9.2.3.3 Solar Power Generation**

24 Solar technologies use energy and light from the sun to provide heating and cooling, light, hot
25 water, and electricity for consumers. Solar energy can be converted to electricity using solar
26 thermal technologies or photovoltaics. Solar thermal technologies employ concentrating
27 devices to create temperatures suitable for power production. Concentrating thermal
28 technologies are currently less costly than photovoltaics for bulk power production. They can
29 also be provided with energy storage or auxiliary boilers to allow operation during periods when
30 the sun is not shining (NWPCC 2006).

31 The ERCOT region has a solar generation capacity of up to 4600 MW(e) with most of the solar
32 resources in the far southwestern region of the State (ERCOT 2008c). As of November 30,
33 2008, there were 863 MW(e) of solar projects in the ERCOT interconnection process (ERCOT
34 2008c). In March 2009, the Austin City Council decided to approve building a solar power array.
35 The new solar power array that will serve Austin will produce almost one percent, or 30 MW(e),
36 of the city's current total power generation needs of 2900 MW(e) (Austin City Council 2009).

37 The world's largest solar site is Solar Energy Generating System (SEGS) located on
38 approximately 600 ha (1500 ac) in the Mojave Desert in southern California collectively
39 producing 354 MW(e) (California Energy Commission 2010; land use is approximately 2 ha (5
40 ac) per MW. In February 2010, DOE awarded a conditional loan guarantee for nearly \$1.4
41 billion to BrightSource Energy for three utility-scale concentrated solar power plants in
42 southeastern California (DOE 2010). Pending regulatory approval, the Ivanpah Solar Complex
43 will generate about 400 MW(e) by the end of 2013 (California Energy Commission 2010); land
44 use is approximately 4 ha (10 ac) per MW. DOE reports that capacity factors for solar facilities
45 range from 0.24 to 0.50 with the higher value in the range resulting from solar storage systems
46 (DOE 2010).

1 Based on the SEGS and Ivanpah land utilization, to fully develop the region's 4600 MW
 2 capacity, almost 200 to 400 ha (23,000 to 46,000 ac) would be needed. This could result in
 3 wildlife habitat loss and fragmentations, reduced productivity, and a local reduction in biological
 4 diversity.

5 In addition to CAES systems (discussed in Section 9.2.2.3), there have been recent advances in
 6 energy storage systems for solar projects to help control the variability of solar energy
 7 production. At the National Solar Thermal Test Facility at Sandia National Laboratories in
 8 Albuquerque, New Mexico, research is being conducted in the use of molten salt as a thermal
 9 storage media (Sandia National Laboratories 2009). In September 2008, the DOE announced
 10 new funding for research opportunities in *Advanced Heat Transfer Fluids* that was designed to
 11 fund more than a dozen research and development projects (DOE 2008c). The energy storage
 12 systems do not increase solar generation capacity or reduce land use requirements and,
 13 therefore, do not provide a substantial increase in baseload capacity.

14 Solar thermal electric technologies also typically require considerable water supplies. While the
 15 quantity of water needed per acre of use is similar to or less than that needed for irrigated
 16 agriculture, dependability of the water supply is an important issue in the sunny, dry areas of
 17 Texas that would be favored for large-scale solar power plants (TSECO 2008).

18 For the preceding reasons, the review team concludes that solar energy would not be a
 19 reasonable alternative to building a 3200-MW(e) nuclear power plant that would be operated as
 20 a baseload plant within Luminant's ROI.

21 **9.2.3.4 Hydropower Generation**

22 Most of Texas does not lend itself to large-scale hydroelectric projects. The reported
 23 hydropower capacity in the ERCOT service area is only 546 MW(e) (winter capacity) and 586
 24 MW(e) (summer capacity) and no new capacity is expected through 2013 (ERCOT 2008c). In
 25 NUREG-1437, the NRC staff estimated that land requirements for hydroelectric power are
 26 approximately 43,000 ha (1 million ac) per 1000 MW(e) (NRC 1996).

27 Because of the relatively low amount of undeveloped hydropower resource in Texas and the
 28 large land-use and related environmental and ecological resource impacts associated with siting
 29 hydroelectric facilities, the review team concludes that hydropower would not be a reasonable
 30 alternative to building of a 3200-MW(e) nuclear power plant that would be operated as a
 31 baseload plant within Luminant's ROI.

32 **9.2.3.5 Geothermal Power Generation**

33 Hydrothermal resources, reservoirs of steam or hot water, are available primarily in the western
 34 states, Alaska, and Hawaii. However, Earth's energy can be tapped almost anywhere with
 35 geothermal heat pumps and direct-use applications. Sources of other geothermal resources
 36 (e.g., hot dry rock, magma) require further technology development (DOE 2006).

37 Texas has some low-temperature resources that are suitable for electricity generation, as well
 38 as direct use and heat pump applications. These resources are found primarily in two large
 39 areas: one area is along the Rio Grande in the Trans-Pecos region and another is from the
 40 southern Rio Grande through the Balcones Trend region in Central Texas (DOE 2006). Ground
 41 source heat pumps are used throughout Texas for residents, schools, and commercial
 42 buildings. Power generation is also considered possible and Texas's extensive oil and gas
 43 wells provide easy access to geothermal resources. Data indicate the possibility of generating
 44 500 MW(e) to 2000 MW(e) from existing oil and gas wells (DOE 2006).

1 Geothermal energy has an average capacity factor of 90 percent and can be used for baseload
2 power where available. Geothermal systems have a relatively small footprint and minimal
3 emissions. However, geothermal technology is not widely used as baseload power generation
4 because of the limited geographical availability of the resource and immature status of the
5 technology (NRC 1996). A recent study led by the Massachusetts Institute of Technology (MIT)
6 concluded that a \$300–\$400 million research investment over 15 years would be needed to
7 make early generation enhanced geothermal system power plant installations competitive in the
8 evolving U.S. electricity supply markets (MIT 2006).

9 Geothermal energy in Texas does have a potential for providing some of the State’s renewable
10 energy portfolio, however, the review team concludes geothermal power generation would not
11 be a reasonable alternative to building a 3200-MW(e) nuclear power plant that would be
12 operated as a baseload plant within Luminant’s ROI.

13 **9.2.3.6 Power Generation from Wood Waste**

14 In NUREG-1437, the NRC staff determined that a wood-burning facility can provide baseload
15 power and operate with an average annual capacity factor of around 70 to 80 percent and with
16 20 to 25 percent efficiency (NRC 1996). The fuels required for a wood waste facility are
17 variable and site specific. A significant impediment to the use of wood waste to generate
18 electricity is the high cost of fuel delivery and high construction cost per megawatt of generating
19 capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in
20 the GEIS for license renewal suggest that the overall level of construction impacts per megawatt
21 of installed capacity would be approximately the same as that for a coal-fired plant, although
22 facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-
23 fired plants, wood waste plants require large areas for fuel storage and processing and involve
24 the same type of combustion equipment.

25 A 100 MW(e) wood-fired biomass power plant being developed in Sacul, Texas, will use logging
26 residue as its main fuel source, but also could use urban wood waste (Texas Comptroller of
27 Public Accounts 2008). The plant owner, Southern Power, estimates that the plant will require
28 approximately 1 million tons of biomass per year, which it plans to procure within a 75-mi radius
29 of the project site (Southern 2009). The plant is scheduled for startup in summer 2012.

30 Because of (1) uncertainties associated with obtaining an adequate supply of wood or wood
31 waste to fuel a baseload power plant, (2) the ecological impacts of large-scale timber cutting
32 (e.g., soil erosion and loss of wildlife habitat), and (3) low power conversion efficiency, the
33 review team concludes that a wood waste power generation would not be a reasonable
34 alternative to building a 3200-MW(e) nuclear power plant that would be operated as a baseload
35 plant within Luminant’s ROI.

36 **9.2.3.7 Power Generation from Municipal Solid Waste**

37 Municipal solid-waste combustors incinerate the waste products and use the resultant heat to
38 produce steam, hot water, or electricity. The combustion process reduces the volume of waste
39 and the need for new solid waste landfills (EPA 2009c). Municipal waste combustors use three
40 basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001).
41 Mass burning technologies are most commonly used in the United States. This group of
42 technologies processes raw municipal solid waste “as is,” with little or no sizing, shredding, or
43 separation before combustion. In NUREG-1437, the NRC staff determined that the initial capital
44 cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at
45 wood-waste facilities because of the need for specialized waste-separation and waste-handling
46 equipment for municipal solid waste (NRC 1996).

1 Municipal solid-waste combustors generate an ash residue that is buried in landfills. The ash
 2 residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the
 3 unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small
 4 particles that rise from the furnace during the combustion process. Fly ash is generally
 5 removed from flue gases using fabric filters and/or scrubbers (DOE/EIA 2001).

6 Currently, approximately 87 waste-to-energy plants are operating in the United States. These
 7 plants generate approximately 2500 MW(e), or an average of approximately 28 MW(e) per plant
 8 (EPA 2009c). However, because construction costs of new plants have increased, economic
 9 factors have limited new construction (EPA 2009c). Given the small size of existing plants, the
 10 review team concludes that generating electricity from municipal solid waste would not be a
 11 reasonable alternative to building a 3200-MW(e) nuclear power plant that would be operated as
 12 a baseload plant within Luminant's ROI.

13 **9.2.3.8 Power Generated from Other Biomass-Derived Fuels**

14 In addition to wood and municipal solid-waste fuel, several other biomass-derived fuels are
 15 available for fueling electric generators, including burning crops, converting crops to a liquid fuel
 16 such as ethanol, and gasifying crops (including wood waste). Texas is the largest producer of
 17 biodiesel transportation fuel in the United States, capable of producing more than 100 million
 18 gallons annually, with another 87 million gallons of capacity under construction (Texas
 19 Comptroller 2008). In 2007, Texas produced 72.9 million gallons of biodiesel (Texas
 20 Comptroller 2008).

21 In NUREG-1437, the NRC staff determined that none of these technologies has progressed to
 22 the point of being competitive on a large scale or of being sufficiently reliable to replace a large
 23 baseload generating plant. EIA estimates that biomass will be the largest source of renewable
 24 electricity generation among the nonhydropower renewable fuels through the year 2030
 25 (DOE/EIA 2009b). The DOE estimates that, in Texas, biomass could produce about 400 MW(e)
 26 of power associated with biomass liquid fuels production (DOE 2009a).

27 Co-firing biomass with coal is possible when low-cost biomass resources are available. Co-
 28 firing is the most economic option for the near future to introduce new biomass power
 29 generation. These projects require small capital investments per unit of power generation
 30 capacity. Co-firing systems range in size from 1 MW to 30 MW of biopower capacity (DOE
 31 2009a).

32 Construction of a biomass plant would have an environmental impact that would be similar to
 33 that for a coal-fired plant, although facilities using wood waste and agricultural residues for fuel
 34 would be built on a smaller scale. Similar to coal-fired plants, biomass-fired plants require areas
 35 for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of biomass-
 36 fired plants has environmental impacts on the aquatic environment and air.

37 Given the relatively small size of biomass generation facilities, the review team concludes that
 38 generating electricity from biomass-fueled power plants would not be a reasonable alternative to
 39 building a 3200-MW(e) nuclear power plant that would be operated as a baseload plant within
 40 Luminant's ROI.

41 **9.2.3.9 Fuel Cells Power Generation**

42 Fuel cells work without combustion and its associated environmental side effects. Power is
 43 produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode,
 44 and then separating the two by an electrolyte. The only by-products are heat, water, and
 45 carbon dioxide. A variety of hydrocarbon resources can generate by subjecting it to steam
 46 under pressure. Natural gas is typically used as the source of hydrogen.

1 Phosphoric acid fuel cells are generally considered first-generation technology. Higher
2 temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal
3 efficiencies and afford the capability to generate steam for cogeneration and combined-cycle
4 operations.

5 During the past three decades, demonstration efforts have been undertaken to develop more
6 practical and affordable fuel cell designs for stationary power applications. The high cost of fuel
7 cell power systems must be reduced before they can become competitive with conventional
8 technologies (DOE 2008b).

9 The review team concludes that, at the present time, fuel cells are not economically or
10 technologically competitive with other alternatives for baseload electricity generation. For the
11 preceding reasons, the review team concludes that generating electricity from fuel cells would
12 not be a reasonable alternative to building a 3200-MW(e) nuclear power plant that would be
13 operated as a baseload plant within Luminant's ROI.

14 **9.2.4 Combination of Alternatives**

15 Individual alternatives to the construction of two new nuclear units at the CPNPP site might not
16 be sufficient to maintain ERCOT's target reserve power margin of 12.5 percent through the
17 operating period of the proposed Units 3 and 4 because of the small size of the resource or lack
18 of cost-effective opportunities. However, while individual alternatives may not be economically
19 or technologically competitive for baseload power generation, it is conceivable that a
20 combination of alternatives might be cost effective as an alternative to the 3200 MW(e) that
21 would be generated from the new units.

22 There are many possible combinations of alternatives. It would not be reasonable to examine
23 every possible combination of energy alternatives in an EIS. Doing so would be counter to
24 CEQ's admonition that an EIS should be analytic rather than encyclopedic, shall be kept
25 concise, and shall be no longer than absolutely necessary to comply with NEPA. Given that
26 Luminant's objective is to provide a new merchant baseload generation facility, a fossil-fueled
27 energy source, most likely coal or natural gas, would need to be a significant contributor to a
28 reasonable combination of energy alternatives. As discussed in Section 9.2.1.3, DSM (including
29 conservation) need not be considered for an Applicant seeking to build a merchant plant and
30 would not change the evaluation appreciably.

31 For a combination of energy alternatives, the review team assessed the environmental impacts
32 of a combination of energy supply sources; for reasons explained in Section 9.2.1 and above,
33 DSM was not considered. The review team considered whether 3200 MW(e) could be
34 provided by wind and solar, each with storage; a combination of sources including biomass,
35 municipal solid waste, and geothermal; and natural gas. Wind or solar energy sources without
36 storage are not considered for baseload purposes, but that does not preclude development; in
37 fact, there is great interest in developing such renewable energy sources. The consumption of
38 natural gas by the facility in the combination of alternatives case can be offset by wind and solar
39 (without storage) energy production when available; however, a combination of alternatives
40 would still necessitate the installation of natural gas power facilities to ensure that power is
41 available as a baseload power source when wind and solar (without storage) sources cannot
42 meet the demand. The review team considered a spectrum of energy alternatives that were
43 reasonable for the ERCOT region and developed a combination of alternatives comprised of
44 650 net MW(e) wind power generation with storage (for example, CAES involving caverns or
45 salt domes in Texas); 430 net MW(e) biomass, municipal solid waste, geothermal, and solar
46 with energy storage; and four 530 MW(e) [2120 net MW(e)] natural-gas-fired, combined-cycle
47 generating units using closed-cycle cooling with cooling towers at the CPNPP site. Of the 430

1 net MW(e), the review team assumes that 100 net MW(e) would be a combination of biomass,
2 municipal solid waste, and geothermal energy and 330 net MW(e) would be from a solar energy
3 source with storage. The review team recognized that biomass energy is commercialized in the
4 State of Texas and, given the experience in the State with oil and gas extraction, there is
5 interest in determining the potential for “geo-powering” Texas to meet a portion of its energy
6 demand (DOE 2006). The 650 net MW(e) contribution of wind power generation with storage
7 and the 330 net MW(e) contribution of solar generation with energy storage to the combination
8 of alternatives case already exceeds the combined total of the two largest operating plants in
9 the world, as was discussed in Section 9.2.3.1 and 9.2.3.3, respectively.

10 The review team assumed that the 2120 MW(e) natural gas-fired portion of the combination of
11 alternatives would be built at the CPNPP site in a manner similar to the natural gas-fired
12 alternative discussed in Section 9.2.2.2. Consequently, the environmental effects for this
13 portion of the combination of alternatives would be scaled to be of the order of 2/3 of the natural
14 gas-fired alternative.

15 In its long-term system assessment, ERCOT analyzed a combination of power technologies in
16 its high-wind generation case for determining potential needs for increased transmission
17 capacity (ERCOT 2008a). To achieve the target reserve power margin of 12.5 percent for
18 ERCOT, the high-wind generation case includes 24,622 MW(e) of installed wind capacity in 10
19 years, two new nuclear units at the South Texas Project totaling 2724 MW(e), and 3295 MW(e)
20 of new combustion gas turbines across the system (ERCOT 2008a).

21 As described in Section 9.2.3.1 a capacity factor of 0.25 to 0.45 for wind power generation is not
22 unreasonable; the higher the capacity factor, the less land necessary to support the wind turbine
23 facilities. Assuming the 0.45 capacity factor, the 650 net MW(e) would require an installed
24 capacity of 1450 MW(e). Land use required for this installed capacity based on the Horse
25 Hollow wind farm land use would be 37,700 ha (92,700 ac). The optimal locations for obtaining
26 energy from wind sources is from northwestern Texas; as discussed earlier, transmission lines
27 of over 200 mi would have to be added to the grid.

28 As described in Section 9.2.3.3, a capacity factor of 0.24 to 0.50 for solar power operation is not
29 unreasonable. Assuming the 0.50 capacity factor the 330 net MW(e) would require an installed
30 capacity of 660 MW(e). Land use required for this installed capacity based on the 354 MW(e)-
31 SEGS and Ivanpah land use would be 1200 ha (3000 ac), The optimal locations for obtaining
32 energy from solar sources is from southwestern Texas, which may necessitate additional
33 transmission lines to provide service to those areas in the east with the largest load growth rate.

34 For the remainder of the energy sources that make up the combination of alternatives (biomass,
35 municipal solid waste, and geothermal), the review team assumed a capacity factor of 0.90,
36 which is consistent with DOE estimates (DOE 2010). While land would necessarily be used to
37 host these facilities and, in the cases of biomass and municipal solid waste, additional land
38 would be needed for storage of fuel materials, combustion residue (such as fly ash), and
39 landfills, the review team did not attempt to quantify the additional land used. In addition there
40 may be attendant environmental effects on air, water, ecology, socioeconomics, waste, cultural
41 and historic resources, and human health; these were discussed earlier for each of the other
42 power sources.

43 Beyond the reliable sources that make up the combined energy sources alternative to the
44 proposed action to provide for baseload power, additional installed wind and solar capacity
45 without storage could be constructed and made available to offset the use of 2120 MW(e) of
46 natural gas-fired power generation. When wind and solar energy systems (without storage) are
47 available, this energy supply would result in reduced air emissions and fuel consumption from
48 the natural gas-fueled power facilities. To offset all of the installed natural gas capacity

1 necessary to provide baseload power in this scenario, the review team assumed that 80 percent
2 [or 1700 net MW(e)] could be provided by wind and 20 percent [or 420 net MW(e)] could be
3 provided by solar. Assuming a more nominal capacity factor of 0.345 for wind and 0.25 for
4 solar, both without storage; this would result in installed capacities of 4850 MW(e) of wind and
5 1680 MW(e) of solar, which in turn, would require 125,000 ha (310,000 ac) and 3000 ha (7600
6 ac), respectively.

7 The review team believes that the preceding contributions are representative of a combination
8 of energy sources that could be considered for comparison with the proposed project and
9 together form a reasonable combination alternative. A summary of the review team's
10 characterization of the environmental impacts associated with the construction and operation of
11 the preceding combination of energy alternatives is shown in Table 9-4.

12 **9.2.5 Summary Comparison of Alternatives**

13 Table 9-5 contains a summary of the review team's environmental impact evaluation for building
14 and operating new nuclear, coal-fired, natural gas-fired combined-cycle generating units at the
15 CPNPP site, and a combination of energy alternatives within ERCOT's service area. The
16 nuclear power impacts presented in the comparison table are evaluated in Chapters 4 and 5.
17 The impacts of fossil fuel alternatives presented in the comparison table are evaluated in
18 Section 9.2.2 and the combination of alternatives in Section 9.2.4. The combination of
19 alternatives shown in Table 9-5 assumes the siting of natural gas combined-cycle generating
20 units at the CPNPP site and the siting of other generating units within ERCOT's service area.
21 Closed-cycle cooling with natural draft or mechanical cooling towers is assumed for all thermal
22 plants.

23 Because of current concerns related to greenhouse gas emissions, it is appropriate to
24 specifically discuss the differences among the alternative energy sources regarding carbon
25 dioxide (CO₂) emissions. The CO₂ emissions for the proposed action and energy generation
26 alternatives are discussed in Sections 5.7.1, 9.2.2.1, 9.2.2.2, and 9.2.4. Table 9-6 summarizes
27 the CO₂ emission estimates for a 40-year period for the reasonable alternatives considered by
28 the review team for baseload power generation. These estimates are limited to the emissions
29 from power generation and do not include CO₂ emissions for workforce transportation, building
30 fuel-cycle, or decommissioning. Among the reasonable energy generation alternatives, the
31 CO₂ emissions for nuclear power are a small fraction of the emissions of the other energy
32 generation alternatives. Even when the transportation emissions for the nuclear plant workforce
33 and fuel cycle emissions are added in, which would increase the emissions for plant operation
34 over a 40-year period to about 45,000,000 metric tons, this number is still significantly lower
35 than the emissions for the other reasonable alternatives.

1

Table 9-4. Summary of environmental impacts of a combination of power sources

Impact Category	Impact	Comment
Land use	LARGE	Uses approximately 250 ac for the natural gas-fired powerblock, infrastructure and support facilities; 200 to 600 km ² per 1000 MW(e) for wind farms plus as many as 230 mi of new transmission capacity. Biomass and municipal solid waste facilities and associated transmission lines would also have land use impacts. A portion of the land required may be available for other compatible uses such as agriculture.
Water use and quality	MODERATE	Impacts would be comparable to the impacts for a new nuclear power plant.
Ecology	MODERATE	Impacts could occur both onsite and offsite and could include wildlife habitat loss and fragmentations, reduced productivity, and local reductions in biological diversity comparable to the impacts associated with a new nuclear plant but with a slight potential for greater habitat loss due to increases in land use from wind farms.
Socioeconomics	MODERATE beneficial to LARGE adverse	Construction-related impacts would be noticeable. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Temporary local traffic disruptions when transporting wind turbine components. The aesthetic impacts based on the large number of wind turbines would be significant.
Waste management	SMALL	Spent SCR catalyst would be regenerated or disposed of offsite. Ash from biomass and municipal solid-waste sources would require disposal.
Environmental justice	SMALL	There are few minority populations and no low-income populations near the CPNPP site; impacts to such populations would likely be minimal.
Historic and cultural resources	SMALL	Adverse effects are unlikely as there are no NRHP-eligible resources in the vicinity of the site. Potential offsite impacts from biomass facilities could likely be effectively managed. Important site-specific resources could be affected by turbines or transmission lines, but these could likely be effectively managed.
Air quality	SMALL to MODERATE	Emission from the natural-gas fired plant would be approximately: Sulfur oxides = 235 tons/yr Nitrogen oxides = 1784 tons/yr Carbon monoxide = 743 tons/yr PM _{2.5} = 95 tons/yr CO ₂ = 5.5 million tons/yr Municipal solid waste and biomass facilities would also have emissions, but in smaller amounts than above.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.

2

1

Table 9-5. Summary of environmental impacts (Impact Category Level) of construction and operation of new nuclear, coal-fired, and natural gas-fired generating units, and a combination of alternatives

Resource area	Nuclear	Coal	Natural Gas	Combination
Land use	MODERATE	MODERATE	SMALL to MODERATE	LARGE
Water use and quality	MODERATE	MODERATE	MODERATE	MODERATE
Ecology	MODERATE	MODERATE	MODERATE	MODERATE
Socioeconomics	LARGE beneficial to MODERATE adverse	LARGE beneficial to LARGE adverse	MODERATE beneficial to SMALL adverse	MODERATE beneficial to LARGE adverse
Waste management	SMALL	MODERATE	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL	SMALL
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Air quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Human health	SMALL	SMALL	SMALL	SMALL

2 The CO₂ emissions associated with generation alternatives such as wind power, solar power,
 3 and hydropower would be associated with workforce transportation, construction, and
 4 decommissioning of the facilities. Because these generation alternatives do not involve
 5 combustion, the review team considers the emissions to be minor and concludes that the
 6 emissions would have a minimal cumulative impact. Other energy generation alternatives
 7 involving combustion of wood waste, municipal solid waste, or biomass-derived fuels would
 8 have CO₂ emissions from combustion as well as from workforce transportation, plant
 9 construction, and plant decommissioning. It is likely that the CO₂ emissions from the combustion
 10 process for these alternatives would dominate the other CO₂ emissions (e.g., from
 11 transportation) associated with the generation alternative. It is also likely that the CO₂ emissions
 12 from these alternatives would be the same order of magnitude as the emissions for the fossil-
 13 fuel alternatives considered in Sections 9.2.2.1, 9.2.2.2, and 9.2.4. However, because the
 14 review team determined that these alternatives do not meet the need for baseload power
 15 generation, the review team has not evaluated the CO₂ emissions quantitatively. Insofar as
 16 some of these alternatives, such as biomass, are considered in the combination of alternatives
 17 discussed in Section 9.2.4, they would increase the total CO₂ emissions beyond the
 18 180,000,000 metric tons; however, the review team considers the small fraction [i.e., 100 net
 19 MW(e) compared to the natural gas component, i.e., 2120 net MW(e)] to the combination of
 20 alternatives case to have a minimal further cumulative impact that does not warrant more
 21 precise analysis.

22 As summarized in Table 9-5 for each of the resource areas, the review team reviewed the
 23 available information on the environmental impacts of power generation alternatives compared
 24 to the construction of new nuclear units at the CPNPP site. The review team concludes that
 25 there are no environmentally preferable, technically reasonable alternatives to baseload nuclear
 26 power.

Table 9-6. Comparison of Carbon Dioxide Emissions for Energy Alternatives

Generation Type	Years	CO ₂ Emission (metric tons)
Nuclear Power ^(a)	40	20,000
Coal-Fired Generation ^(b)	40	980,000,000
Natural Gas-Fired Generation ^(c)	40	250,000,000
Combination of Alternatives ^(d)	40	180,000,000

^(a) From Appendix J.
^(b) From Section 9.2.2.1.
^(c) From Section 9.2.2.2.
^(d) From Section 9.2.4 (assuming only natural gas generation has significant CO₂ emissions).

1 **9.3 Alternative Sites**

2 NRC guidance in Section 9.3 of the ESRP (NRC 2000) provides information on the scope of the
 3 evaluation of alternative sites to determine if any obviously superior alternative exists to the site
 4 proposed. This section includes a discussion of Luminant’s ROI for siting a new nuclear power
 5 plant, and describes its site selection process. It provides the NRC staff’s description of the
 6 alternative sites that were considered and discusses the environmental impacts of locating the
 7 new 3200 MW(e) units at each alternative site. And finally, the impacts of alternative sites are
 8 compared to the proposed site.

9 **9.3.1 Site Selection Process**

10 NRC EISs prepared in conjunction with a COL application are to analyze alternatives to the
 11 proposed action [10 CFR 51.71(d)]. This section discusses CPNPP’s process for selecting its
 12 proposed and alternative sites and the review team’s evaluation of the process. CPNPP’s site
 13 selection process was based on guidance in the following documents (Luminant 2009a): NRC’s
 14 Regulatory Guide 4.7 (NRC 1998) and the Electric Power Research Institute’s (EPRI) Siting
 15 Guide (EPRI 2002).

16 NRC’s site selection process guidance calls for identification of an ROI followed by successive
 17 screening to candidate areas, potential sites, candidate sites, and the proposed site (NRC 2000,
 18 ESRP 9.3).

19 Within the ROI, screening criteria are applied to sequentially evaluate candidate areas, potential
 20 sites, and candidate sites, leading to the selection of the proposed site and alternative sites.
 21 The process the Applicant used to identify its alternative sites is described in the following
 22 sections.

23 **9.3.1.1 Selection of Region of Interest**

24 The ROI is the geographic area considered in searching for candidate sites (NRC 2000). The
 25 ROI is typically the State in which the proposed site is located or the relevant service area for
 26 the proposed plant, if it is sufficiently large (NRC 2000).

27 The Applicant selected the ERCOT service area as its ROI; the areal extent of the ERCOT
 28 service area is sufficiently expansive to ensure that an adequate slate of potential sites could be
 29 found. The designated ROI is consistent with the ROI description in NRC’s Environmental
 30 Standard Review Plan for preparation of EISs. The review team concludes that the ROI used in

1 the Applicant's COL application is reasonable for consideration and analysis of potential sites.
2 The review team also finds that the Applicant's basis for defining its ROI did not arbitrarily
3 exclude desirable candidate locations.

4 **9.3.1.2 Selection of Candidate Areas**

5 Candidate areas are one or more areas within an applicant's ROI that remain after unsuitable
6 areas for a new nuclear power plant (e.g., due to high population, lack of water, fault lines, or
7 distance to transmission lines) have been removed (NRC 2000). Luminant's site selection
8 process is described in a document titled *NuBuild Project, Nuclear Power Plant Siting Report*
9 (Luminant 2007). The site selection process used by the Applicant was based on the *EPRI*
10 *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application* (EPRI
11 2002). The process described in the Siting Guide was used as a general basis, and the
12 Applicant adapted the criteria used to evaluate sites based on its specific business needs.

13 The general approach, initially, was to apply a multi-step process as follows:

- 14 • Step 1: Regional Analysis, including desktop review and helicopter reconnaissance, to
15 identify candidate areas and potential sites with the ROI for evaluation;
- 16 • Step 2: Site screening analysis of potential sites against screening criteria to develop a list
17 of highly feasible (primary) sites to be visited;
- 18 • Step 3: Conduct of site visits and identification of candidate sites; and
- 19 • Step 4: Detailed evaluation of candidate sites to select proposed site.

20 **9.3.1.3 Selection of Potential Sites**

21 Potential sites are those sites within a candidate area that have been identified by an applicant
22 for preliminary assessment in establishing candidate sites (NRC 2000). The first step in the
23 process was a desktop review of maps, data, and knowledge of existing plant sites throughout
24 the ROI to identify general areas in which power plant development could be feasible (Luminant
25 2009a). These areas were assessed using aerial helicopter reconnaissance, resulting in the
26 definition of sites to be selected for screening level analysis. This process was performed in
27 September 2006, and resulted in the identification of 47 potential sites which were subjected to
28 a screening analysis for the selection of "highly suitable" primary sites.

29 **9.3.1.4 Selection of Primary Sites**

30 The site screening analysis step was actually performed by the Applicant two separate times.
31 The initial site screening analysis consisted of evaluation of the 47 sites against six screening
32 criteria, which included:

- 33 • Land area availability of at least 1000 ac;
- 34 • Water availability of at least 50,000 ac-ft per year;
- 35 • Distance to existing transmission lines;
- 36 • Distance to existing railroad access;
- 37 • Geotechnical criteria, including availability of a bedrock foundation and the level of seismic
38 risk; and
- 39 • Environmental acceptability, including presence of population centers, sites eligible for the
40 National Register of Historic Places, and adjacent land uses.

41 This process resulted in the characterization of eight primary sites as "highly suitable."

1 At this point, the Applicant used information obtained during the process to refine the
 2 characterization of some of the potential sites. This included refining the site boundaries of
 3 some of the potential sites, and splitting some large individual properties into multiple potential
 4 sites for evaluation. This refinement resulted in a total of 60 potential sites being subjected to a
 5 second site screening analysis in October 2006.

6 In addition to refining the characterization of the potential sites, the Applicant also refined the
 7 screening criteria that were used. The original criteria of water availability, available land area,
 8 railroad access, transmission line access, and geotechnical characteristics remained the same
 9 as in the initial screening analysis. The criterion of environmental acceptability was still used,
 10 but was modified from the initial screening analysis. In the initial screening analysis, the density
 11 of population was used, qualitatively, as part of the environmental acceptability criterion. In the
 12 second screening analysis, population density was extracted from the evaluation of
 13 environmental acceptability, and was made a separate screening criterion. In addition, the
 14 population density criterion was made quantitative, based on a number of 25,000 persons within
 15 a 10-mi radius. Finally, a criterion on cost was added, and it applied specifically to the cost to
 16 acquire and transport cooling water.

17 This second screening analysis increased the population of primary sites from 8 to 13, and
 18 carried them forward into Step 3 of the process. The 13 primary sites included:

- 19 • Coastal (McFaddin West)
- 20 • Coastal
- 21 • Lake Livingston – Goodrich
- 22 • Lake Livingston – Staley
- 23 • Lake Livingston – Glendale
- 24 • Lake O' the Pines
- 25 • Sam Rayburn Reservoir – Pineland
- 26 • Sam Rayburn Reservoir – North
- 27 • Sam Rayburn Reservoir – South
- 28 • Comanche Peak Nuclear Power Plant
- 29 • Toledo Bend – Blue Hills
- 30 • Toledo Bend – West
- 31 • Tradinghouse

32 **9.3.1.5 Selection of Candidate Sites**

33 Site visits were conducted by the Applicant at the 13 primary sites to field-check the information
 34 used in the screening process. The field evaluations included review of site-specific issues
 35 including potential for site flooding, presence of previously unknown populations or
 36 environmentally sensitive features, and means of access to cooling water. In addition, this
 37 process included contact with landowners, resulting in identification of complex land ownership
 38 patterns or landowners who were unlikely to make the land available for acquisition.

39 In some cases, multiple sites were located within a single candidate area, and the process was
 40 used to identify the single best site from within that candidate area. This was the case for the
 41 Coastal (McFaddin West) site; it is located near the Coastal site, but was not considered further
 42 because the owner of the Coastal site was more receptive to allow the Applicant to conduct
 43 more detailed analysis. Similarly, the Pineland site was judged to be the best of the three
 44 potential sites located on Sam Rayburn Reservoir.

1 The results of the field evaluations were used to establish four candidate sites for detailed
2 analysis and site selection. These four candidate sites are the CPNPP site, the Tradinghouse
3 site, the Pineland site, and the Coastal site, as shown in Figure 9-1.

4 Of the candidate sites, only one location (i.e., Comanche Peak) has undergone a thorough
5 NEPA; it is currently an active nuclear site with operating reactors. Co-locating new nuclear
6 generating units with an existing power plant can have the advantages of using less land for
7 each unit in that existing infrastructure and support facilities can be shared between new and
8 existing units.

9 The four candidate sites were subjected to a detailed evaluation process to select a proposed
10 site. The evaluation criteria were derived from Chapter 3 of the EPRI Siting Guide (EPRI 2002),
11 and included 34 separate evaluations. The importance of each criterion was included in the
12 assessment by incorporation of a criteria weighting factor. The result of the analysis was
13 Luminant's selection of the CPNPP site as the proposed site. The review team's detailed
14 analysis of the other three candidate sites as alternative sites is presented in Section 9.3.2.

15 Through this site identification and analysis process, two sites that had previously been
16 considered potentially suitable for nuclear power development were not evaluated as candidate
17 sites, although they were considered potentially viable nuclear sites (Luminant 2007). These
18 are the Toledo Bend–Blue Hills site and the Allen's Creek site. Both of these sites are
19 considered feasible nuclear sites and were considered candidate sites as part of the selection
20 process; however, the distance from railroads and transmission lines (Blue Hills) as well as the
21 close proximity to a National Forest (Blue Hills) and to a population center (Allen's Creek)
22 reduced the desirability of these two sites as candidate sites. In addition, both sites had unique
23 circumstances that had to be overcome to acquire adequate access to cooling water (Luminant
24 2007; BRA 2005). For these reasons, these sites were not selected as final candidate sites by
25 Luminant.

26 **9.3.1.6 Evaluation of the Applicant's Site Selection Process**

27 The review team evaluated the methodology used by the Applicant to select its proposed and
28 alternative sites. The ROI selected by the Applicant covers a largely isolated grid system
29 (ERCOT) that encompasses a large and ecologically varied area. Use of such an area is
30 consistent with the guidance in ESRP 9.3 (NRC 2000). The Applicant then established
31 candidate areas based on a group of exclusionary criteria similar to those described in ESRP
32 9.3. Next the Applicant identified potential sites within the candidate areas based on qualitative
33 criteria. The list of sites was further narrowed using more detailed criteria to identify the primary
34 of "highly suitable" sites. Finally, the Applicant used more specific criteria to evaluate the
35 primary sites and identify the alternative sites. Based on its review of the Applicant's site
36 selection process and the guidance in ESRP 9.3 (NRC 2000), the review team concludes that
37 the Applicant's process for selecting its ROI, candidate areas, potential sites, primary sites,
38 candidate sites, and the proposed CPNPP site was reasonable and did not arbitrarily exclude
39 locations that might be suitable choices for siting two new nuclear generating units to satisfy the
40 need for power identified in Chapter 8.

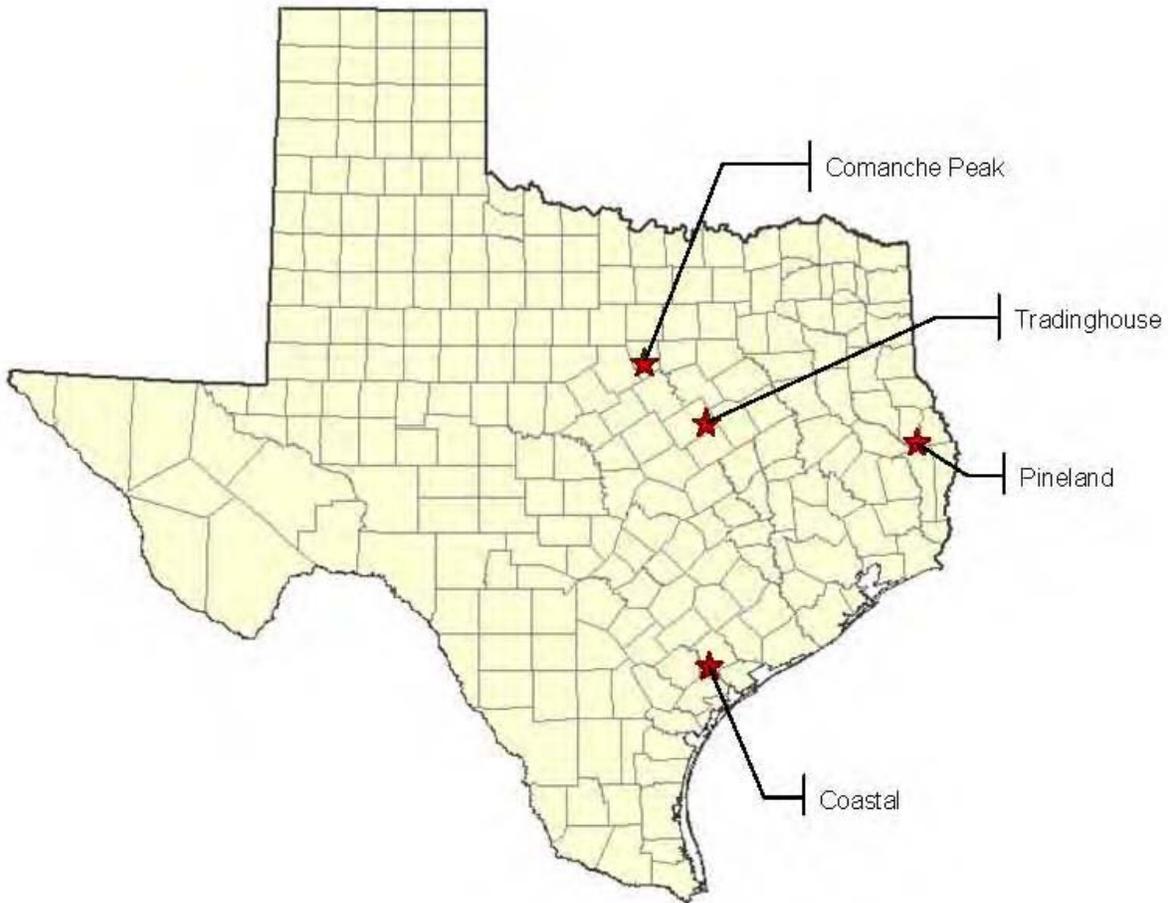


Figure 9-1. Map showing the locations of Luminant’s alternative sites. (Luminant 2009a)

1 The three alternative sites examined in detail in Section 9.3 are the Coastal site in Victoria
 2 County, the Pineland site in San Augustine County, and the Tradinghouse site in McLennan
 3 County. The review team used information in the Applicant’s ER related to the three alternative
 4 sites, independently collected and analyzed reconnaissance-level information for each of the
 5 alternative sites using ESRP 9.3 (NRC 2000) as guidance, and conducted site visits at each of
 6 the alternative sites.

7 In the discussion of the alternative sites that follows, the review team evaluated cumulative
 8 impacts of building and operating two new nuclear units at each site for each resource category,
 9 considering the impacts of other nearby projects on that resource. Included in the cumulative
 10 analysis are past, present, and reasonably foreseeable Federal, non-Federal, and private
 11 actions that could have meaningful cumulative impacts with the proposed action. For purposes
 12 of this analysis, the past is defined as the time period before receipt of the COL application.
 13 The present is defined as the time period from the receipt of the COL application until the start
 14 of building proposed CPNPP Units 3 and 4. The future is defined as the start of building Units 3
 15 and 4 through operation and eventual decommissioning.

16 Using Chapter 7 as a guide, the specific resources and components that could be affected by
 17 the new incremental effects of the proposed action if implemented at the alternative site and
 18 other actions in the same geographic area were identified. The affected environment that

1 serves as the baseline for the cumulative impacts analysis is described for each alternative site
2 and includes a qualitative discussion of the general effects of past actions. For each resource
3 area, the geographic area over which past, present, and future actions could reasonably
4 contribute to cumulative impacts is defined and described in later sections. The analysis for
5 each resource area at each alternative site concludes with a cumulative impact finding (SMALL,
6 MODERATE, or LARGE). For those cases in which the impact level to a resource was greater
7 than SMALL, the review team also discussed whether building and operating the nuclear units
8 would be a significant contributor to the cumulative impact. In the context of this evaluation,
9 "significant" is defined as a contribution that is important in reaching that impact level
10 determination.

11 The impacts described in Chapter 6 (e.g., nuclear fuel cycle; decommissioning) would not vary
12 significantly from one site to another. This is true because the alternative sites and the
13 proposed site are in low-population areas and because the review team assumes the same
14 reactor design (therefore, the same fuel cycle technology, transportation methods, and
15 decommissioning methods) for each of the sites. As such, these impacts would not differentiate
16 between the sites and would not be useful in the determination of whether an alternative site is
17 environmentally preferable to the proposed site. For this reason, these impacts are not
18 discussed in the evaluation of the alternative sites.

19 The cumulative impacts are summarized for each resource area at each site in the sections that
20 follow. The level of detail is commensurate with the significance of the impact for each resource
21 area. The findings for each resource area at each alternative site then are compared in
22 Table 9-24 at the end of this section to the cumulative impacts at the proposed site (brought
23 forward from Chapter 7). The results of this comparison are used to determine if any of the
24 alternative sites are environmentally preferable to the proposed site.

25 **9.3.2 The Coastal Site**

26 This section covers the review team's evaluation of the potential environmental impacts of siting
27 a new two-unit nuclear power plant at the Coastal site in Victoria County, Texas. The Coastal
28 site is a greenfield site near McFaddin, Texas, and is not currently owned by the Luminant.

29 The following sections include a cumulative impact assessment conducted for each major
30 resource area. The specific resources and components that could be affected by the new
31 incremental effects of the proposed action if implemented at the Coastal site and other actions
32 in the same geographical area were considered. This assessment includes the impacts of
33 NRC-authorized construction and operations and impacts of preconstruction activities. Also
34 included in the assessment are past, present and reasonably foreseeable future Federal, non-
35 Federal, and private actions that could have meaningful cumulative impacts when considered
36 together with the proposed action if implemented at the Coastal site. Other actions and projects
37 considered in this cumulative analysis are described in Table 9-7.

Table 9-7. Projects and Other Actions Considered in the Cumulative Analysis at the Coastal Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Victoria County Nuclear Station	One or more large-scale nuclear power reactors	Within 5 mi of the Coastal site	Proposed. ^(a) Exelon Generation submitted an application to the NRC for an Early Site Permit on March 25, 2010
Calhoun Liquefied Natural Gas (LNG) Terminal	LNG terminal on Port Lavaca-Point Comfort	About 25 mi east	Proposed. ^(b)
E.S. Joslin Power Plant Project	Proposed upgrade from 261 MW to 303 MW power plant fueled by petroleum coke	About 25 mi east	The plant operated from 1971 until 2004. Currently not operating; however, NuCoastal Power Corp plans to repower the plant. Air permits have been issued. Scheduled to be on line by late 2012. ^(c)
South Texas Project	Two large scale nuclear reactors with two additional reactors proposed	About 60 mi east	South Texas Project Units 1 and 2 – currently operating South Texas Project Units 3 and 4 – STP Nuclear Operating Company submitted to obtain a combined license for two Advanced Boiling Water Reactors designated as South Texas Project, Units 3 and 4.
Transportation Projects			
I-69 Trans-Texas Corridor	New interstate corridor connecting Texarkana/Shreveport to Mexico (possibly the Rio Grande Valley or Laredo)	Section B of corridor could come within 5 mi west	Proposed. ^(d)
Parks			
Parks, forests, and reserves	Numerous state and national parks, forests, reserves, and other recreational areas are located within a 50-mi region	Throughout 50-mi region	Parks are currently being managed by national, state, and/or local agencies

Table 9-7. (contd)

Project Name	Summary of Project	Location	Status
Other Actions/Projects			
Invista-DuPont Plant	Manufactures chemicals, polymers, and resins related to the textiles, carpet, and fiber industries	About 8 mi northeast	Operational. ^(e)
Formosa Plastics Corporation	Manufactures plastic resins and petrochemicals	About 25 mi east	Operational. ^(f)
Alcoa Aluminum Plant	Aluminum manufacturing	About 25 mi east	Operational. ^(g)
Texas Liquid Fertilizer Co. (Point Comfort)	Manufactures nitrogenous fertilizer	About 25 mi east	Operational. ^(h)
Air emissions sources	Air emissions sources within county include small-scale commercial facilities (emissions below reporting limits), on-road mobile sources (cars and trucks), non-road mobile sources (airplanes, boats, tractors, etc), and industrial stationary point emissions sources. ⁽ⁱ⁾	Within Victoria County	Emissions already result in Victoria County being a Near Non-Attainment Area for ozone. ⁽ⁱ⁾ New emissions in County subject to Eight-Hour Ozone Maintenance Plan. ⁽ⁱ⁾
Various hospitals and industries that use radioactive materials	Medical and other isotopes	Within 50 miles	Operational in nearby cities and towns
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water-and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents	Throughout region	Construction would occur in the future, as described in state and local land use planning documents

^(a) Source: Exelon 2010.

^(b) Source: FERC 2007.

^(c) Source: O'Grady 2008.

^(d) Source: TxDOT 2010.

^(e) Source: DuPont 2009.

^(f) Source: EPA 2009d.

^(g) Source: EPA 2009e.

^(h) Source: EPA 2009f.

⁽ⁱ⁾ Source: TCEQ 2007.

^(j) Source: TCEQ 2009.

1 The CPNPP site is approximately 260 mi from the Coastal site and was therefore not included in
2 this analysis. The only other nuclear power plant currently operating in Texas is the South
3 Texas Project, near Bay City, Texas. The South Texas Project plant is approximately 60 mi
4 east of the Coastal site and, with the exception of cumulative impacts of postulated radiological
5 accidents, is not included in other resource area analyses. The site for the proposed Victoria
6 County Nuclear Station is located within 5 mi of the Coastal site.

7 **9.3.2.1 Land Use**

8 The Coastal site is located in the southern portion of Victoria County, Texas, near the border
9 with Calhoun County. The site is approximately 7 mi east of U.S. Highway 77, 17 mi south of
10 the City of Victoria, and 5 mi east of the unincorporated community of McFaddin. An existing
11 rail line approximately 2.3 mi northwest of the site could be used to transport heavy equipment
12 and components to the vicinity of the site, but a spur rail line or heavy-duty haul road would be
13 required to reach the construction area. Local paved and gravel roads provide vehicular access
14 to the site.

15 The greenfield site is privately owned and is currently used for cattle ranching. A nuclear power
16 plant at the Coastal site would make use of the current owner's water rights. The site is subject
17 to multiple mineral leases, and several pipelines cross the site carrying natural gas, ethylene
18 glycol, gasoline, and water. Using data from the National Wetlands Inventory, the Applicant
19 estimates that the site contains approximately 65 ac of wetlands (Luminant 2009a).

20 Two possible configurations could be considered for the Coastal site; one encompasses about
21 2000 ac of land, and the other encompasses about 2500 ac. Luminant estimates that less than
22 one-half of the site would be disturbed for building and operating the nuclear power plant.
23 Assuming that the entire site is presently used for grazing and that the site would be devoted to
24 energy production use, the addition of a nuclear power plant would reduce non-crop agricultural
25 land in Victoria and Calhoun Counties by approximately 0.3 to 0.5 percent. This would
26 represent a minimal impact on the predominant land use of the surrounding agricultural
27 landscape. However, the introduction of such a large and intensive industrial facility into the
28 rural landscape would constitute a disruptive impact on local land-use patterns. This direct
29 impact would be compounded by the indirect impacts of induced changes in land use
30 associated with preconstruction, construction, and operations workforces.

31 The site is located outside the boundary of the Texas Coastal Management Program, and no
32 State or local zoning or land use restrictions apply to the site. The site is outside the 100-yr
33 floodplain. Sensitive lands in the area include Guadalupe Delta Wildlife Management Area
34 (approximately 9 mi to the east), Aransas National Wildlife Refuge (approximately 22 mi to the
35 south), and Matagorda Island Wildlife Management Area and State Park (approximately 29 mi
36 to the southeast). Workers at a nuclear power plant would likely increase recreational use of
37 these sites modestly, but resulting in only a minimal impact.

38 An existing 345-kV transmission line is located approximately 2 mi southeast of the site. While
39 detailed information concerning the routing of possible new transmission line corridors is not
40 known at this time, a connection to the nearby 345-kV line would likely cross grassland, forested
41 areas, and wetlands along Kuy Creek, Smith Bayou, and Elm Bayou. It appears that new
42 transmission lines in this area could be supported on towers placed outside wetlands. Thus,
43 installing and operating the transmission lines are not expected to result in substantial changes
44 to land use. Ranching and crop uses of land in the ROWs would be able to continue except at
45 the tower pads and along tower access roads. Transmission towers or poles would be built
46 outside of floodplains wherever possible; however towers or poles built in floodplains would not
47 substantially interfere with movement of floodwaters. The selection of a final transmission line

1 route would be subject to environmental review and approval by the Public Utilities Commission
2 of Texas.

3 **Cumulative Impacts**

4 The geographic area of interest for consideration of cumulative land-use impacts includes
5 Victoria and Calhoun Counties. This area includes most other projects and actions that could
6 combine with development and operation of two nuclear power units at the Coastal site to
7 produce cumulative land-use impacts. These counties are located in a coastal prairie region
8 that is nearly level to gently rolling and covered with grasses and deciduous forest. Major land
9 uses in the area are oil production and agriculture (sorghum, rice, corn, beef cattle, hogs, and
10 poultry).

11 Historically, land in the area of interest has been used primarily for livestock grazing and
12 farming. Port Lavaca in Calhoun County also has a strong history of shipping and trade. Oil
13 and gas production has increased since the 1930s, and the amount of land devoted to
14 manufacturing has grown since World War II (TSHA 2010). However, land use in the area
15 continues to be dominated by non-farm agriculture (such as ranching). Based on information
16 provided by the Applicant (Luminant 2009a), approximately 85 percent of the land in the two-
17 county area of interest is in agricultural use. Of this amount, approximately 66 percent, or
18 500,919 ac, is used for non crop-agriculture, primarily supporting cattle, hogs, sheep, and
19 poultry.

20 Other proposed projects and actions that could contribute to cumulative impacts on land use in
21 the area of interest include the Victoria County Nuclear Station (VCNS), the Calhoun Liquefied
22 Natural Gas Terminal (CLNGT), and the E.S. Joslin Power Plant Project (JPPP) (see Table 9-
23 7). The VCNS is being considered for property immediately adjacent to the Coastal site. The
24 CLNGT and JPPP are proposed for the eastern shore of Lavaca Bay, approximately 24 mi east
25 of the Coastal site. The addition of these facilities, particularly the development and operation
26 of another nuclear plant on an adjacent parcel, would potentially have a major effect on land use
27 in the two county area. In addition to the sizeable amount of land devoted to the projects
28 themselves, induced development due to increases in the area workforce could induce
29 significant changes in land-use patterns and future land availability and could change the rural
30 character of the area.

31 The Texas State Data Center (TSDC) projects that the population in a seven-county area
32 surrounding the CPNPP site (including Calhoun, DeWitt, Goliad, Jackson, Lavaca, Refugio, and
33 Victoria Counties) will increase by 10.7 percent by the year 2040 (TSDC 2009). Future
34 urbanization in the review area could contribute to decreases in grazing lands, cultivated lands,
35 forests, and wetlands. Urbanization in the vicinity of the Coastal site would reduce natural
36 vegetation and open space, resulting in an overall decline in the extent and connectivity of
37 wetlands, forests, and wildlife habitat. Despite the relatively low TSDC projection of population
38 growth, development of a nuclear power plant at the Coastal site, in combination the proposed
39 VCNS, CLNGT, and JPPP, could substantially increase the projected level of urbanization. The
40 increased levels of urbanization could noticeably alter land uses in the geographic area of
41 interest.

42 The report on *Global Climate Change Impacts in the United States*, provided by the U.S. Global
43 Change Research Program (GCRP), summarizes the projected impacts of future climate
44 changes in the United States (Karl et al. 2009). The report divides the United States into nine
45 regions. The Coastal site is located in the Southeast region. The GCRP climate models for this
46 region project continued warming in all seasons and an increase in of approximately 4.5°F by
47 the 2080s. Additionally, climate models project that there will tend to be less rainfall in this area.
48 The GCRP states that the warming projected for the Southeast could result in a potential

1 reduction in crop yields and livestock productivity, which may change portions of agricultural and
 2 ranching land uses in the area of interest. In addition, the GCRP projects increase sea level
 3 and storm surges in this area, thus potentially changing land use through inundation and loss of
 4 coastal wetlands and other low-lying areas.

5 Based on the information provided by the Applicant and the review team's independent review,
 6 the review team concludes that the cumulative land-use impacts of constructing and operating
 7 two new nuclear generating units at the Coastal site would be LARGE. This conclusion reflects
 8 (1) the substantial amount of land (up to 2500 ac onsite plus additional offsite land for roads and
 9 a railroad spur) that would be needed for the proposed project, (2) the combined direct and
 10 indirect land-use impacts from the proposed nearby VCNS, CLNGT, and JPPP, and (3)
 11 increased urbanization beyond that currently projected by TSDC. NRC-authorized construction
 12 and operation of two new nuclear units at the Coastal site would be a substantial contributor to
 13 the LARGE impact.

14 **9.3.2.2 Water Use and Quality**

15 The Coastal site is in an area of generally flat topography on the Gulf Coastal Plain near San
 16 Antonio Bay, between the Guadalupe and San Antonio Rivers. It is in the South Central Texas
 17 Regional Water Planning Area (Region L of the Texas State Water Plan) and within the
 18 jurisdiction of the Guadalupe-Blanco River Authority (GBRA). For this analysis, the geographic
 19 area of interest encompasses the entire South Central Texas Regional Water Planning Area,
 20 with primary focus on surface water and groundwater in the immediate site vicinity and
 21 downstream.

22 The combined watersheds of the Guadalupe and San Antonio Rivers encompass 10,128 mi² in
 23 a region with a humid subtropical climate (Exelon 2008). The San Antonio River flows into the
 24 Guadalupe River upstream of the Lower Guadalupe Diversion Dam and Salt Water Barrier,
 25 which is a short distance upstream from the mouth of the Guadalupe at San Antonio Bay. A
 26 significant consideration for water management in this region is the extensive interaction
 27 between groundwater and surface water. In upstream areas, springs discharging from the
 28 Edwards aquifer are a major source of streamflow to Guadalupe River tributaries, while near the
 29 coast there is extensive interaction between streams and shallow groundwater (TWDB 2007).
 30 Freshwater inflows from the rivers are important for maintaining salinity concentrations in
 31 downstream tidal estuaries (Guadalupe River estuary and San Antonio Bay) within ranges
 32 required for aquatic organisms. Plant water use may need to be coordinated with maintenance
 33 of salinity concentrations, including delivery of freshwater pulses needed during the spring and
 34 early summer (South Central Texas Regional Water Planning Group 2009, Exelon 2008).

35 ***Building Impacts***

36 Facility construction activities would not cause significant surface hydrologic alterations, but
 37 dewatering of shallow groundwater might be necessary. Impacts would, however, be temporary
 38 and localized. Except for water intakes, discharge structures, and pipelines, there would be no
 39 construction within 100-yr or 500-yr floodplains or in the zone potentially subject to storm surge
 40 from hurricanes. Construction of water intakes and discharge structures could have SMALL to
 41 MODERATE impacts on surface water quality, depending on the extent of required dredging
 42 and the waterbody affected. Impacts on groundwater from construction would be SMALL, as
 43 there would be no use of groundwater and the potential for contamination would be minimized
 44 by implementation of appropriate management practices during construction.

45 ***Operational Impacts***

1 It is assumed that two new nuclear units at the Coastal site would use closed-cycle cooling with
2 a mechanical draft cooling tower, and that no Blowdown Treatment Facility (BDTF) would be
3 required at the Coastal site due to the lack of a need for water treatment prior to discharge.
4 Cooling water requirements are assumed to be somewhat larger than the 62,400 ac-ft/yr annual
5 consumption estimated for the CPNPP site due to the warmer air temperatures (TSECO 2008)
6 and higher humidity (NOAA 2009) of the Coastal site. Although the current availability of water
7 and the excess of supply over demand in the water planning region may provide water for
8 operation, over the long term a nuclear power plant at the Coastal site may contribute to
9 regional water-use conflicts or shortages, as well as contribute to increased salinity in sensitive
10 estuarine habitats downstream from the site.

11 Legal rights to the water required for a nuclear power plant would be obtained from the site
12 landowner, who has senior rights to a large volume of water. These water rights are currently
13 used for some other purpose. Several possible physical sources of water exist, including
14 treated wastewater effluent from the City of San Antonio, water withdrawn from the nearby
15 Victoria Barge Canal above the Lower Guadalupe Diversion Dam and Salt Water Barrier (about
16 50,000 ac-ft/yr potentially available), or water withdrawn from the Calhoun Canal system, a
17 network of irrigation canals located in the coastal plain on the downstream side of the Lower
18 Guadalupe Diversion Dam and Salt Water Barrier that is supplied by water diverted from the
19 rivers above the barrier (about 65,000 ac-ft/yr potentially available). Luminant considers the
20 Calhoun Canal system to be the most likely source. Effluent discharge would be directed to
21 either the barge canal or one of the rivers; the barge canal is considered more likely. The
22 Calhoun Canal system diverts water from the Guadalupe River and distributes to industrial,
23 municipal, and agricultural customers in Calhoun County through a series of irrigation canals,
24 checks, pump stations and pipelines (GBRA 2009). The Guadalupe River and Victoria Barge
25 Canal appear to have adequate dimensions to provide suitable water intake sites; however,
26 when the Calhoun Canal system was observed by the review team in February 2009, it was
27 narrow and appeared shallow (typical depth in the main canal is about 10 ft, according to Exelon
28 2008). Significant dredging and other modifications likely would be needed to construct and
29 maintain a suitable water intake for a nuclear station in the canal system.

30 Siltation is likely to be a considerable problem in the Calhoun Canal system, which appears to
31 have sluggish flow. High suspended solids loads in this water source would necessitate
32 extensive pretreatment (i.e., settling) of cooling water. High salinity would likely constrain
33 cooling water discharge at the Coastal site and would increase the environmental impacts of
34 cooling tower drift.

35 Operations at the Coastal site would have SMALL to MODERATE impacts on surface water
36 quality due to the moderately high salinity and suspended solids in the intake water and the
37 potential need for periodic maintenance dredging at intakes. There would be no use of
38 groundwater for operations; therefore, the impact on groundwater would be SMALL.

39 ***Cumulative Impacts***

40 In addition to water use and water quality impacts from building and operations activities,
41 cumulative analysis considers past, present, and reasonably foreseeable future actions that
42 impact the same environmental resources. For the cumulative analysis of impacts on surface
43 water, the geographic area of interest for the Coastal site is considered to be the drainage basin
44 of the Guadalupe and San Antonio Rivers and downstream of the site because this is the
45 resource that would be affected by the proposed project. Key actions that have past, present,
46 and future potential impacts to water supply and water quality in the watersheds of the
47 Guadalupe and San Antonio Rivers include the management of the existing Calhoun Canal
48 system.

1 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
 2 summarizes the projected impacts of future climate changes in the United States (Karl et al.
 3 2009). The report divides the United States into nine regions, and the Coastal site is located in
 4 the Southeast region. The GCRP climate models for this region project continued warming in all
 5 seasons and an increase in of approximately 4.5°F by the 2080s. Additionally, climate models
 6 project that there will tend to be less rainfall in this area. The GCRP states that the warming
 7 projected for the Southeast region could result in a potential reduction in crop yields and
 8 livestock productivity, which may change portions of agricultural and ranching land uses in the
 9 area of interest. Decreased water availability due to increased temperatures and longer periods
 10 between rainfall events would likely affect the region's economy, as well as its natural systems.
 11 In addition, the GCRP projects that an increase in sea level and storm surges in this area, thus
 12 changing land use through inundation and loss of coastal wetlands and other low-lying areas.

13 **Cumulative Water Use Impacts**

14 Total existing water availability for consumptive use in Region L is estimated at 1,049,769
 15 ac-ft/yr on average, and existing demand is estimated at 985,237 ac-ft/yr (TWDB 2007). By
 16 2060, regional demand is projected to grow to 1,273,003 ac-ft/yr, thus exceeding existing
 17 supply. However, it is expected that a combination of management strategies, including water
 18 conservation, water reuse, groundwater and seawater desalination, and interbasin transfers
 19 from the Colorado River, can be used to increase supply to both accommodate the increased
 20 demand and provide excess capacity, at a total capital cost of about \$5.2 billion (TWDB 2007).
 21 The cumulative impacts to water use from construction and operation would therefore be
 22 SMALL to MODERATE.

23 **Cumulative Water Quality Impacts**

24 Impacts on groundwater quantity and quality from construction and operation would be SMALL,
 25 as there would be no use of groundwater, there is little or no use of near-surface groundwater
 26 that might be subject to contamination from the facility, and the potential for contamination
 27 would be minimized by implementation of appropriate management practices.

28 **9.3.2.3 Terrestrial Resources**

29 The following impact analysis includes impacts from building activities and operations on the
 30 Coastal site. The analysis also considers other past, present, and reasonably foreseeable
 31 future actions that impact terrestrial resources, including other Federal and non-Federal projects
 32 listed in Table 9-8.

33 The Coastal site lies in the Western Gulf Coastal Plain ecoregion (Griffith et al. 2004). It is on
 34 relatively level land near the confluence of the Guadalupe and San Antonio Rivers. The
 35 surrounding landscape consists of a mixture of low-lying grassland interspersed with brush, as
 36 well as agricultural land. Two possible configurations could be used for development of the
 37 proposed units on the site, one consisting of 2000 ac of land, and the other 2500 ac. Should
 38 this site be developed, then it is likely that the ultimate footprint of development would be even
 39 less than 2000 ac. The Coastal site is currently used for cattle ranching.

40 The principal distinguishing characteristics of the Western Gulf Coastal Plain are its relatively
 41 flat topography and mainly grassland natural vegetation. The flora includes tall grasses and live
 42 oaks (*Quercus virginiana*), mesquite (*Prosopis* spp.), prickly pear (*Opuntia* spp.), and other
 43 native vegetation. Where native vegetation has been displaced by agriculture, the principal
 44 crops are rice (*Oryza sativa*), grain sorghum (*Sorghum bicolor*), cotton (*Gossypium* spp.), and
 45 soybeans (*Glycine max*). Animal life includes quail (*Colinus virginianus*), whitetail deer
 46 (*Odocoileus virginianus*), doves (*Zenaida macroura*), cottontail rabbits (*Sylvilagus floridanus*),

1 armadillos (*Dasypus novemcinctus*), skunks (*Mephitis mephitis*), opossums (*Didelphis*
 2 *virginiana*), raccoons (*Procyon lotor*), and coyotes (*Canis latrans*). Of these species white-tailed
 3 deer and doves are highly sought after by hunters and are considered important species. Urban
 4 and industrial land uses have expanded greatly in recent decades, and oil and gas production is
 5 common (Griffith et al. 2004).

Table 9-8. Threatened or Endangered Terrestrial Species that May Occur within 10 mi of Coastal Site

Group	Common Name	Scientific Name	Federal Status ^a	State Status ^b
Reptiles	Texas scarlet snake	<i>Cemophora coccinea lineri</i>	-	T
Birds	Atwater's greater prairie chicken	<i>Tympanuchus cupido attwateri</i>	E	E
	Bald eagle	<i>Haliaeetus leucocephalus</i>	-	T
	Peregrine falcon	<i>Falco peregrinus</i>	-	T/E
	Piping plover	<i>Charadrius melodus</i>	T	T
	Interior least tern	<i>Sterna antillarum athalassos</i>	E	E
	Whooping crane	<i>Grus Americana</i>	E	E
Mammals	Jaguarundi	<i>Herpailurus yaguarondi</i>	E	E

^a Federal status: E = endangered; T = threatened.

^b State status: E = endangered; T = threatened.

Source TPWD 2009a.

6 The Western Gulf Coastal Plains is one of the most ecologically complex and biologically
 7 diverse regions of Texas. With nearly 500 recorded species of resident and migratory birds, it is
 8 one of the richest birding areas in North America (Griffith et al. 2004). Nearby protected areas
 9 of ecological value include the Guadalupe Delta Wildlife Management Area (WMA), Aransas
 10 National Wildlife Refuge (NWR), and Matagorda Island WMA. The Guadalupe Delta WMA is
 11 closest to the site at 7.5 mi to the southeast; Aransas NWR and Matagorda Island WMA are
 12 located 17 and 26 mi to the south, respectively. The Guadalupe delta area was identified by the
 13 USFWS and Texas Parks and Wildlife Department (TPWD) in the 1970s as a wetlands area
 14 that needed to be preserved to protect the wildlife habitat (Luminant 2007).

15 **Federally and State-Listed Species**

16 No site specific surveys have been conducted for threatened and endangered species at the
 17 Coastal site. The following list of threatened and endangered species that occur within 10 mi of
 18 the Coastal site was compiled from information on rare resource occurrences contained in the
 19 Texas Natural Diversity Database. The information was provided by Texas Parks and Wildlife
 20 Department (TPWD 2009a).

1 ***Building Impacts***

2 The proposed site is relatively level and relatively little grading would be required to prepare the
3 site for development. It is reported that development of the plant facilities would affect from 2000
4 to 2500 ac (Luminant 2007). The review team believes that the ultimate footprint of
5 development would be less than the 2000 ac reported. Most of the area is currently used for
6 cattle production and its value as undisturbed wildlife habitat is therefore limited.

7 New transmission lines on new ROWs would be required to connect the proposed units to an
8 existing 345-kV transmission line approximately 2 mi to the southeast (Luminant 2007). While
9 detailed information concerning the routing of new transmission lines is not known at this time,
10 the review team expects the right-of-way would cross grassland, forested areas, and wetlands
11 along Kuy Creek, Smith Bayou, and Elm Bayou. The required right-of-way would not come
12 closer than about 5 mi to the protected areas described above. Building new transmission lines
13 would be subject to additional environmental review. The new ROWs would be subjected to
14 site-specific investigations prior to development, possibly including, but not limited to,
15 reconnaissance to determine the presence or absence of Federally and state-listed species and
16 other important species and habitats defined in NUREG-1555 or as required by Federal or state
17 agency regulatory requirements.

18 Little to no grading would be required for the new transmission lines due to the level terrain.
19 Furthermore, the ability to relocate proposed transmission tower sites laterally along the ROW
20 means that towers could usually be sited to avoid environmentally sensitive areas such as those
21 that might contain small populations of special interest plants, waterbodies and waterways, and
22 wetlands.

23 Building the proposed facilities at the Coastal site would result in the permanent loss of mostly
24 agricultural land and grassland currently used as cattle range. Loss of terrestrial habitat and
25 habitat fragmentation would noticeably alter terrestrial resources. New power transmission lines
26 on new ROWs would result in additional alteration of habitat and possible fragmentation of
27 some of widely scattered remaining tracts of forest in the surrounding landscape. Other sources
28 of impacts to terrestrial resources at the site such as increased traffic, noise, and displacement
29 of wildlife would likely be temporary and/or result in minimal impact to the resource.

30 ***Operational Impacts***

31 Terrestrial ecological impacts that may result from operation of new nuclear units at the Coastal
32 site include those associated with cooling towers, transmission system structures, and
33 maintenance of transmission line ROWs (Luminant 2007).

34 Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be
35 evaluated in detail in the absence of information about the type (mechanical or natural draft),
36 number, and specific location of cooling towers at each alternative site. Similarly, bird collisions
37 with cooling towers cannot be evaluated in the absence of information about the type
38 (mechanical or natural draft for a wet cooling system; dry for a dry system) and number of
39 cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing
40 power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance
41 for nuclear power plants in general, including those with various numbers and types of cooling
42 towers. On this basis, the review team concludes, for the purpose of comparing the alternative
43 sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from
44 operation of new nuclear units would be minor.

45 For mechanical draft cooling towers, the anticipated noise level from cooling-tower operation is
46 anticipated to be approximately 55 dBA at 1000 ft (Luminant 2009a). This noise level is well

1 below the 80 to 85 dBA threshold at which birds and small mammals are startled or frightened
2 (Golden et al. 1980). Thus, noise from operating cooling towers at the Coastal site would not be
3 likely to disturb wildlife beyond 1000 ft from the source. The noise level for natural draft cooling
4 towers would be lower. Consequently, the review team concludes that the impacts of cooling-
5 tower noise on wildlife would be minimal.

6 The impacts associated with transmission-line corridor maintenance activities include alteration
7 of habitat due to cutting and herbicide application, as well as similar related impacts where
8 corridors cross floodplains and wetlands.

9 Impacts from bird collisions with transmission lines and the effects of electromagnetic fields
10 (EMFs) on flora and fauna are expected to be minimal. Transmission lines and associated
11 structures are recognized as a potential avian collision hazard. Bird collisions with transmission
12 lines are recognized as being of minor significance at operating nuclear power plants, including
13 transmission-line corridors with variable numbers of power lines (NRC 1996). Although
14 additional transmission lines would be required for new nuclear units at the Coastal site,
15 increases in bird collisions would be minor and would likely not be expected to cause a
16 measurable reduction in local bird populations. Consequently, the number of bird collisions
17 posed by the addition of new transmission lines is expected to be negligible.

18 EMFs are unlike other agents (e.g., toxic chemicals and ionizing radiation) that have an adverse
19 impact in that dramatic acute effects cannot be demonstrated and long-term effects, if they
20 exist, are subtle. A careful review of biological and physical studies of EMFs did not reveal
21 consistent evidence linking harmful effects with field exposures. The impacts of EMFs on
22 terrestrial flora and fauna are recognized as being of small significance at operating nuclear
23 power plants, including transmission systems with variable numbers of power lines (NRC 1996).
24 Therefore, the risk of EMF impacts of new transmission lines at the Coastal site would be
25 negligible.

26 New access roads would be required during the establishment of new transmission line ROW at
27 the Coastal site. Transmission line right-of-way management activities (such as cutting and
28 herbicide application) and related impacts to terrestrial habitats in transmission line ROWs are
29 of minor significance at operating nuclear power plants, including those with transmission line
30 ROWs of variable widths (NRC 1996). Consequently, the effects of transmission line right-of-
31 way maintenance and associated impacts to terrestrial habitats of new transmission line ROWs
32 units at the Coastal site would be negligible.

33 ***Cumulative Impacts***

34 For purposes of this cumulative analysis, the geographic area of interest is defined as Victoria
35 and Calhoun Counties. These counties encompass the Coastal site, anticipated transmission
36 line ROWs, and adjoining areas. This geographic area of interest is expected to encompass the
37 ecologically relevant landscape features and species. The impacts of building and operating
38 two nuclear units at the Coastal site were evaluated by the review team to determine their
39 contribution to cumulative impacts on terrestrial ecological resources. Activities related to
40 building include loss of habitat due to land clearing for the plant and transmission lines. Past
41 actions that have affected terrestrial resources include conversion of most natural terrestrial
42 habitat for land used in crop production and grazing, as well as rural residential development.
43 This agricultural and other development has displaced wildlife habitat and increased
44 fragmentation of remaining habitats. Highway projects such as the I-69 Trans-Texas Corridor,
45 and development of the proposed Victoria County Nuclear Station and ancillary facilities (Table
46 9-7), as well as possible future residential development, and increasing urbanization would

1 continue to consume and fragment the wildlife habitat that remains in this predominately
2 agricultural landscape.

3 The TSDC projects that the population in a seven-county area surrounding the Coastal site
4 (including Calhoun, DeWitt, Goliad, Jackson, Lavaca, Refugio, and Victoria Counties) will
5 increase by 10.7 percent by the year 2040 (TSDC 2009). Future urbanization in the review area
6 could contribute to decreases in grazing lands, cultivated lands, forests, and wetlands.
7 Urbanization in the vicinity of the Coastal site would reduce natural vegetation and open space,
8 resulting in an overall decline in the extent and connectivity of wetlands, forests, and wildlife
9 habitat. Despite the relatively low TSDC projection of population growth, development of a
10 nuclear power plant at the Coastal site, in combination the VCNS, CLNGT, and JPPP, could
11 substantially increase the projected level of urbanization.

12 The cumulative urbanization in the geographic area of interest could noticeably alter attributes
13 of land use by reducing wildlife habitat in localized areas. However, this would not be expected
14 to substantially affect the overall availability of wildlife habitat or wildlife migration corridors near
15 the Coastal site or the general extent of forests near the Coastal site.

16 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
17 summarizes the projected impacts of future climate changes in the United States (Karl et al.
18 2009). The report divides the United States into nine regions. The Coastal site is located in the
19 Southeast region. The GCRP climate models for this region project continued warming in all
20 seasons and an increase of approximately 4.5°F by the 2080s. Additionally, climate models
21 project that there will tend to be less rainfall in this area. The warming projected by the GCRP
22 for the Southeast could possibly alter the character of terrestrial habitats. This could further
23 stress terrestrial resources affected by the activities described above.

24 The potential cumulative impacts to terrestrial resources considering the two new reactors at the
25 Coastal site, and the proposed Victoria County Nuclear Station, in addition to the other activities
26 described above, would noticeably alter terrestrial resources. These activities would remove or
27 modify terrestrial habitats with the potential to affect important species living or migrating
28 through the area. For the reasons discussed above, the incremental contribution of building and
29 operating the two new reactors at the Coastal site to the cumulative impacts would be clearly
30 noticeable.

31 **Summary**

32 Impacts to terrestrial ecology resources were analyzed based on the information provided by
33 Luminant and the review team's independent review. Terrestrial resources in the areas that
34 would be temporarily disturbed if the Coastal site were to be developed would be expected to
35 return to predominantly pre-development conditions. However, habitat would be lost to
36 permanent project structures. Therefore, the review team concludes that the cumulative
37 impacts on terrestrial plants and wildlife, including threatened or endangered species, and
38 wildlife habitat would be noticeable in the surrounding landscape, and therefore MODERATE.
39 The incremental contribution of NRC-authorized activities would, be SMALL because of the
40 limited area affected by NRC-authorized construction activities. However, the incremental
41 contribution of the overall project would be noticeable.

42 **9.3.2.4 Aquatic and Wetlands Resources**

43 **Affected Environment**

44 The Coastal site is located near the Texas Gulf Coast in the southeastern portion of Victoria
45 County, west of Port Lavaca, south of Victoria, close to McFaddin, and near Green Lake. The
46 site is on private property that is a working cattle ranch and is located approximately 1.5 mi west

1 of the Guadalupe River. Approximately 65 ac of wetlands are present on the 2500-ac site
 2 (Luminant 2009a). As discussed in Section 9.3.2.2, there are several possible sources of water
 3 for the facility, including treated wastewater effluent from the City of San Antonio, water
 4 withdrawn from the nearby Victoria Barge Canal above the Lower Guadalupe Diversion Dam
 5 and Salt Water Barrier, or water withdrawn from the Calhoun Canal System, which is
 6 considered by Luminant the most likely water source. The Calhoun Canal System, managed by
 7 the Guadalupe Brazos River Authority, diverts water from the Guadalupe River above the Lower
 8 Guadalupe Diversion Dam and Salt Water Barrier (located near Tivoli about 10 mi upstream of
 9 the mouth of the Guadalupe River) and distributes it to industrial, municipal, and agricultural
 10 customers in Calhoun County through a series of irrigation canals, pump stations, and pipelines
 11 on the downstream side of the barrier (GBRA 2009). Thus, the ultimate source of cooling water
 12 for this site would be the Guadalupe River near Green Lake, and the Guadalupe River is the
 13 aquatic resource with the greatest potential to be affected by construction and operation of new
 14 reactor units at the Coastal site.

15
 16 The Guadalupe River flows approximately 370 mi southeast from Hunt, Texas to its mouth at
 17 San Antonio Bay. The Coastal site is adjacent to segment 1803 of the lower Guadalupe River,
 18 an approximately 170-mi reach below the confluence with the San Marcos River. In this reach,
 19 the Guadalupe River is a freshwater stream that flows with little turbulence through the flat
 20 coastal plain (GBRA 2008). The banks of this coastal reach of the Guadalupe River are lined by
 21 pecan bottoms, and the river itself is characterized by slow-moving flow and a silty substrate
 22 (GBRA 2008). The aquatic community of the Guadalupe River and associated canals in the
 23 vicinity of the site likely includes a variety of minnows and shiners, catfish, darters, and sunfish,
 24 such as the largemouth bass (*Micropterus salmoides*), Guadalupe bass (*M. treculii*), and green
 25 sunfish (*Lepomis cyanellus*) (Hassan-Williams and Bonner 2007). Downstream the river
 26 empties into Guadalupe Bay and San Antonio Bay. This estuarine system provides essential
 27 fish habitat (EFH) as defined by the National Marine Fisheries Service for at least one life stage
 28 of the following managed species: red drum (*Sciaenops ocellatus*), gray snapper (*Lutjanus*
 29 *griseus*), lane snapper (*Lutjanus synagris*), yellowtail snapper (*Ocyurus chrysurus*), Spanish
 30 mackerel (*Scomberomorus maculatus*), Gulf stone crab (*Menippe mercenaria*), brown shrimp
 31 (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), and white shrimp
 32 (*Litopenaeus setiferus*) (GMFMC 2004).

33
 34 **Important Species**

35 No Federally listed threatened or endangered aquatic species occur in Victoria County;
 36 however, five aquatic species State listed as threatened potentially occur in the county: Cagle's
 37 map turtle (*Graptemys caglei*), the black-spotted newt (*Notophthalmus meridionalis*), and three
 38 freshwater mussels, the golden orb (*Quadrula aurea*), Texas pimpleback (*Q. petrina*), and false
 39 spike mussel (*Quincuncina mitchelli*). Aquatic species with the potential to occur in Victoria
 40 County and with a State listing status or designation as a State species of concern are included
 41 in Table 9-9. Listed species are described below.

Table 9-9. State-listed Aquatic Species and State Species of Concern Potentially Occurring in the Vicinity of the Coastal Site

Scientific Name	Common Name	State Status ^a	County ^b
Reptile			
<i>Graptemys caglei</i>	Cagle's map turtle	ST	Victoria
Amphibian			
<i>Notophthalmus meridionalis</i>	black-spotted newt	ST	Victoria
Fish			
<i>Anguilla rostrata</i>	American eel	SSC	Victoria
Mussels			
<i>Quadrula aurea</i>	golden orb	ST	Victoria
<i>Quadrula petrina</i>	Texas pimpleback	ST	Victoria
<i>Quincuncina mitchelli</i>	false spike mussel	ST	Victoria
<i>Tritogonia verrucosa</i>	pistolgrip	SSC	Victoria
<i>Arcidens confragosus</i>	rock pocketbook	SSC	Victoria
<i>Strophitus undulates</i>	creeper (squawfoot)	SSC	Victoria
Insects			
<i>Asaphomyia texensis</i>	Texas asaphomyian tabanid fly	SSC	Victoria
<i>Tortopus circumfluus</i>	a mayfly	SSC	Victoria

^a State status definitions: ST = State-listed, threatened; SSC = State species of concern.

^b Counties listed are those in which components of the alternative would be located and where TPWD has identified the potential for occurrence of the species based on evidence such as recorded occurrences, historic ranges, field guides, staff expertise, and scientific publications.

Source: TPWD 2010a.

2 Cagle's map turtle is endemic to the Guadalupe River system of south-central Texas. Its
3 preferred habitat is short segments of shallow water with moderate to swift current and a
4 substrate of cobble or gravel connected by pools with deeper water, slower current, and a
5 substrate of mud or silt. Riffles are especially important as a source of insects on which they
6 feed. Eggs are laid in nests in gently sloping, sandy banks within about 30 ft of the water
7 (TPWD 2008b). Only about 7 percent of the overall population of Cagle's map turtle occurs in
8 the lower reach of the Guadalupe River, and the southern extent of the turtle's range in the
9 Guadalupe River is in the vicinity of Victoria (Killebrew et al. 2002), which is slightly upstream of
10 the Coastal site. Given the distribution of Cagle's map turtle in the Guadalupe River and the low
11 potential for riffle habitat to be present in the lower segment of the river, occurrence of this turtle
12 in the reach adjacent to the site is unlikely. If individuals of this species were to be present in
13 the area where the intake and/or discharge would be located, the potential for turtles to be
14 affected by their construction or operation likely would be minimal due to the turtle's mobility and
15 ability to avoid the area.

16 The black-spotted newt is an aquatic amphibian that feeds on invertebrates, inhabits wet or
17 sometimes wet areas, such as canals, ditches, or depressions, and can aestivate underground

1 during dry periods. Its range in Texas is within the Gulf Coastal Plain south of the San Antonio
2 River (TPWD 2010a). The Coastal site would be located slightly north of the northern end of
3 this current known range of the black-spotted newt; consequently, its occurrence in potentially
4 affected habitats is unlikely.

5 The golden orb inhabits substrates of gravel, sand, or mud in rivers in the Guadalupe, San
6 Antonio, and Nueces River basins; it typically is intolerant of impoundments (TPWD 2010a); it
7 has not been recorded in the lower Guadalupe River in decades (Howells 2002). The false
8 spike mussel, which possibly has been extirpated in Texas, probably occurred in medium to
9 large rivers (including the Guadalupe, Brazos, Colorado, and Rio Grande River basins) and
10 utilized substrates ranging from mud to mixtures of sand, gravel, and cobble. The Texas
11 pimpleback inhabits substrates of mud, sand, and gravel usually in areas of slow current in
12 medium-size streams and rivers of the Colorado and Guadalupe River basins (TPWD 2010a),
13 though it is no longer known to survive in the Guadalupe River system (Howells 2002).

14 ***Building Impacts***

15 The review team believes that the footprint of development on the site would be less than 2000
16 ac; most of the site is currently used for cattle grazing. The approximately 65 ac of wetlands on
17 the site likely would not be affected directly by building the proposed facility but could be
18 affected by building pipelines for cooling water access and transmission lines and their access
19 roads (Luminant 2007).

20 New pipelines on new ROWs would be required to carry water from the source to the proposed
21 facility and from the facility to the discharge structure. New transmission lines on new ROWs
22 would be required to connect the proposed facility to an existing 345-kV transmission line
23 approximately 2 mi to the southeast (Luminant 2007). The review team assumed that during
24 the building of new transmission line and pipeline ROWs, new access roads also would be
25 required. While detailed information concerning the routing of possible new transmission line
26 ROWs is not available at this time, ROWs could cross wetlands along Kuy Creek, Smith Bayou,
27 and Elm Bayou. Construction of any new transmission lines and pipelines would be subject to
28 additional environmental review. The new ROW would be subjected to site-specific pre-
29 development investigations, possibly including, but not limited to, reconnaissance to ascertain
30 the presence or absence of Federally and State-listed species and other important species and
31 habitats defined in NUREG-1555 or as required by Federal or State agency regulatory
32 requirements. Little to no grading would be required for the new transmission lines due to the
33 level terrain. Further, the ability to relocate proposed transmission tower sites laterally along the
34 ROW means that towers could usually be sited to avoid environmentally sensitive areas such as
35 waterbodies and wetlands.

36 TCEQ requires stormwater permits for construction sites of 1 ac or more; obtaining a permit
37 requires development and implementation of a stormwater pollution prevention plan (SWPPP)
38 specifying the best management practices (BMPs) to be used in protecting water bodies (TCEQ
39 2008). Compliance with permitting requirements and associated use of BMPs to minimize or
40 prevent stormwater impacts is expected to minimize erosion-related impacts on surface waters
41 and wetlands. BMPs that likely would be implemented under an SWPPP include the installation
42 and maintenance of silt fencing, the maintenance of vegetated buffer zones between
43 waterbodies and areas undergoing development, and the diversion of runoff to sediment
44 retention basins.

45 The aquatic impacts from construction of the proposed type of closed-cycle cooling system at
46 this site likely would be similar to the impacts of such systems at other sites and would be of
47 minor significance, involving localized and mostly temporary effects of building intake and

1 discharge structures near the shoreline. Except for water intakes, discharge structures, and
2 pipelines, there would be no construction within 100-yr or 500-yr floodplains. Facility
3 construction activities would not cause substantial changes in surface water quality, hydrology,
4 or aquatic communities. Aquatic species would be unlikely to be substantially affected by the
5 loss of small areas of aquatic or wetland habitat potentially within the footprint of facilities that
6 would be built for the project. Threatened species of mussels would not be expected to occur in
7 the potentially affected habitats, and the mobility of Cagle's map turtle and the black-spotted
8 newt likely would allow them to avoid the construction activities even if they were present in the
9 area. Thus, construction of water intakes and discharge structures likely would have minor
10 impacts on aquatic resources during the construction period, with the specific effects being
11 dependent on the extent of required dredging and the waterbody affected.

12 ***Operational Impacts***

13 Operational impacts on aquatic and wetlands ecology that may result from new nuclear units at
14 the Coastal site include entrainment and impingement of organisms due to the cooling water
15 intakes; thermal, chemical, and physical effects from the discharge of cooling water and other
16 effluents; impacts related to operation/maintenance of transmission line and pipeline ROWs;
17 and impacts from increased water use, such as higher salinities downstream. In the immediate
18 vicinity of the site, the increased impervious surface resulting from buildings and paving could
19 increase runoff and cause greater storm flows in nearby streams, rivers, and wetlands. Nearby
20 water bodies and wetlands also could be affected by salt deposition from cooling tower drift,
21 which may increase salinities and alter the aquatic communities of the affected habitats. A
22 detailed evaluation of impacts resulting from operation of the intake and discharge and
23 maintenance of the ROWs could be conducted due to lack of specific survey information that
24 would have to be developed (i.e., more than reconnaissance-level information), such as the
25 design and location of cooling water intakes and discharges at this site, and the numbers and
26 locations of new ROWs that could be required. Consequently, the NRC review team relies upon
27 the conclusions in the Generic Environmental Impact Statement for License Renewal of Nuclear
28 Plants (GEIS), NUREG-1437 (NRC 1996) to inform the assessment of aquatic impacts from the
29 operation of the cooling system and maintenance of transmission line ROWs. Additionally,
30 designated EFH could be adversely affected as a result of these operational impacts if salinities
31 in downstream estuaries are increased.

32 NUREG-1437 (NRC 1996) evaluated aquatic ecological impacts resulting from operation of
33 existing nuclear power plants. In evaluating this alternative site, the review team assumed that
34 a new nuclear power plant would utilize a cooling system similar to that proposed at the CPNPP
35 site, consisting of a closed-cycle system with cooling towers. Consequently, the types of
36 aquatic ecological impacts that would result from operation of the new nuclear units would be
37 similar to those of existing nuclear power plants that have closed-cycle cooling systems with
38 cooling towers. For impacts resulting from ROW maintenance, the review team assumed that
39 construction of the proposed project at the Coastal greenfield site would require new
40 transmission line and pipeline ROWs. However, operation and maintenance of the new ROWs
41 after they are built would be the same as for existing ROWs elsewhere. Given these
42 assumptions, conclusions in NUREG-1437 (NRC 1996) were considered to be appropriate to
43 inform the review team's assessment of impacts resulting from transmission line ROW
44 maintenance.

45 The aquatic impacts from operation of cooling systems for existing power plants were evaluated
46 in NUREG-1437 (NRC 1996) and found to be of minor significance for all plants that utilize
47 closed-cycle cooling systems with cooling towers. With regard to cooling water intakes, NRC
48 staff found that entrainment and impingement of fish and shellfish have not been a problem at

1 existing facilities that use closed-cycle systems with cooling towers. Minimal impacts from
2 intake operation would be expected if it is assumed the following conditions would apply at this
3 site in accordance with EPA's Phase I regulations for new facilities under Section 316(b) of the
4 CWA (66 FR 65256): (1) a closed-cycle cooling system, (2) a maximum through-screen velocity
5 of 0.5 ft/s at the cooling water intake, (3) an intake flow that would be less than or equal to
6 5 percent of the mean annual flow of the Guadalupe River at the Coastal site, and (4) location of
7 the new intake in an area of the source waterbody away from areas with the potential for high
8 productivity of fish or other important organisms (66 FR 65256). With regard to effluent
9 discharges from facilities with closed-cycle cooling systems, NRC found that the thermal and
10 water-quality effects from the relatively small volumes of blowdown water discharged did not
11 have more than minor impacts on the aquatic ecology of the receiving waterbody (NRC 1996).
12 Likewise, although specific survey information is not available to prepare a detailed EFH
13 assessment, the adverse impacts on EFH are not likely to be noticeable assuming that the
14 intake and discharge designs would be similar to those proposed for the CPNPP site.

15 Operation of the intake for the Coastal site could have minimal to noticeable impacts on surface
16 water quality due to the possible need for periodic maintenance dredging at intakes. The limited
17 dimensions of the canals in the Calhoun Canal System make it likely that substantial dredging
18 and other modifications would be needed to maintain the operation of a water intake in the canal
19 system. The Guadalupe River and Victoria Barge Canal appear to have adequate dimensions
20 to provide suitable water intake sites. Effluent discharge would be directed to either the Victoria
21 Barge Canal or Guadalupe River, with the barge canal considered more likely. Moderately high
22 salinity in the intake water would likely constrain the discharge of cooling water and would
23 increase the potential for cooling tower drift to increase salinities in downwind wetlands or water
24 bodies. Increased water use by a nuclear power facility at the Coastal site may contribute to
25 regional water shortages over the long term and increased salinity in estuarine habitats
26 downstream due to lower freshwater inflows. This could adversely affect EFH for at least nine
27 species that utilize San Antonio bay at various life stages; depending on the locations of the
28 intake and discharge and on the dredging activities, such adverse impacts on EFH could range
29 from minor to noticeable.

30 The potential for impacts to aquatic ecosystems from transmission line and pipeline ROW
31 maintenance activities mainly are associated with the possibility of soil disturbance leading to
32 erosion and sedimentation impacts in adjacent aquatic habitats, and the possibility of herbicides
33 used to control terrestrial vegetation running off into waterbodies crossed by ROWs.
34 Transmission line ROW management activities (vegetation cutting and herbicide application)
35 and related impacts to wetlands, floodplains, and associated waterbodies in transmission line
36 ROWs have been found to be of no more than minor significance at operating nuclear power
37 plants (NRC 1996). Assuming standard best management practices (BMPs) are followed as
38 described in Section 5.3, the effects of these activities are expected to be similarly minor at the
39 Coastal site with the potential exception of adverse impacts on EFH.

40 As discussed above, five aquatic species that are State listed as threatened have recorded
41 occurrences in Victoria County, in which the cooling water intake and discharge and the
42 transmission lines and pipelines would be located. Based on their ranges and habitats, these
43 species are unlikely to occur in the areas where the intake, discharge, and ROWs potentially
44 could be located. However, even the low rates of entrainment and impingement at the intake for
45 a closed-cycle cooling system and the relatively small volumes of effluent discharged could be a
46 concern if an unusually important aquatic resource such as a threatened species would be
47 affected (NRC 1996). It is unlikely that such species or their habitats would be noticeably
48 affected by the relatively small volumes of water withdrawn and discharged by the closed-cycle
49 cooling system proposed for the Coastal site (NRC 1996). However, if individuals of these

1 species were to occur in these areas, then they could be adversely affected by the operation of
2 the intake (such as from impingement of newts or turtle hatchlings, reduced water levels, or
3 changes in flow) or discharge (such as from physical alteration of habitat or increased water
4 temperatures) or by maintenance dredging. Given the assumption that BMPs would be
5 followed, these State-listed species would be unlikely to be affected by operation of
6 transmission lines and pipelines and the maintenance of their ROWs.

7 Thus, the potential for operation of two new reactor units at the Coastal site to adversely affect
8 aquatic resources, including threatened or endangered species, is expected to range from
9 minimal to noticeable depending on the intake, discharge, and ROW locations and whether
10 threatened or endangered species are present.

11 **Cumulative Impacts**

12 The impacts of building and operating two nuclear units at the Coastal site were evaluated by
13 the review team to determine the magnitude of their contribution to cumulative impacts on
14 aquatic and wetlands resources in the geographic area of interest. The area of interest includes
15 the site; adjacent water bodies in the vicinity, including Guadalupe River, Victoria Barge Canal,
16 and Calhoun Canal System; and the Guadalupe River downstream to Guadalupe Bay. Past
17 actions that have affected aquatic resources in the area include water use for agricultural,
18 industrial, commercial, and residential development; contribution by these land uses to
19 increased stormwater runoff carrying sediment, chemicals, and nutrients to water bodies and
20 wetlands; and discharge of sewage and other effluents. Possible future actions that could affect
21 aquatic resources in the geographic area of interest include development of the proposed
22 Victoria County Nuclear Station (VCNS) within 5 mi northwest of the Coastal site, associated
23 facilities, and construction of water and/or wastewater treatment and distribution facilities in
24 conjunction with future residential and commercial development (Table 9-7).

25 The TSDC projects that the population in a seven-county area surrounding the Coastal site
26 (including Calhoun, DeWitt, Goliad, Jackson, Lavaca, Refugio, and Victoria Counties) will
27 increase by 10.7 percent by the year 2040 (TSDC 2009). Future urbanization in the geographic
28 area of interest could contribute to decreases in undeveloped land, including wetlands, as well
29 as increased demand for water and reduced water quality. These impacts also would result
30 from the development of a nuclear power plant at the Coastal site in combination with the
31 proposed VCNS. The potential cumulative impacts on aquatic resources from the two new
32 reactors proposed for the Coastal site in addition to the proposed Victoria County Nuclear
33 Station nearby and the other development activities described above would be likely to
34 noticeably alter aquatic and wetlands resources in the geographic area of interest. Increased
35 use of freshwater by these facilities and activities likely would reduce freshwater input to the
36 downstream estuaries of Guadalupe and San Antonio Bays, resulting in increased salinities in
37 the estuaries. A noticeable increase in salinity could adversely affect EFH for at least nine
38 managed species of fish and shellfish (GMFMC 2004) and habitat for estuarine species such as
39 the opossum pipefish (*Microphis brachyurus*), which is State-listed as threatened, and the
40 American eel (*Anguilla rostrata*), a State species of concern (TPWD 2009b). Changes in
41 estuarine salinities could affect ecological communities in the bay area, including those in
42 sensitive areas such as Guadalupe Delta Wildlife Management Area, Matagorda Island WMA,
43 and Aransas National Wildlife Refuge.

44 In addition to direct effects from anthropogenic activities, global climate change (GCC) could
45 affect aquatic communities. The report *Global Climate Change Impacts in the United States*
46 (Karl et al. 2009), from the GCRP, summarizes the projected impacts of future climate changes
47 in the United States. The report divides the United States into nine regions, and the Coastal site
48 is located in the southwestern part of the Southeast region and is also in the Coastal region.

1 The GCRP climate models for this region project continued warming in all seasons and an
2 increase of approximately 4.5°F by the 2080s. Additionally, climate models project that there
3 will tend to be less rainfall in this area. The warming projected for the Southeast region could
4 result in decreased water availability due to increased temperatures and longer periods between
5 rainfall events, which would affect the region's aquatic ecosystems. In addition, the GCRP
6 projects increases in sea level, storm surges, coastal storm intensity, and increased nonpoint
7 source pollution from runoff during such storms in the geographic area of interest, resulting in
8 inundation and loss of coastal wetlands and other low-lying areas.

9 Such changes could alter salinity, change freshwater inflow, and reduce dissolved oxygen,
10 which could directly affect aquatic habitat in the Guadalupe River and San Antonio Bay. Rising
11 sea levels due to GCC could alter water levels in the lower Guadalupe River and San Antonio
12 Bay and affect the mixing of freshwater and estuarine waters (Montagna et al. 1995; Nielsen-
13 Gammon 1995; Karl et al. 2009). The effects of rising sea level likely would add to the effects of
14 increased use of freshwater upstream in increasing estuarine salinities. Changes in water
15 quality downstream of the Coastal site could create areas that are hypoxic (low in dissolved
16 oxygen) and lead to further stress on aquatic communities (Montagna et al. 1995). These
17 stressors would result in shifts in species ranges, habitats, and migratory behaviors and also
18 alter ecosystem processes (Karl et al. 2009).

19 **Summary**

20 Cumulative impacts on aquatic and wetlands resources were estimated based on the
21 information provided by Luminant and the review team's independent evaluation. Past, present,
22 and future activities in the geographic area of interest could contribute to cumulative effects.
23 Future development of industries that compete for water in the region as well as the
24 management of water budgets across the South Central Texas Regional Water Planning Area
25 by the Guadalupe-Blanco River Authority (GBRA) likely would affect aquatic resources in the
26 lower Guadalupe River. The building and maintenance of transmission line and pipeline ROWs
27 for the proposed new nuclear units at the Coastal site would have minimal effects on aquatic
28 species in the area and would be a minor contribution to cumulative impacts on aquatic
29 communities from other projects in the geographic area of interest. Direct and indirect
30 anthropogenic and natural environmental stressors, including other energy projects, in the
31 geographic area of interest would cumulatively affect aquatic communities and may noticeably
32 alter important attributes, such as species diversity, abundance, and distributions; habitat
33 availability, and ecosystem processes.

34 The review team concludes that the impacts on aquatic resources from building two new
35 nuclear units at the Coastal site would be noticeable but not destabilizing to aquatic and
36 wetlands resources. Based on the information provided by Luminant and the review team's
37 independent evaluation, the review team concludes that the cumulative impacts from past,
38 present, and reasonably foreseeable future activities to aquatic and wetlands resources in the
39 geographic area of interest would be MODERATE. The incremental contribution of building and
40 operating two new reactors at the Coastal site to cumulative impacts on aquatic and wetlands
41 resources in the geographic area of interest would range from minimal to noticeable.

42 **9.3.2.5 Socioeconomics**

43 The following impact analysis includes impacts from building activities and operations. The
44 analysis also considers other past, present, and reasonably foreseeable future actions that
45 impact socioeconomics, including the other Federal and non-Federal projects listed in
46 Table 9-8. For the analysis of socioeconomic impacts at the Coastal site, the geographic area
47 of interest is the 12-county area around the Coastal site (Table 9-10) that was evaluated in

1 *Luminant Nuclear Power Plant Siting Report* (Luminant 2007). In evaluating the socioeconomic
 2 impacts of site development and operation at the Coastal site, the review team used the
 3 population and labor force data provided in *Luminant Nuclear Power Plant Siting Report*
 4 (Luminant 2007).

5 The Coastal site is located in Victoria County, Texas, approximately 7 mi east of U.S. Highway
 6 77, 17 mi south of the city of Victoria, and 5 mi east of the unincorporated community of
 7 McFaddin. Section 9.3.2.1 contains a description of the Coastal site.

Table 9-10. Population and Labor Force in Victoria County, Texas, and the Other Counties Surrounding the Coastal Site

County	Total population 2006	Projected total population 2010	Total labor force 2000	Total construction labor force 2000
Victoria	85,648	87,280	38,464	3311
Calhoun	20,606	20,560	8246	1246
Jackson	14,339	14,280	6034	474
Lavaca	18,925	18,640	8677	763
De Witt	20,507	21,020	7893	629
Goliad	7102	7280	2949	357
Wharton	41,475	41,641	17,563	1816
Nueces	321,457	326,600	131,718	16,484
Refugio	7639	7460	3239	272
Bee	32,873	33,400	9944	690
Aransas	24,831	26,544	8578	1468
San Patricio	69,209	71,350	24,212	2578
Total	649,932	676,055	267,787	30,088

Source: Luminant 2007.

8 As indicated in Table 9-10, Victoria County and the 11 other counties surrounding the Coastal
 9 site have a combined 2010 population of 676,055, a combined 2000 labor force of 267,787, and
 10 a combined 2000 construction labor force of 30,088. Thus, the Coastal site has a relatively
 11 smaller labor pool from which to draw construction and operations, which would result in more
 12 in-migrating workers. More in-migrating workers would result in larger socioeconomic impacts,
 13 especially to housing and public services.

14 The review team concludes that building and operating a new two-unit nuclear power plant at
 15 the Coastal site would have MODERATE to LARGE socioeconomic impacts in Victoria County
 16 and the surrounding counties for three reasons. First, the Coastal site is a greenfield site and
 17 significant road, rail, and infrastructure development would be required in the surrounding area
 18 to access and use it. Second, the Coastal site has a relatively small labor force from which to
 19 draw construction and operations workers, so large numbers of workers would need to in-
 20 migrate. Third, the Coastal site is in a rural area that likely would not have the existing housing,
 21 infrastructure, and public services to support the in-migration of a large number of workers and
 22 their families.

23 9.3.2.6 Environmental Justice

24 The following impact analysis includes impacts from building activities and operations. The
 25 analysis also considers other past, present, and reasonably foreseeable future actions that

1 impact socioeconomics, including the other Federal and non-Federal projects listed in
2 Table 9-8. For the analysis of environmental justice impacts at the Coastal site, the geographic
3 area of interest is the 12-county area around the Coastal site (Table 9-11) that was evaluated in
4 *Luminant Nuclear Power Plant Siting Report* (Luminant 2007). In evaluating the environmental
5 justice impacts of site development and operation at the Coastal site, the review team used the
6 minority and low-income data provided in *Luminant Nuclear Power Plant Siting Report*
7 (Luminant 2007).

8 As indicated in Table 9-11, Victoria County and the 11 other counties surrounding the Coastal
9 site have a combined minority percentage of 44.4 percent. This percentage of minority
10 residents is much lower than that for the State of Texas (61.1 percent) (Table 2-27). Thus,
11 when compared to the State of Texas, the Coastal site has a relatively small minority
12 percentage for purposes of environmental justice analysis.

13 In terms of low-income residents, the 12 counties surrounding the Coastal site have a combined
14 low-income percentage of 17.1 percent. This percentage of low-income residents is slightly
15 higher than that for the State of Texas (14.0 percent) (Table 2-27). However, when compared
16 to the State of Texas, the Coastal site does not have a significantly higher low-income
17 percentage for purposes of environmental justice analysis.

18 In Section 9.3.2.5, the review team concluded that building and operating a new two-unit
19 nuclear power plant at the Coastal site would have MODERATE to LARGE socioeconomic
20 impacts in Victoria County and the surrounding counties. Based on that conclusion, the review
21 team concludes that the socioeconomic impacts of building and operating at the Coastal site
22 could have MODERATE environmental justice impacts by disproportionately and adversely
23 affecting low-income populations, especially in the area of housing price and availability.

24 As indicated in Table 9-11, Victoria County and the 11 other counties surrounding the Coastal
25 site have a combined minority percentage of 44.4 percent. This percentage of minority
26 residents is much lower than that for the State of Texas (61.1 percent) (Table 2-27). Thus,
27 when compared to the State of Texas, the Coastal site has a relatively small minority
28 percentage for purposes of environmental justice analysis.

29 In terms of low-income residents, the 12 counties surrounding the Coastal site have a combined
30 low-income percentage of 17.1 percent. This percentage of low-income residents is slightly
31 higher than that for the State of Texas (14.0 percent) (Table 2-27). However, when compared
32 to the State of Texas, the Coastal site does not have a significantly higher low-income
33 percentage for purposes of environmental justice analysis.

34 In Section 9.3.2.5, the review team concluded that building and operating a new two-unit
35 nuclear power plant at the Coastal site would have MODERATE to LARGE socioeconomic
36 impacts in Victoria County and the surrounding counties. Based on that conclusion, the review
37 team concludes that the socioeconomic impacts of building and operating at the Coastal site
38 could have MODERATE environmental justice impacts by disproportionately and adversely
39 affecting low-income populations, especially in the area of housing price and availability.

1

Table 9-11. Minority and Low-income Percentages in Victoria County, Texas, and the Other Counties Surrounding the Coastal Site

County	Total population 2006	Percent Non-minority ^a	Percent minority ^b	Percent low-income
Victoria	85,648	51.1	48.9	15.5
Calhoun	20,606	49.4	50.6	16.3
Jackson	14,339	64.9	35.1	14.1
Lavaca	18,925	79.0	21.0	13.3
De Witt	20,507	59.8	40.2	19.0
Goliad	7102	58.7	41.3	15.2
Wharton	41,475	49.5	50.5	15.7
Nueces	321,457	34.7	65.3	19.1
Refugio	7639	47.9	52.1	15.9
Bee	32,873	55.7	44.3	24.6
Aransas	24,831	72.0	28.0	18.2
San Patricio	69,209	44.2	55.8	17.9
Total	649,932	55.6	44.4	17.1

^a Non-minority = White persons, not Hispanic.

^b Minority = Black persons, American Indian and Alaska Native persons, Asian persons, Native Hawaiian and Other Pacific Islander persons, and Hispanic persons.

Sources: Luminant 2007; USCB 2009a.

2 9.3.2.7 Historic and Cultural Resources

3 The following impact analysis includes impacts from building and operating two new nuclear
4 power plants at the Coastal site. The analysis also considers other past, present, and
5 reasonably foreseeable future actions that impact historic and cultural resources, including
6 Federal and non-Federal projects listed in Table 9-7. For the analysis of historic and cultural
7 impacts at the Coastal site, the geographic area of interest is considered to be the APE that
8 would be defined for this proposed undertaking. This includes the physical APE, defined as the
9 area directly affected by the site-development and operation activities at the site and
10 transmission lines, and the visual APE. The visual APE is defined as the additional 1-mi radius
11 around the physical APE as a reasonable assumption for defining a maximum distance from
12 which the structures can be seen.

13 Reconnaissance activities in a cultural resource review have a particular meaning. For
14 example, these activities include preliminary field investigations to confirm the presence or
15 absence of cultural resources. However, in developing its EIS, the review team relies upon
16 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-
17 level information is data that are readily available from agencies and other public sources. It
18 can also include information obtained through visits to the site area. To identify the historic and
19 cultural resources at the Coastal site the following information was used:

- 20 • Luminant ER (Luminant 2009a);
- 21 • Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4, Luminant Nuclear Power
22 Plant Siting Report (Luminant 2007)
- 23 • Texas Historical Commission's Texas Archaeological Sites Atlas (THC 2010); and,

- 1 • NRC Alternative Sites Visit, February 2009.

2 The Coastal site is a “greenfield” site located in Victoria County in southeastern Texas on the
3 Coastal Plain. Historically, the site has been used for agricultural purposes. The current major
4 industries in Victoria County are oil and agriculture.

5 The siting report provided by Luminant indicated that there were 50 properties listed in the
6 National Register of Historic Places (NRHP) located in Victoria County, Texas (Luminant 2007).
7 These sites, except for one NRHP eligible archaeological site (location is undisclosed), are
8 located in the City of Victoria, 16 mi north of the site. Additionally, artifacts from the Paleo-
9 Indian period and paleontological resources have been recorded in Victoria County.

10 According to the Texas Historical Commission’s Texas Archaeological Sites Atlas, there are no
11 National Register Properties or National Register Districts located within the APE (THC 2010).
12 There are, however, two recorded Texas Historical Landmarks and one undesignated site
13 located nearby in the city of McFaddin. The project has the potential to affect resources through
14 visual impacts from buildings and transmission lines. Should such properties be subsequently
15 listed on the National Register, then these impacts may result in significant alterations to the
16 visual landscape within the geographic area of interest.

17 Historic and cultural resource impacts for a new plant located at the Coastal site would likely be
18 similar to the impacts for a new plant at the CPNPP site as discussed in Sections 4.6 and 5.6.
19 A cultural resources inventory would likely be needed for any portion of the property that has not
20 been previously surveyed at the Coastal site. Other lands that may be acquired to support the
21 plant would also likely require a survey to identify potential historic and archaeological
22 resources, and identification of mitigative measures to offset adverse effects of ground
23 disturbing activities. These studies would likely be needed for areas of potential disturbance at
24 the Coastal site, offsite affected areas, such as mining and waste disposal sites, and along
25 associated corridors where new construction would occur, for example, roads and pipeline
26 corridors. The types of historic and cultural resource impacts resulting from operation of new
27 nuclear units would likely be similar to those of existing nuclear power plants.

28 There are no existing transmission corridors connecting directly to the Coastal site (Luminant
29 2007). However, there is a 345-kV transmission line located approximately 2-mi southeast of
30 the site. A new transmission line corridor would be needed to connect the Coastal site to this
31 line. There are no listed NRHP or known historic or prehistoric sites in the area where the
32 transmission line would be routed. In the event that the Coastal site was chosen for the
33 proposed project, the review team assumes that the transmission service provider for this region
34 would conduct its transmission line related cultural resource surveys and procedures similar to
35 those performed by Oncor for the CPNPP site in section 4.6 of this EIS. In addition, visual
36 impacts from transmission lines may result in significant alterations to the visual landscape
37 within the geographic area of interest.

38 One project listed in Table 9-7 has the potential to contribute to cumulative impacts to historic
39 and cultural resources. The Victoria County Nuclear Station Early Site Permit project is located
40 approximately 5 mi from the coastal site and would have impacts similar to those associated
41 with building and operating new nuclear units at the Coastal site. Additionally, the Texas State
42 Data Center predicts the average population growth rate will be 10.7 percent from 2010 to 2040
43 for the 7 counties surround the coastal site (TSDC 2009). The seven counties included
44 Calhoun, DeWitt, Goliad, Jackson, Lavaca, Refugio, and Victoria counties. The average
45 population growth rate could result in an increase in urbanization in the area. Urbanization
46 includes increases in residential, commercial, industrial, and infrastructure development that
47 could encroach on historic cultural resources near the geographic area of interest.

1 Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources
2 is cumulative. Based on the reconnaissance level information the review team concludes that
3 the cumulative impacts on historic and cultural resources of building and operating new nuclear
4 units on the Coastal site and from other projects and urbanization would be SMALL. This
5 impact level determination reflects no known cultural resources that could be affected. However,
6 if the Coastal site were to be developed, cultural resource surveys could reveal important
7 historic and archaeological resources that might result in greater cumulative impacts.

8 **9.3.2.8 Air Quality**

9 The following impact analysis includes impacts from building activities and operations. The
10 analysis also considers other past, present, and reasonably foreseeable future actions that
11 impact air quality, including other federal and non-Federal projects listed in Table 9-7. The
12 geographic area of interest for the Coastal site is Victoria County.

13 The emissions related to building and operating a nuclear power plant at the Coastal site
14 alternative would be similar to those associated with the proposed location at CPNPP. The air
15 quality attainment status for Victoria County as set forth in 40 CFR 81.344 reflects the effects of
16 past and present emissions from all pollutant sources in the region. Victoria County is
17 designated by the TCEQ as a "Near Non-Attainment Area" for ozone (TCEQ 2009). Victoria
18 County has previously been designated as non-attainment for ozone, and is subject to an Eight-
19 Hour Ozone Maintenance Plan adopted in March 2007 (TCEQ 2007).

20 The atmospheric emissions related to building and operating a nuclear power plant at the
21 CPNPP site in Somervell County, Texas, are described in Chapters 4 and 5. The criteria
22 pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of the
23 criteria pollutants at the CPNPP site were evaluated and also determined to be SMALL.

24 Reflecting on the specific industrial projects listed in Table 9-7, the most significant are the Early
25 Site Permit application for the proposed Victoria County Nuclear Station, the Calhoun Liquefied
26 Natural Gas Terminal, and the E.S. Joslin Power Plant. Other industrial projects listed in
27 Table 9-7 would have *de minimis* impacts. Although these projects would be subject to
28 institutional controls, Victoria County is already designated as a Near Non-Attainment Area for
29 ozone due to the combined effect of industrial projects and other general air emission sources.

30 The air quality impact of the Coastal site development would be local and temporary. The
31 distance from building activities to the site boundary would be sufficient to generally avoid
32 significant air quality impacts. Although the Coastal site development and the specific industrial
33 projects listed in Table 9-7 would be subject to institutional controls, the current designation of
34 Victoria County as a Near Non-Attainment Area for ozone suggests that site development, in
35 combination with other air emissions sources, could potentially result in degradation of air
36 quality within the region.

37 Releases from operation of two units at the Coastal site would be intermittent and made at low
38 levels with little or no vertical velocity. The air quality impacts of other general emissions
39 sources in the area are included in the baseline air quality status. The cumulative impacts from
40 emissions from the Coastal site and the aforementioned sources could be noticeable but not
41 destabilizing. Should the Coastal site be developed, additional air permits, a conformity review,
42 and more stringent emissions limits would likely be required for operations.

43 The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in
44 Section 7.5. The impacts of the emissions are not sensitive to location of the source.
45 Consequently, the discussion in Section 7.5 is applicable to a nuclear power plant located at the
46 Coastal site. The review team concludes that the national and worldwide cumulative impacts of

1 greenhouse gas emissions are noticeable but not destabilizing. The review team further
2 concludes that the cumulative impacts would be noticeable but not destabilizing, with or without
3 the greenhouse gas emissions of the project at the Coastal site.

4 Cumulative impacts to air quality resources are estimated based on the information provided by
5 Luminant and the review team's independent evaluation. Other past, present and reasonably
6 foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants
7 and global for greenhouse gas emissions) that could affect air quality resources. The
8 cumulative impacts on criteria pollutants from emissions of effluents from the Coastal site and
9 other projects could be noticeable but not destabilizing, principally as a result of the existing
10 emissions sources that have resulted in designation of Victoria County as a Near Non-
11 Attainment Area for ozone. The national and worldwide cumulative impacts of greenhouse gas
12 emissions are noticeable but not destabilizing. The review team concludes that the cumulative
13 impacts would be noticeable but not destabilizing, with or without the greenhouse gas emissions
14 from the Coastal site. The review team concludes that cumulative impacts from other past,
15 present, and reasonably foreseeable future actions on air quality resources in the geographic
16 areas of interest would be MODERATE for criteria pollutants and MODERATE for greenhouse
17 gas emissions. The incremental contribution of impacts on air quality resources from building
18 and operating two units at the Coastal site would be insignificant for both criteria pollutants and
19 greenhouse gas emissions.

20 **9.3.2.9 Nonradiological Health Impacts**

21 The following impact analysis includes impacts from building activities and operations. The
22 analysis also considers other past, present, and reasonably foreseeable future actions that
23 impact nonradiological health, including other Federal and non-Federal projects listed in Table
24 9-7. This section covers the review team's evaluation of the potential environmental impacts of
25 siting a new two-unit nuclear power plant at the Coastal site in Victoria County, Texas. The
26 Coastal site is a greenfield site not currently owned by the Applicant. Additionally, the Coastal
27 site would not require the use of a BDTF to treat blowdown water discharges.

28 For the analysis of nonradiological health impacts at the Coastal alternative site, the geographic
29 area of interest is considered to include projects within a 5-mi radius from the site's center
30 based on the localized nature of the impacts. For impacts associated with transmission lines,
31 the geographic area of interest in the transmission line corridor.

32 The building activities that have the potential to impact the health of members of the public and
33 workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the
34 transport of construction materials and personnel to and from the sites. The operation-related
35 activities that have the potential to impact the health of members of the public and workers
36 includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers
37 to and from the site.

38 ***Building Impacts***

39 Nonradiological health impacts to construction workers and members of the public from building
40 two nuclear units at the Coastal site would be similar to those evaluated in Section 4.8 for the
41 CPNPP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and
42 transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air
43 quality and noise would be complied with during the site preparations and building phase. The
44 incidence of construction worker accidents would not be expected to be significantly different
45 from the incidence of accidents estimated for the CPNPP site. Some modifications to the
46 transportation routes immediately near the Coastal site may be warranted to facilitate traffic

1 flow. The Coastal site is located in a rural area, and nonradiological health impacts from
2 building would likely be negligible on the surrounding populations.

3 Exelon Generation submitted an application to the NRC for a proposed site of a nuclear station
4 in Victoria County within 5 mi of the Coastal site (Exelon 2010). If so, there would be the
5 potential for traffic impacts in the vicinity of the Coastal site include traffic associated with the
6 proposed Exelon station. Interactions between the traffic destined for the Coastal site nuclear
7 power plant project and the proposed Exelon station would likely increase the nonradiological
8 health effects from traffic accidents in the vicinity of the Coastal site. The additional injuries and
9 fatalities from traffic accidents involving transportation of materials and personnel for building of
10 a new nuclear power plant at the Coastal site would be similar to those evaluated in Section
11 4.8.3 for the CPNPP site and would represent a small fraction of the total traffic fatalities in
12 Victoria County. If Corpus Christi is included in the construction workforce there would be a 6.7
13 percent increase in the available nearby workforce, if not the number would be 14.7 percent
14 (Luminant 2009a). In either case, the workforce increase represents a minor addition to the
15 general area.

16 There are no past or present construction projects in the geographic area of interest that have
17 similarly impacted the public and workers from nonradiological resources. Proposed future
18 actions that would impact nonradiological health in a similar way to development at the Coastal
19 site within the geographical area of interest include the proposed Exelon nuclear station (Exelon
20 2010) and construction of the I-69 Trans-Texas Interstate Corridor, which could pass within 5 mi
21 of the site.

22 ***Operational Impacts***

23 Nonradiological health impacts from operation of two nuclear units on occupational health and
24 members of the public at the Coastal site would be similar to those evaluated in Section 5.8.
25 Occupational health impacts to workers (e.g., falls, electric shock or exposure to other hazards)
26 at the coastal site would likely be similar to those evaluated for workers at the new units at the
27 CPNPP site.

28 Additional occupational health impacts may result from exposure to hazards such as noise, toxic
29 or oxygen-replacing gases, thermophilic microorganisms in the condenser bays, and caustic
30 agents. Luminant's current safety and health programs promote safe work practices and
31 respond to occupational injuries and illnesses. The same or a similar program would be
32 expected for new units at the Coastal site. Health impacts to workers from nonradiological
33 emissions, noise, and EMFs would be monitored and controlled in accordance with the
34 applicable OSHA regulations and would be minimal.

35 Exposure to the public from water-borne etiological agents at the Coastal site would be similar
36 to the types of exposures evaluated in Section 5.8.1, and the operation of the new units at the
37 alternative sites would not likely lead to an increase in water-borne diseases in the vicinity.
38 Noise and EMF exposure would be monitored and controlled in accordance with applicable
39 Occupational Safety and Health Administration (OSHA) regulations. Effects of EMF on human
40 health would be controlled and minimized by conformance with National Electrical Safety Code
41 (NESC) criteria and adherence to the standards for transmission systems regulated by the
42 Public Utility Commission of Texas (PUCT). Nonradiological impacts of traffic associated with
43 the operations workforce would be less than the impacts during building. Mitigation measures
44 taken during building to improve traffic flow would also minimize impacts during operation of the
45 two new units.

46 There are no past and present activities in the geographic areas of interest that would have
47 nonradiological impacts to the public or workers similar to those discussed for the Coastal site.

1 The only significant proposed operation in the area of interest is the Victoria County Nuclear
2 Station. These proposed transmission line systems, and future growth and urbanization would
3 have nonradiological impacts to the public and workers, and these impacts would be similar to
4 those described for the proposed two new nuclear units at the Coastal site.

5 The review team is also aware of the potential climate changes that could affect human health;
6 a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been
7 considered in the preparation of this EIS. Projected changes in the climate for the region
8 include an increase in average temperature and a decrease in precipitation, which may alter the
9 presence of microorganisms and parasites in any reservoir that would be used. The review
10 team did not identify anything that would alter its conclusion regarding the presence of
11 etiological agents or change in the incidence of water-borne diseases.

12 **Summary**

13 Based on the information provided by Luminant and the review team's independent evaluation,
14 the review team expects that nonradiological health impacts from building and operation of two
15 new units at the Coastal alternative site would be similar to the impacts evaluated for the
16 CPNPP site. These impacts would be localized and managed through adherence to existing
17 regulatory requirements. The review team concludes, therefore, that cumulative impacts would
18 be SMALL.

19 **9.3.2.10 Radiological Health Impacts of Normal Operations**

20 The following impact analysis includes impacts from building activities and operations. The
21 analysis also considers other past, present, and reasonably foreseeable future actions that
22 impact radiological health, including other Federal and non-Federal projects listed in Table 9-7
23 within the geographical area of interest. As described in Section 9.3.2, the Coastal site is an
24 undeveloped site; there are currently no nuclear facilities on the site. The geographic area of
25 interest is the area within a 50-mi radius of the Coastal site. In addition, an application for an
26 early site permit for a new nuclear power plant at Victoria County site has been submitted to the
27 NRC. Finally, there are likely to be hospitals and industrial facilities within 50 mi of the Coastal
28 site that use radioactive materials.

29 The radiological impacts of building and operating the proposed US-APWR units at the Coastal
30 site include doses from direct radiation, and liquid and gaseous radioactive effluents. These
31 pathways would result in low doses to people and biota offsite that would be well below
32 regulatory limits. These impacts are expected to be similar to those estimated for the CPNPP
33 site.

34 The radiological impacts of the other operating nuclear power plants listed above also include
35 doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result
36 in low doses to people and biota offsite that are well below regulatory limits as demonstrated by
37 the ongoing radiological environmental monitoring programs (REMP) conducted around these
38 plants. The proposed plants at the Victoria County site would also result in radiological impacts
39 from direct radiation and liquid and gaseous radioactive effluents. The NRC staff expects that
40 these pathways would result in low doses to people and biota offsite that would be well below
41 regulatory limits. The NRC staff concludes that the dose from direct radiation and effluents from
42 hospitals and industrial facilities that use radioactive materials would be an insignificant
43 contribution to the cumulative impact around the Coastal site. This conclusion is based on data
44 from REMPs conducted around currently operating nuclear power plants.

45 Based on the information provided by Luminant and the NRC staff's independent analysis, the
46 NRC staff concludes that the cumulative radiological impacts from building and operating the

1 proposed MHI US-APWR units and other existing and planned projects and actions in the
 2 geographic area of interest around the Coastal site would be SMALL.

3 **9.3.2.11 Postulated Accidents**

4 The following impact analysis includes radiological impacts from postulated accidents from
 5 operations for two nuclear units at the Coastal alternative site. The analysis also considers
 6 other past, present, and reasonably foreseeable future actions that impact radiological health
 7 from postulated accidents, including other Federal and non-Federal projects and those projects
 8 listed in Table 9-7 within the geographic area of interest. As described in Section 9.3.2, the
 9 Coastal site is a greenfield site near McFaddin, Texas. There are currently no nuclear facilities
 10 on the site. The geographic area of interest considers existing and proposed nuclear power
 11 plants that have the potential to increase the probability-weighted consequences (i.e., risks)
 12 from a severe accident at any location within 50 mi of the Coastal site. Table 9-12 summarizes
 13 the nearby nuclear facilities. Note that although the South Texas Project is located greater than
 14 50 mi from the coastal site, it is included for completeness.

Table 9-12. Nearby Nuclear Projects/Facilities Considered in the Cumulative Analysis at the Coastal Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Victoria County Nuclear Station	One or more large-scale nuclear power reactors	Within 5 mi of the Coastal site	Proposed. Exelon Generation submitted an application to the NRC for an Early Site Permit on March 25, 2010
South Texas Project	Two large scale nuclear reactors with two additional reactors proposed	About 60 mi east	South Texas Project Units 1 and 2 – currently operating South Texas Project Units 3 and 4 – STP Nuclear Operating Company submitted to obtain a combined license for two Advanced Boiling Water Reactors designated as South Texas Project, Units 3 and 4 on September 20, 2007.

15 Existing facilities potentially affecting radiological accident risk within this geographic area of
 16 interest are the existing South Texas Project Units 1 and 2, the proposed South Texas Project
 17 Units 3 and 4, and the proposed Exelon Victoria County Nuclear Station. No other reactors
 18 have been proposed within the geographic area of interest.

19 As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of
 20 design basis accidents (DBAs) at the CPNPP site would be minimal for US-APWR DBAs are
 21 addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety
 22 criteria. The US-APWR design is independent of site conditions and the meteorology of the
 23 Coastal and CPNPP sites are similar. Therefore, the NRC staff concludes that the environmental
 24 consequences of DBAs at the Coastal site would be minimal. Because the meteorology,
 25 population distribution, and land use for the Coastal alternative site are expected to be similar to
 26 the proposed CPNPP site, risks from a severe accident for a US-APWR reactor located at the
 27 Coastal alternative site are expected to be similar to those analyzed for the proposed CPNPP
 28 site. These risks for the proposed CPNPP site are presented in Table 5-23 and Table 5-24 and

1 are well below the median value for current-generation reactors. In addition, estimates of
2 average individual early fatality and latent cancer fatality risks are well below the Commission's
3 safety goals (51 FR 30028). For existing nuclear power plants within the geographic area of
4 interest, which are South Texas Project Units 1 and 2, the Commission has determined that the
5 probability-weighted consequences of severe accidents are small (10 CFR 51, Appendix B,
6 Table B-1). Because of the NRC's safety review criteria, it is expected that risks for any new
7 reactors at the South Texas Project and the Exelon Victoria County site would be well below
8 risks for current-generation reactors and meet the Commission's safety goals. On this basis, the
9 NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of
10 the Coastal alternative site would be SMALL.

11 **9.3.3 The Pineland Site**

12 This section covers the review team's evaluation of the potential environmental impacts of siting
13 a new two-unit nuclear power plant at the Pineland site in San Augustine County, Texas. The
14 Pineland site is located on the northern shore of the Sam Rayburn Reservoir approximately 5 mi
15 south of Pineland, Texas. The site is a greenfield site not currently owned by the Applicant.

16 The following sections include a cumulative impact assessment conducted for each major
17 resource area. The specific resources and components that could be affected by the
18 incremental effects of the proposed action if implemented at the Pineland site, and other actions
19 in the same geographical area were considered. This assessment includes the impacts of
20 NRC-authorized construction and operations and impacts of preconstruction activities. Also
21 included in the assessment are past, present and reasonably foreseeable future Federal, non-
22 Federal, and private actions that could have meaningful cumulative impacts when considered
23 together with the proposed action if implemented at the Pineland site. Other actions and
24 projects considered in this cumulative analysis are described in Table 9-13.

25 The CPNPP site is approximately 230 mi from the Pineland site and was therefore not included
26 in this analysis. The only other nuclear power plant currently operating in Texas is the South
27 Texas Project, near Bay City, Texas. The South Texas Project plant is approximately 200 mi
28 southwest of the Pineland site and is therefore also not included in this analysis.
29

1

Table 9-13. Projects and Other Actions Considered in the Cumulative Analysis at the Pineland Site

Project Name	Summary of Project/Activity	Location	Status
Energy Projects			
Sam Rayburn Dam	Hydroelectric power generation of up to 118,000 kW annually	About 10 mi southwest, on Sam Rayburn Reservoir	Operational. ^(a)
Transportation Projects			
Highway improvements to U.S. 96	\$6.2 million repaving and infrastructure improvements funded by the Texas Department of Transportation under the American Recovery and Reinvestment Act	Within 5 mi to east	Proposed. ^(b)
Highway improvements to U.S. 59	\$1.3 million repaving and infrastructure improvements funded by the Texas Department of Transportation under the American Recovery and Reinvestment Act	25 mi north	Less than 50 percent complete. ^(c)
I-69 Trans-Texas Corridor	New interstate corridor connecting Texarkana/Shreveport to Mexico (possibly the Rio Grande Valley or Laredo)	Section D of corridor could come within 40 mi northwest	Proposed. ^(d)
Parks and Other Recreation			
Sam Rayburn Reservoir	A 114,500 ac impoundment of the Angelina River. Provides recreational opportunities, including over 300 fishing tournaments annually.	Adjacent to and surrounding the site	Operational. ^(a)
Sam Rayburn Reservoir	A 114,500 ac impoundment of the Angelina River. Provides recreational opportunities, including over 300 fishing tournaments annually.	Adjacent to and surrounding the site	Operational. ^(a)

2

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Table 9-13. (contd)

Project Name	Summary of Project/Activity	Location	Status
San Augustine Park	A highly developed campground managed by USACE for public recreation with 100 campsites with water and electricity. Also contains three waterborne restroom/shower buildings, a group shelter, a trailer dump station, a playground, a designated swimming area, a courtesy dock, an interpretive trail, two volleyball courts, a basketball court, a horseshoe court, and a boat ramp with four launching lanes	Within 3 mi to northwest	Operational. ^(e)
Other parks, forests, and reserves	Numerous state and national parks, forests, reserves, and other recreational areas are located within a 50-mi region	Throughout 50- mi region	Parks are currently being managed by national, state, and/or local agencies
Other Actions/Projects			
City of Pineland Sewer System Replacement	Infrastructure improvements funded by the U.S. Department of Housing and Urban Development under the American Recovery and Reinvestment Act	5 mi northeast	Proposed. ^(f)
Future Urbanization	Building of housing units and associated commercial buildings; roads, bridges, and rail; building of water- and/or wastewater- treatment and distribution facilities and associated pipelines, as described in local land use planning documents.	Throughout region	Building would occur in the future, as described in local land use planning documents.
Existing residential developments on the peninsula in Sam Rayburn Reservoir	Construction of residential structures and supporting utilities and infrastructure.	As close as 1.5 mi to site	Possible future actions.

2

1

Table 9-13. (contd)

Project Name	Summary of Project/Activity	Location	Status
Various hospitals and industries that use radioactive materials	Medical and other isotopes	Within 50 miles	Operational in nearby cities and towns.

(a) Source: USACE 2010.
 (b) Source: RATB 2010c.
 (c) Source: RATB 2010d.
 (d) Source: TxDOT 2010.
 (e) Source: USACE 2009.
 (f) Source: RATB 2010e.

2 **9.3.3.1 Land Use**

3 The Pineland site is located on a peninsula abutting the Sam Rayburn Reservoir in San
 4 Augustine and Sabine Counties in east Texas. The site is near the border with Jasper County.
 5 The site is located approximately 4 mi west of U.S. Highway 96 and approximately 5 mi south of
 6 the Town of Pineland. The site covers about 3800 ac and is managed for timber production.
 7 The site is accessed via a gravel road, and no rail or barge access is available in the vicinity.

8 The greenfield site is privately owned and covered mostly by pine forest managed for timber
 9 production. There are no mineral leases or pipelines on the site. Based on data from the
 10 National Wetlands Inventory, the Applicant estimates there are approximately 214 ac of
 11 wetlands located on the site (Luminant 2009a). No zoning ordinances restrict land use on
 12 the site. The site is outside the 100-yr floodplain.

13 Sam Rayburn Reservoir is owned and operated by the U.S. Army Corps of Engineers (USACE).
 14 The USACE also controls an easement of approximately 200 ft from the mean high water line
 15 around the shoreline of the reservoir in addition to other recreational and operational lands. The
 16 USACE operates a campground, San Augustine Park, located approximately 0.6 mi west of the
 17 Pineland site. Two residential areas are located on the peninsula adjacent to the site. One of
 18 these areas consists of moderately priced homes covering an area of approximately 170 ac; the
 19 other area covers roughly 180 ac and is currently under development. Access to both of these
 20 residential areas is provided by the single gravel road that runs down the spine of the peninsula
 21 and transects the potential nuclear power plant site.

22 Luminant estimates that less than half of the 3800-ac site would likely be disturbed for building
 23 and operating the nuclear power plant. However, even if the entire site were closed to timber
 24 production, the impact would be minimal because of the large amount of remaining timberlands
 25 in the surrounding area.

26 Building and operating a nuclear power plant would affect recreational use of Sam Rayburn
 27 Reservoir and surrounding areas. During daylight hours, the heavy evergreen timber cover on
 28 remaining on and adjoining the site would help hide the facility from the view of recreation users
 29 on the lake and surrounding lands. However, noise associated with building and operating the
 30 power plant would likely be noticeable in nearby recreational areas, such as San Augustine
 31 Park. In addition, nighttime security and safety lighting of the power plant would also likely be
 32 visible from these sensitive surrounding areas.

1 Access to residential areas located on the same peninsula as the proposed new units would
2 likely be significantly disrupted while the project is being built. Construction traffic would almost
3 certainly rely on the single road providing access to the peninsula, and the location of the road
4 would likely have to be changed. Access to the peninsula could improve compared to current
5 conditions during project operations because the access road would be paved at least to the
6 location of the power plant. However, the residential areas would likely be exposed to some
7 noise and light pollution from the facility.

8 At least one transmission corridor would be required to connect a nuclear plant at the Pineland
9 site to the ERCOT grid. The closest existing 345 kV transmission line is located approximately
10 45 mi northwest of the site. A transmission line through this area would cross predominantly
11 forested and agricultural areas. The line would have the potential to cross and impact portions
12 of the San Angelina National Forest. Because detailed information concerning the routing of the
13 possible new transmission line corridors is not known at this time, a complete evaluation of
14 potential land-use impacts cannot be made. Nevertheless, based on the available information,
15 the review team estimates that construction of one or more transmission lines could have
16 significant impacts on land use including land use within the San Angelina National Forest. The
17 selection of a final transmission line route would be subject to environmental review and
18 approval by PUCT.

19 ***Cumulative Impacts***

20 The geographic area of interest for consideration of land-use impacts includes San Augustine,
21 Sabine, and Jasper Counties. The area of interest is located at the border between the
22 Redlands and east Texas Timberland physiographic regions, characterized by gently rolling to
23 hilly terrain that is naturally covered by pines interspersed with hardwoods and native grasses.
24 Direct and indirect land use impacts of building two nuclear power generating units at the
25 Pineland site would be largely confined to this area.

26 Historically, land in the geographic area of interest has been used primarily for timber production
27 and agriculture. Major changes in the use of land came first in the 1930s as land was
28 purchased for the Sabine and Angelina National Forests, and then in the 1960s with the
29 impoundment of the Sam Rayburn and Toledo Bend Reservoirs. Approximately 185,200 ac of
30 the two national forests are located within the area of interest. The reservoirs cover
31 approximately 335,000 ac, of which roughly one-half is in the three-county area. These
32 changes reinforced the use of land for timber production and also opened up the area for
33 recreation use. Currently, the primary land uses in the area include agriculture (cattle, dairy
34 products, poultry, grain, and timber), manufacturing (agricultural products, building products,
35 and industrial products), and public forests and parks (TSHA 2010).

36 Other projects and actions that could contribute to cumulative impacts on land use in the area of
37 interest include highway improvements proposed for U.S. Highway 96 and future urbanization
38 and GCC. The proposed highway improvements are scheduled to be completed before building
39 would start on the nuclear power plant, so cumulative land use impacts are expected to be
40 negligible.

41 The TSDC projects that the population in a six-county area surrounding the CPNPP site
42 (including Angelina, Jasper, Nacogdoches, Sabine, San Augustine, and Shelby Counties) will
43 increase by 14.5 percent by the year 2040 (TSDC 2009). Future urbanization in the review area
44 could contribute to additional decreases in grazing lands, cultivated lands, forests, and
45 wetlands. Urbanization in the vicinity of the Pineland site could reduce natural vegetation and
46 open space, resulting in an overall decline in the extent and connectivity of wetlands, forests,

1 and wildlife habitat. However, the level of growth projected by TSDC is relatively low and
2 therefore, capable of only relatively low land-use impacts.

3 The report on *Global Climate Change Impacts in the United States*, provided by the,
4 summarizes the projected impacts of future climate changes in the United States (Karl et al.
5 2009). The report divides the United States into nine regions. The Pineland site is located in
6 the Southeast region. The GCRP climate models for this region project continued warming in all
7 seasons and an increase in of approximately 4.5°F by the 2080s. Additionally, climate models
8 project that there will tend to be less rainfall in this area. The GCRP states that the warming
9 projected for the Southeast could result in a potential reduction in crop yields and livestock
10 productivity, which may change portions of agricultural and ranching land uses in the area of
11 interest.

12 Based on information provided by the Applicant and the review team's independent review, the
13 review team concludes that the cumulative land-use impacts of constructing and operating two
14 new nuclear generating units at the Pinelands site would be MODERATE. This conclusion
15 reflects the substantial amount of land (up to 3800 ac onsite plus additional offsite land for roads
16 and a railroad spur) that would be needed for the proposed project, access disruption and noise
17 and light pollution experienced by nearby residential and recreational areas and the possibility
18 of having to construct a transmission line across the San Angelina National Forest. NRC-
19 authorized construction and operation of two new nuclear units at the Pinelands site would be a
20 substantial contributor to the MODERATE impact.

21 **9.3.3.2 Water Use and Quality**

22 The Pineland site is located on a peninsula on the northern shore of the Sam Rayburn
23 Reservoir near Pineland in eastern Texas. The site is in the East Texas Regional Water
24 Planning Area (Region I of the Texas State Water Plan) and within the territorial jurisdiction of
25 the Angelina & Neches River Authority. For this analysis, the geographic area of primary
26 interest is the immediate site vicinity and the Sam Rayburn Reservoir, but the entire East Texas
27 Regional Water Planning Area is also considered in the analysis. This is the ROI because it
28 encompasses the water resources potentially affected by the proposed project if it were to be
29 located at the Pineland site.

30 The principal surface water feature related to the Pineland site is the Sam Rayburn Reservoir, a
31 USACE water project on the Angelina River, built and operated in cooperation with the Lower
32 Neches Valley Authority, which is based in Beaumont, Texas. The 114,500-ac reservoir, which
33 has a maximum depth of 90 ft and a watershed area of about 3449 mi², was completed in 1965
34 for purposes that include flood control, hydroelectric power, and water supply. The reservoir
35 also is used for recreation, including fishing. It has a storage capacity of 2,898,300 ac-ft and a
36 firm (dependable) yield of 820,000 ac-ft/yr (TWDB 2007). The Lower Neches Valley Authority
37 holds water rights to the entire firm yield of the reservoir (LNVA 2010). The City of Lufkin holds
38 rights to 43,000 ac-ft annually, but uses groundwater for its public water supply (East Texas
39 Water Planning Group 2010).

40 Total water supply in the 20-county East Texas Regional Water Planning Area as of the year
41 2060 is estimated at about 3 million ac-ft per year in 2060, with about 85 percent from surface-
42 water sources and 15 percent from groundwater (East Texas Water Planning Group 2010).
43 Regional water demand is estimated to be 875,189 ac-ft/yr in 2010, increasing to 1,405,971 ac-
44 ft/yr in 2060 (East Texas Water Planning Group 2010).

45 Soil on the peninsula is sandy, derived from local bedrock. The peninsula is drained by several
46 small streams that enter the reservoir. These streams are assumed to have associated
47 floodplains. No wetlands have been identified on the peninsula.

1 Water quality data for Sam Rayburn reservoir indicate good natural water quality, including very
2 low dissolved solids concentrations and high water clarity. Samples collected near the Pineland
3 site between 1967 and 1999 had chloride values less than 25 mg/L and measurements of
4 specific conductance that were typically less than 200 $\mu\text{S}/\text{cm}$ (USGS 2010a, USGS 2010b),
5 corresponding to very low levels of dissolved solids. Secchi disk readings during the 1990s
6 ranged from 1.3 to 2.7 m, which corresponds to very clear water (USGS). The reservoir water
7 appeared relatively clear during the review team visit to the site in 2009. TCEQ-designated
8 uses of the reservoir are for contact recreation, high aquatic life use, and public water supply.
9 The reservoir fully supports the designations for recreation and water supply. However, it is
10 classified as having impaired water quality because several areas of the reservoir do not fully
11 support the aquatic life designation due to water-quality limitations, including low dissolved
12 oxygen concentrations in several areas, high concentrations of nutrients in several areas, and
13 elevated concentrations of dissolved aluminum in one 5120-ac area (Angelina & Neches River
14 Authority 2010). Septic systems and poultry production operations around the reservoir and in
15 its watershed are among the possible contributors to these water quality concerns (TetraTech
16 2003). Also, 29 facilities discharge a total of about 22.5 million gpd of wastewater into the
17 reservoir and tributary streams under state-issued discharge permits (Angelina & Neches River
18 Authority 2010).

19 The uppermost aquifer in the immediate site area is the Yegua-Jackson aquifer, which is a
20 minor contributor to regional water supply (TWDB 2007). It has limited geographic extent, but
21 produces good quality water in a limited area (East Texas Water Planning Group 2010).
22 Groundwater is an important resource in other parts of the East Texas Regional Water Planning
23 Area. Major aquifers in this region are the Carrizo-Wilcox aquifer in the upper basin (north of
24 the Pineland site) and the Gulf Coast aquifer in the lower basin (south of the site) (East Texas
25 Water Planning Group 2010).

26 ***Building Impacts***

27 For purposes of this analysis, the review team assumed that the water needed for building and
28 operating the proposed plant at this site would be obtained from Sam Rayburn reservoir through
29 a contract with the Lower Neches Valley Authority.

30 Water requirements for building the plant would be similar to those for building the plant at the
31 CPNPP site. This water use would not have detectable effects on water quantity in the reservoir
32 or water availability for other uses. Building activities on the peninsula would alter onsite
33 hydrologic conditions, including increasing runoff and possibly changing the courses of natural
34 streams on the peninsula. During building activities, runoff from the site could increase
35 sediment transport into the reservoir.

36 Sam Rayburn reservoir would be the water source and effluent discharge site for a nuclear
37 power plant, with the water intake on one side of the peninsula and the outfall on the other side.
38 The intake and discharge sites probably would be located in areas of relatively deep water near
39 the lake shore. Installation of a raw water intake and discharge line would disturb the bed of the
40 reservoir, but significant dredging is not likely to be needed to construct or maintain the intake
41 and outfall. Although these actions could temporarily affect surface water quality, effects would
42 be minor due to the expected implementation of best management practices and site-specific
43 factors such as the small size of the disturbed area relative to the total area of the reservoir and
44 the sandy character of the soil and lake bottom sediment, which is unlikely to contribute
45 significantly to turbidity.

46 There would be no use of groundwater in building the plant. Dewatering of excavated areas, if
47 needed, would lower the shallow groundwater table in the site vicinity, but this would not affect

1 existing uses or users of groundwater. Implementation of appropriate management practices
2 would minimize the potential impacts to groundwater of accidental contaminant releases.

3 **Operational Impacts**

4 Mechanical draft cooling towers would likely be used for nuclear units at this site, since natural
5 draft cooling would not be an option due to the warm humid climate. Also, no BDTF would be
6 required at the Pineland site due to the lack of a need for water treatment prior to discharge.
7 Cooling water requirements for a mechanical draft system are assumed to be somewhat larger
8 than the 62,400 ac-ft/yr annual consumption estimated for two units at the CPNPP site due to
9 the warmer air temperatures and higher humidity of the Pineland site. Water for cooling and
10 other water required for facility operations would be obtained from Sam Rayburn reservoir.
11 Because the required water volume is well below estimates of available water supply from the
12 reservoir, use of this volume of water would not noticeably affect water availability for other
13 uses. Similarly, effects on water levels in the reservoir would be minor. Annual water
14 consumption would be only about 2 percent of the reservoir's total volume, and effects on water
15 levels would be small relative to the annual fluctuation of about 8 ft (TetraTech 2003) that
16 results from reservoir operations.

17 Water from Sam Rayburn Reservoir water likely would need only minimal treatment prior to use
18 in the facility. Sanitary wastewater generating during building and operation of the facility would
19 require treatment in a wastewater treatment plant before discharge to the lake, but cooling tower
20 blowdown and most other effluents likely could meet water quality standards for dissolved
21 constituents with little or no treatment before being discharged to the reservoir. Discharge of
22 this water would have no more than minor impacts on chemical water quality in the reservoir, as
23 the volume of water in the reservoir would be sufficient for assimilation of dissolved materials in
24 facility effluents. Thermal impacts to the reservoir from the discharge of cooling water would
25 depend on the temperature and volume of discharged water as well as mixing processes in the
26 reservoir, but are assumed to be minor because the volume of water in the reservoir would be
27 sufficient for assimilation of thermal loads and because discharges would need to comply with
28 requirements of a state-issued discharge permit. No detectable water quality effects would be
29 expected downstream from Sam Rayburn dam.

30 Plant operation would not use groundwater and would not affect groundwater quantities.
31 Implementation of appropriate management practices would minimize the potential impacts to
32 groundwater from accidental contaminant releases during plant operation.

33 **Cumulative Impacts**

34 In addition to water use and water quality impacts from building and operations activities,
35 cumulative analysis considers past, present, and reasonably foreseeable future actions that
36 impact the same environmental resources. For the cumulative analysis of impacts on surface
37 water, the geographic area of interest for the Pineland site is considered to be the Sam Rayburn
38 Reservoir and downstream of the site because this is the resource that would be affected by the
39 proposed project. Key actions that have past, present, and future potential impacts to water
40 supply and water quality in the Sam Rayburn Reservoir include the operation and maintenance
41 of the reservoir and its hydroelectric dam.

42 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
43 summarizes the projected impacts of future climate changes in the United States (Karl et al.
44 2009). The report divides the United States into nine regions, and the Pineland site is located in
45 the Southeast region. The GCRP climate models for this region project continued warming in all
46 seasons and an increase in of approximately 4.5°F by the 2080s. Additionally, climate models

1 project that there will tend to be less rainfall in this area. The GCRP states that the warming
2 projected for the Southeast could result in a potential reduction in crop yields and livestock
3 productivity, which may change portions of agricultural and ranching land uses in the area of
4 interest. Decreased water availability due to increased temperatures and longer periods
5 between rainfall events would likely affect the region's economy, as well as its natural systems.

6 **Cumulative Water Use Impacts**

7 The East Texas Water Plan addresses the impacts of ongoing and projected future water
8 demands in the East Texas Regional Water Planning Area (East Texas Water Planning Group
9 2010). Based on a comparison of projected water availability and projected demands through
10 2060, water supply in the planning area should continue to be more than adequate to meet
11 demands for the reasonably foreseeable future. The addition of two nuclear power units at the
12 Pineland site would not change this situation.

13 Based on consideration the potential impacts to water use from building and operating the
14 proposed plant at the Pineland site, and effects resulting from other sources of impact to these
15 resources in the site vicinity and the East Texas Regional Water Planning Area, the review team
16 concluded that cumulative impacts to water use for two new nuclear power units at the Pineland
17 site would be SMALL for both surface water and groundwater resources.

18 **Cumulative Water Quality Impacts**

19 Point and nonpoint sources of pollution, particularly nutrients, in the Sam Rayburn reservoir
20 watershed are likely to continue to contribute to dissolved oxygen depletion and other water
21 quality concerns in the reservoir. Future urbanization and residential development near the
22 reservoir are likely to contribute to dissolved oxygen depletion by adding to the reservoir's
23 nutrient load, but building and operating two new nuclear power units at the Pineland site would
24 not be expected to make more than a minor contribution to either the nutrient load or the
25 resulting oxygen depletion; hence, the impacts on surface water quality would be SMALL.

26 Impacts on groundwater quality from construction and operation would be SMALL, as there
27 would be no use of groundwater, there is little or no use of near-surface groundwater that might
28 be subject to contamination from the facility, and the potential for contamination would be
29 minimized by implementation of appropriate management practices.

30 **9.3.3.3 Terrestrial Resources**

31 The following impact analysis includes impacts from building activities and operations on the
32 Pineland site. The analysis also considers other past, present, and reasonably foreseeable
33 future actions that impact terrestrial resources, including other Federal and non-Federal projects
34 listed in Table 9-14.

35 The Pineland site lies in the Tertiary Uplands of the South Central Plains ecoregion (Griffith et
36 al. 2004). It is located on a peninsula near the northeastern side of Sam Rayburn Reservoir in
37 eastern Texas. The site is in gently rolling topography currently covered by a loblolly pine (*Pinus*
38 *taeda*) plantation in an area once blanketed by a mix of pine and hardwood forests (Luminant
39 2009a). Surrounding land is covered in pines interspersed with hardwoods, particularly oaks,
40 and some native grasses. Wildlife includes quail, white-tailed deer, doves, cottontail rabbits,
41 skunks, opossums, raccoons, and coyotes. Of these species white-tailed deer and doves are
42 highly sought after by hunters and are therefore considered important species as determined by
43 NRC (NRC 2000). The area in which Pinelands is located is locally termed the "piney woods."
44 Many parts of the historic longleaf pine (*Pinus palustris*) forest on rolling sandy uplands of in
45 Texas were characterized by a species-rich herbaceous understory with bluestem grasses and
46 a variety of forbs and shrubs. Today about one sixth of the region is in cropland, and about two

1 thirds of the region is in forests and woodland. Lumber, pulpwood, oil, and gas production are
 2 major economic activities. (Griffith et al. 2004).

3 The peninsula on which the Pineland site is located lies immediately between two ecologically
 4 important areas: the Sabine and Angelina National Forests. The Angelina National Forest is
 5 about 3 mi west of the site and consists of 154,916 ac; the Sabine National Forest is about 4 mi
 6 to the east and comprises 188,220 ac.

7 **Federally and State-Listed Species**

8 No site-specific surveys have been conducted for threatened and endangered species at the
 9 Pineland site. The following list of threatened and endangered species that occur within 10 mi
 10 of the Pineland site was compiled from information on rare resource occurrences contained in
 11 the Texas Natural Diversity Database. The information was provided by TPWD (TPWD 2009a).

Table 9-14. Threatened or endangered terrestrial species that may occur within 10 mi of the Pineland Site

Group	Common Name	Scientific Name	Federal Status ^a	State Status ^b
Reptiles	Louisiana pine snake	<i>Pituophis ruthveni</i>	-	T
	Northern scarlet snake	<i>Cemophora coccinea copei</i>	-	T
	Bald eagle	<i>Haliaeetus leucocephalus</i>	-	T
Birds	Red-cockaded woodpecker	<i>Picoides borealis</i>	E	E
Mammals	Black bear	<i>Ursus americanus</i>	-	T
	Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>	-	T
Plants	White bladderpod	<i>Lesquerella pallida</i>	E	E
	Navasota ladies'-tresses	<i>Spiranthes parksii</i>	E	E

^a Federal status: E = endangered; T = threatened.

^b State status: E = endangered; T = threatened.

Source: TPWD 2009a.

12 Suitable habitat for one of these species, the red-cockaded woodpecker, is located on the
 13 eastern boundary of the peninsula away from the proposed power block location. This 30-ac
 14 area of mature pines is not subject to logging, and has been preserved to protect the desirable
 15 habitat (Luminant 2007).

16 **Building Impacts**

17 The Pineland site is in gently rolling topography, and clearing and substantial grading would be
 18 necessary to prepare the site for development. Since most of the site is in rotation for loblolly
 19 pine harvest, its value as undisturbed wildlife habitat is limited. A new transmission line on a
 20 new ROW would be required to connect the power plant to existing transmission lines. Either of
 21 two lines could be developed. One is 45 mi northwest of the Pineland site, the other is 25 mi to
 22 the southeast. Either route would cross predominantly forested and agricultural areas. The route
 23 to the northeast would have the potential to cross and impact portions of the Angelina National
 24 Forest.

1 Development of new transmission lines would be subject to additional environmental review
2 requirements. The new ROWs would be subjected to site-specific pre-disturbance
3 investigations, possibly including, but not limited to, reconnaissance to ascertain the presence
4 or absence of Federally and State-listed species and other important species and habitats or as
5 required by Federal or state agency regulatory requirements. If the new transmission line route
6 crosses the Angelina National Forest, the process would likely involve required mitigation for
7 impacts to sensitive resources located there.

8 Building two new nuclear reactors at the Pineland site would result in the permanent loss of
9 about half of the 3800-ac site. The review team believes that the ultimate footprint of
10 development would be less than the estimated 1900 ac reported. Loss of terrestrial habitat and
11 forest fragmentation at the site would noticeably alter terrestrial resources. New power
12 transmission lines on new ROWs would result in additional alteration of habitat in the
13 surrounding landscape. Other sources of impacts to terrestrial resources at the site such as
14 increased traffic, noise, and displacement of wildlife would likely be temporary and/or result in
15 minimal impact to the resource.

16 ***Operational Impacts***

17 Terrestrial ecological impacts that may result from operation of new nuclear units at the
18 Pineland site include those associated with cooling towers, transmission system structures, and
19 maintenance of transmission line ROWs (Luminant 2007).

20 Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be
21 evaluated in detail in the absence of information about the type (mechanical or natural draft),
22 number, and specific location of cooling towers at each alternative site. Similarly, bird collisions
23 with cooling towers cannot be evaluated in the absence of information about the type
24 (mechanical or natural draft for a wet cooling system; dry for a dry system) and number of
25 cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing
26 power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance
27 for nuclear power plants in general, including those with various numbers and types of cooling
28 towers. On this basis, the review team concludes, for the purpose of comparing the alternative
29 sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from
30 operation of new nuclear units would be minor.

31 For mechanical draft cooling towers, the anticipated noise level from cooling-tower operation is
32 anticipated to be approximately 55 dBA at 1000 ft (Luminant 2009a). This noise level is well
33 below the 80 to 85 dBA threshold at which birds and small mammals are startled or frightened
34 (Golden et al. 1980). Thus, noise from operating cooling towers at the Pineland site would not
35 be likely to disturb wildlife beyond 1000 ft from the source. The noise level for natural draft
36 cooling towers would be lower. Consequently, the review team concludes that the impacts of
37 cooling-tower noise on wildlife would be minimal.

38 The impacts associated with transmission-line corridor maintenance activities include alteration
39 of habitat due to cutting and herbicide application, and similar related impacts where corridors
40 cross floodplains and wetlands.

41 Impacts from bird collisions with transmission lines and the effects of electromagnetic fields
42 (EMFs) on flora and fauna are expected to be minimal. Transmission lines and associated
43 structures are recognized as a potential avian collision hazard. Bird collisions with transmission
44 lines are recognized as being of minor significance at operating nuclear power plants, including
45 transmission-line corridors with variable numbers of power lines (NRC 1996). Although
46 additional transmission lines would be required for new nuclear units at the Pineland site,
47 increases in bird collisions would be minor and these would likely not be expected to cause a

1 measurable reduction in local bird populations. Consequently, the number of bird collisions
2 posed by the addition of new transmission lines for new nuclear units would be negligible.

3 EMFs are unlike other agents (e.g., toxic chemicals and ionizing radiation) that have an adverse
4 impact in that dramatic acute effects cannot be demonstrated and long-term effects, if they
5 exist, are subtle. A careful review of biological and physical studies of EMFs did not reveal
6 consistent evidence linking harmful effects with field exposures. The impacts of EMFs on
7 terrestrial flora and fauna are recognized as being of small significance at operating nuclear
8 power plants, including transmission systems with variable numbers of power lines (NRC 1996).
9 Therefore, the EMF impact posed by addition of new transmission lines for new nuclear units at
10 the Coastal site would be noticeable.

11 New access roads would be required during the establishment of new transmission line ROW at
12 the Pineland site. Transmission line ROW management activities (such as cutting and herbicide
13 application) and related impacts to terrestrial habitats in transmission line ROWs are of minor
14 significance at operating nuclear power plants, including those with transmission line ROWs of
15 variable widths (NRC 1996). Consequently, the effects of transmission line ROW maintenance
16 and associated impacts to terrestrial habitats posed by the addition of new transmission line
17 ROWs for new nuclear units at the Pineland site would be negligible.

18 ***Cumulative Impacts***

19 The impacts of building and operating two nuclear units at the Pineland site were evaluated by
20 the review team to determine the magnitude of their contribution to cumulative impacts on
21 terrestrial ecological resources. For purposes of this cumulative analysis, the geographic area
22 of interest is defined as San Augustine, Sabine, and Jasper Counties. These counties
23 encompass the Pineland site, anticipated transmission line ROWs, and adjoining areas. This
24 geographic area of interest is expected to encompass the ecologically relevant landscape
25 features and species. Activities related to building include loss of habitat due to clearing for
26 building the plant and transmission lines. Past actions that have affected terrestrial resources
27 include the creation of Sam Rayburn Reservoir, the replacement of natural forests with those
28 managed for wood production and cropland, and residential development in the area. These
29 changes have displaced wildlife habitat and increased habitat fragmentation. Highway and
30 sewer replacement projects in the area, as well as possible future residential development,
31 increasing urbanization, and potential impacts of GCC would continue to change habitat (Table
32 9-13).

33 The TSDC projects that the population in a six-county area surrounding the Pineland site
34 (including Angelina, Jasper, Nacogdoches, Sabine, San Augustine, and Shelby Counties) will
35 increase by 14.5 percent by the year 2040 (TSDC 2009). Future urbanization in the review area
36 could contribute to additional decreases in grazing lands, cultivated lands, forests, and
37 wetlands. Urbanization in the vicinity of the Pineland site could reduce natural vegetation and
38 open space, resulting in an overall decline in the extent and connectivity of wetlands, forests,
39 and wildlife habitat. However, the level of growth projected by TSDC is relatively low and,
40 therefore, capable of only relatively low terrestrial ecology impacts.

41 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
42 summarizes the projected impacts of future climate changes in the United States (Karl et al.
43 2009). The report divides the United States into nine regions. The Pineland site is located in
44 the Southeast region. The GCRP climate models for this region project continued warming in all
45 seasons and an increase in of approximately 4.5°F by the 2080s. Additionally, climate models
46 project that there will tend to be less rainfall in this area. The warming projected by the GCRP
47 could result in a decrease in annual precipitation over time, possibly altering the character of

1 terrestrial habitats. This could further stress terrestrial resources affected by the activities
2 described above.

3 The potential cumulative impacts to terrestrial resources considering the two new reactors at the
4 Pineland site, in addition to the other activities described above, would noticeably alter terrestrial
5 resources. These activities would remove or modify terrestrial habitats with the potential to
6 affect important species living or migrating through the area. For the reasons discussed above,
7 the incremental contribution of building and operating the two new reactors at the Pineland site
8 to the cumulative impacts would be substantial.

9 **Summary**

10 Impacts to terrestrial ecology resources were analyzed based on the information provided by
11 Luminant and the review team's independent review. After building at the Pineland site is
12 complete, terrestrial resources in the areas that are temporarily disturbed are expected to return
13 to predominantly pre-development conditions. However, much habitat would be lost to
14 permanent project structures and by development and operation of the required power
15 transmission ROW. The review team therefore concludes that the cumulative impacts on
16 terrestrial plants and wildlife, including threatened or endangered species, and wildlife habitat
17 would be MODERATE.

18 The incremental contribution of NRC-authorized activities, which do not include preconstruction,
19 would, be SMALL. The incremental contribution of the overall project, including preconstruction,
20 would be noticeable.

21 **9.3.3.4 Aquatic and Wetlands Resources**

22 **Affected Environment**

23 The Pineland site is located on the border of San Augustine and Sabine Counties in eastern
24 Texas near the northeastern portion of Sam Rayburn Reservoir. The facility, intake, and
25 discharge would be located on a peninsula extending from the north into the central portion of
26 the reservoir. The dam was built across the Angelina River, the largest tributary to the Neches
27 River. The reservoir, which covers an area of 142,500 ac at normal water surface elevation,
28 would supply cooling water. The shoreline is predominantly undeveloped and wooded. The
29 topography of the 3800-ac site is mostly gently rolling upland. No wetlands have been identified
30 on the peninsula, which is drained by several small streams that enter the reservoir. The site is
31 outside the 100-yr floodplain.

32 **Important Species**

33 Game fish are important species in Sam Rayburn Reservoir, which provides excellent
34 recreational fishing. The largemouth bass is the most popular game fish in the reservoir. Other
35 common game fish in the reservoir include white crappie (*Pomoxis annularis*), catfish (*Ictalurus*
36 spp.), white bass (*Morone chrysops*), hybrid striped bass (*M. chrysops x saxatilis*), bluegill
37 (*Lepomis macrochirus*), and redear sunfish (*L. microlophus*) (TPWD 2008a).

38 No Federally listed threatened or endangered aquatic species occur in San Augustine, Sabine,
39 or Jasper Counties, the counties in which the reservoir is located (the downstream reach of the
40 Angelina River also is in Jasper County). However, four State-listed threatened aquatic species
41 potentially occur or have occurred historically in one or more of these counties. Two fish
42 species that are State-listed as threatened, creek chubsucker (*Erimyzon oblongus*) and
43 paddlefish (*Polyodon spathula*), potentially occur in the three counties, whereas another fish
44 that is State-listed as threatened, the blue sucker (*Cycleptus elongatus*), potentially occurs in

1 Sabine and Jasper Counties. In addition, the alligator snapping turtle (*Macrochelys temminckii*)
2 is State-listed as threatened and potentially occurs in San Augustine and Sabine Counties.
3 Aquatic species that have a State listing status or designation as a State species of concern and
4 the potential to occur in San Augustine, Sabine, or Jasper Counties are included in Table 9-15.
5 Listed species are described below.

6 The creek chubsucker inhabits creeks and small rivers and seldom if ever occurs in
7 impoundments (Hassan-Williams and Bonner 2007). Thus, creek chubsucker is unlikely to
8 occur in the reservoir but potentially could occur in the Angelina River downstream. The blue
9 sucker inhabits large, deep rivers and deep areas of lakes, though few occur in reservoirs.
10 Their preferred spawning habitat appears to be deep riffles with substrates of cobble and
11 bedrock in rivers (Hassan-Williams and Bonner 2007). Thus, the blue sucker potentially could
12 occur but is unlikely to occur in the reservoir or the river downstream.

13 The paddlefish is a potentially large (up to 7 ft in length) fish that inhabits large rivers and their
14 tributaries, particularly backwaters, oxbows, and deep channels. The paddlefish prefers large,
15 free-flowing rivers providing an abundance of the zooplankton on which it filter feeds, but it also
16 inhabits impoundments that have access to spawning sites upstream with substantial flow and
17 substrates of gravel and cobble (Hassan-Williams and Bonner 2007). Sam Rayburn Reservoir
18 potentially could provide habitat supportive of paddlefish, and paddlefish fingerlings were
19 stocked in the reservoir as recently as 1995 (TPWD 2007a).

20 The alligator snapping turtle is native to eastern Texas, and its range extends east and north in
21 the Mississippi River drainage and south in other Gulf Coast drainages. It is a highly aquatic
22 and potentially large turtle that can reach a weight of over 250 lb. Its preferred habitat is deep
23 waters primarily in rivers, but also in lakes and swamps, where it feeds on mainly fish, smaller
24 turtles, crayfish, and mollusks (Fuller and Somma 2010). Based on its range and habitat
25 requirements, this turtle potentially could occur in Sam Rayburn Reservoir or the Angelina River
26 downstream.

27 The six species of State-listed freshwater mussels (Texas pigtoe [*Fusconaia askewi*], triangle
28 pigtoe [*F. lananensis*], sandbank pocketbook [*Lampsilis satura*], southern hickorynut [*Obovaria*
29 *jacksoniana*], Louisiana pigtoe [*Pleurobema riddellii*], and Texas heelsplitter [*Potamilus*
30 *amphichaenus*]) occur predominantly in riverine habitats. The Texas pigtoe inhabits mixed mud,
31 sand, and fine gravel substrates in protected areas with fallen trees or other structure in the
32 Sabine, Trinity, and San Jacinto River basins of east Texas. The triangle pigtoe inhabits
33 substrates of mixed mud, sand, and fine gravel in the Angelina Branch of the Neches River
34 basin. The sandbank pocketbook inhabits substrates of sand, gravel-sand, and gravel in small
35 to large rivers with moderate to swift current in the Neches River and other river basins of east
36 Texas. The southern hickorynut inhabits substrates of medium-size gravel in rivers with low to
37 moderate current in the Neches, Sabine, and Cypress River basins. The Louisiana pigtoe
38 inhabits substrates of mud, sand, and gravel usually in flowing water of streams and moderate-
39 size rivers of the Neches, Sabine, and, historically, Trinity River basins. The Texas heelsplitter
40 inhabits substrates of mud or sand in quiet waters of streams in the Neches, Sabine, and Trinity
41 River basins, and it also inhabits reservoirs (TPWD 2010c). Given their ranges and habitat
42 preferences, five of these species (the triangle pigtoe, sandbank pocketbook, southern
43 hickorynut, Louisiana pigtoe, and Texas heelsplitter) potentially occur in the Neches River
44 downstream of Sam Rayburn Reservoir. Only the Texas heelsplitter inhabits reservoirs and,
45 thus, has a potential to occur in the lake and, if present, to be directly affected by the intake or
46 discharge of water by the facility.

Table 9-15. State-listed Aquatic Species and State Species of Concern Potentially Occurring in the Vicinity of the Pineland Site

Scientific Name	Common Name	State Status ^a	Counties ^b
Reptiles			
<i>Macrochelys temminckii</i>	Alligator snapping turtle	ST	San Augustine, Sabine
<i>Graptemys ouachitensis sabinensis</i>	Sabine map turtle	SSC	San Augustine, Sabine
Amphibian			
<i>Rana grylio</i>	Pig frog	SSC	Jasper
Fishes			
<i>Erimyzon oblongus</i>	Creek chubsucker	ST	San Augustine, Sabine, Jasper
<i>Etheostoma radiosum</i>	Orangebelly darter	SSC	San Augustine, Sabine, Jasper
<i>Polyodon spathula</i>	Paddlefish	ST	San Augustine, Sabine, Jasper
<i>Cycleptus elongatus</i>	Blue sucker	ST	Sabine, Jasper
<i>Notropis chalybaeus</i>	Ironcolor shiner	SSC	Sabine, Jasper
<i>Ammocrypta clara</i>	Western sand darter	SSC	Sabine, Jasper
Mussels			
<i>Fusconaia askewi</i>	Texas pigtoe	ST	San Augustine, Sabine
<i>Fusconaia lananensis</i>	Triangle pigtoe	ST	San Augustine
<i>Lampsilis satura</i>	Sandbank pocketbook	ST	San Augustine, Sabine
<i>Obovaria jacksoniana</i>	Southern hickorynut	ST	San Augustine, Sabine
<i>Pleurobema riddellii</i>	Louisiana pigtoe	ST	San Augustine, Sabine
<i>Potamilus amphichaenus</i>	Texas heelsplitter	ST	San Augustine, Sabine
<i>Arcidens confragosus</i>	Rock pocketbook	SSC	San Augustine, Sabine
<i>Fusconaia flava</i>	Wabash pigtoe	SSC	San Augustine, Sabine
<i>Quadrula nodulata</i>	Wartyback	SSC	San Augustine, Sabine
<i>Strophitus undulates</i>	Creeper (squawfoot)	SSC	San Augustine, Sabine
<i>Tritogonia verrucosa</i>	Pistolgrip	SSC	San Augustine, Sabine
<i>Truncilla donaciformis</i>	Fawnsfoot	SSC	San Augustine, Sabine
<i>Villosa lienosa</i>	Little spectaclecase	SSC	San Augustine, Sabine
Insects			
<i>Somatochlora margarita</i>	Texas emerald dragonfly	SSC	San Augustine, Sabine
<i>Plauditis gloveri</i>	A mayfly	SSC	Jasper

^a State status definitions: ST = State-listed, threatened; SSC = State species of concern.

^b Counties listed are those in which components of the alternative would be located and where TPWD has identified the potential for occurrence of the species based on evidence such as recorded occurrences, historic ranges, field guides, staff expertise, and scientific publications.

Source: TPWD 2010b, 2010c, and 2010e.

1 **Building Impacts**

2 The aquatic impacts from construction of the proposed type of closed-cycle cooling system at
3 this site likely would be similar to the impacts of such systems at other sites and would be of
4 minor significance, involving localized and mostly temporary effects of building intake and
5 discharge structures at the shoreline. Building activities could increase stormwater runoff due to
6 increased areas of impervious surface, increase storm flows in streams, or change the course of
7 streams on the site. Soil disturbance combined with increased runoff could increase sediment
8 transport into the reservoir. TCEQ requires stormwater permits for construction sites of 1 ac or
9 more, and obtaining a permit requires development and implementation of an SWPPP
10 specifying the BMPs to be used in protecting water bodies (TCEQ 2008). Compliance with
11 permitting requirements and associated use of BMPs to minimize or prevent stormwater impacts
12 would minimize erosion-related impacts on surface waters and wetlands. BMPs that likely
13 would be implemented under an SWPPP include the installation and maintenance of silt
14 fencing, the maintenance of vegetated buffer zones between waterbodies and areas undergoing
15 development, and the diversion of runoff to sediment retention basins.

16 Sam Rayburn reservoir would be the water source for the proposed nuclear power facility. The
17 water intake would be located on one side of the peninsula and the outfall on the other side, and
18 the intake and discharge sites probably would be located in areas of relatively deep water near
19 the lake shore. Installation of a raw water intake and discharge line would disturb the sediments
20 on the bottom of the reservoir, but significant dredging is not likely to be needed to construct or
21 maintain the intake and outfall. Although these actions could temporarily affect surface water
22 quality, effects would be minor due to the expected implementation of BMPs, the small size of
23 the disturbed area relative to the total area of similar habitat in the reservoir, and the sandy
24 characteristics of the soil and lake bottom, making it unlikely that their disturbance would
25 contribute significantly to turbidity. Thus, building of facilities would not cause substantial
26 changes in surface water quality or hydrology, and aquatic communities would not be noticeably
27 affected.

28 A new transmission line on a new right-of-way (ROW) would be required to connect the
29 proposed nuclear power facility to existing transmission lines. Either of two existing lines could
30 be tapped: one is 45 mi to the northwest, and the other is 25 mi to the southeast. Either route
31 would cross mostly forested and agricultural areas. It is assumed that during the building of
32 new transmission line ROWs, the building of new access roads also would be required. While
33 detailed information concerning the routing of possible new transmission line ROWs is not
34 available at this time, ROWs would cross streams and possibly wetlands. Construction of new
35 transmission lines would be subject to additional environmental review. The new ROW would
36 be subjected to site-specific pre-development investigations, possibly including, but not limited
37 to, reconnaissance to ascertain the presence or absence of listed species and other important
38 species and habitats defined in NUREG-1555 or as required by Federal or State agency
39 regulatory requirements. The ability to relocate proposed transmission tower sites laterally
40 along the ROW means that towers could usually be sited to avoid environmentally sensitive
41 areas such as waterbodies and wetlands.

42 Aquatic species would be unlikely to be substantially affected by the loss of small areas of
43 aquatic or wetland habitat potentially within the footprint of facilities and the ROW that would be
44 built for the project. If State-listed species potentially occurring in the region, described above,
45 were present near a location where facilities were being built, the mobility of some species,
46 including the fish and alligator snapping turtle, would allow them to avoid the activities.
47 Individuals of relatively immobile species, such as mussels, would not be able to avoid the
48 activities and may be injured or killed if present in the affected area. Of the listed mussels
49 potentially occurring in the area, only the Texas heelsplitter inhabits reservoirs and may occur in

1 the lake where it could be affected. Thus, building of water intakes and discharge structures
2 would likely have minimal impacts on aquatic resources, but impacts could be noticeable if the
3 Texas heelsplitter is present at the affected location in the lake.

4 ***Operational Impacts***

5 Operation of proposed new nuclear units at the Pineland site could affect aquatic resources as a
6 result of entrainment and impingement of organisms at the cooling water intake and thermal,
7 chemical, and physical effects from the discharge of cooling water and other effluents. An
8 evaluation of impacts resulting from operation of the intake and discharge cannot be conducted
9 in detail due to lack of specific information that would have to be developed (i.e., more than
10 reconnaissance-level information), such as the design and location of cooling water intakes and
11 discharges at this site, and the locations of a new ROW that could be required. Consequently,
12 the review team relies upon the conclusions in the Generic Environmental Impact Statement for
13 License Renewal of Nuclear Plants (GEIS), NUREG-1437 (NRC 1996) to inform the
14 assessment of aquatic impacts from the operation of the cooling system.

15 NUREG-1437 (NRC 1996) evaluated aquatic ecological impacts resulting from operation of
16 existing nuclear power plants. The aquatic impacts from operation of cooling systems for
17 existing power plants were found to be of minor significance for all plants that utilize closed-
18 cycle cooling systems with cooling towers. In evaluating this alternative site, the review team
19 assumed that the new nuclear power plant that would be constructed at this site would utilize a
20 similar cooling system, consisting of a closed-cycle system with cooling towers. Consequently,
21 the types of aquatic ecological impacts that would result from operation of the new nuclear units
22 would be similar to those of existing nuclear power plants that have closed-cycle cooling
23 systems with cooling towers.

24 With regard to cooling water intakes, NRC found that entrainment and impingement of fish and
25 shellfish have not been a problem at existing facilities that use closed-cycle systems with
26 cooling towers. Minimal impacts from intake operation would be expected if it is assumed the
27 following conditions would apply at this site in accordance with EPA's Phase I regulations for
28 new facilities under Section 316(b) of the CWA (66 FR 65256): (1) a closed-cycle cooling
29 system, (2) a maximum through-screen velocity of 0.5 ft/s at the cooling water intake, (3) an
30 intake flow that would not disrupt the natural thermal stratification or turnover pattern of the lake
31 at the Pineland site, and (4) location of the new intake in an area of the source waterbody away
32 from areas with the potential for high productivity of fish or other important organisms (66 FR
33 65256). With regard to effluent discharges from facilities with closed-cycle cooling systems,
34 NRC found that the thermal and water-quality effects from the relatively small volumes of
35 blowdown water discharged did not have more than minor impacts on the aquatic ecology of the
36 receiving waterbody (NRC 1996).

37 Thermal impacts on the reservoir from the discharge of cooling water are expected to be minor
38 because cooling towers would be used, the large volume of water in the reservoir would be
39 sufficient for dissipation of thermal inputs, and discharges would need to comply with
40 requirements of a State-issued discharge permit. Use of Sam Rayburn Reservoir as the source
41 for cooling and other water required for facility operations would not have more than minor
42 effects on water levels in the reservoir. Effects on water levels would be small relative to the
43 annual fluctuation of about 8 ft (TetraTech 2003) that results from reservoir operations.
44 Discharge of cooling tower blowdown and other effluents, such as treated sanitary wastewater,
45 would have no more than minor impacts on chemical water quality in the reservoir, as the
46 volume of water in the reservoir would be sufficient for assimilation of dissolved materials in
47 facility effluents. In periods of low flow through the reservoir, there may be a potential for
48 recirculation of water from the discharge to the intake. Such a recirculation pattern may result in

1 constituent concentrations that are locally elevated above ambient concentrations in a larger
2 than normal area in the vicinity of the diffuser. However, the effluent concentrations discharged
3 likely would remain below water quality criteria. Given the assimilative capacity of the reservoir,
4 detectable water quality effects would not be expected downstream from Sam Rayburn Dam.
5 Thus, aquatic species are unlikely to be adversely affected by hydrological alterations or water
6 quality, thermal, or other physical effects from operations in either the lake or the river
7 downstream.

8 As discussed above, ten aquatic species that are State-listed as threatened have recorded
9 occurrences in San Augustine, Sabine, or Jasper Counties, in which the reservoir and the
10 downstream reach of the Angelina River (Jasper County) are located: the alligator snapping
11 turtle, creek chubsucker, blue sucker, paddlefish, and five mussel species. It is unlikely that
12 such species or their habitats would be substantially affected by the relatively small volumes of
13 water withdrawn and discharged by the closed-cycle cooling system proposed for the Pineland
14 site (NRC 1996). However, even the low rates of entrainment and impingement at the intake for
15 a closed-cycle cooling system and the relatively small volumes of effluent discharged could be a
16 concern if an unusually important aquatic resource such as a threatened species would be
17 affected (NRC 1996).

18 The creek chubsucker seldom if ever occurs in impoundments, and the blue sucker has rarely
19 been found in impoundments (Hassan-Williams and Bonner 2007), so these fish are unlikely to
20 occur in the reservoir or near the intake or discharge. If present in the Angelina River
21 downstream, they would be unlikely to be affected by operation of the proposed facility. The
22 paddlefish was stocked in the reservoir historically and potentially could be present, but its size,
23 mobility, and life history make it unlikely that this species would be affected. Similarly, the
24 alligator snapping turtle could occur in the reservoir but would not be affected by facility
25 operation. Of the listed mussels potentially occurring in the area, only the Texas heelsplitter
26 may inhabit the reservoir, but it would be unlikely to be affected by facility operation. The State-
27 listed mussels in Table 9-15 could occur in the Angelina River downstream of the reservoir, but
28 these species would be unlikely to be adversely affected by the minimal hydrological and water
29 quality effects on the river from facility operation at the Pineland site.

30 Given the assumption that BMPs would be followed in maintaining the new ROW, if State-listed
31 aquatic species occur in the small streams and wetlands that may be traversed by the
32 transmission lines, they would be unlikely to be affected by operation of the lines and the
33 maintenance of the ROW. Thus, the overall potential for operation of two new reactor units at
34 the Pineland site and a new ROW to affect threatened or endangered species is expected to be
35 minimal.

36 ***Cumulative Impacts***

37 The impacts of building and operating two nuclear units at the Pineland site were evaluated by
38 the review team to determine the magnitude of their contribution to cumulative impacts on
39 aquatic and wetlands resources in the geographic area of interest. The area of interest includes
40 the site and adjacent water bodies wetlands in the vicinity, including Sam Rayburn Reservoir
41 and the Angelina River downstream to where it enters the upper reaches of Steinhagen Lake,
42 approximately 18 mi southeast of Sam Rayburn Dam. Past actions that have affected aquatic
43 resources in the area include use of water for agriculture, residential development, increased
44 runoff from clearing of forests and development that creates impervious surfaces associated
45 with buildings and pavement, ongoing operation of Sam Rayburn dam and its hydroelectric
46 turbines, and sewage discharge. Possible future actions that could affect aquatic resources in
47 the geographic area of interest include the continued operation of Sam Rayburn Reservoir and
48 its hydroelectric facility, and construction of water and/or wastewater treatment and distribution

1 facilities in conjunction with future residential and commercial development (Table 9-13). In
2 addition, GCC could alter aquatic habitats in the area.

3 Past actions that have affected aquatic resources in the area include water use for operation of
4 the existing electric power facility at the site (which is ceasing operation in 2010), operation of
5 Tradinghouse Dam, water use for and runoff from agriculture, and water use and sewage
6 discharge from some residential development. Possible future actions that could affect aquatic
7 resources in the geographic area of interest include the continued operation of Tradinghouse
8 Reservoir and construction of water and/or wastewater treatment and distribution facilities in
9 conjunction with future residential and commercial development (Table 9-17). In addition, GCC
10 could alter aquatic habitats in the area.

11 Future urbanization in the geographic area of interest could contribute to decreases in
12 undeveloped land, including wetlands, as well as increased demand for water and reduced
13 water quality. The TSDC projects that the population in a six-county area surrounding the
14 Pineland site (including Angelina, Jasper, Nacogdoches, Sabine, San Augustine, and Shelby
15 Counties) will increase by 14.5 percent by the year 2040 (TSDC 2009). Future urbanization in
16 the geographic area of interest could contribute to additional demand for water, increased need
17 for wastewater assimilation, and reduced water quality. Water supply in the area should
18 continue to be more than adequate to meet demand from users for the reasonably foreseeable
19 future even with the addition of two nuclear power units at the Pineland site. Point and nonpoint
20 sources of pollution, particularly nutrients, in the watershed of Sam Rayburn reservoir are likely
21 to continue to contribute to dissolved oxygen depletion and other water quality effects in some
22 areas of the reservoir. Urbanization and residential development near the reservoir in the future
23 are likely to contribute to dissolved oxygen depletion by adding to the reservoir's nutrient load.
24 However, building and operating two new nuclear power units at the Pineland site would not be
25 expected to make more than a minor contribution to either the nutrient load or the resulting
26 oxygen depletion. Cumulatively, these effects on water quality would likely have minimal
27 impacts on aquatic organisms.

28 The report on *Global Climate Change Impacts in the United States* (Karl et al. 2009), provided
29 by the GCRP, summarizes the projected impacts of future climate changes in the United
30 States. The report divides the United States into nine regions, and the Pineland site is located
31 in the Southeast region. The GCRP climate models for this region project continued warming in
32 all seasons and an increase in average temperatures in the region of approximately 4.5°F by
33 the 2080s. Additionally, the amount of water available to natural systems and its timing are
34 likely to be affected by climate change and human responses to it. Climate models project that
35 there will tend to be less water available in the region due to the higher temperatures and longer
36 periods between rainfall events combined with increased demand for water, which may drive the
37 building of dams for storage capacity and increases in crop irrigation. Thus, the projected
38 effects of climate change for the Southeast region could affect aquatic ecosystems through
39 higher water temperatures, longer periods of drought, increased damming of rivers, and higher
40 human consumption of water.

41 **Summary**

42 The review team concludes that the impacts on aquatic resources from building two new
43 nuclear units at the Pineland site would be noticeable but not destabilizing to aquatic resources.
44 The review team also concludes that the impacts from operation of two new units would be
45 minimal. Based on the information provided by Luminant and the review team's independent
46 evaluation, the review team concludes that the cumulative impacts of from past, present, and
47 reasonable foreseeable activities affecting aquatic and wetlands resources in the geographic
48 area of interest would be SMALL. The incremental contribution of building and operating two

1 new reactors at the Pineland site to cumulative impacts on aquatic and wetlands resources in
2 the geographic area of interest would be minimal.

3 **9.3.3.5 Socioeconomics**

4 The following impact analysis includes impacts from building activities and operations. The
5 analysis also considers other past, present, and reasonably foreseeable future actions that
6 impact socioeconomics, including the other Federal and non-Federal projects listed in
7 Table 9-8. For the analysis of socioeconomic impacts at the Pineland site, the geographic area
8 of interest is the 14-county area around the Pineland site (Table 9-16) that was evaluated in
9 *Luminant Nuclear Power Plant Siting Report* (Luminant 2007). In evaluating the socioeconomic
10 impacts of site development and operation at the Pineland site, the review team used the
11 population and labor force data provided in *Luminant Nuclear Power Plant Siting Report*
12 (Luminant 2007).

13 The Pineland site is located in San Augustine County in east Texas on a peninsula on Sam
14 Rayburn Reservoir. The site is located approximately 4 mi west of U.S. Highway 96 and
15 approximately 5 mi south of the town of Pineland. Section 9.3.3.1 contains a description of the
16 Pineland site.

17 As indicated in Table 9-16, San Augustine County and the 13 other counties and parishes
18 surrounding the Pineland site have a combined 2010 population of 480,767, a combined 2000
19 labor force of 177,738, and a combined 2000 construction labor force of 24,786. Thus, the
20 Pineland site has a relatively small labor pool from which to draw construction and operations
21 workers, which would result in more in-migrating workers. More in-migrating workers would
22 result in larger socioeconomic impacts, especially to housing and public services.

23 The review team concludes that building and operating a two-unit nuclear power plant at the
24 Pineland site would have MODERATE to LARGE socioeconomic impacts in San Augustine
25 County and the surrounding counties and parishes for three reasons. First, the Pineland site is
26 a greenfield site and significant road, rail, and infrastructure development would be required in
27 the surrounding area to access and use it. Second, the Pineland site has a relatively small
28 labor force from which to draw construction and operations workers; consequently a large
29 numbers of workers would need to in-migrate. Third, the Pineland site is in a rural area that
30 likely would not have the existing housing, infrastructure, and public services to support the in-
31 migration of a large number of workers and their families. In addition, building and operating a
32 nuclear power plant at the Pineland site could affect use of the USACE's existing San Augustine
33 Park as well as existing residential developments on the peninsula in Sam Rayburn Reservoir
34 (Section 9.3.3.1).

35 **9.3.3.6 Environmental Justice**

36 The following impact analysis includes impacts from building activities and operations. The
37 analysis also considers other past, present, and reasonably foreseeable future actions that
38 impact socioeconomics, including the other Federal and non-Federal projects listed in
39 Table 9-8. For the analysis of environmental justice impacts at the Pineland site, the
40 geographic area of interest is the 14-county area around the Pineland site (Table 9-16) that was
41 evaluated in *Luminant Nuclear Power Plant Siting Report* (Luminant 2007). In evaluating the
42 environmental justice impacts of site development and operation at the Pineland site, the review
43 team used the minority and low-income data provided in *Luminant Nuclear Power Plant Siting*
44 *Report* (Luminant 2007).

1

Table 9-16. Population and Labor Force in San Augustine County, Texas, and the Other Counties and Parishes Surrounding the Pineland Site

County	Total population 2006	Projected total population 2010	Total labor force 2000	Total construction labor force 2000
San Augustine	8888	8852	3210	472
Sabine	10,457	10,451	3258	502
Jasper	35,293	35,081	13,327	2189
Angelina	82,524	84,174	33,857	3927
Tyler	20,557	20,351	6827	1168
Newton	14,090	13,484	5222	1047
Nacogdoches	61,079	62,362	25,637	2388
Shelby	26,575	27,532	9801	1158
Vernon Parish, Louisiana	46,748	43,335	16,520	2767
Sabine Parish, Louisiana	23,934	24,245	8466	1220
DeSoto Parish, Louisiana	26,390	27,261	9707	1526
Rusk	48,354	49,030	18,825	2815
Panola	22,989	23,150	9075	1505
Polk	46,995	51,459	14,006	2102
Total	468,264	480,767	177,738	24,786

Source: Luminant 2007.

2 As indicated in Table 9-17, San Augustine County and the 13 other counties and parishes
3 surrounding the Pineland site have a combined minority percentage of 28.3 percent. This
4 percentage of minority residents is much lower than that for the State of Texas (61.1 percent)
5 (Table 2-27). Thus, when compared to the State of Texas, the Pineland site has a small
6 minority percentage for purposes of environmental justice analysis.

7 In terms of low-income residents, the 14 counties and parishes surrounding the Pineland site
8 have a combined low-income percentage of 17.9 percent. This percentage of low-income
9 residents is slightly higher than that for the State of Texas (14.0 percent) (Table 2-27).
10 However, when compared to the State of Texas, the Pineland site does not have a significantly
11 higher low-income percentage for purposes of environmental justice analysis.

12 In Section 9.3.3.5, the review team concluded that building and operating a new two-unit
13 nuclear power plant at the Pineland site would have MODERATE to LARGE socioeconomic
14 impacts in San Augustine County and the surrounding counties. Based on that conclusion, the
15 review team concludes that the socioeconomic impacts of building and operating at the
16 Pineland site could have MODERATE environmental justice impacts by disproportionately and
17 adversely affecting low-income populations, especially in the area of housing price and
18 availability.

Table 9-17. Minority and Low-income Percentages in San Augustine County, Texas, and the Other Counties and Parishes Surrounding the Pineland Site

County	Total Population 2006	Percent Nonminority ^a	Percent Minority ^b	Percent Low-Income
San Augustine	8888	68.3	31.7	20.2
Sabine	10,457	86.9	13.1	16.4
Jasper	35,293	76.5	23.5	18.7
Angelina	82,524	67.0	33.0	17.3
Tyler	20,557	82.3	17.7	18.1
Newton	14,090	73.2	26.8	21.1
Nacogdoches	61,079	67.8	32.2	20.1
Shelby	26,575	65.0	35.0	18.8
Vernon Parish, Louisiana	46,748	71.3	28.7	16.4
Sabine Parish, Louisiana	23,934	70.9	29.1	18.8
DeSoto Parish, Louisiana	26,390	56.4	43.6	19.9
Rusk	48,354	68.9	31.1	13.1
Panola	22,989	75.0	25.0	13.7
Polk	46,995	73.9	26.1	17.5
Total	468,264	71.7	28.3	17.9

^a Non-minority = White persons, not Hispanic.

^b Minority = Black persons, American Indian and Alaska Native persons, Asian persons, Native Hawaiian and Other Pacific Islander persons, and Hispanic persons.

Sources: Luminant 2007; USCB 2009a; USCB 2009b.

1 9.3.3.7 Historic and Cultural Resources

2 The following impact analysis includes impacts from building and operating two new nuclear
3 power plants at the Pineland site. The analysis also considers other past, present, and
4 reasonably foreseeable future actions that impact historic and cultural resources, including
5 Federal and non-Federal projects listed in Table 9-13. For the analysis of historic and cultural
6 impacts at the Pineland site, the geographic area of interest is considered to be the APE that
7 would be defined for this proposed undertaking. This includes the physical APE, defined as the
8 area directly affected by the site-development and operation activities at the site and
9 transmission lines, and the visual APE. The visual APE is defined as the additional 1-mi radius
10 around the physical APE as a reasonable assumption for defining a maximum distance from
11 which the structures can be seen.

12 Reconnaissance activities in a cultural resource review have a particular meaning. For
13 example, these activities include preliminary field investigations to confirm the presence or
14 absence of cultural resources. However, in developing its EIS, the review team relies upon
15 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-
16 level information is data that are readily available from agencies and other public sources. It
17 can also include information obtained through visits to the site area.

1 To identify the historic and cultural resources at the Pineland site the following information was
2 used:

- 3 • Luminant ER (Luminant 2009a);
- 4 • Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4, Luminant Nuclear Power
5 plant Siting Report (Luminant 2007)
- 6 • Texas Historical Commission's Texas Archaeological Sites Atlas (THC 2010); and,
- 7 • NRC Alternative Sites Visit, February 2009.

8 The Pineland site is a "greenfield" site located in San Augustine County in east Texas in the
9 Timberlands region. Historically, the site has been used for its timber resources and agricultural
10 purposes. The current major industries in San Augustine County are oil, silviculture, tourism,
11 and agriculture.

12 The siting report provided by Luminant indicated that there were 7 properties listed in the NRHP
13 located in San Augustine County and 2 NRHP sites in adjacent Sabine County (Luminant 2007).
14 The NRHP sites are located in City of San Augustine (approximately 25 mi from the Pineland
15 site), city of Hemphill (in Sabine County approximately 12.6 mi from the Pineland site), and city
16 of Milam (also in Sabine County approximately 20 mi from the Pineland site). Additionally,
17 prehistoric fossils and artifacts from the Paleo-Indian period are known to occur in the county.

18 According to the Texas Historical Commission's Texas Archaeological Sites Atlas, there are no
19 National Register Properties or National Register Districts located in the APE or visual APE
20 (THC 2010). Additionally, there are no recorded Texas Historical Landmarks located near the
21 APE or visual APE.

22 Historic and cultural resource impacts for a new plant located at the Pineland site would likely
23 be similar to the impacts for a new plant at the CPNPP site as discussed in Sections 4.6 and
24 5.6. A cultural resources inventory would likely be needed for any portion of the property that
25 has not been previously surveyed at the Pineland site. Other lands that may be acquired to
26 support the plant would also likely require a survey to identify potential historic and
27 archaeological resources, and identification of mitigative measures to offset adverse effects of
28 ground disturbing activities. These studies would likely be needed for areas of potential
29 disturbance at the Pineland site, offsite affected areas, such as mining and waste disposal sites,
30 and along associated corridors where new construction would occur, for example, roads and
31 pipeline corridors. The types of historic and cultural resource impacts resulting from operation
32 of new nuclear units would likely be similar to those of existing nuclear power plants.

33 There are no existing transmission corridors connecting directly to the Pineland site (Luminant
34 2007). However, there is a 345-kV transmission line located approximately 45-mi northwest of
35 the site and a 500 kV transmission line is located approximately 25 mi southeast of the site
36 (Luminant 2009a). New transmission line corridors would be needed to connect the Pineland
37 site to these existing lines. Several historic and cultural resource sites are located in this region
38 and could potential be affected by the addition of new transmission line corridors. In the event
39 that the Pineland site was chosen for the proposed project, the review team assumes that the
40 transmission service provider for this region would conduct its transmission line related cultural
41 resource surveys and procedures similar to those performed by Oncor for the CPNPP site in
42 section 4.6 of this EIS. In addition, visual impacts from transmission lines may result in
43 significant alterations to the visual landscape within the geographic area of interest. Given the
44 potential size of the area to be disturbed by adding new transmission line corridors, the visual
45 impacts of the transmission line corridor could noticeably alter historic and cultural resources.
46 However, the visual impact would not destabilize important attributes of the resource.

1 One project listed in Table 9-12 has the potential to contribute to cumulative impacts to historic
2 and cultural resources. Proposed highway improvements to U.S. 96 is within 5 mi of the
3 Pineland site. There are also residential developments within 1.5 mi of the site on the Sam
4 Rayburn Reservoir. Additionally, the Texas State Data Center predicts the average population
5 growth rate will be 14.57 percent from 2010 to 2040 for the 6 counties surround the Pineland
6 site (TSDC 2009). The 6 counties included Angelina, Jasper, Nacogdoches, Sabine, San
7 Augustine, and Shelby counties. The average population growth rate could result in an increase
8 in urbanization in the area. Urbanization includes increases in residential, commercial,
9 industrial, and infrastructure development. The highway improvement, residential development,
10 and urbanization could encroach on historic cultural resources near the geographic area of
11 interest.

12 Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources
13 is cumulative. Based on the reconnaissance level information, specifically the potential addition
14 of new transmission line corridors, the review team concludes that the cumulative impacts on
15 historic and cultural resources of construction, pre-construction, and operating new nuclear units
16 on the Pineland site and from other projects, developments, and urbanization would be
17 MODERATE. The incremental impact associated with NRC-authorized construction and
18 operation would be SMALL. This impact level determination reflects that no known cultural
19 resources would be affected on the Pineland site. However, if the site were to be developed,
20 cultural resource surveys may reveal important historic properties that could result in greater
21 cumulative impacts. In this event, documentation and mitigation procedures laid out in Section
22 106 of the National Historic Preservation Act would need to be followed to minimize the effect of
23 this action.

24 **9.3.3.8 Air Quality**

25 The following impact analysis includes impacts from building activities and operations. The
26 analysis also considers other past, present, and reasonably foreseeable future actions that
27 impact air quality, including other federal and non-Federal projects listed in Table 9-13. The
28 geographic area of interest for the Pineland site is Sabine and San Augustine counties.

29 The emissions related to building and operating a nuclear power plant at the Pineland site
30 alternative would be similar to those associated with the proposed location at CPNPP. The air
31 quality attainment status for both Sabine and San Augustine counties as set forth in 40 CFR
32 81.344 reflects the effects of past and present emissions from all pollutant sources in the region.
33 Sabine and San Augustine counties are not out of attainment of any National Ambient Air
34 Quality Standard.

35 The atmospheric emissions related to building and operating a nuclear power plant at the
36 CPNPP site in Somervell County, Texas, are described in Chapters 4 and 5. The criteria
37 pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of the
38 criteria pollutants at the CPNPP site were evaluated and also determined to be SMALL.

39 Reflecting on the projects listed in Table 9-13, they are not expected to be significant with
40 respect to emission of criteria air pollutants. The industrial projects listed in Table 9-13 would
41 have *de minimis* impacts, and it is therefore unlikely that the air quality in the region would
42 degrade to the extent that the region is in nonattainment of National Ambient Air Quality
43 Standards.

44 The air quality impact of the Pineland site development would be local and temporary. The
45 distance from building activities to the site boundary would be sufficient to generally avoid
46 significant air quality impacts. There are no land uses or projects, including the aforementioned

1 sources, that would have emissions during site development that would, in combination with
2 emissions from the Pineland site, result in degradation of air quality in the region.

3 Releases from operation of two units at the Pineland site would be intermittent and made at low
4 levels with little or no vertical velocity. The air quality impacts of other general emissions
5 sources in the area are included in the baseline air quality status. The cumulative impacts from
6 emissions from the Pineland site and the aforementioned sources could be noticeable but not
7 destabilizing. The cumulative impacts from emissions of effluents from the Pineland site and
8 the aforementioned sources could be noticeable but not destabilizing.

9 The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in
10 Section 7.5. The impacts of the emissions are not sensitive to location of the source.
11 Consequently, the discussion in Section 7.5 is applicable to a nuclear power plant located at the
12 Pineland site. The review team concludes that the national and worldwide cumulative impacts
13 of greenhouse gas emissions are noticeable but not destabilizing. The review team further
14 concludes that the cumulative impacts would be noticeable but not destabilizing, with or without
15 the greenhouse gas emissions of the project at the Pineland site.

16 Cumulative impacts to air quality resources are estimated based on the information provided by
17 Luminant and the review team's independent evaluation. Other past, present and reasonably
18 foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants
19 and global for greenhouse gas emissions) that could affect air quality resources. The
20 cumulative impacts on criteria pollutants from emissions of effluents from the Pineland site and
21 other projects could be noticeable but not destabilizing. The national and worldwide cumulative
22 impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team
23 concludes that the cumulative impacts would be noticeable but not destabilizing, with or without
24 the greenhouse gas emissions from the Pineland site. The review team concludes that
25 cumulative impacts from other past, present, and reasonably foreseeable future actions on air
26 quality resources in the geographic areas of interest would be SMALL for criteria pollutants and
27 MODERATE for greenhouse gas emissions. The incremental contribution of impacts on air
28 quality resources from building and operating two units at the Pineland site would be
29 insignificant for both criteria pollutants and greenhouse gas emissions.

30 **9.3.3.9 Nonradiological Health Impacts**

31 The following impact analysis includes impacts from building activities and operations.
32 The analysis also considers other past, present, and reasonably foreseeable future actions
33 that impact nonradiological health, including other Federal and non-Federal projects listed in
34 Table 9-13. This section covers the review team's evaluation of the potential environmental
35 impacts of siting a new two-unit nuclear power plant at the Pineland site on the Sam Rayburn
36 reservoir. The Pineland site, a Greenfield site, is not currently owned by the Applicant.
37 Additionally, the Pineland site would not require the use of a BDTF to treat blowdown water
38 discharges.

39 For the analysis of nonradiological health impacts at the Pineland site, the geographic area of
40 interest is considered to include projects within a 5-mi radius from the site's center based on the
41 localized nature of the impacts. Only one unincorporated area of population is found in this
42 radius, but there is a seasonal influx of tourists, because the site is between the Angelina and
43 Sabine National Forests (Luminant 2007). In addition, there are approximately 300 fishing
44 contests held annually on the reservation. For impacts associated with transmission lines, the
45 geographic area of interest in the transmission line corridor.

46 The building activities that have the potential to impact the health of members of the public and
47 workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the

1 transport of construction materials and personnel to and from the site. The operation-related
2 activities that have the potential to impact the health of members of the public and workers
3 includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers
4 to and from the site.

5 ***Building Impacts***

6 Nonradiological health impacts to construction workers and members of the public from building
7 two nuclear units at the Pineland site would be similar to those evaluated in Section 4.8 for the
8 CPNPP site. These impacts include noise, vehicle exhaust, dust, occupational injuries, and
9 transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air
10 quality and noise would be met during the site preparation and building phase. The incidence of
11 construction worker accidents would not be expected to be different from the incidence of
12 accidents estimated for the CPNPP site. Some modifications to the transportation routes
13 immediately near the Pineland site may be warranted to facilitate traffic flow. The Pineland site
14 is located in a rural area, and nonradiological health impacts from building would likely be
15 negligible on the surrounding populations.

16 Some current pipelines through the site may require relocation (Luminant 2007). Proposed
17 future actions would include transmission line development and/or upgrading, and transportation
18 upgrades, including improvements to U.S. 96, which would both occur throughout the
19 designated geographical areas of interest. An additional 345 kV transmission line is already
20 planned for the area (Luminant 2009a).

21 In the past, the construction of the Sam Rayburn Dam (10 mi away) may have had similar
22 nonradiological impacts on the public and workers. There are no major current construction
23 projects in the geographic area of interest that would cumulatively impact nonradiological health.
24 Part of the proposed improvements to U.S. Highway 59 would be within 5 mi of the site.

25 ***Operational Impacts***

26 Nonradiological health impacts from operation of two nuclear unit on occupational health and
27 members of the public at the Pineland site would be similar to those evaluated in Section 5.8.
28 Occupational health impacts to workers (e.g., falls, electric shock or exposure to other hazards)
29 at the Pineland site would likely be similar to those evaluated for workers at the new units at the
30 CPNPP site

31 Additional occupational health impacts may result from exposure to hazards such as noise, toxic
32 or oxygen-replacing gases, thermophilic microorganisms in the condenser bays, and caustic
33 agents. Luminant's current safety and health programs promote safe work practices and
34 respond to occupational injuries and illnesses. The same or a similar program would be
35 expected for new units at the Pineland site. Health impacts to workers from nonradiological
36 emissions, noise, and EMFs would be monitored and controlled in accordance with the
37 applicable OSHA regulations and would be minimal.

38 Exposure to the public from water-borne etiological agents from the mechanical draft cooling
39 towers would not likely increase the incidence of water-borne diseases in the vicinity of the site.
40 Noise and EMF exposure would be monitored and controlled in accordance with applicable
41 Occupational Safety and Health Administration regulations. Effects of EMF on human health
42 would be minimized by conformance with National Electrical Safety Code (NESC) criteria.
43 Nonradiological impacts of traffic associated with the operations workforce would be less than
44 the impacts during construction. Road improvements during construction would also minimize
45 impacts during operation of the two new units.

1 There are no identified past and present activities in the geographic areas of interest that could
2 have nonradiological impacts to the public or workers. In the future, these facilities, the
3 proposed transmission line systems, and growth and future urbanization would have
4 nonradiological impacts to the public and workers, and these impacts would be similar to those
5 described for the proposed two new units at the CPNPP site.

6 The review team is also aware of the potential climate changes that could affect human health;
7 a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been
8 considered in the preparation of this EIS. Projected changes in the climate for the region
9 include an increase in average temperature and a decrease in precipitation, which may alter the
10 presence of microorganisms and parasites in any reservoir that would be used. The review
11 team did not identify anything that would alter its conclusion regarding the presence of
12 etiological agents or change in the incidence of water-borne illness.

13 **Summary**

14 Based on the information provided by Luminant and the review team's independent evaluation,
15 the review team expects that the impacts to nonradiological health from construction and
16 operation of a new unit at the Pineland site would be similar to the impacts evaluated for the
17 CPNPP site. These impacts would be localized and managed through adherence to existing
18 regulatory requirements. The review team concludes, therefore, that the cumulative impacts
19 would be SMALL.

20 **9.3.3.10 Radiological Health Impacts of Normal Operations**

21 The following impact analysis includes impacts from building activities and operations for two
22 nuclear units at the Pineland alternative site. The analysis also considers other past, present,
23 and reasonably foreseeable future actions that impact radiological health, including other
24 Federal and non-Federal projects listed in Table 9-13. As described in Section 9.3.3, the
25 Pineland site is an undeveloped site in the east Texas timberlands near the small town of
26 Pineland; there are currently no nuclear facilities on site. The geographic area of interest is the
27 area within a 50-mi radius of the Pineland site. There are no major facilities that result in
28 regulated exposures to the public or biota within the 50-mi radius of the Pineland site. However,
29 there are likely to be hospitals and industrial facilities within 50 mi of the Pineland site that use
30 radioactive materials.

31 The radiological impacts of building and operating the proposed two MHI US-APWR units at the
32 Pineland site include doses from direct radiation and liquid and gaseous radioactive effluents.
33 These pathways would result in low doses to people and biota offsite that would be well below
34 regulatory limits. These impacts are expected to be similar to those estimated for the CPNPP
35 site. The NRC staff concludes that the dose from direct radiation and effluents from hospitals
36 and industrial facilities that use radioactive material would be an insignificant contribution to the
37 cumulative impact around the Pineland site. This conclusion is based on data from the
38 radiological environmental monitoring programs in place around currently operating nuclear
39 power plants.

40 Based on the information provided by Luminant and the NRC staff's independent analysis, the
41 NRC staff concludes that the cumulative radiological impacts from building and operating the
42 two proposed MHI US-APWRs and other existing and planned projects and actions in the
43 geographic area of interest around the Pineland site would be SMALL.

1 **9.3.3.11 Postulated Accidents**

2 The following impact analysis includes radiological impacts from postulated accidents from
3 operations for two nuclear units at the Pineland alternative site. The analysis also considers
4 other past, present, and reasonably foreseeable future actions that impact radiological health
5 from postulated accidents, including other Federal and non-Federal projects and those projects
6 listed in Table 9-13. As described in Section 9.3.3, the Pineland site is a greenfield site; there
7 are currently no nuclear facilities on the site. The geographic area of interest considers existing
8 and proposed nuclear power plants that have the potential to increase the probability-weighted
9 consequences (i.e., risks) from a severe accident at any location within 50 mi of the Pineland
10 site. There are no existing or proposed reactors that have the potential to increase the
11 probability-weighted consequences (i.e., risks) from a severe accident at any location within 50
12 mi of the Pineland site.

13 As described in Section 5.11.1, the NRC staff concludes that the environmental consequences
14 of design basis accidents (DBAs) at the CPNPP site would be minimal for US-APWRs. DBAs
15 are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC
16 safety criteria. The US-APWR design is independent of site conditions, and the meteorology of
17 the Pineland and CPNPP sites are similar; therefore, the NRC staff concludes that the
18 environmental consequences of DBAs at the Pineland site would be minimal.

19 Because the meteorology, population distribution, and land use for the Pineland alternative site
20 are expected to be similar to the proposed CPNPP site, risks from a severe accident for a US-
21 APWR reactor located at the Pineland alternative site are expected to be similar to those
22 analyzed for the proposed CPNPP site. These risks for the proposed CPNPP site are
23 presented in Tables 5-23 and 5-24 and are well below the median value for current-generation
24 reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks
25 are well below the Commission's safety goals (51 FR 30028). On this basis, the NRC staff
26 concludes that the cumulative risks of severe accidents at any location within 50 mi of the
27 Pineland alternative site would be SMALL.

28 **9.3.4 The Tradinghouse Site**

29 This section covers the review team's evaluation of the potential environmental impacts of siting
30 a new two-unit nuclear power plant at the Tradinghouse site in McLennan County, Texas. The
31 Tradinghouse site is located approximately 8 mi east of Waco, Texas, and the site is owned by
32 the Applicant; until December 2009, a fossil-fueled power plant was in operation at the site.

33 The following sections include a cumulative impact assessment conducted for each major
34 resource area. The specific resources and components that could be affected by the
35 incremental effects of the proposed action if implemented at the Tradinghouse site and other
36 actions in the same geographical area were considered. This assessment includes the impacts
37 of NRC-authorized construction and operations and impacts of preconstruction activities. Also
38 included in the assessment are past, present and reasonably foreseeable future Federal, non-
39 Federal, and private actions that could have meaningful cumulative impacts when considered
40 together with the proposed action if implemented at the Tradinghouse site. Other actions and
41 projects considered in this cumulative analysis are described in Table 9-18.

42 The CPNPP site is approximately 70 mi from the Tradinghouse site and was therefore not
43 included in this analysis. The only other nuclear power plant currently operating in Texas is the
44 South Texas Project, near Bay City, Texas. The South Texas Project plant is approximately
45 200 mi south-southeast of the Tradinghouse site and is therefore also not included in this
46 analysis.

1

Table 9-18. Projects and other actions considered in the cumulative analysis at the Tradinghouse Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Tradinghouse Power Plant	Two gas-fired units that provide electric power to customers in the area	Adjacent to Tradinghouse site	Both units were to be taken out of service by end of 2010 ^(a) ; the units were actually taken out of service in 2009.
Limestone Electric Generating Station	Currently comprised of two lignite/coal-fueled steam units, with a combined 1700 MW capacity. The proposed expansion project would add a third 744 MW unit	About 50 mi southeast	Units 1 and 2 operational. Unit 3 expected to begin operating in 2012 ^(b)
Streetman Expanded Shale and Clay Plant	Lightweight aggregate production facility	About 30 mi southeast	Operational ^(c)
Parks			
McLennan County Park	Park managed by McLennan County for public recreation. Park has two public boat ramps with parking but no public campgrounds.	Southern shore of Tradinghouse Creek Reservoir	Operational. ^(d)
Other parks, forests, and reserves	Numerous state and national parks, forests, reserves, and other recreational areas are located within a 50-mi region	Throughout 50- mi region	Parks are currently being managed by national, state, and/or local agencies
Other Actions/Projects			
Waco Airport Runway Improvements	\$3.2 million in infrastructure improvements funded by the Department of Transportation under the American Recovery and Reinvestment Act	About 15 mi west	Proposed. ^(e)
China Springs Water System Improvements	\$3.1 million in new wells and irrigation infrastructure improvements funded by the Department of Agriculture under the American Recovery and Reinvestment Act	About 20 mi northwest	Proposed. ^(f)
Various hospitals and industries that use radioactive materials	Medical and other isotopes	Within 50 miles	Operational in nearby cities and towns

2

1

Table 9-18. (contd)

Project Name	Summary of Project	Location	Status
Future Urbanization	Building of housing units and associated commercial buildings; roads, bridges, and rail; building of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land use planning documents	Throughout region.	Building would occur in the future, as described in local land use planning documents

(a) Source: Smith 2010.

(b) Source: NRG 2009.

(c) Source: EPA 2009g.

(d) Source: TPWD 2009c.

(e) Source: RATB 2010a.

(f) Source: RATB 2010b.

2 **9.3.4.1 Land Use**

3 The Tradinghouse site is located in McLennan County, Texas, approximately 8 mi east of the
4 City of Waco. The site occupies approximately 2010 ac and, according to data from the
5 National Wetlands Inventory, includes approximately 220 ac of wetlands (Luminant 2009a). The
6 site is currently owned by Luminant and housed two gas-fired power-generating units that, at
7 the time of this application, were scheduled to be taken out of service in 2010; they were taken
8 out of service in 2009. The majority of the site is covered by an impoundment, Tradinghouse
9 Creek Reservoir, which provided water to the power plant. The remainder of the site is fairly flat
10 and covered by grassland and evergreen and deciduous forest. The site is outside the 100-yr
11 floodplain. The site is not subject to local zoning regulations. Vehicular access to the site is
12 provided by Lake Felton Parkway, and a rail line is located approximately 5 to 10 mi south of the
13 site.

14 Tradinghouse Creek Reservoir, although owned by the Applicant and designed to support the
15 gas-fired power plant, is used by the local population for fishing, swimming, and passive
16 recreation. McLennan County Park, a county-maintained picnic area with boat ramps, is located
17 on leased land on the opposite bank of the reservoir from the power plant site, and land on the
18 upper reaches of the reservoir (approximately 2 mi east of the potential reactor locations) is
19 leased to the Boy Scouts of America. Because the site was recently used for energy production,
20 building and operating two nuclear generating units would not substantially change the current
21 land use of the Tradinghouse site. The impact of site disturbance activities would be similar to
22 that described for the CPNPP site. While the presence of two nuclear power plants would
23 necessitate increasing the security of the site, the public would likely continue to have access to
24 Tradinghouse Creek Reservoir. Impacts on recreational use, of the reservoir, including impacts
25 to McLennan County Park and the area leased to the Boy Scouts, would be similar to impacts
26 associated with the current gas-fired power plant.

27 Offsite impacts on land use would include constructing a rail spur to the site. The rail spur
28 would be between 5 and 10 mi long and would affect mostly grass and scrub land used primarily
29 for livestock grazing.

30 Six existing transmission line ROW exit the Tradinghouse site and pass through generally flat
31 to gently rolling agricultural lands. While only existing transmission line ROWs would be used to

1 connect with the potential new nuclear units, the Applicant assumes that some of the lines
2 would have to be replaced. It might be necessary to widen parts of some ROWs to
3 accommodate replacement structures. Detailed information about the design of the
4 transmission lines is not yet available; however, since new ROWs would follow existing ROW,
5 the land-use impacts of the transmission lines would be minimal.

6 **Cumulative Impacts**

7 The geographic area of interest for consideration of land-use impacts is McLennan County.
8 This area includes most other projects and actions that could combine with development and
9 operation of two nuclear power units at the Tradinghouse site to produce cumulative land-use
10 impacts. The county is located in the Grand Prairie and Blackland Prairie regions which are
11 characterized by flat to rolling terrain (TSHA 2010). Agricultural farmland is the predominant
12 land use, and most industrial uses in the county are agriculturally related (e.g., poultry
13 processing and manufacture of feeds). Sensitive land uses in the larger region include four
14 wildlife management areas: Aquilla approximately 30 mi NNW of the proposed site, Richland
15 Creek approximately 40 mi NE, Gus Engeling approximately 64 mi ENE, and Cedar Creek
16 Islands approximately 71 mi NE.

17 Historically, land in the area of interest has been used primarily for farming and livestock
18 grazing. Before the Civil War, large cotton plantations were located near the Brazos River with
19 cattle grazing taking place on the surrounding prairie. After the war, the plantations were
20 broken up into smaller tenant farms raising cotton, wheat, and corn. The introduction of new rail
21 lines through the county led to an increase in the use of land to support livestock and also led to
22 the creation of numerous small new communities at rail stops. The county became increasingly
23 industrialized after 1900. Industrial growth accelerated following World War II, leading to a
24 corresponding shift in agricultural land use as tenant farms gave way to much larger commercial
25 agricultural enterprises and cotton cultivation yielded to a more diverse mix of crops (TSHA
26 2010). According to information provided by the Applicant (Luminant 2009a), approximately 81
27 percent of the land area of McLennan County is devoted to agricultural use. Of this amount, 55
28 percent is in cropland (primarily cotton, corn, and wheat), and 45 percent supports livestock
29 (cattle, hogs, sheep, and poultry).

30 The TSDC projects that the population in a seven-county area surrounding the CPNPP site
31 (including Bell, Bosque, Coryell, Falls, Hill, Limestone, and McLennan Counties) will increase by
32 29.2 percent by the year 2040 (TSDC 2009). Urbanization in the vicinity of the Tradinghouse
33 site would reduce natural vegetation and open space, resulting in an overall decline in the
34 extent and connectivity of wetlands, forests, and wildlife habitat. Building and operating two
35 nuclear power generating units at the site could contribute to urbanization by attracting workers
36 needed to build and operate the facility. Future urbanization trends could noticeably alter land
37 uses in the geographic area of interest.

38 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
39 summarizes the projected impacts of future climate changes in the United States (Karl et al.
40 2009). The report divides the United States into nine regions. The Tradinghouse site is located
41 in the Great Plains region. The GCRP climate models for this region project continued warming
42 in all seasons and an increase of as much as 12°F from 2000 to 2090. Additionally, climate
43 models project that there will tend to be less rainfall in this area. The GCRP states that the
44 precipitation decrease projected for the Great Plains could result in a potential reduction in crop
45 yields and livestock productivity, which may change distribution of agricultural and ranching
46 land, as well as reduce forests and wetlands.

47 Based on information provided by the Applicant and the review team's independent review, the
48 review team concludes that the cumulative land-use impacts of building and operating two new

1 nuclear generating units at the Tradinghouse site would be MODERATE. This conclusion
 2 reflects primarily the impacts of building a rail connection to the site and, to a lesser extent, the
 3 direct and indirect land-use impacts associated with increased urbanization. NRC-authorized
 4 construction and operation of the two new nuclear units at the Tradinghouse site, which do not
 5 include preconstruction, would not be a significant contributor to the MODERATE impact.
 6 However, the incremental contribution of the overall project, including preconstruction, would be
 7 noticeable.

8 **9.3.4.2 Water Use and Quality**

9 The Tradinghouse site is on the shore of Tradinghouse Creek Reservoir, an impoundment of
 10 Tradinghouse Creek, a tributary of the Brazos River. The site is in the Brazos River Region G
 11 of the Texas State Water Plan and within the jurisdiction of the Brazos River Authority. For this
 12 analysis, the geographic area of interest encompasses Brazos Region G, with primary focus on
 13 Tradinghouse Creek Reservoir, the immediate site vicinity, and downstream.

14 Tradinghouse Creek Reservoir is impounded by an earthen dam with a concrete control
 15 structure. The lake has a surface area of 2010 ac, a maximum depth of 42 ft (TPWD 2007b),
 16 and a conservation storage capacity of 35,100 ac-ft (TWDB 2007). It was impounded in 1968
 17 (TPWD 2007b). The dam is owned by Luminant, but Luminant does not own the reservoir. The
 18 reservoir currently is a source of cooling water for Luminant's two existing natural gas-fired
 19 units. Inflow to the reservoir is augmented by water diverted from the Brazos River and
 20 delivered by a pipeline from the river to the lake. The Brazos River intake is in a section of the
 21 river that is impounded. The principal groundwater aquifer underlying the Tradinghouse site is
 22 the Trinity Aquifer, present in the subsurface near the eastern limit of its suitability for water
 23 supply (TWDB 2007).

24 Public recreational use of the Tradinghouse Creek Reservoir would be maintained if a nuclear
 25 power plant were to be developed on the site.

26 ***Building Impacts***

27 Building a new nuclear power plant at the Tradinghouse site would require some recontouring of
 28 the site, resulting in changes in stormwater runoff patterns and a temporary increase in release
 29 of sediment into Tradinghouse Creek Reservoir. The relatively flat terrain and the past
 30 disturbance of the area would reduce the potential for impacts on hydrology and water quality
 31 from site preparation, and implementation of standard control measures would further reduce
 32 impacts.

33 Impacts on groundwater quantity and quality from building new nuclear units would be minimal,
 34 as there would be no use of groundwater and the potential for contamination would be
 35 minimized by implementation of appropriate management practices.

36 ***Operational Impacts***

37 It is assumed that two nuclear power units at the Tradinghouse site would use the same
 38 mechanical-draft cooling design as is proposed at the CPNPP site and would consume about
 39 the same volume of water (62,400 ac-ft/yr) as is estimated for the CPNPP site. Water needed
 40 for operation of the two new nuclear power units would be supplied from Tradinghouse Creek
 41 Reservoir and the Brazos River. The existing water rights to 27,000 ac-ft per year that
 42 Luminant currently holds would be transferred to the new facility. Additional Brazos River water
 43 would be obtained from the Brazos River Authority. The existing pipeline from the Brazos River
 44 would need to be expanded to accommodate the additional water requirements of a nuclear
 45 power plant.

1 Because the Tradinghouse site is in the same water planning region as the CPNPP site, the
2 operational impacts of surface water use on water supply would be similar in kind to those at the
3 CPNPP site (Section 5.2). The magnitude of effects would be less, however, because the
4 redirection of water supply from the retired natural-gas units to the new nuclear units would
5 reduce the new water demand from the Brazos River for operation of the nuclear units.

6 The potential for adverse impacts on surface water quality would be somewhat less than at
7 CPNPP (Section 5.2.3.1) because salinities in Tradinghouse Creek Reservoir and in the Brazos
8 River near the Tradinghouse site are lower than in Lake Granbury and the Brazos River
9 downstream from Lake Granbury; consequently, the concentration of salts in blowdown water
10 would be less likely to lead to exceedance of critical thresholds in receiving waters. Discharge
11 location for facility effluents has not been identified; effluents could be discharged to either
12 Tradinghouse Creek Reservoir or the Brazos River. Unlike the CPNPP site, it is expected that
13 no BDTF would be required at the Tradinghouse site due to the lack of a need for water
14 treatment prior to discharge. If water treatment were needed at the Tradinghouse site, less
15 water would need treatment than at the CPNPP site.

16 Potential thermal impacts to the quality of surface waters receiving effluents are expected to be
17 similar to potential thermal impacts at the CPNPP site.

18 Impacts on groundwater quantity and quality from operation would be minimal, as there would
19 be no use of groundwater, there is little or no use of near-surface groundwater that might be
20 subject to contamination from the facility, and the potential for contamination would be
21 minimized by implementation of appropriate management practices.

22 **Cumulative Impacts**

23 In addition to water use and water quality impacts from building and operations activities,
24 cumulative analysis considers past, present, and reasonably foreseeable future actions that
25 impact the same environmental resources. For the cumulative analysis of impacts on surface
26 water, the geographic area of interest for the Tradinghouse site is considered to be the drainage
27 basin of Tradinghouse Creek and the nearby Brazos River and downstream of the site because
28 this is the resource that would be affected by the proposed project. Key actions that have past,
29 present, and future potential impacts to water supply and water quality in the geographic area of
30 interest include the continued operation and maintenance of Tradinghouse Creek Reservoir and
31 the consumption of water from the nearby Brazos River.

32 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
33 summarizes the projected impacts of future climate changes in the United States (Karl et al.
34 2009). The report divides the United States into nine regions, and the Tradinghouse site is
35 located in the Great Plains region. The GCRP climate models for this region project continued
36 warming in all seasons, with the summer changes projected to be larger than those in winter for
37 the Tradinghouse area. An increase in of approximately 5°F is projected for the area by the
38 2080s. More frequent extreme events, such as heat waves, droughts, and heavy rainfall, will
39 affect this region; however, the projected increases in precipitation are unlikely to be sufficient to
40 offset decreasing soil moisture and water availability in the Great Plains due to rising
41 temperatures and aquifer depletion. The GCRP states that the warming projected for the Great
42 Plains could result in a potential reduction in crop yields and livestock productivity, which may
43 change portions of agricultural and ranching land uses in the area of interest.

44 **Cumulative Water Use Impacts**

45 Growing demand for water and other cumulative changes are expected to result in lower
46 average streamflows in the Brazos River, more frequent occurrence of low water levels in
47 Brazos River Basin reservoirs, and reduced seasonal variation in streamflow in the Brazos

1 River. If GCC results in decreased precipitation and increased temperatures in the Brazos
 2 River Basin as many predictions suggest, the resulting reduction in surface runoff and increase
 3 in evapotranspiration would contribute to cumulative impacts on surface water quantity by
 4 reducing streamflows in the river and streams such as Tradinghouse Creek. Water
 5 management under the SOP and other TWDB-approved strategies would, however, minimize
 6 adverse impact on water availability for users with valid water rights under the Texas Water
 7 Code.

8 Based on this analysis, the review team concludes that cumulative impacts on surface-water
 9 quantity for the Tradinghouse site are MODERATE because there would be noticeable
 10 alterations in the Brazos River System. Water consumption for operation of nuclear units at the
 11 Tradinghouse site would be an important contributor to these impacts.

12 Water demand in the region is a cumulative source of stress on groundwater supplies, but
 13 increased emphasis on sustainable aquifer management is expected to mitigate adverse
 14 impacts (TWDB 2007). The review team concludes that cumulative groundwater use impacts for
 15 the Tradinghouse site are SMALL. Building and operating nuclear units at the site would not
 16 contribute to cumulative groundwater use impacts.

17 **Cumulative Water Quality Impacts**

18 Cumulative impacts of past and ongoing actions have resulted in Tradinghouse Creek Reservoir
 19 having a moderately high salinity that generally ranges between 400 and 500 ppm (Tarleton
 20 undated). The discharge of blowdown water to the Brazos River from two new nuclear units at
 21 this site could contribute to salinity concerns. Cumulative impacts on surface water quality at
 22 the Tradinghouse site are judged to be MODERATE.

23 Potential sources of cumulative adverse impacts to groundwater quality in the region include (1)
 24 oil and gas exploration and extraction and (2) spills and leaks at construction and industrial
 25 sites. These potential impacts would be localized, and implementation of good engineering
 26 practices could avoid or reduce the potential impacts. Accordingly, the review team concludes
 27 that cumulative impacts to groundwater quality would be SMALL. Building and operating
 28 nuclear units at the site would be a minimal contributor to cumulative groundwater quality
 29 impacts because there is little or no use of the near-surface groundwater that might be subject
 30 to contamination from the facility and the potential for contamination would be minimized by
 31 implementation of appropriate management practices.

32 **9.3.4.3 Terrestrial Resources**

33 The following impact analysis includes impacts from building activities and operations on the
 34 Tradinghouse site. The analysis also considers other past, present, and reasonably
 35 foreseeable future actions that impact terrestrial resources, including other Federal and non-
 36 Federal projects listed in Table 9-19.

37 The Tradinghouse site lies in the Northern Blackland Prairies ecoregion (Griffith et al. 2004).
 38 The site consists of about 2010 ac owned by Luminant where it operated a natural gas-fired
 39 steam electric plant on a lake, Tradinghouse Creek Reservoir, about 8 mi east of Waco, Texas.
 40 Should this site be selected, it is likely that the ultimate footprint of development would be less
 41 than the entire 2010 ac. The terrain is flat to rolling. Vegetation in undeveloped areas of the
 42 site consists of a mixture of deciduous forest and brushland containing post oak (*Quercus*
 43 *stellata*), mesquite, and broomsedge (*Andropogon* sp.), as well as various invasive species.
 44 Mesquite is widely distributed and is reported to have spread throughout what was previously
 45 grassland following suppression of wildfire. Wildlife in the area includes white-tail deer, coyotes,
 46 rabbits, bobcats (*Lynx rufus*), beaver (*Castor canadensis*), opossums, fox (*Vulpes vulpes*),

1 raccoon , mink (*Mustela vison*), skunks , Eastern spotted skunk (*Spilogale putorius*), as well as
 2 assorted birds, fish, and reptiles; prior to extensive settlement, the county's wildlife also included
 3 antelope (*Antilocapra americana*), buffalo (*Bison bison*), and bear (*Ursus americanus*). Typical
 4 game species include mourning dove and northern bobwhite (*Colinus virginianus*) on uplands,
 5 and eastern fox squirrel (*Sciurus niger*) along bottomlands (Griffith et al. 2004). Of these species
 6 white-tailed deer and rabbits are highly sought after by hunters and are considered important
 7 species.

8 Historically, land in McLennan County has been used primarily for farming and livestock
 9 grazing, and that is still the case today. About 81 percent of the county is currently in
 10 agricultural use. Slightly more than half of this is cropland, and the rest is used for livestock
 11 (Luminant 2009a). Less than one percent of the original vegetation of the Texas Blackland
 12 Prairies remains and it is scattered in small parcels throughout the region (Griffith et al. 2004).
 13 The closest ecologically important areas to the Tradinghouse site are wildlife management
 14 areas to the north: Aquilla Lake, Richland Creek, Cedar Creek Islands, and Gus Engeling. The
 15 closest of these areas to the Tradinghouse site is 30 mi to the NNW (Aquilla Lake), and thus
 16 well outside the geographic area of interest.

Table 9-19. Threatened or endangered terrestrial species that may occur within 10 mi of Tradinghouse Site

Group	Common Name	Scientific Name	Federal Status ^a	State Status ^b
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	-	T
	Black-capped vireo	<i>Vireo atricapillus</i>	E	E
	Golden-cheeked warbler	<i>Dendroica chrysoparia</i>	E	E
	Interior least tern	<i>Sterna antillarum athalassos</i>	E	E
Plants	Large-fruited Sand-verbena	<i>Abronia macrocarpa</i>	E	E
	Navasota ladies'-tresses	<i>Spiranthes parksii</i>	E	E

^a Federal status: E = endangered; T = threatened.
^b State status: E = endangered; T = threatened.
 Source: TPWD 2009a.

17 **Federally and State-Listed Species**

18 No site-specific surveys have been conducted for threatened and endangered species at the
 19 Tradinghouse site. The following list of threatened and endangered species that occur within
 20 10 mi of the Tradinghouse site was compiled from information on rare resource occurrences
 21 contained in the Texas Natural Diversity Database. The information was provided by TPWD
 22 (TPWD 2009a).
 23

24 **Building Impacts**

25 The Tradinghouse site is relatively level and relatively little grading would be required to prepare
 26 the site for development. Most of the area where plant structures would be located is presently
 27 occupied by a deteriorating aircraft runway of limited wildlife habitat value. Transmission line

1 upgrades associated with the project would follow existing ROW and thus impacts would be
2 minimal.

3 Building two new nuclear reactors at the Tradinghouse site would result in the permanent loss of
4 terrestrial habitat over much of the 2010 ac site. The review team believes that the ultimate
5 footprint of development would be less than the estimated 2010 ac reported. Additional loss of
6 terrestrial habitat and habitat fragmentation would occur; however, much of this area is currently
7 in industrial use. Upgrade of power transmission lines on existing ROWs would be expected to
8 have only short-term impacts. Other sources of impacts to terrestrial resources at the site such
9 as increased traffic, noise, and displacement of wildlife would likely be temporary and/or result
10 in minimal impact to the resource.

11 ***Operational Impacts***

12 Terrestrial ecological impacts that may result from operation of new nuclear units at the
13 Tradinghouse site include those primarily associated with cooling towers (Luminant 2007).

14 Impacts on crops, ornamental vegetation, and native plants from cooling-tower drift cannot be
15 evaluated in detail in the absence of information about the type (mechanical or natural draft),
16 number, and specific location of cooling towers at each alternative site. Similarly, bird collisions
17 with cooling towers cannot be evaluated in the absence of information about the type
18 (mechanical or natural draft for a wet cooling system; dry for a dry system) and number of
19 cooling towers at the site. The impacts of cooling-tower drift and bird collisions for existing
20 power plants were evaluated in NUREG-1437 (NRC 1996) and found to be of minor significance
21 for nuclear power plants in general, including those with various numbers and types of cooling
22 towers. On this basis, the review team concludes, for the purpose of comparing the alternative
23 sites, that the impacts of cooling-tower drift and bird collisions with cooling towers resulting from
24 operation of new nuclear units would be minor.

25 For mechanical draft cooling towers, the anticipated noise level from cooling-tower operation is
26 anticipated to be approximately 55 dBA at 1000 ft (Luminant 2009a). This noise level is well
27 below the 80 to 85 dBA threshold at which birds and small mammals are startled or frightened
28 (Golden et al. 1980). Thus, noise from operating cooling towers at the Tradinghouse site would
29 not be likely to disturb wildlife beyond 1000 ft from the source. The noise level for natural draft
30 cooling towers would be lower. Consequently, the review team concludes that the impacts of
31 cooling-tower noise on wildlife would be minimal.

32 Because the new transmission lines replace already existing lines, and would be located entirely
33 within existing ROW, impacts from operation of the transmission lines would continue at present
34 levels.

35 ***Cumulative Impacts***

36 The impacts of building and operating two nuclear units at the Tradinghouse site were evaluated
37 by the review team to determine the magnitude of their contribution to cumulative impacts on
38 terrestrial ecological resources in the geographic area of interest. For purposes of this
39 cumulative analysis, the geographic area of interest is defined as McLennan County. This
40 county encompasses the Tradinghouse site, anticipated transmission line ROWs, and adjoining
41 areas. This geographic area of interest is expected to encompass the ecologically relevant
42 landscape features and species. Terrestrial ecological impacts related to building
43 predominantly consist of loss of habitat due to clearing and grading. Past actions that have
44 affected terrestrial resources include the construction of the two gas-fired units that provide
45 power to customers in the area presently served by the Tradinghouse site, and the agricultural
46 and urban development that has displaced wildlife habitat and increased habitat fragmentation

1 in the surrounding landscape. These changes have displaced wildlife habitat and increased
2 habitat fragmentation.

3 The TSDC projects that the population in a seven-county area surrounding the Tradinghouse
4 site (including Bell, Bosque, Coryell, Falls, Hill, Limestone, and McLennan Counties) will
5 increase by 29.2 percent by the year 2040 (TSDC 2009). Urbanization in the vicinity of the
6 Tradinghouse site would reduce natural vegetation and open space, resulting in an overall
7 decline in the extent and connectivity of wetlands, forests, and wildlife habitat.

8 The report on *Global Climate Change Impacts in the United States*, provided by the GCRP,
9 summarizes the projected impacts of future climate changes in the United States (Karl et al.
10 2009). The report divides the United States into nine regions. The Tradinghouse site is located
11 in the Great Plains region. The GCRP climate models for this region project continued warming
12 in all seasons and an increase of as much as 12°F from 2000 to 2090. Additionally, climate
13 models project that there will tend to be less rainfall in this area. The precipitation decrease
14 projected by the GCRP for the Great Plains could result in a decrease in annual precipitation
15 over time, possibly altering the character of terrestrial habitats. This could further stress
16 terrestrial resources affected by the activities described above.

17 These activities, including the building and operation of the two new reactors at the
18 Tradinghouse site, would remove or modify terrestrial habitats with the potential to affect
19 important species living or migrating through the area. However, some of the affected area
20 consists of an abandoned aircraft runway of limited habitat value. In addition, the two new
21 nuclear units would replace the retired gas fired units at the Tradinghouse site. The additional
22 cumulative impacts from the two nuclear units would be largely offset by those already incurred
23 during the construction or operation of the gas fired units, and thus would greatly increase the
24 magnitude. Noise, heat, and many other impacts from nuclear plant operation would replace
25 similar impacts realized due to operation of the gas fired units. Thus, while the cumulative
26 impacts within the geographic area of interest to terrestrial resources have been noticeable, the
27 contribution of building and operating two new nuclear units at the Tradinghouse site would not
28 substantially add to those impacts.

29 The potential cumulative impacts to terrestrial resources considering the two new reactors at the
30 Tradinghouse site, in addition to the other activities described above, would not noticeably alter
31 important attributes of terrestrial resources. Therefore, the incremental contribution of building
32 and operating the two new reactors at the Tradinghouse site to the cumulative impacts would be
33 minimal.

34 **Summary**

35 Impacts to terrestrial ecology resources were analyzed based on the information provided by
36 Luminant and the review team's independent review. After building at the Tradinghouse site is
37 complete, terrestrial resources in the areas that are temporarily disturbed are expected to return
38 to predominantly pre-development conditions. Some habitat would be lost to permanent project
39 structures, but the losses would be minimal due to the already low habitat value present on the
40 site. The review team therefore concludes that the cumulative on terrestrial plants and wildlife,
41 including threatened or endangered species, and wildlife habitat would be SMALL.

42 **9.3.4.4 Aquatic and Wetlands Resources**

43 ***Affected Environment***

44 The Tradinghouse site is adjacent to a recently retired natural-gas-fired power plant in
45 McLennan County approximately 8 mi east of Waco. The intake and discharge would be
46 located on Tradinghouse Creek Reservoir on a peninsula extending from the north into the

1 central portion of the reservoir. The reservoir covers an area of 2010 ac at normal water
 2 surface elevation and is about 60-ft deep where the earthfill dam crosses the streambed of
 3 Tradinghouse Creek. Water levels in the lake can fluctuate widely (Luminant 2007). Adjacent
 4 to the proposed site is existing recently retired gas-fired power facility with two units.
 5 Tradinghouse Creek is a tributary to the middle Brazos River near Waco. Inflow to the reservoir
 6 is augmented by pumping water through a 36-in.-diameter pipeline from the Brazos River. The
 7 shoreline is lined by cattails and bulrushes, and adjacent land is predominantly undeveloped
 8 and wooded. The geographic area of interest for aquatic and wetland resources includes the
 9 site and adjacent water bodies and wetlands in the vicinity, including Tradinghouse Reservoir,
 10 Tradinghouse Creek below the reservoir, and the reach of the Brazos River from the City of
 11 Waco and the mouth of Tradinghouse Creek south to the border of McLennan County.
 12 McLennan County encompasses Tradinghouse Reservoir and the existing transmission line
 13 ROWs that would be used by the proposed facility, and the reach of the Brazos River with the
 14 greatest potential to be affected by hydrology or water quality effects.

15 **Important Species**

16 Important species in the aquatic community of Tradinghouse Creek Reservoir include game
 17 fish. The reservoir provides good fishing, particularly for largemouth bass. Other common
 18 game fish in the reservoir include white crappie, catfish, white bass, and bluegill and other
 19 sunfish. Another game fish present is the red drum (*Sciaenops ocellata*), which is an introduced
 20 estuarine/marine fish that is stocked in Tradinghouse Creek Reservoir and grows well in the
 21 warm, slightly salty conditions of Tradinghouse Creek (TPWD 2007b, TPWD 2009d).

22 No Federally listed threatened or endangered aquatic species occur in McLennan County.
 23 However, two fish species potentially occurring in the county, the sharpnose shiner (*Notropis*
 24 *oxyrhynchus*) and smalleye shiner (*N. buccula*), are designated as Federal candidates for
 25 listing. Three State-listed aquatic species potentially occur in McLennan County, all of which
 26 are freshwater mussels with a State status of threatened. Aquatic species with the potential to
 27 occur in McLennan County and having a Federal or State status or designation as species of
 28 concern are included in Table 9-20. Listed species are described below.

29 The characteristics and life histories of the sharpnose and smalleye shiners were described in
 30 Section 2.4.2.3.4. Both species are endemic to the Brazos River basin, occur in riverine
 31 habitats, and likely have been extirpated from the middle reaches of the Brazos River, including
 32 the area near Tradinghouse Creek. Given these characteristics, neither species would occur in
 33 Tradinghouse Creek Reservoir, neither would be likely to occur downstream of the dam in
 34 Tradinghouse Creek or the Brazos River, and neither would be adversely affected by
 35 construction or operation of a cooling water system at the Tradinghouse site.

36 The habitat requirements of the Texas fawnsfoot (*Truncilla macrodon*) are not well known; it
 37 appears to occur in rivers and larger streams with moderate flows, to be intolerant of
 38 impoundments, and to utilize substrates that may include gravel, sand, or sandy mud. The false
 39 spike (*Quincuncina mitchelli*), which possibly has been extirpated in Texas, probably occurred in
 40 medium to large rivers (including the Brazos River) and utilized substrates ranging from mud to
 41 mixtures of sand, gravel, and cobble. The smooth pimpleback (*Quadrula houstonensis*) occurs
 42 in rivers and streams of moderate to small size and moderate-size reservoirs; it prefers
 43 substrates of mixed mud, sand, and fine gravel; it tolerates moderate to very slow flows; and it
 44 appears not to tolerate dramatic fluctuations in water levels or substrates of scoured bedrock or
 45 shifting sand (TPWD 2010d). Of the State-listed mussels, only the smooth pimpleback inhabits
 46 reservoirs and, thus, has a potential to occur in the lake and, if present, to be directly affected by
 47 the intake or discharge of water by the facility. The listed Texas fawnsfoot and false spike
 48 potentially could occur in Tradinghouse Creek or the Brazos River downstream of the reservoir.

- 1 The pistolgrip and rock pocketbook are State species of concern that also may occur
- 2 downstream in the Brazos River, and the rock pocketbook also can occur in reservoirs, so it
- 3 may be present in Tradinghouse Reservoir.

Table 9-20. Federally and State-listed Aquatic Species and State Species of Concern Potentially Occurring in the Vicinity of the Tradinghouse Site

Scientific Name	Common Name	Federal Status ^a	State Status ^b	Counties ^c
Fishes				
<i>Notropis oxyrhynchus</i>	sharpnose shiner	FC	SSC	McLennan
<i>Notropis buccula</i>	smalleye shiner	FC	SSC	McLennan
<i>Micropterus treculii</i>	Guadalupe bass	---	SSC	McLennan
Mussels				
<i>Quadrula houstonensis</i>	smooth pimpleback	---	ST	McLennan
<i>Quincuncina mitchelli</i>	false spike	---	ST	McLennan
<i>Truncilla macrodon</i>	Texas fawnsfoot	---	ST	McLennan
<i>Tritogonia verrucosa</i>	pistolgrip	---	SSC	McLennan
<i>Arcidens confragosus</i>	rock pocketbook	---	SSC	McLennan

^a Federal status definitions: FC = Federal candidate for listing.

^b State status definitions: ST = State-listed, threatened; SSC = State species of concern.

^c Counties listed are those in which components of the alternative would be located and where TPWD has identified the potential for occurrence of the species based on evidence such as recorded occurrences, historic ranges, field guides, staff expertise, and scientific publications.

Source: TPWD 2010d.

4 **Building Impacts**

5 The aquatic impacts from building of the proposed type of closed-cycle cooling system at this
 6 site likely would be similar to the impacts of building such systems at other sites. These impacts
 7 would be minor and involve localized and mostly temporary effects from building intake and
 8 discharge structures, which probably would be located in areas of relatively deep water near the
 9 lake shore. Building activities could increase stormwater runoff due to increased areas of
 10 impervious surface, resulting in increased storm flows in streams and other drainages on the
 11 site. Soil disturbance combined with increased runoff could increase sediment transport into the
 12 reservoir. TCEQ requires stormwater permits for construction sites of 1 ac or more, and
 13 obtaining a permit requires development and implementation of a stormwater pollution
 14 prevention plan specifying the BMPs to be used in protecting water bodies (TCEQ 2008).
 15 Compliance with permitting requirements and associated use of BMPs to minimize or prevent
 16 stormwater impacts are expected to minimize erosion-related impacts on surface waters and
 17 wetlands. BMPs that likely would be implemented under an SWPPP include the installation and
 18 maintenance of silt fencing, the maintenance of vegetated buffer zones between water bodies
 19 and areas undergoing development, and the diversion of runoff to sediment retention basins.

20 Six transmission line ROWs currently extend from the Tradinghouse site due to the presence of
 21 the existing gas-fired power facility. These existing ROWs would be used to connect the
 22 potential new nuclear units, though Luminant assumes that some lines within those ROWs
 23 would need to be replaced. Because existing ROWs would be used, the potential for impacts
 24 on water bodies and wetlands from upgrading the transmission lines would be negligible.

25 Aquatic species would be unlikely to be substantially affected by the loss of small areas of
 26 aquatic habitat potentially within the footprint of facilities that would be built for the project.

1 Important species such as game fish are highly mobile and would be able to avoid areas where
2 building activities occur. State-listed mussels are essentially immobile and could be lost if
3 present within the relatively small building footprint within the reservoir. Only the smooth
4 pimpleback potentially could occur in this habitat. Thus, building of water intakes and discharge
5 structures would be expected to have minimal impacts on aquatic resources. However, if a
6 State-listed mussel species were to be present in the reservoir in an area of building activity,
7 impacts may be noticeable.

8 **Operational Impacts**

9 Operation of proposed new nuclear units at the Tradinghouse site could affect aquatic
10 resources as a result of entrainment and impingement of organisms at the cooling water intake
11 and thermal, chemical, and physical effects from the discharge of cooling water and other
12 effluents. An evaluation of impacts on aquatic biota resulting from operation of the intake and
13 discharge cannot be conducted in detail due to lack of specific information that would have to be
14 developed (i.e., more than reconnaissance-level information), such as the design and location of
15 cooling water intakes and discharges at this site. Consequently, the review team relies upon
16 the conclusions in the *Generic Environmental Impact Statement for License Renewal of Nuclear*
17 *Plants* (GEIS), NUREG-1437 (NRC 1996) to inform the assessment of aquatic impacts from the
18 operation of the cooling system.

19 NUREG-1437 (NRC 1996) evaluated aquatic ecological impacts resulting from operation of
20 existing nuclear power plants. The aquatic impacts from operation of cooling systems for
21 existing power plants were found to be of minor significance for all plants that utilize closed-
22 cycle cooling systems with cooling towers. In evaluating this alternative site, the review team
23 assumed that the new nuclear power plant that would be constructed at this site would utilize a
24 similar cooling system, consisting of a closed-cycle system with cooling towers. Consequently,
25 the types of aquatic ecological impacts that would result from operation of the new nuclear units
26 would be similar to those of existing nuclear power plants that have closed-cycle cooling
27 systems with cooling towers.

28 With regard to cooling water intakes, NRC found that entrainment and impingement of fish and
29 shellfish have not been a problem at existing facilities that use closed-cycle systems with
30 cooling towers. Minimal impacts from intake operation would be expected if it is assumed the
31 following conditions would apply at this site in accordance with EPA's Phase I regulations for
32 new facilities under Section 316(b) of the CWA (66 FR 65256): (1) a closed-cycle cooling
33 system, (2) a maximum through-screen velocity of 0.5 ft/s at the cooling water intake, (3) an
34 intake flow that would not disrupt the natural thermal stratification or turnover pattern of the lake
35 at the Tradinghouse site, and (4) location of the new intake in an area of the source waterbody
36 away from areas with the potential for high productivity of fish or other important organisms
37 (66 FR 65256). With regard to effluent discharges from facilities with closed-cycle cooling
38 systems, NRC found that the thermal and water-quality effects from the relatively small volumes
39 of blowdown water discharged did not have more than minor impacts on the aquatic ecology of
40 the receiving waterbody (NRC 1996).

41 Thermal impacts on Tradinghouse Reservoir from the discharge of cooling water are expected
42 to be minor because cooling towers would be used, the large volume of water in the reservoir
43 likely would be sufficient for dissipation of thermal inputs, and discharges would need to comply
44 with requirements of a State-issued discharge permit. The relative locations of the intake and
45 discharge are not known at this time, but it is assumed they would be on opposite sides of the
46 peninsula. Discharge of cooling tower blowdown and other effluents, such as treated sanitary
47 wastewater, likely would have minor effects on chemical water quality in the reservoir, as the
48 volume of water in the reservoir would be sufficient for assimilation of dissolved materials in

1 facility effluents. In periods of low flow through the reservoir, there may be a potential for
2 recirculation of water from the discharge to the intake. Such a recirculation pattern may result in
3 constituent concentrations that are locally elevated above ambient concentrations in a larger
4 than normal area in the vicinity of the diffuser. However, the effluent concentrations discharged
5 likely would remain below water quality criteria limits.

6 Water quality effects downstream from Tradinghouse Reservoir are likely to be minimal
7 assuming State-issued permit limits are met at the discharge in the reservoir. Thus, aquatic
8 species are unlikely to be adversely affected by water quality, thermal, or other physical effects
9 from operations in the reservoir or the creek and river downstream. However, the consumption
10 of water from the Brazos River system by the proposed new nuclear units at the Tradinghouse
11 site likely would result in alterations by the BRA of water management within its system and
12 could result in altered flow regimes and reduced river flows downstream.

13 Reduced flows would reduce the average extent and volume of aquatic habitat available in the
14 river relative to existing conditions. As a result, fish and invertebrates could lose protective
15 cover and nesting, spawning, foraging, and nursery areas. Such habitat losses could result in
16 increased predation, crowding, and competition. Lower flows also can affect substrate
17 characteristics by altering processes such as sediment transport, suspension, siltation, and
18 sorting. Changes in sediment composition and other characteristics could alter the benthic
19 habitats available on and within the substrate for invertebrates, fish, and their eggs. In addition,
20 lower flows and shallower water can increase water temperatures and reduce turbulence, which
21 may reduce dissolved oxygen levels in some areas of the river. Effects on riverine habitat such
22 as these potentially could result in reductions in populations of some species of fish and
23 invertebrates.

24 The magnitude of potential changes in flow in the Brazos River above and below the withdrawal
25 for Tradinghouse Reservoir has not been defined, and the likelihood and magnitude of
26 associated effects on the aquatic communities of these river reaches similarly are undefined.
27 Riverine organisms are adapted to the highly variable flow regime of the Brazos River, and
28 there is uncertainty about the magnitude of the impacts on riverine biota that may result from the
29 relatively limited alterations in river flow that may be associated with the operation of new
30 nuclear units at the Tradinghouse site. Such impacts may range from negligible to noticeable
31 depending on the species and the degree to which its habitat is affected.

32 As discussed above, important species known to be present in the reservoir and potentially
33 affected by the operation of the proposed new nuclear power facility are game fish. Also, there
34 is a possibility that a State-listed mussel, the smooth pimpleback, could occur in the reservoir. It
35 is unlikely that such species or their habitats would be substantially affected by the relatively
36 small volumes of water withdrawn and discharged by the closed-cycle cooling system proposed
37 for the Tradinghouse site (NRC 1996). Three mussels that are State-listed as threatened as
38 well as others that are State species of concern, could occur in Tradinghouse Creek or the
39 Brazos River in the area of interest. These mussels as well other rare species and game fish
40 could be adversely affected, as described above, by reduced flows or other hydrological
41 changes in the Brazos River.

42 ***Cumulative Impacts***

43 The impacts of building and operating two nuclear units at the Tradinghouse site were evaluated
44 by the review team to determine the magnitude of their contribution to cumulative impacts on
45 aquatic and wetlands resources in the geographic area of interest. Past actions that have
46 affected aquatic resources in the area include water use for operation of the recently retired
47 electric power facility at the site, operation of Tradinghouse Dam, water use for and runoff from
48 agriculture, water use and sewage discharge from some residential development, and

1 recreational fishing. Many of the past actions have continued and are present activities as well.
 2 Possible future actions that could affect aquatic resources in the geographic area of interest
 3 include the change in operating status of the gas-fired power facility at the site, continued
 4 operation of Tradinghouse Reservoir and construction of water and/or wastewater treatment
 5 and distribution facilities in conjunction with future residential and commercial development
 6 (Table 9-20), and continued recreational fishing in the lake. In addition, GCC could alter aquatic
 7 habitats in the area.

8 Future urbanization in the geographic area of interest could contribute to decreases in
 9 undeveloped land, including wetlands, as well as increased demand for water and reduced
 10 water quality. The TSDC projects that the population in a seven-county area surrounding the
 11 Tradinghouse site (including Bell, Bosque, Coryell, Falls, Hill, Limestone, and McLennan
 12 Counties) will increase by 29.2 percent by the year 2040 (TSDC 2009). Future urbanization in
 13 the geographic area of interest could contribute to additional demand for water, increased need
 14 for wastewater assimilation, reduced water quality and increased fishing pressure. Urbanization
 15 in the vicinity of the Tradinghouse site would reduce natural vegetation and open space,
 16 resulting increased stormwater runoff and an overall decline in the extent and connectivity of
 17 wetlands and aquatic habitat. Cumulatively, these effects on water quality would likely have
 18 minimal impacts on aquatic organisms.

19 The report on *Global Climate Change Impacts in the United States* (Karl et al. 2009)
 20 summarizes the projected impacts of future climate changes in the United States. The report
 21 divides the United States into nine regions, and the Tradinghouse site is located in the Great
 22 Plains region. The climate models for this region project continued warming in all seasons, with
 23 the summer changes projected to be larger than those in winter for the Tradinghouse area. An
 24 increase in temperature of approximately 5°F is projected for the area by the 2080s. More
 25 frequent extreme events, such as heat waves, droughts, and heavy rainfall, will affect this region
 26 in combination with the projected decreases in annual precipitation. Such factors would reduce
 27 aquatic habitat causing shifts in species ranges, diversity, and abundances in the geographic
 28 area of interest for the Tradinghouse site.

29 **Summary**

30 The review team concludes that the impacts on aquatic resources from building two new
 31 nuclear units at the Tradinghouse site would be noticeable but not destabilizing to important
 32 attributes of aquatic resources. The review team also concludes that the impacts from
 33 operation of two new units would range from minimal to noticeable. Based on the information
 34 provided by Luminant and the review team's independent evaluation, the review team
 35 concludes that the cumulative impacts from past, present, and reasonably foreseeable activities
 36 on aquatic and wetlands resources in the geographic area of interest would be SMALL to
 37 MODERATE. The incremental contribution of building and operating two new reactors at the
 38 Tradinghouse site to cumulative impacts on aquatic and wetlands resources in the geographic
 39 area of interest would range from minimal to noticeable.

40 **9.3.4.5 Socioeconomics**

41 The following impact analysis includes impacts from building activities and operations. The
 42 analysis also considers other past, present, and reasonably foreseeable future actions that
 43 impact socioeconomics, including the other Federal and non-Federal projects listed in
 44 Table 9-8. For the analysis of socioeconomic impacts at the Tradinghouse site, the geographic
 45 area of interest is the nine-county area around the Tradinghouse site (Table 9-21) that was
 46 evaluated in *Luminant Nuclear Power Plant Siting Report* (Luminant 2007). In evaluating the
 47 socioeconomic impacts of site development and operation at the Tradinghouse site, the review

1 team used the population and labor force data provided in *Luminant Nuclear Power Plant Siting*
 2 *Report* (Luminant 2007).

Table 9-21. Population and Labor Force in McLennan County, Texas, and the Other Counties Surrounding the Tradinghouse Site

County	Total population 2006	Projected total population 2010	Total labor force 2000	Total construction labor force 2000
McLennan	226,189	235,010	94,076	9822
Bell	257,897	272,339	90,230	9382
Falls	17,547	18,511	6359	872
Limestone	22,720	23,174	8533	1026
Navarro	49,440	52,604	18,477	2167
Hill	35,806	38,384	13,365	1775
Coryell	72,667	74,141	21,078	2473
Bosque	18,058	18,609	7101	993
Ellis	139,300	162,563	53,528	7032
Total	773,105	895,380	312,747	35,542

Source: Luminant 2007.

3 The Tradinghouse site is located in McLennan County, Texas, approximately 8 mi east of the
 4 City of Waco. Section 9.3.4.1 contains a description of the Tradinghouse site.

5 As indicated in Table 9-21, McLennan County and the eight other counties surrounding the
 6 Tradinghouse site have a combined 2010 population of 895,380, a combined 2000 labor force
 7 of 312,747, and a combined 2000 construction labor force of 35,542. Therefore, the
 8 Tradinghouse site has a relatively small labor pool from which to draw construction and
 9 operations workers, which would result in more in-migrating workers. More in-migrating workers
 10 would result in larger socioeconomic impacts, especially to housing and public services.

11 The review team concludes that building and operating a two-unit nuclear power plant at the
 12 Tradinghouse site would have MODERATE to LARGE socioeconomic impacts in McLennan
 13 County and the surrounding counties for three reasons. First, although the site is not a
 14 greenfield site, some rail and infrastructure development would be required in the surrounding
 15 area to access and use it. Second, the Tradinghouse site has a relatively small labor force from
 16 which to draw construction and operations workers, so large numbers of workers would need to
 17 in-migrate. Third, the Tradinghouse site is in a rural area that likely would not have the existing
 18 housing, infrastructure, and public services to support the in-migration of a large number of
 19 workers and their families. In addition, building and operating a nuclear power plant at the
 20 Tradinghouse site could adversely affect or eliminate recreational use of Tradinghouse Creek
 21 Reservoir (Section 9.3.4.1). The reservoir has one public park (McLennan County Park) and is
 22 popular with local anglers.

23 9.3.4.6 Environmental Justice

24 The following impact analysis includes impacts from building activities and operations. The
 25 analysis also considers other past, present, and reasonably foreseeable future actions that
 26 impact socioeconomics, including the other Federal and non-Federal projects listed in

1 Table 9-8. For the analysis of environmental justice impacts at the Tradinghouse site, the
 2 geographic area of interest is the nine-county area around the Tradinghouse site (Table 9-22)
 3 that was evaluated in *Luminant Nuclear Power Plant Siting Report* (Luminant 2007). In
 4 evaluating the environmental justice impacts of site development and operation at the
 5 Tradinghouse site, the review team used the minority and low-income data provided in *Luminant*
 6 *Nuclear Power Plant Siting Report* (Luminant 2007).

Table 9-22. Minority and Low-income Percentages in McLennan County, Texas, and the Other Counties Surrounding the Tradinghouse Site

County	Total Population 2006	Percent Non-minority ^a	Percent Minority ^b	Percent Low Income
McLennan	226,189	62.0	38.0	18.3
Bell	257,897	54.8	45.2	13.2
Falls	17,547	55.0	45.0	21.7
Limestone	22,720	64.4	35.6	7.8
Navarro	49,440	62.1	37.9	17.1
Hill	35,806	75.7	24.3	16.2
Coryell	72,667	60.2	39.8	13.7
Bosque	18,058	81.7	18.3	19.6
Ellis	139,300	66.1	33.9	10.7
Total	773,105	64.7	35.3	16.5

^a Non-minority = White persons, not Hispanic.

^b Minority = Black persons, American Indian and Alaska Native persons, Asian persons, Native Hawaiian and Other Pacific Islander persons, and Hispanic persons.

Sources: Luminant 2007; USCB 2009a.

7 As indicated in Table 9-22, the nine counties surrounding the Tradinghouse site have a
 8 combined minority percentage of 35.3 percent. This percentage of minority residents is much
 9 lower than that for the State of Texas (61.1 percent) (Table 2-27). Thus, when compared to the
 10 State of Texas, the Tradinghouse site has a small minority percentage for purposes of
 11 environmental justice analysis.

12 In terms of low-income residents, the nine counties surrounding the Tradinghouse site have a
 13 combined low-income percentage of 16.5 percent. This percentage of low-income residents is
 14 slightly higher than that for the State of Texas (14.0 percent) (Table 2-27). However, when
 15 compared to the State of Texas, the Tradinghouse site does not have a significantly higher low-
 16 income percentage for purposes of environmental justice analysis.

17 In Section 9.3.4.5, the review team concluded that building and operating a new two-unit
 18 nuclear power plant at the Tradinghouse site would have MODERATE to LARGE
 19 socioeconomic impacts in McLennan County and the surrounding counties. Based on that
 20 conclusion, the review team concludes that the socioeconomic impacts of building and
 21 operating at the Tradinghouse site could have MODERATE environmental justice impacts by
 22 disproportionately and adversely affecting low-income populations, especially in the area of
 23 housing price and availability.

1 **9.3.4.7 Historic and Cultural Resources**

2 The following impact analysis includes impacts from building and operating two new nuclear
3 power plants at the Tradinghouse site. The analysis also considers other past, present, and
4 reasonably foreseeable future actions that impact historic and cultural resources, including
5 Federal and non-Federal projects listed in Table 9-18. For the analysis of historic and cultural
6 impacts at the Tradinghouse site, the geographic area of interest is considered to be the APE
7 that would be defined for this proposed undertaking. This includes the physical APE, defined as
8 the area directly affected by the site-development and operation activities at the site and
9 transmission lines, and the visual APE. The visual APE is defined as the additional 1-mi radius
10 around the physical APE as a reasonable assumption for defining a maximum distance from
11 which the structures can be seen.

12 Reconnaissance activities in a cultural resource review have a particular meaning. For
13 example, these activities include preliminary field investigations to confirm the presence or
14 absence of cultural resources. However, in developing its EIS, the review team relies upon
15 reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-
16 level information is data that are readily available from agencies and other public sources. It
17 can also include information obtained through visits to the site area. To identify the historic and
18 cultural resources at the Tradinghouse site the following information was used:

- 19 • Luminant ER (Luminant 2009a);
- 20 • Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4, Luminant Nuclear Power
21 Plant Siting Report (Luminant 2007)
- 22 • Texas Historical Commission's Texas Archaeological Sites Atlas (THC 2010); and,
- 23 • NRC Alternative Sites Visit, February 2009.

24 The Tradinghouse site is in industrial site located in McLennan County in central Texas situated
25 partially in the Grand Prairie and Blackland Prairie region (Luminant 2007). Historically, the site
26 has been used for agricultural purposes. Currently the site hosts a recently retired gas-fired
27 electric generating plant. The major industries in the area include poultry processing,
28 manufacture of prepared feeds, and dairy production.

29 The Texas Historical Commission's Archaeological Sites Atlas indicates that there are 17 NRHP
30 located in McLennan County, Texas (THC 2010). The City of Waco has 12 NRHP sites and 4
31 National Register Districts (THC 2010) and is located approximately 10 mi from the
32 Tradinghouse site. The City of McGregor contains 1 NRHP site and is located 27 mi from the
33 Tradinghouse site.

34 According to the Texas Historical Commission's Texas Archaeological Sites Atlas, there are no
35 National Register Properties, National Register Districts, or sites designated as having historic
36 or cultural value in the APE (THC 2010). The project has the potential to affect resources
37 through visual impacts from buildings and transmission lines. Should such properties be
38 subsequently listed on the National Register, then these impacts may result in significant
39 alterations to the visual landscape within the geographic area of interest.

40 Since the site has been previously disturbed for industrial purposes, historic and cultural
41 resource impacts for a new plant located at the Tradinghouse site would likely be similar to the
42 impacts for a new plant at the CPNPP site as discussed in Sections 4.6 and 5.6. A cultural
43 resources inventory would likely be needed for any portion of the property that has not been
44 previously surveyed at the Tradinghouse site. Other lands that may be acquired to support the
45 plant would also likely require a survey to identify potential historic and archaeological
46 resources, and identification of mitigative measures to offset adverse effects of ground
47 disturbing activities. These studies would likely be needed for areas of potential disturbance at

1 the Tradinghouse site, offsite affected areas, such as mining and waste disposal sites, and
2 along associated corridors where new construction would occur, for example, roads and
3 pipeline corridors. The types of historic and cultural resource impacts resulting from operation
4 of new nuclear units would likely be similar to those of existing nuclear power plants.

5 The Tradinghouse site contains an existing electric generating facility and transmission lines are
6 available (Luminant 2007). It is possible that the transmission lines currently servicing the site
7 could be used if a nuclear power plant was located at the Tradinghouse site. Therefore,
8 potential impacts have already occurred and no new impacts would affect historic or cultural
9 resources as a result of building and maintaining new transmission line corridors.

10 The Texas State Data Center predicts the average population growth rate will be 29.2 percent
11 from 2010 to 2040 for the 7 counties surround the Tradinghouse site (TSDC 2009). The seven
12 counties included Bell, Bosque, Coryell, Falls, Hill, Limestone, and McLennan counties. The
13 average population growth rate could result in an increase in urbanization in the area.
14 Urbanization includes increases in residential, commercial, industrial, and infrastructure
15 development that could encroach on historic cultural resources near the geographic area of
16 interest.

17 Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources
18 is cumulative. Based on the reconnaissance level information, the review team concludes that
19 the cumulative impacts on historic and cultural resources of building and operating new nuclear
20 units on the Tradinghouse site and urbanization would be SMALL. This impact level
21 determination reflects no known cultural resources that could be affected. However, if the
22 Tradinghouse site were to be developed, then cultural resource surveys may reveal important
23 historic properties that could result in greater cumulative impacts.

24 **9.3.4.8 Air Quality**

25 The following impact analysis includes impacts from building activities and operations. The
26 analysis also considers other past, present, and reasonably foreseeable future actions that
27 impact air quality, including other federal and non-Federal projects listed in Table 9-18. The
28 geographic area of interest for the Tradinghouse site is McClellan and Waco counties.

29 The emissions related to building and operating a nuclear power plant at the Tradinghouse site
30 alternative would be similar to those associated with the proposed location at CPNPP. The air
31 quality attainment status for both McClellan and Waco counties as set forth in 40 CFR 81.344
32 reflects the effects of past and present emissions from all pollutant sources in the region.
33 McClellan and Waco counties are not out of attainment of any National Ambient Air Quality
34 Standard.

35 The atmospheric emissions related to building and operating a nuclear power plant at the
36 CPNPP site in Somervell County, Texas, are described in Chapters 4 and 5. The criteria
37 pollutants were found to have a SMALL impact. In Chapter 7, the cumulative impacts of the
38 criteria pollutants at the CPNPP site were evaluated and also determined to be SMALL.

39 Reflecting on the projects listed in Table 9-18, they are not expected to be significant with
40 respect to emission of criteria air pollutants. The Tradinghouse Power Plant has been retired
41 and would not contribute to air emissions during the development or operation of the
42 Tradinghouse site. The industrial projects listed in Table 9-18 would have *de minimis* impacts,
43 and it is therefore unlikely that the air quality in the region would degrade to the extent that the
44 region is in nonattainment of National Ambient Air Quality Standards.

45 The air quality impact of the Tradinghouse site development would be local and temporary. The
46 distance from building activities to the site boundary would be sufficient to generally avoid

1 significant air quality impacts. There are no land uses or projects, including the aforementioned
2 sources, that would have emissions during site development that would, in combination with
3 emissions from the Tradinghouse site, result in degradation of air quality in the region.

4 Releases from operation of two units at the Tradinghouse site would be intermittent and made
5 at low levels with little or no vertical velocity. The air quality impacts of other general emissions
6 sources in the area are included in the baseline air quality status. The cumulative impacts from
7 emissions from the Tradinghouse site and the aforementioned sources could be noticeable but
8 not destabilizing. The cumulative impacts from emissions of effluents from the Tradinghouse
9 site and the aforementioned sources could be noticeable but not destabilizing.

10 The cumulative impacts of greenhouse gas emissions related to nuclear power are discussed in
11 Section 7.5. The impacts of the emissions are not sensitive to location of the source.
12 Consequently, the discussion in Section 7.5 is applicable to a nuclear power plant located at the
13 Tradinghouse site. The review team concludes that the national and worldwide cumulative
14 impacts of greenhouse gas emissions are noticeable but not destabilizing. The review team
15 further concludes that the cumulative impacts would be noticeable but not destabilizing, with or
16 without the greenhouse gas emissions of the project at the Tradinghouse site.

17 Cumulative impacts to air quality resources are estimated based on the information provided by
18 Luminant and the review team's independent evaluation. Other past, present and reasonably
19 foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants
20 and global for greenhouse gas emissions) that could affect air quality resources. The
21 cumulative impacts on criteria pollutants from emissions of effluents from the Tradinghouse site
22 and other projects could be noticeable but not destabilizing. The national and worldwide
23 cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. The
24 review team concludes that the cumulative impacts would be noticeable but not destabilizing,
25 with or without the greenhouse gas emissions from the Tradinghouse site. The review team
26 concludes that cumulative impacts from other past, present, and reasonably foreseeable future
27 actions on air quality resources in the geographic areas of interest would be SMALL for criteria
28 pollutants and MODERATE for greenhouse gas emissions. The incremental contribution of
29 impacts on air quality resources from building and operating two units at the Tradinghouse site
30 would be insignificant for both criteria pollutants and greenhouse gas emissions.

31 **9.3.4.9 Nonradiological Health**

32 The following impact analysis includes nonradiological health impacts from building activities
33 and operations. The analysis also considers the other past, present, and reasonably
34 foreseeable future actions that impact nonradiological health, including other Federal and non-
35 Federal projects listed in Table 9-18. This section covers the review team's evaluation of the
36 potential environmental impacts of siting a new two-unit nuclear plant at the Tradinghouse site.
37 The Tradinghouse site, which Luminant already owns, is the site of a recently retired gas-
38 generated power plant. Additionally, the Tradinghouse site would not require the use of a BDTF
39 to treat blowdown water discharges.

40 For the analysis of nonradiological health impacts at the Tradinghouse alternative site, the
41 geographic area of interest is considered to include projects within a 5-mi radius from the site's
42 center based on the localized nature of the impacts. For impacts associated with transmission
43 lines, the geographic area of interest is the transmission line corridor.

44 The building activities that have the potential to impact the health of members of the public and
45 workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the
46 transport of construction materials and personnel to and from the site. The operation-related
47 activities that have the potential to impact the health of members of the public and workers

1 includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers
2 to and from the site.

3 ***Building Impacts***

4 Nonradiological health impacts to construction workers and members of the public from building
5 two nuclear units at the Tradinghouse site would be similar to those evaluated in Section 4.8 for
6 the CPNPP site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and
7 transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air
8 quality and noise would be complied with during the site preparation and building phase. The
9 incidence of construction worker accidents would not be expected to be significantly different
10 from the incidence of accidents estimated for the CPNPP site. The Tradinghouse site hosts a
11 recently retired natural- gas- power generation plant, so that building impacts on the
12 surrounding populations would likely be minimal.

13 The additional injuries and fatalities from traffic accidents involving transportation of materials
14 and personnel for building of a new nuclear power plant at the Tradinghouse site would be
15 similar to those evaluated in Section 4.8.3 for the CPNPP site and would represent a small
16 fraction of the total traffic accidents. Anticipated construction would use about 5.6 percent of the
17 current total construction workforce. Past actions in the geographic area of interest that have
18 similarly impacted the public and workers from nonradiological resources include construction of
19 the existing gas-fired plant. There are no major current or proposed future construction projects
20 in the geographic area of interest that would cumulatively impact nonradiological health.

21 ***Operational Impacts***

22 Nonradiological health impacts from operation of two nuclear units on occupational health and
23 members of the public at the Tradinghouse site would be similar to those evaluated in Section
24 5.8 for the CPNPP site. Occupational health impacts to workers (e.g., falls, electric shock or
25 exposure to other hazards) at the Tradinghouse site would likely be similar to those evaluated
26 for workers at the new units at the CPNPP site.

27 Additional occupational health impacts may result from exposure to hazards such as noise, toxic
28 or oxygen-replacing gases, thermophilic microorganisms in the condenser bays, and caustic
29 agents. Luminant's current safety and health programs promote safe work practices and
30 respond to occupational injuries and illnesses. The same or a similar program would be
31 expected for new units at the Tradinghouse site. Health impacts to workers from
32 nonradiological emissions, noise, and EMFs would be monitored and controlled in accordance
33 with the applicable OSHA regulations and would be minimal.

34 Exposure to the public from water-borne etiological agents at the Tradinghouse site would be
35 similar to the types of exposures evaluated in Section 5.8.1, and the operation of the new units
36 at the alternative sites would not likely lead to an increase in water-borne diseases in the
37 vicinity. Noise and EMF exposure would be monitored and controlled in accordance with
38 applicable Occupational Safety and Health Administration (OSHA) regulations. Effects of EMF
39 on human health would be controlled and minimized by conformance with National Electrical
40 Safety Code (NESC) criteria and adherence to the standards for transmission systems
41 regulated by the Public Utility Commission of Texas (PUCT). Nonradiological impacts of traffic
42 associated with the operations workforce would be less than the impacts during building.
43 Mitigation measures taken during building to improve traffic flow would also minimize impacts
44 during operation of a new unit.

45 The existing transmission lines create nonradiological impacts from operations to the public and
46 workers. The nonradiological impacts from the recently retired power plant would not overlap

1 with any new impacts if the site were to be developed for a nuclear power plant. Continued
2 operations of a park on the reservoir would have little impact. There are no past or present
3 activities in the geographic areas of interest that would have nonradiological impacts to the
4 public or workers similar to those discussed for the proposed nuclear units. In the future, these
5 facilities, the proposed transmission line systems, and growth and future urbanization would
6 have nonradiological impacts to the public and workers, and these impacts would be similar to
7 those described for the proposed two new units at the CPNPP site.

8 The review team is also aware of the potential climate changes that could affect human health;
9 a recent compilation of the state of the knowledge in this area (Karl et al. 2009) has been
10 considered in the preparation of this EIS. Projected changes in the climate for the region
11 include an increase in average temperature and a decrease in precipitation, which may alter the
12 presence of microorganisms and parasites in any reservoir that would be used. The review
13 team did not identify anything that would alter its conclusion regarding the presence of
14 etiological agents or change in the incidence of water-borne diseases.

15 **Summary**

16 Based on the information provided by Luminant and the review team's independent evaluation,
17 the review team expects that nonradiological health impacts from building and operation of two
18 new units at the Tradinghouse site would be similar to the impacts evaluated for the CPNPP
19 site. These impacts would be localized and managed through adherence to existing regulatory
20 requirements. The review team concludes, therefore, that the cumulative nonradiological
21 impacts of construction, preconstruction, and operation on health would be SMALL.

22 **9.3.4.10 Radiological Health Impacts of Normal Operations**

23 The following impact analysis includes impacts from building activities and operations for two
24 nuclear units at the Tradinghouse alternative site. The analysis also considers other past,
25 present, and reasonably foreseeable future actions that impact radiological health, including
26 other Federal and non-Federal projects listed in Table 9-18. As described in Section 9.3.4, the
27 Tradinghouse site is on a lake, approximately 8 mi east of Waco, Texas. The recently retired
28 Tradinghouse Power Plant (two gas-fired units) is located adjacent to the site; there are
29 currently no nuclear facilities on the site. The geographic area of interest is the area within a
30 50-mi radius of the Tradinghouse site. There are no other major facilities that result in regulated
31 exposures to the public or biota within the 50-mi radius of the Tradinghouse site. However,
32 there are likely to be hospitals and industrial facilities within 50 mi of the Tradinghouse site that
33 use radioactive materials.

34 The radiological impacts of building and operating the proposed two MHI US-APWR units at the
35 Tradinghouse site include doses from direct radiation and liquid and gaseous radioactive
36 effluents. These pathways would result in low doses to people and biota offsite that would be
37 well below regulatory limits. These impacts are expected to be similar to those estimated for the
38 CPNPP site. The NRC staff concludes that the dose from direct radiation and effluents from
39 hospitals and industrial facilities that use radioactive material would be an insignificant
40 contribution to the cumulative impact around the Tradinghouse site. This conclusion is based
41 on data collected from the radiological environmental monitoring programs conducted around
42 currently operating nuclear power plants.

43 Based on the information provided by Luminant and the NRC staff's independent analysis, the
44 NRC staff concludes that the cumulative radiological impacts from building and operating the
45 two proposed MHI US-APWRs and other existing and planned projects and actions in the
46 geographic area of interest around the Tradinghouse site would be expected to be SMALL.

1 9.3.4.11 Postulated Accidents

2 The following impact analysis includes radiological impacts from postulated accidents from
 3 operations for two nuclear units at the Tradinghouse alternative site. The analysis also
 4 considers other past, present, and reasonably foreseeable future actions that impact
 5 radiological health from postulated accidents, including other Federal and non-Federal projects
 6 and those projects listed in Table 9-18 within the geographic area of interest. As described in
 7 Section 9.3.4, the Tradinghouse site is located in McLennan County, Texas approximately 8 mi
 8 east of Waco, Texas. There are currently no nuclear facilities on the site. The geographic area
 9 of interest considers existing and proposed nuclear power plants that have the potential to
 10 increase the probability-weighted consequences (i.e., risks) from a severe accident at any
 11 location within 50 mi of the Tradinghouse site. Table 9-23 summarizes the nearby nuclear
 12 facilities. Note that although the CPNPP site is located greater than 50 mi from the
 13 Tradinghouse site, it is included for completeness.

Table 9-23. Nearby Nuclear Projects/Facilities Considered in the Cumulative Analysis at the Tradinghouse Site

Project Name	Summary of Project	Location	Status
Energy Projects			
Comanche Peak Nuclear Power Plant	Two large scale nuclear reactors	Within 70 mi of the Tradinghouse site	Currently operating

14 Existing facilities potentially affecting radiological accident risk within this geographic area of
 15 interest are the existing CPNPP Units 1 and 2. No other reactors have been proposed within
 16 the geographic area of interest.

17 As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of
 18 design basis accidents (DBAs) at the CPNPP site would be minimal for US-APWR DBAs are
 19 addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety
 20 criteria. The US-APWR design is independent of site conditions and the meteorology of the
 21 Tradinghouse and CPNPP sites are similar. Therefore, the NRC staff concludes that the
 22 environmental consequences of DBAs at the Tradinghouse site would be minimal. Because the
 23 meteorology, population distribution, and land use for the Tradinghouse alternative site are
 24 expected to be similar to the proposed CPNPP site, risks from a severe accident for a US-APWR
 25 reactor located at the Tradinghouse alternative site are expected to be similar to those analyzed
 26 for the proposed CPNPP site. These risks for the proposed CPNPP site are presented in Table
 27 5-23 and Table 5-24 and are well below the median value for current-generation reactors. In
 28 addition, estimates of average individual early fatality and latent cancer fatality risks are well
 29 below the Commission's safety goals (51 FR 30028). For existing nuclear power plants within
 30 the geographic area of interest, which are CPNPP Units 1 and 2, the Commission has
 31 determined that the probability-weighted consequences of severe accidents are small (10 CFR
 32 51, Appendix B, Table B-1). Because of the NRC's safety review criteria, it is expected that risks
 33 for any new reactors at the CPNPP site would be well below risks for current-generation reactors
 34 and meet the Commission's safety goals. On this basis, the NRC staff concludes that the
 35 cumulative risks of severe accidents at any location within 50 mi of the Tradinghouse alternative
 36 site would be SMALL.

37 9.3.5 Comparison of the Impacts of the Proposed Action and Alternative Sites

38 This section summarizes the review team's characterization of the cumulative impacts related to
 39 locating a two-unit US-APWR nuclear power facility at the proposed CPNPP site and at each of

1 the alternative sites. The three sites selected for detailed review as part of the alternative sites
2 environmental analysis included the Coastal, Pineland, and Tradinghouse sites in Texas (see
3 Figure 9-1). Comparisons are made between the proposed site and the alternative sites to
4 evaluate if one of the alternative sites would be environmentally preferable to the proposed site.
5 The NRC's determination is independent of the Corps' determination of a Least Environmentally
6 Damaging Practicable Alternative pursuant to the Clean Water Act Section 404(b)(1) guidelines
7 at 40 CFR Part 230. The Corps will conclude its analysis of both off-site and on-site alternatives
8 in its Record of Decision.

9 The need to compare the proposed site with alternative sites arises from the requirement in
10 Section 102(2)(c)(iii) of NEPA (42 USC 4332) that environmental impact statements include an
11 analysis of alternatives to the proposed action. The NRC criteria to be employed in assessing
12 whether a proposed site is to be rejected in favor of an alternative site is based on whether the
13 alternative site is "obviously superior" or "environmentally preferable" to the site proposed by the
14 Applicant (Public Service Company of New Hampshire 1977). An alternative site is "obviously
15 superior" to the proposed site if it is "clearly and substantially" superior to the proposed site
16 (Rochester Gas & Electric Corp. 1978). The standard of obviously superior "...is designed to
17 guarantee that a proposed site will not be rejected in favor of an alternate unless, on the basis
18 of appropriate study, the Commission can be confident that such action is called for (New
19 England Coalition on Nuclear Pollution 1978)."

20 The "obviously superior" test is appropriate for two reasons. First, the analysis performed by the
21 NRC in evaluating alternative sites is necessarily imprecise. Key factors considered in the
22 alternative site analysis, such as population distribution and density, hydrology, air quality,
23 aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics, are
24 difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site
25 must have a wide range of uncertainty. Second, the Applicant's proposed site has been
26 analyzed in detail, with the expectation that most adverse environmental impacts associated
27 with the site have been identified. The alternative sites have not undergone a comparable level
28 of detailed study. For these reasons, a proposed site may not be rejected in favor of an
29 alternative site when the alternative site is marginally better than the proposed site, but only
30 when it is obviously superior (Rochester Gas & Electric Corp. 1978). NEPA does not require
31 that a nuclear plant be constructed on the single best site for environmental purposes. Rather,
32 "...all that NEPA requires is that alternative sites be considered and that the effects on the
33 environment of building the plant at the alternative sites be carefully studied and factored into
34 the ultimate decision (New England Coalition on Nuclear Pollution 1978)."

35 Section 9.3.5.1 reviews the cumulative environmental impacts of building and operating a two-
36 unit nuclear plant at the proposed CPNPP site. Cumulative impact levels from Chapter 7 (for
37 the proposed CPNPP site), and the three alternative sites (from Sections 9.3.2, 9.3.3, and 9.3.4)
38 are listed in Table 9-24. Sections 9.3.5.2 and 9.3.5.3 discuss the cumulative impacts of the
39 proposed project located at the CPNPP site and at the alternative sites as they relate to a
40 determination of environmental preference or obvious superiority.

41 **9.3.5.1 Comparison of Cumulative Impacts at the Proposed and Alternative Sites**

42 The following section summarizes the review team's independent assessment of the proposed
43 and alternative sites. The team characterized the expected cumulative environmental impacts
44 of building and operating new units at the CPNPP site and alternative sites. These impacts are
45 summarized by resource area in Table 9-24.

46 The environmental resource areas listed in the following table have been evaluated using the
47 NRC's three-level standard of impact significance: SMALL, MODERATE, or LARGE. These

1 levels were developed using the CEQ guidelines and set forth in the footnotes to Table B-1 of
2 10 CFR Part 51, Subpart A, Appendix B:

3 SMALL – Environmental effects are not detectable or are so minor that they will neither
4 destabilize nor noticeably alter any important attribute of the resource.

5 MODERATE – Environmental effects are sufficient to alter noticeably, but not to
6 destabilize, important attributes of the resource.

7 LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize
8 important attributes of the resource.

9 Full explanations for the specific cumulative impact characterizations are provided in Chapter 7
10 for the proposed site and in Sections 9.3.2, 9.3.3, and 9.3.4 for the alternative sites. The review
11 team's impact category levels are based on professional judgment, experience, and
12 consideration of controls likely to be imposed under required Federal, State, or local permits that
13 would not be acquired until an application for a COL is underway. The considerations and
14 assumptions were similarly applied at each of the alternative sites to provide a common basis
15 for comparison. In the following discussion, the review team compares the impact levels
16 between the proposed site, and each alternative site.

17 **9.3.5.2 Environmentally Preferable Sites**

18 As shown in Table 9-24, the cumulative impacts of building and operating two new units at the
19 proposed site and the alternative sites vary across the impact categories. The resource areas
20 for which the impact level at an alternative site is the same as that for the proposed site does
21 not contribute to the alternative site being judged to be environmentally preferable to the
22 proposed site. Therefore, these resource areas are not discussed further in determining
23 whether an alternate site is environmentally preferable to the proposed site. The resource
24 areas for which an alternative site has a different impact level than the proposed site are
25 discussed further to determine if an alternative site is environmentally preferable to the
26 proposed site. Where there is a range of impacts for a resource, the upper value of the impacts
27 is used for the comparison. In addition, for those cases in which the cumulative impacts for a
28 resource area are greater than SMALL, consideration is given to resource areas in which the
29 impacts of the project at the specific site do not make any significant contribution to the
30 cumulative impact level. As shown in Table 9-24, there are some differences in impacts among
31 the sites.

1

Table 9-24. Comparison of Cumulative Impacts at the CPNPP Site and Alternative Sites

Resource Area	CPNPP Site	Coastal Site	Pineland Site	Tradinghouse Site
Land-Use Impacts	MODERATE	LARGE	MODERATE	MODERATE
Water-Related Impacts				
Water Use	MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Water Quality	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Ecological Impacts				
Terrestrial Ecosystems	MODERATE	MODERATE	MODERATE	SMALL
Aquatic Ecosystems and Wetlands	SMALL to MODERATE	MODERATE	SMALL	SMALL to MODERATE
Socioeconomic Impacts				
Physical	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Demography	SMALL	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Taxes and Economy	LARGE (beneficial)	LARGE (beneficial)	LARGE (beneficial)	LARGE (beneficial)
Infrastructure and Community Services	SMALL to MODERATE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Environmental Justice	SMALL	MODERATE	MODERATE	MODERATE
Historic and Cultural Resources	SMALL	SMALL	MODERATE	SMALL
Air Quality	MODERATE	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Nonradiological Health	SMALL to MODERATE	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL

2 ***The Coastal Site***

3 The Coastal site is characterized in Table 9-24 as less favorable than the CPNPP site for the
4 land use and socioeconomic resource areas. Conversely, the review team identified no
5 resource areas in which the Coastal site was more favorable than the CPNPP site.

6 Conversion of the Coastal site from its present uses to building and operating two nuclear units
7 would require up to 2500 ac of this greenfield site and would therefore involve greater land use
8 impacts than at the CPNPP site. Building and operating a new nuclear plant at the Coastal site
9 would create adverse socioeconomic impacts because (1) the site is a greenfield site without
10 existing adequate road, rail and other infrastructure access; (2) there is a relatively small labor
11 force in the area from which to draw construction and operations workers, thus large numbers of
12 such workers would have to in-migrate into the area; and (3) the site is in a rural area that does
13 not have the existing housing, infrastructure, and public services to support the in-migration of
14 large numbers of workers and their families.

1 Based on the results and comparison of the impact characterizations shown in Table 9-24, the
2 review team concludes that the Coastal site would not be environmentally preferable to the
3 CPNPP site for two new nuclear generating units.

4 ***The Pineland Site***

5 The Pineland site is characterized in Table 9-24 as less favorable than the CPNPP site for the
6 socioeconomics and historic and cultural resources resource areas. Conversely, the review
7 team identified the following resource areas in which the Pineland site was more favorable than
8 the CPNPP site: water use, water quality, and aquatic and wetlands ecosystems.

9
10 Similar to Coastal site, the Pineland site is also a greenfield site. The Pineland site is located on
11 a peninsula on the Sam Rayburn Reservoir, which would provide an abundant water supply with
12 less potential for impacts to water quality than would the CPNPP site. Withdrawal of cooling
13 water from the reservoir would not have more than a minor effect on the water levels in the
14 reservoir. Aquatic species would be unlikely to be substantially affected by the loss of small
15 areas of habitat potentially within the footprint of the proposed facilities. No wetlands have been
16 identified on the peninsula; consequently, it is unlikely that there would be impacts to wetland
17 resources at the Pineland site.

18 Because the Pineland site is in a rural area, it would have the same types of socioeconomic
19 impacts as described above for the Coastal site. While prehistoric fossils and artifacts from the
20 Paleo-Indian period are known to occur in the same county as the Pineland site, with one
21 exception the impacts to historic and cultural resource impacts for a new plant located at the
22 Pineland site would likely be similar to the impacts for a new plant at the CPNPP site. There are
23 no existing transmission corridors connecting directly to the Pineland site; consequently, new
24 transmission line corridors would be needed to connect the Pineland site to these existing lines.
25 Several historic and cultural resource sites are located in this region and could be affected by
26 the addition of new transmission line corridors.

27 The Pineland site and the CPNPP site are closely ranked in terms of environmental attributes; in
28 comparing the impacts of the proposed action across different resource areas, both site areas
29 would experience environmental effects, albeit different intensities in different resource areas.
30 On balance, it was not clearly evident that the Pineland site is environmentally preferable.

31 Therefore, based on the results and comparison of the impact characterizations shown in Table
32 9-24, the review team concludes that the Pineland site would not be environmentally preferable
33 to the CPNPP site for two new nuclear generating units.

34 ***The Tradinghouse Site***

35 The Tradinghouse site is characterized in Table 9-24 as less favorable than the CPNPP site for
36 the socioeconomics resource area. Conversely, the review team identified terrestrial
37 ecosystems as the only resource area in which the Tradinghouse site was more favorable than
38 the CPNPP site. A new nuclear plant constructed at the Tradinghouse site would obtain its
39 water from the nearby Tradinghouse Creek Reservoir.

40 After construction and preconstruction activities are complete at the Tradinghouse site,
41 terrestrial resources in the areas that are temporarily disturbed are expected to return to
42 predominantly pre-development conditions. While some habitat would be lost to permanent
43 project structures, the losses would be minimal due to the existing low habitat value present on
44 the Tradinghouse site.

1 Although the Tradinghouse site is not a greenfield site, it would still have the same types of
2 socioeconomic impacts as described above for the Coastal site. In addition, the use of the
3 Tradinghouse site for a new nuclear plant could adversely affect or eliminate the recreational
4 use of Tradinghouse Creek Reservoir, which hosts one public park and is popular with local
5 anglers.

6 Although there are differences and distinctions between the cumulative environmental impacts
7 of building and operating two new nuclear generating units at the proposed CPNPP site and the
8 alternative sites, the review team concludes that these differences are not sufficient to
9 determine that any of the alternative sites would be environmentally preferable to the proposed
10 site for building of two new nuclear generating units.

11 Therefore, based on the results and comparison of the impact characterizations shown in Table
12 9-24, the review team concludes that the Tradinghouse site would not be environmentally
13 preferable to the CPNPP site for two new nuclear generating units.

14 **9.3.5.3 Obviously Superior Sites**

15 None of the alternative sites were determined to be environmentally preferable to the proposed
16 CPNPP site. Therefore, the NRC staff concludes that none of the alternative sites would be
17 obviously superior to the CPNPP site. The Corps will conclude its analysis of both offsite and
18 onsite alternatives in its Record of Decision.

19 **9.4 System Design Alternatives**

20 The review team considered a variety of heat dissipation systems and circulating water systems
21 (CWS) alternatives. While other heat dissipation systems and water systems are used in
22 conjunction with the project, the one most likely to dominate the environmental consequences of
23 operation is the CWS that cools and condenses the steam for the turbine-generator. Other
24 water systems, such as service water and ultimate heat sink cooling systems, are much smaller
25 than the CWS. Consequently, the review team only considered alternative heat dissipation and
26 water treatment systems for the CWS. The proposed CWS is a closed-loop system that uses
27 new mechanical draft cooling towers (MDCT) for heat dissipation (Luminant 2009a). The
28 proposed system is discussed in detail in Chapter 3.

29 This section provides the review team's basis for its conclusions with respect to the evaluation
30 of alternative heat dissipation systems, and if such systems may be environmentally preferable
31 to the proposed system.

32 **9.4.1 Heat Dissipation Systems**

33 About two-thirds of the thermal power produced by a commercial light-water reactor is rejected
34 as heat to the environment; one-third is converted into electrical power. Normal heat sink
35 cooling systems transfer the rejected heat load into the atmosphere and/or nearby waterbodies,
36 primarily as latent heat exchange (evaporating water) or sensible heat exchange (warmer air or
37 water). Different heat-dissipation systems rely on different exchange processes. The following
38 sections describe alternative heat dissipation systems considered by the review team for
39 proposed Units 3 and 4 at the CPNPP site.

40 The impacts associated with the proposed heat dissipation system, a cooling reservoir, are
41 discussed in Sections 4.2, 4.3, 5.2, and 5.3. Luminant proposes a cooling system designed to
42 meet the cooling needs of proposed CPNPP Units 3 and 4 while minimizing the effects upon the
43 operation of CPNPP Units 1 and 2. At the same time, the cooling system is expected to protect
44 the waters of the Squaw Creek Reservoir (SCR), Lake Granbury, and the Brazos River. To

1 meet these requirements, Luminant focused its analysis on closed-loop cooling systems and
 2 concluded that the use of MDCT was the best available technology that would result in the least
 3 environmental impact from the project. The review team determined in Chapter 4 that the
 4 impacts of building the proposed heat dissipation system would be SMALL for both hydrologic
 5 and ecological resources. The review team also determined in Chapter 5 that the impacts of
 6 operating the proposed heat dissipation system would be MODERATE and SMALL to
 7 MODERATE for hydrologic and ecological resources, respectively.

8 Heat dissipation systems, broadly categorized as once-through (or open) and closed-loop
 9 systems, differ in how heat is transferred; therefore, each system has a different set of potential
 10 environmental impacts. The once-through method involves the use of large quantities of cooling
 11 water, withdrawn from and returned to a large water source following its circulation through the
 12 main condenser. Closed-loop cooling systems involve the use of less water by comparison.

13 The scope of the review team's review is limited to reasonable alternative heat dissipation
 14 systems considered feasible for construction and operation at the proposed plant site and that
 15 (1) are not prohibited by Federal, State, regional, or local regulations, or Native American Tribal
 16 agreements; (2) are consistent with findings under the Clean Water Act (CWA); and (3) can be
 17 judged as practical from a technological standpoint with respect to the proposed dates of plant
 18 construction and operation. The review team evaluated the reasonable alternative heat
 19 dissipation systems considered feasible for construction and operation at the proposed site to
 20 determine if any of the alternatives could provide a reasonable reduction in overall
 21 environmental impact or offer solutions to potential adverse impacts predicted for the proposed
 22 heat dissipation system. When an environmentally preferable alternative is identified, the
 23 review team then compares the alternative to the proposed design to determine if it was
 24 preferable to the proposed heat dissipation system. This review includes the review team's
 25 independent evaluation of alternatives proposed by the Applicant to mitigate impacts associated
 26 with construction and operation of the proposed heat dissipation system.

27 Multiple closed-cycle alternatives were evaluated by Luminant in the ER. Due to the limited
 28 available water supply for waste heat transfer from the reactor cooling system to the
 29 environment, the review team determined that the elimination of a once-through wet cooling
 30 option for CPNPP Units 3 and 4 is appropriate.

31 Only the following closed-loop heat dissipation systems were considered by Luminant as
 32 alternatives to the proposed MDCTs:

- 33 • Wet/dry cooling tower,
- 34 • Natural draft wet cooling tower, and
- 35 • Dry cooling towers.

36 The review team did not identify other reasonable alternatives that could meet the needs of the
 37 project. The review team concluded that these alternatives meet the three criteria described
 38 above and (1) are not prohibited by law or regulation, (2) are consistent with any findings of the
 39 CWA, and (3) are technologically practical.

40 **9.4.1.1 Dry Cooling Towers**

41 Heat is transferred from heated water to cooler air in dry cooling towers by a sensible heat-
 42 transfer process by circulating water enclosed in piping and tubes with fins; the heat is
 43 transferred to air passing over the fins much like a radiator. Therefore, while water is used,
 44 there is no water loss by evaporation because the receiving air does not directly contact the
 45 water. Water use impacts are avoided with dry cooling tower alternatives as dry cooling

1 systems use less than 10 percent of the water required for a wet-cooled plant (World Nuclear
2 Association 2008).

3 A dry cooling system heat transfer is less efficient than a wet cooling system and much larger
4 and mechanically complex cooling plants are required (World Nuclear Association 2008).
5 According to the Cooling Technology Institute, the US DOE, and the California Energy
6 Commission (CEC), a dry cooling system comes with energy and efficiency penalties and is not
7 as cost-effective as a wet or evaporative system (Cooling Technology Institute 2009, DOE
8 2009b, CEC 2002). There is reduced generation efficiency with the use of dry cooling towers as
9 they would use 1.5 to 10 percent of the power station's output (World Nuclear Association 2008,
10 DOE 2009b). In another study, the incremental costs of using dry cooling towers at a 1200
11 MW(e) nuclear plant are approximately 22 percent to 25 percent greater than an all wet system
12 (Choi and Glicksman 1979). The project proposed by the Applicant is for 3200 net MW(e);
13 should dry cooling be considered for the project, the net power produced would be reduced by
14 the approximately 50 MW(e) needed to power forced air cooling systems and result in reduced
15 generating efficiency.

16 Dry cooling towers could minimize water-related impacts from the cooling system operation
17 because water losses through evaporation are minimized. While very little makeup water would
18 be needed and no blowdown water would be generated, dry cooling systems require much
19 larger cooling systems and result in loss in electrical generation efficiency due to energy
20 demands to operate the large array of fans needed to move large volumes of air through the
21 cooling system. In a dry cooling tower, the temperature of the water leaving the cooling tower
22 can only approach the dry-bulb air temperature not the lower wet-bulb temperature approached
23 in wet cooling tower. As such, in the summer month, the higher temperature of the water
24 returning to the plant could result in significant loss in thermal plant efficiency. This loss in
25 energy generation efficiency could translate into increased operational costs and either
26 increased fuel cycle impacts, (i.e., more fuel is needed to produce the equivalent net electrical
27 power for distribution to the grid) or impacts in other resource areas, albeit displaced from the
28 site area, i.e., air quality and socioeconomics, should the power shortfall be overcome by a
29 fossil-fueled power generation facility.

30 In Sections 5.2 and 5.3, the review team concluded that the impacts associated with aquatic
31 ecology and water quality for the construction and operation of the proposed wet cooling system
32 were SMALL to MODERATE; this means that the impacts would be minimal to noticeable but
33 would not destabilize important attributes of the resource. Impacts associated with water use
34 for the construction and operation of the proposed wet cooling system were MODERATE; this
35 means that the impacts would be noticeable but not destabilizing. In comparison, the CEC
36 reported that in some other cases, the environmental impacts of dry cooling can be greater than
37 the environmental impacts of wet systems (CEC 2002). The report identifies the facts that dry
38 cooling towers are physically larger, can create a greater visual impact, reduced plant efficiency
39 (results in higher fuel consumption), and generate more noise from air-cooled systems.
40 However, because the cooling system would be built on an existing nuclear power plant site that
41 includes multiple structures including two 69.9-meter high containment buildings, the aesthetic
42 impacts from dry cooling towers would be minimal.

43 The loss in power generated from the project would need to be supplemented to meet the
44 project purpose [i.e., 3200 MW(e)]. This could result in minor increases in fuel cycle impacts, if
45 the power level would need to be increased, or in minor increases in air quality and
46 socioeconomic impacts, which could be remote from the site area if the power to be
47 supplemented is from a fossil-fuel power plant. It is unlikely that the other resource areas would
48 have noticeable changes in environmental effects using dry cooling. Consequently, even
49 though dry cooling could avoid some of the water-related impacts, it is not apparent that the

1 alternative is environmentally preferable to the proposed MCDTs because of the additional
2 power needed to meet the project goals even if the attendant environmental impacts of such
3 power production occur in a different location.

4 **9.4.1.2 Combination Wet/Dry Cooling Tower System**

5 A combination mechanical draft wet/dry cooling tower system uses both wet and dry cooling
6 cells to limit consumption of cooling water, often with the added benefit of reducing the size of
7 the visible plume. Heated water first passes through the dry portion of the cooling tower where
8 heat is transferred to the air passing over tubes. The water then passes through the wet portion
9 of the tower where it is sprayed into a moving air stream; additional heat is removed from the
10 water by evaporation and sensible heat transfer. When ambient air temperatures are low, the
11 dry portion of these cooling towers may be sufficient to meet cooling needs. However,
12 whenever the dry portion of the system is used, it would result in a loss in generating efficiency
13 that would also translate into increased fuel cycle impacts as described in the previous section
14 and displaced environmental impacts, air quality impacts or socioeconomic impacts, or a
15 combination of impacts; furthermore, some of these impacts may be displaced from the site
16 area.

17 Reducing plume visibility is not a priority mitigation measure for reducing environmental
18 impacts: the goal of operating a wet/dry cooling system would be to minimize water-related
19 impacts. To minimize efficiency and energy penalties, the plant operator would use the wet/dry
20 system to balance water impacts and energy demands. If efficiency and energy penalties can
21 be reduced to an economically viable level (cost of cooling is less than the cost of water, water
22 treatment, etc), then the dry cooling functions would dominate.

23 In Sections 5.2 and 5.3, the review team concluded that the impacts associated with aquatic
24 ecology and water quality for the construction and operation of the proposed wet cooling system
25 were SMALL to MODERATE; this means that the impacts would be minimal to noticeable but
26 would not destabilize important attributes of the resource. Impacts associated with water use
27 for the construction and operation of the proposed wet cooling system were MODERATE; this
28 means that the impacts would be noticeable but not destabilizing. In comparison, during the
29 operation of wet/dry cooling towers the impacts could be reduced when it is feasible to operate
30 the dry portion to, for example, reduce water consumption during low flow periods. Using the
31 dry portion at any time displaces some environmental impacts because the power demand
32 would still need to be satisfied from some other power source.

33 The loss in power generated from the project would need to be supplemented to meet the
34 project purpose [i.e., 3200 MW(e)]. To meet the shortfall in power supply when the dry portion
35 is operated, an alternate power generating facility would have to be available on demand; the
36 type of power source that could be brought online on demand would most likely be a natural gas
37 generating facility with all of the associated environmental impacts similar, but scaled, to those
38 discussed in Section 9.2.2.2. It is unlikely that the other resource areas would have noticeable
39 changes in environmental effects using a combination wet/dry cooling system. Consequently,
40 even though a combination wet/dry cooling system could avoid some of the water-related
41 impacts, it is not apparent that the alternative is environmentally preferable to the proposed
42 MCDTs because of the additional power needed to meet the project goals even if the attendant
43 environmental impacts of such power production occur in a different location.

44 **9.4.1.3 Wet Natural Draft Cooling Towers**

45 Wet natural draft cooling towers (NDCT) induce circulation through large (500 ft tall and 400 ft in
46 diameter) towers by cascading warm water downward in the lower portion of the cooling tower.

1 As heat transfers from the water to the air in the tower, the air becomes more buoyant and rises.
2 This buoyant circulation induces more air to enter the tower through its open base to replace air
3 that exits the tower through its open top. The size of the cooling towers results both in a large
4 visual and land-use footprint and, when operating, an elevated visible plume. NDCTs take
5 advantage of air circulation induced by the shape of the tower and density difference between
6 the water inlet temperature created by the circulating water system and the cold water
7 temperature from Lake Granbury to transfer heat from the water to the air. For the natural draft
8 circulation to be effective at 20°F temperature difference between the warmed air and the
9 ambient air temperature is needed. During the warmer times of the year, the 20°F temperature
10 difference cannot reliably achieved given under the current thermal conditions and size of Lake
11 Granbury to meet cooling tower design parameters (Luminant 2009b, 2009c). To increase the
12 cooling capability of the waterbody, Lake Granbury would have to be expanded; this would
13 result in significant land use and ecological impacts. It is unlikely that the other resource areas
14 would have noticeable changes in environmental effects using a NDCT system. Therefore,
15 based on the consideration of land use and ecological impacts, the review team concluded that
16 expanding Lake Granbury or the SCR and building and operating a NDCT would not be an
17 environmentally preferable alternative for the CPNPP site.

18 **9.4.2 Circulating Water System**

19 The CWS is an integral part of the heat dissipation system discussed in Section 9.4.1. The
20 CWS provides the heat transfer medium between the main condenser and the heat dissipation
21 system. The review team evaluated alternatives to the proposed intakes and discharges for the
22 normal heat sink cooling system, based on the proposed heat dissipation system water
23 requirements. The capacity requirements of the intake and discharge system are defined by the
24 recommended heat dissipation system. For CPNPP Units 3 and 4, the proposed heat
25 dissipation system is a closed-loop system that uses new MDCTs for heat dissipation.

26 The proposed system is considered feasible for construction and operation based on the
27 existing experience of CPNPP Units 1 and 2 makeup water system that has worked well since
28 1990 (Luminant 2009a). The existing CWS at CPNPP is designed and operated to comply with
29 TPDES and CWA 316(b) requirements. The proposed and alternative systems are considered
30 technologically achievable and available.

31 **9.4.2.1 Intake Alternatives**

32 The proposed location of the intake structure is on the southwest bank of Lake Granbury The
33 impacts associated with the proposed intake system are discussed in Sections 4.2, 4.3, 5.2, and
34 5.3. CPNPP proposes to use a new water intake structure located adjacent to the existing
35 makeup water intake structure on Lake Granbury as the intake system for the proposed units,
36 upstream of the existing intake and pumping station for CPNPP Units 1 and 2 makeup water
37 and more than a mile upstream of the De Cordova Bend Dam. The intake screens would be
38 located approximately 110 ft from shore at a depth of approximately 34 ft at a location where the
39 depth of the lake is approximately 40 ft (Luminant 2009a). The review team determined in
40 Chapter 4 that the impacts of building the proposed intake structure would be minimal for both
41 hydrologic and ecological resources. In chapter 5, the review team determined that hydrologic
42 alterations due to operation of CPNPP Units 3 and 4 would have MODERATE impacts on
43 surface water resources and SMALL to MODERATE impacts on aquatic resources. These
44 impact levels were associated with the consumptive use of water resources related to the heat
45 dissipation systems. The proposed intake system would not significantly contribute to the
46 MODERATE level of impact associated with surface water use or the SMALL to MODERATE
47 level of impact associated with aquatic ecology.

1 Alternative intake designs that were considered by the review team include alternative intake
 2 locations (Luminant 2009b, 2009c). While intake options included both SCR and Lake
 3 Granbury as sources for CNPP Units 3 and 4 cooling water, SCR options had the disadvantage
 4 of further degrading the water supply situation in SCR (Luminant 2009b, 2009c). Alternative
 5 system designs considered by Luminant for Lake Granbury included:

- 6 • Shoreline intake structure with pump-wells behind conventional traveling screens equipped
 7 with Ristoph-type bucket fish handling and return system.
- 8 • Offshore-bottom mounted velocity cap intake with a shoreline pump-house (potentially also
 9 requiring traveling screens with fish return capability).
- 10 • Offshore-bottom mounted intake with passive, fine-mesh, screens with a shoreline
 11 pumphouse (not requiring traveling screens in the pump-house).

12 While Lake Granbury intake options require an intake structure and pump-house, the major
 13 benefit of using Lake Granbury as the source for cooling water is the minimal impact to the
 14 water supply and water quality in SCR. The existing intake structure on SCR for CPNPP Units
 15 1 and 2 has been in operation for many years, and the impact to fish has been minimal to date
 16 (Luminant 2009a). Similarly, the proposed and alternative intake facilities on Lake Granbury
 17 would have a similar minimal environmental impact. It is unlikely that the other resource areas,
 18 beyond the ecological and the hydrologic resource areas would have noticeable changes in
 19 environmental effects with a different intake alternative. The NRC staff reviewed the analysis of
 20 the intake alternatives (Luminant 2009b, 2009c) and concurs with the conclusions presented by
 21 Luminant on the intake options. The review team determined that an alternative intake system
 22 is not environmentally preferable to the proposed system for the CPNPP site.

23 **9.4.2.2 Discharge Alternatives**

24 Luminant is proposing the use of a single discharge system for each unit. This system would
 25 consist of piping to Lake Granbury where cooling tower blowdown is discharged through a multi-
 26 port diffuser system (Luminant 2009d, 2009e). Each unit is designed with a 42-in diameter
 27 blowdown pipe that would run from the MDCTs to the outfall structure on Lake Granbury ending
 28 with a submerged 82-ft long multi-port discharge pipe diffuser (Luminant 2009d, 2009e). Each
 29 diffuser would be equipped with 18 nozzles; each nozzle would have a 4-in. diameter with a
 30 spacing of 4 ft 4 in., center-to-center distance (Luminant 2009d, 2009e).

31 The following possible alternative locations of discharge were evaluated and eliminated as
 32 potential discharge locations in the ER (Luminant 2009a). Several of these options and a Zero
 33 Liquid Discharge option were also analyzed in Luminant (2009b).

- 34 • SCR – cannot support the thermal load of CPNPP Units 3 and 4 without affecting CPNPP
 35 Units 1 and 2;
- 36 • Brazos River downstream of Lake Granbury – has periods of limited flow and the thermal
 37 plume of blowdown from the proposed units has little dilution or dissipation in the receiving
 38 water in the river causing significant impact to the ecology along the river;
- 39 • Possum Kingdom Lake – would require pumping blowdown many miles from the CPNPP
 40 site, which could introduce environmental impacts that could otherwise be avoided along the
 41 rights-of-way for the pipeline as well as at the Lake;
- 42 • Squaw Creek – small stream with flow existing mainly from letdown from SCR dam that
 43 converges with the Brazos River resulting in the same potential ecological impact; and
- 44 • Paluxy River – small river that converges with the Brazos River south of SCR at Glen Rose,
 45 TX; flows thorough Dinosaur Valley State Park; this could introduce environmental impacts
 46 that could otherwise be avoided, including the potential effects on natural heritage sites.

1 Discharging to the SCR or immediately below the dam into Squaw Creek would likely cause the
2 greatest environmental impact because of the high total dissolved solids (TDS) issues in either
3 SCR or downstream of the SCR dam. Discharges into Lake Granbury would likely have the
4 least environmental impact and the greatest potential to meet water quality standards because
5 discharges to the Brazos River would have to meet lower TDS limits (Luminant 2009b, 2009c).

6 The Zero Liquid Discharge option results in no outfall for CPNPP Units 3 and 4 and avoids
7 installation and discharge water quality issues. However, the option would require the disposal
8 of a significant volume of solids (salts) that are generated in the process of evaporating the
9 cooling water to dryness – a far greater volume than would be generated at the proposed BDTF.

10 Two other discharge configurations were considered but rejected in the design selection
11 process as alternatives to the multi-port pipe diffuser (Luminant 2009d, 2009e). These
12 alternatives included the impact-type energy dissipater structure with a weir (low head dam) and
13 a direct open pipe discharge into the lake. The impact-type dissipater structure alternative
14 structure was rejected because a new off-shore concrete structure would be required and the
15 energy dissipation in this type of system is essentially uncontrolled (Luminant 2009d, 2009e).

16 The direct open pipe discharge was rejected because flow velocity cannot be controlled at the
17 discharge end (Luminant 2009d, 2009e). These alternative discharge structures are not
18 environmentally preferred, as they do not decrease the small effect of plume or potential
19 physical scour problems. While the direct open pipe discharge system would be the least costly
20 alternative to construct and operate, it would not achieve the required degree of mixing to
21 ensure compliance with water quality standards (Luminant 2009d, 2009e). Therefore, the NRC
22 staff determined that there were no alternative discharge designs that were environmentally
23 preferable to proposed discharge design to Lake Granbury.

24 **9.4.2.3 Water Supplies**

25 The review team considered alternative sources for both normal heat sink cooling water and
26 service water.

27 ***Water Reuse***

28 Sources of water for reuse can be developed either from the plant itself or from other local water
29 users. Sanitary waste water treatment plants generally used by communities with modest sized
30 populations are the most ubiquitous source of water for reuse. Based on the discuss in Section
31 2.5.2.6 of this EIS, the total amount of wastewater generated by local sanitary waste water
32 treatment plants would not be a sufficient source of water for use the proposed new reactors.
33 Agricultural processing, industrial processing, and oilfield production can also provide significant
34 supplies of water for reuse. Additional treatment (e.g., tertiary treatment, chlorination) may be
35 required to provide water of appropriate quality for the specific plant need. Population is very
36 low and there is little industry around the CPNPP site. Consequently, the staff determined that
37 no sources of water for reuse at the CPNPP site in sufficient quantities were available.
38 Therefore, the NRC staff concluded that water reuse was not a reasonable alternative for water
39 supply at the CPNPP site.

40 ***Groundwater***

41 Luminant's plan presented in the ER reduces usage of groundwater at the site. Based on the
42 discussion in Section 2.3.1.2, groundwater near the site would not be suitable as a water source
43 for the proposed new nuclear units. As a result, groundwater was eliminated as a possible
44 alternative water source (Luminant 2009), and the review team concluded that groundwater use
45 was not an a reasonable alternative for water supply at the CPNPP site.

1 **Surface Water**

2 Only surface waterbodies were considered for normal heat sink cooling water and service water.
3 The staff concluded that the Lake Granbury reservoir is the only viable water supply for service
4 water and heat dissipation for CPNPP Units 3 and 4. Other nearby water resources are either
5 too small or they are potentially more environmentally sensitive. Therefore, the NRC staff
6 concluded that surface water supply alternatives was not a reasonable alternative for water
7 supply at the CPNPP site.

8 **9.4.2.4 Water Treatment**

9 Both inflow and effluent water may require treatment to ensure that it meets plant water needs
10 and effluent water standards. The Applicant proposes to add chemicals to plant water to meet
11 appropriate water quality process needs. The primary chemical additives anticipated would be
12 required to maintain the appropriate chemistry in the cooling towers to preclude biofouling. The
13 effluent water chemistry is regulated by the TCEQ through the TPDES permitting process.
14 Mechanical treatment may be a viable option for scale and biofilm removal. Other alternatives
15 to manage biofouling, such as UV treatment, are also feasible. These alternatives, while
16 feasible, would not eliminate the need for some chemical treatment. Chemical treatment is a
17 reliable and well-established engineering practice that has been shown to provide minimal
18 impacts in a variety of settings.

19 Water quality is a concern in this watershed area. The Brazos River system and the lakes
20 associated with the river exhibit a highly variable TDS content (Luminant 2009a). Because
21 blowdown water contains solids and salts, discharge of the blowdown must comply with site
22 TPDES permits. Section 3.3.2.1, and 3.3.4.1 of this EIS provides a description of the proposed
23 BDTF that would be built to produce a clean permeate stream, which would then be blended
24 with the remaining untreated blowdown and routed to Lake Granbury via two new pipelines and
25 underwater diffusers in the lake. The impacts of the proposed BDTF to land use, water quality,
26 and terrestrial ecology are minimal to noticeable and are described in Sections 5.1.1, 5.2.3, and
27 5.3.1 of this EIS. Possible alternatives to the proposed BDTF include: reusing both treated and
28 untreated blowdown water; diluting blowdown from the circulating water system with additional
29 makeup water; and increase the number of cycles of concentration from 2.4 to 5.0 (Luminant
30 2009a).

31 The option of reusing treated and untreated blowdown water would eliminate the need to
32 construct a discharge structure and water quality affects in Lake Granbury. However, the option
33 would require the disposal of a significant volume of solids (salts) that are generated in the
34 process of evaporating the cooling water to dryness – a far greater volume than would be
35 generated by the proposed BDTF.

36 The option of increasing the makeup water supply to the system to dilute blowdown from the
37 circulating water system would eliminate the need for a BDTF and the impacts associated with
38 it. However, the alternative would require additional water usage and would increase the
39 impacts described in Section 5.2.2 of this EIS.

40 Increasing the number of cycles from 2.4 to 5.0 cycles of concentration would reduce the
41 amount of water need for makeup and the amount of blowdown discharging to Lake Granbury.
42 However, this method would require additional chemical usage and potentially produce a waste
43 concentration higher than water quality stream standard set by the TCEQ (Luminant 2009a).

44 Other water treatment of the CWS water includes biocides, algacides, pH adjusters, corrosion
45 inhibitors, scale inhibitors, and silt dispersants. These additives in the blowdown water could
46 impact water quality. The treatment of the blowdown water will be required to remove

1 chemicals, salts and TDS to meet TPDES discharge limits and to ensure that the water quality
2 in the lower part of Lake Granbury is not impacted. Any water treatment depends on the final
3 (post-construction) TPDES permit requirements.

4 The effluents from cooling tower blowdown are specifically regulated in 40 CFR Part 423 by the
5 EPA to protect the environment. In the State of Texas, this regulatory authority is administered
6 by the TCEQ. The review team identified no environmentally preferable alternative to CPNPP's
7 proposed chemical water treatment.

8 **9.4.3 Conclusion**

9 The NRC staff considered alternative systems designs including three alternative heat
10 dissipation systems and alternative intake, discharge, and water supply systems. As discussed
11 in the above sections, the NRC staff identified no alternative that was environmentally
12 preferable to the proposed plant systems design.

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10.0 CONCLUSIONS AND RECOMMENDATIONS

1 This chapter provides a discussion of the conclusions reached in earlier parts of this
2 environmental impact statement (EIS), as well as recommendations. Section 10.1 summarizes
3 the impacts of the proposed action, Section 10.2 summarizes the proposed project's
4 unavoidable adverse impacts with an accompanying table, and Section 10.3 discusses the
5 relationship between the short-term use of resources and long-term productivity of the human
6 environment. Section 10.4 summarizes the irretrievable and irreversible use of resources, and
7 Section 10.5 summarizes the alternatives to the proposed action. Section 10.6 discusses
8 benefits and costs. Section 10.7 includes the NRC staff's recommendation, and Section 10.8
9 provides the references.

10 The U.S. Nuclear Regulatory Commission (NRC) received an application from the Luminant
11 Generation Company LLC (Luminant) for combined construction permits and operating licenses
12 (combined licenses or COLs) for Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4
13 at the CPNPP site. The CPNPP site is located about 45 mi southwest of Fort Worth, Texas,
14 and about 5 mi north of Glen Rose, Texas. The location of the proposed Units 3 and 4 is
15 approximately 0.5 mi northwest of the existing CPNPP Units 1 and 2. The CPNPP site and the
16 existing facilities are owned by Luminant. Luminant is currently the licensed operator of the
17 existing Units 1 and 2, and would also be the owner and licensed operator of the proposed Units
18 3 and 4. In its application, Luminant specified the U.S. Advanced Pressurized-Water Reactor
19 (US-APWR) as the proposed reactor design for Units 3 and 4.

20 As part of the permitting process for CPNPP Units 3 and 4, Luminant plans to submit a joint
21 application to the U.S. Army Corps of Engineers (Corps) Fort Worth District and the Texas
22 Commission on Environmental Quality for activities associated with the alteration of any
23 floodplain, waterway, tidal wetland, or nontidal wetland in Texas.

24 The proposed actions related to the Units 3 and 4 application are (1) the NRC issuance of COLs
25 for construction and operation of two new nuclear units at the CPNPP site in Hood and
26 Somervell Counties, Texas; and (2) the Corps' issuance of a permit pursuant to Section 404 of
27 the Clean Water Act and Section 10 of the Rivers and Harbors Appropriation Act.

28 Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC
29 4321 et seq.), directs that an EIS is required for major Federal actions that significantly affect
30 the quality of the human environment. Section 102(2)(C) of NEPA requires that an EIS include
31 information about the following:

- 32 • the environmental impacts of the proposed action;
- 33 • any adverse environmental effects that cannot be avoided should the proposal be
34 implemented;
- 35 • alternatives to the proposed action;
- 36 • the relationship between local short-term uses of the environment and the maintenance and
37 enhancement of long-term productivity; and
- 38 • any irreversible and irretrievable commitments of resources that would be involved if the
39 proposed action is implemented.

40 The NRC has implemented NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51.
41 In 10 CFR 51.20, the NRC requires preparation of an EIS for issuance of a COL to construct
42 and operate a nuclear power plant. Subpart C of 10 CFR Part 52 contains the NRC regulations
43 related to COLs.

1 The environmental review described in this EIS was conducted by a team consisting of NRC
2 staff, its contractor's staff at the Oak Ridge National Laboratory and the Information Systems
3 Laboratories, Inc., and staff from the Corps. During the course of preparing this EIS, the review
4 team reviewed the Environmental Report (ER) submitted by Luminant (Luminant 2009a) and
5 supplemental documentation from Luminant in response to requests by NRC staff and the
6 Corps for additional information; consulted with Federal, State, Tribal, and local agencies; and
7 followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plans* (NRC
8 2000). In addition, the NRC considered the public comments related to the environmental
9 review received during the scoping process. These comments are provided in Appendix D of
10 this EIS.

11 Included in this EIS are (1) the results of the review team's preliminary analyses, which consider
12 and weigh the environmental effects of the proposed actions; (2) mitigation measures for
13 reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the
14 proposed action; and (4) the NRC staff's preliminary recommendation regarding the proposed
15 action based on its environmental review.

16 As a cooperating agency, the Corps has participated in the environmental review and EIS
17 preparation. The proposed action includes impacts on waters of the United States. For
18 proposed actions requiring a Section 404 Clean Water Act permit for the discharge of dredged
19 and/or fill material into waters of the United States, regulations promulgated by the U.S.
20 Environmental Protection Agency (EPA) require the Corps to limit its authorization to the least
21 environmentally damaging practicable alternative. The Corps will document its conclusion of
22 the review process, including the requirement for compensatory mitigation, in accordance with
23 33 CFR Part 332, Compensatory Mitigation for Losses of Aquatic Resources, in its permit-
24 decision document, or Record of Decision.

25 Environmental issues are evaluated using the three-level standard of significance—SMALL,
26 MODERATE, or LARGE—developed by the NRC using guidelines from the Council on
27 Environmental Quality (CEQ) (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A,
28 Appendix B, provides the following definitions of the three significance levels:

29 SMALL—Environmental effects are not detectable or are so minor that they will neither
30 destabilize nor noticeably alter any important attribute of the resource.

31 MODERATE—Environmental effects are sufficient to alter noticeably, but not to destabilize,
32 important attributes of the resource.

33 LARGE—Environmental effects are clearly noticeable and are sufficient to destabilize
34 important attributes of the resource.

35 Mitigation measures were considered for each environmental issue and are discussed in the
36 appropriate sections. During its environmental review, the review team considered planned
37 activities and actions that Luminant indicates it and others would likely take should Luminant
38 receive the requested COLs. In addition, Luminant provided estimates of the environmental
39 impacts resulting from the building and operation of two new nuclear units on the proposed site.

40 **10.1 Impacts of the Proposed Action**

41 In a final rule dated October 9, 2007 (72 FR 57416), the Commission limited the definition of
42 "construction" to those activities that fall within its regulatory authority in 10 CFR 51.4. Many of
43 the activities required to build a nuclear power plant are not part of the NRC action to license the
44 plant. Activities associated with building the plant that are not within the purview of the NRC
45 action are grouped under the term "preconstruction." Preconstruction activities include clearing
46 and grading, excavating, erection of support buildings and transmission lines, and other

1 associated activities. Because the “preconstruction” activities are not part of the NRC action,
 2 their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the
 3 preconstruction activities are considered in the context of cumulative impacts. In addition,
 4 certain preconstruction activities require permits from the Corps, as well as from other Federal,
 5 State, and local agencies.

6 Chapter 4 describes the relative magnitude of impacts related to preconstruction and
 7 construction activities with a summary of impacts in Table 4-15. Impacts associated with
 8 operation of the proposed facilities are discussed in Chapter 5 and are summarized in
 9 Table 5-28. Chapter 6 describes the impacts associated with the fuel cycle, transportation, and
 10 decommissioning. Chapter 7 describes the impacts associated with preconstruction and
 11 construction activities and operation of Units 3 and 4 when considered along with the cumulative
 12 impacts of other past, present, and reasonably foreseeable future projects in the geographic
 13 region around the CPNPP site. Chapter 9 of this EIS includes the review team’s review of
 14 alternative sites and alternative power generation systems.

15 **10.2 Unavoidable Adverse Environmental Impacts**

16 Section 102(2)(C)(ii) of NEPA requires that an EIS include information on any adverse
 17 environmental effects that cannot be avoided should the proposal be implemented. Unavoidable
 18 adverse environmental impacts are those potential impacts of the NRC action and the Corps’
 19 action that cannot be avoided and for which no practical means of mitigation are available.

20 **10.2.1 Unavoidable Adverse Impacts during Construction and Preconstruction**

21 Chapter 4 discusses in detail the potential impacts from construction and preconstruction of the
 22 proposed Units 3 and 4 at the CPNPP site and presents mitigation and controls intended to
 23 lessen the adverse impacts. Table 10-1 presents the adverse impacts associated with
 24 construction and preconstruction activities to each of the resource areas evaluated in this EIS,
 25 and the mitigation measures that would reduce the impacts. Those impacts remaining after
 26 mitigation is applied are identified in Table 10-1 as the unavoidable adverse impacts.

27 The impact determinations in Table 10-1 are for the combined impacts of construction and
 28 preconstruction; however, the impact determinations for NRC-authorized construction are the
 29 same for all resources, except for land use and terrestrial ecology. For impact determinations
 30 that differ for the combined construction and preconstruction activities and the NRC-authorized
 31 activities, the impacts from the NRC-authorized activities are also identified in Table 10-1.

32 The unavoidable adverse environmental impacts are identified in Table 10-1 and are primarily
 33 attributable to preconstruction activities involving the initial land disturbance from clearing the
 34 land, filling areas of wetlands (probably less than 1 ac) and intermittent streams (about 0.3 mi),
 35 and building new transmission lines and pipeline corridors. All construction and preconstruction
 36 activities for CPNPP Units 3 and 4, including ground-disturbing activities, would occur within the
 37 existing CPNPP site boundary and along the existing and new transmission line and pipeline
 38 rights-of-way (ROWs). According to Luminant, the area that would be affected as a result of
 39 constructing and operating permanent facilities is approximately 675 ac, including areas
 40 disturbed on a short-term basis as a result of temporary activities and facilities and laydown
 41 areas. The construction of new make-up water and blowdown discharge pipelines between
 42 Lake Granbury and the CPNPP site, including a new intake structure and a new discharge
 43 structure at Lake Granbury, would also result in land disturbance as well as permanent loss of
 44 aquatic habitat within the footprints of the submersed structures. Additional areas would be
 45 disturbed on a short-term basis as a result of temporary activities related to the building of
 46 facilities.

Conclusions and Recommendations

1 The water-use impacts during construction and preconstruction activities would be associated
2 with dewatering of the site, which would depress the groundwater table in the general vicinity,
3 and with use of surface water from the SCWD for process water (including the water used in the
4 concrete batch plant) and fire protection and for potable water and sanitary needs during
5 construction. Impacts to water quality during construction and preconstruction would be
6 primarily limited to those associated with surface water runoff from the site; however, such
7 impacts would be mitigated by implementation of BMPs and through the SWPPP.

8 The impacts to terrestrial ecology would be associated with the disturbance of a total of 570 ac
9 of terrestrial habitat including temporary and permanent losses of Ashe juniper (*Juniperus*
10 *ashei*), mixed hardwood, and grassland habitat. A significant portion of this area (445 ac) would
11 remain disturbed on a long-term basis. The building of new transmission line and pipeline
12 corridors would result in the disturbance of additional terrestrial habitat.

13 The impacts to aquatic ecology would be associated with loss of about 0.12 ac of habitat in
14 Lake Granbury for the building of the intake and discharge structures. Additionally, 0.3 mi of
15 intermittent stream and less than 1 ac of wetlands adjacent to SCR would be lost during
16 construction of the facilities associated with the proposed new units. Finally, about 5.5 ac of
17 stream would be affected by culvert installation in the ROWs. Implementation of BMPs is expected
18 to prevent other impacts from runoff during building activities.

19 The socioeconomic impacts of construction include an increase in local traffic from construction
20 workers, and possible demand pressure on the local housing market if workers concentrate in
21 Hood or Somervell counties. No unusual resource dependencies on minority and low-income
22 populations in the region were identified. In addition, no environmental pathways related to
23 preconstruction or construction activities were found that would lead to adverse and
24 disproportionate impacts on minority and low-income populations.

25 The review team did not identify any cultural resources that would be affected by building the
26 proposed units. Luminant has agreed to follow procedures to minimize impacts if historic or
27 cultural resources are discovered during ground-disturbing activities associated with building the
28 proposed Units 3 and 4.

Table 10-1. Unavoidable Adverse Environmental Impacts during Construction and Preconstruction

Resource Area	Adverse Impacts	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Land Use	MODERATE (NRC-authorized construction impact is SMALL)	Comply with requirements of applicable Federal, State, Tribal, and local permits. The impact level could be reduced by designating Dinosaur Valley State Park and all areas visible from the park as well as Fossil Rim Wildlife Center property as exclusion areas in the routing study that would be conducted for the proposed transmission line to Whitney Switch.	Approximately 675 ac would be committed to the project throughout preconstruction and construction, of which 125 ac would be available for use after construction is complete. Offsite transmission and pipelines would commit approximately 1217 ac. Installation of proposed transmission lines and erection of steel lattice support towers could adversely affect land uses.
Water Use	SMALL	Obtain a Clean Water Act (CWA) Section 401 certification prior to site-preparation activities.	Dewatering systems would depress the water table in the general vicinity, but the impacts would be localized and temporary.
Water Quality	SMALL	Implement best management practices (BMPs) and a site-specific Stormwater Pollution Prevention Plan (SWPPP). Comply with Federal and State permits and implementation of BMPs.	Onsite and offsite water bodies would receive stormwater runoff during building phase. Inadvertent spills that seep into aquifers.
Ecological (Terrestrial)	SMALL to MODERATE (NRC-authorized construction impact is SMALL)	Implement BMPs. Attempt to route Whitney transmission line away from Dinosaur Valley State Park to avoid habitat of federally listed black-capped vireo and golden-cheeked warbler. Revegetate temporarily disturbed areas.	A total of 570 ac of terrestrial habitat would be disturbed, of which approximately 125 ac would be revegetated (445 ac of terrestrial habitat disturbed on a long-term basis). New transmission and pipeline rights-of-way (ROWs) would modify an additional 1217 ac of terrestrial habitat.
Ecological (Aquatic and Wetlands)	SMALL	Implement BMPs such as vegetation buffers, sediment fencing, retention basis, and turbidity curtains to prevent sediment impacts from runoff and disturbance of lake sediments during construction.	Loss of less than about 1 ac of wetlands and 0.3 mi of intermittent stream onsite. Total of about 5.5 ac of streams affected by culvert installation in ROWs. Loss of habitat (about 0.12 ac total) in Lake Granbury where intake and discharge structures would be built.

Table 10-1. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Socioeconomic			
Economic Impacts	None	None	None
Community Services and Infrastructure	SMALL to MODERATE	Provide funds to local communities to expand services; stagger shifts and require carpooling to reduce impacts of traffic on local roads; coordinate with TxDOT to implement additional measures to reduce impacts of traffic on local roads.	Impacts of population growth on community services (water and wastewater, solid waste, police, fire, and medical services, social services, and education). Impacts of additional traffic on level of service and safety on local roads.
Environmental Justice	SMALL	None	None
Historic and Cultural	SMALL	Inadvertent discovery procedures are in place to minimize impacts to potential onsite historic and cultural resources.	None
Air Quality	SMALL	Comply with Federal, State, and local regulations governing construction activities and construction vehicle emissions. Implement actions to reduce fugitive dust.	Equipment emissions and fugitive dust from operation of earth-moving equipment are sources of air pollution, but impacts would be temporary.
Nonradiological Health	SMALL	Adhere to permits and authorizations issued by State and local agencies.	Temporary public health impacts from exposure to fugitive dust and vehicular emissions, noise, and increased occupational injuries and traffic fatalities during the building phase.
Radiological Health	SMALL	Doses to construction workers would be maintained below NRC public dose limits.	Small radiological dose to construction workers from the two operating units would be less than NRC public dose limits.
Nonradiological Wastes	SMALL	Develop sediment and erosion control plans; stabilize disturbed land to prevent erosion; adhere to local, State and Federal permits and regulations regarding the classification and disposition of wastes.	Erosion from construction activities and disposal of construction debris and wastes may impact water quality. Consumption of landfill space for the disposition of such wastes would occur.

1 Atmospheric and meteorological impacts include fugitive dust from land disturbing and building
 2 activities that can be mitigated by the dust-control plan. Nonradiological health impacts to
 3 members of the public from construction, including public and occupational health, noise and
 4 transportation of materials, equipment and personnel, would be minimized through Luminant's
 5 controls and measures associated with compliance to Federal, State, and local regulations,
 6 permits and authorizations.

7 Radiological health impacts to members of the public from building of the proposed unit would
 8 be below annual exposure limits set to protect the general public. Radiological doses to
 9 construction workers at Units 3 and 4 from the adjacent operating units are expected to be well
 10 below regulatory limits.

11 Solid, liquid, and gaseous wastes would be generated when building Units 3 and 4. These
 12 wastes would be handled according to county, State, and Federal regulations. County and State
 13 permits and regulations for handling and disposal of solid waste would ensure compliance with
 14 the Clean Water Act and TCEQ air and water quality standards.

15 The NRC staff concludes that the potential unavoidable adverse impacts from NRC-authorized
 16 construction activities would be SMALL. Nearly all such unavoidable adverse impacts would be
 17 attributable to preconstruction activities.

18 **10.2.2 Unavoidable Adverse Impacts during Operation**

19 Chapter 5 provides a detailed discussion of the potential impacts from operation of the proposed
 20 Units 3 and 4 at the CPNPP site. Table 10-2 presents the adverse impacts associated with
 21 operation of the two proposed units to each of the resource areas evaluated in this EIS and the
 22 mitigation measures that would reduce the impacts. Those impacts remaining after mitigation is
 23 applied are identified in the table as the unavoidable adverse impacts.

24 The unavoidable adverse impacts from operations for land use would be minimal and are
 25 associated with land being unavailable for other uses until after decommissioning of the two
 26 existing and two proposed CPNPP units.

27 Water-related impacts during operation would be mitigated through Luminant's adherence to
 28 BMPs, the SWPPP, and State permits for water withdrawal and discharge. Unavoidable
 29 adverse impacts to hydrological water-use during operation as a result increase water use by
 30 the proposed new units would be noticeable but would not destabilize important attributes.
 31 Water-quality impacts during operation would be minimal (except possibly during low flow or
 32 drought conditions) and would be limited to potential increases in naturally occurring total
 33 dissolved solids (TDS) and chlorides above ambient concentrations in surface water bodies,
 34 and potential surface and groundwater contamination from inadvertent spills.

35 Unavoidable adverse impacts to terrestrial ecology resources would include increased risks of
 36 bird and bat collisions with structures or overhead transmission lines, wildlife avoidance due to
 37 noise, continued maintenance, disturbance of habitats within transmission corridors, and
 38 potential impacts of salt deposition on vegetation near the proposed BDTF. Assuming that
 39 BMPs are followed, terrestrial ecology impacts during operation would be minor. Changes to
 40 the shoreline vegetation on Lake Granbury and Possum Kingdom as a result of the operation of
 41 the proposed new units would be noticeable. Aquatic impacts would be minimal to substantial
 42 during operation. While the design of the intake structure on Lake Granbury would have
 43 minimal effects to aquatic organisms from impingement, entrainment, and entrapment, impacts
 44 on aquatic and wetlands biota and habitat could be substantial as a result of hydrological
 45 alterations to the Brazos River system, specifically including Lake Granbury and Possum
 46 Kingdom Lake.

Conclusions and Recommendations

1 Adverse impacts to socioeconomic resources likely would be similar in character to those during
2 the building phase but much smaller due to the smaller project-related population and the fact
3 that much of the mitigation of housing and infrastructure shortages would have occurred in
4 response to the larger impacts during the building period. Socioeconomic impacts would
5 primarily include increased traffic, some damage to roads, an increase in the demand for
6 housing and public services, along with increased employment opportunities and an increase in
7 tax revenue to support the increase in service demand. Additionally, operating CPNPP Units 3
8 and 4 could reduce Possum Kingdom's water level and would have a noticeable impact on
9 recreational use of the lake.

10 Unavoidable adverse environmental justice impacts would be minimal based on the distribution
11 and composition of the region's minority and low-income populations and because the review
12 team found no evidence of unique characteristics or practices among current minority or low-
13 income populations that would make them differentially affected by operations activities. No
14 unusual resource dependencies of minority or low-income populations in the region were
15 identified.

16 No adverse impacts to historic or cultural resources during plant operations would be expected
17 due to the procedures to be followed if historic or cultural resources are discovered during
18 operation activities associated with the proposed Units 3 and 4.

19 It is expected that air-quality impacts would be negligible and that pollutants emitted during
20 operations would be insignificant. Nonradiological and radiological health impacts would be
21 minimal. Nonradiological health impacts to members of the public from operation, including
22 etiological agents, noise, electromagnetic fields, occupational health and transportation of
23 materials and personnel would be minimal through controls and measures by Luminant
24 associated with compliance with Federal and State regulations.

25 Radiological doses to members of the public from operation of proposed Units 3 and 4 would be
26 below NRC and EPA standards. Doses to workers from operation of proposed Units 3 and 4
27 would also be below NRC limits and would be maintained ALARA. The radiation protection
28 measures designed to maintain doses to members of the public below NRC and EPA standards
29 would also ensure that doses to biota other than humans would be well below the guidelines of
30 the National Council on Radiation Protection and Measurements (NCRP) and the International
31 Atomic Energy Agency (IAEA).

Table 10-2. Unavoidable Adverse Environmental Impacts from Operations

Resource Area	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Land use	SMALL to MODERATE	Reduce or compensate for the effects of salt drift by using a salt fence and unidirectional arrangement of misters to reduce salt drift, providing salt-tolerant vegetation to affected land owners, providing compensation for corrosion of metal property, or (as a last resort) purchase of affected residential properties.	Operation of the blowdown treatment facility (BDTF) could adversely affect nearby residential property due to salt drift. Additional land in the region would likely be required for waste disposal uses due to the quantity of salt waste generated by the proposed project. Land would not be available for other uses until after decommissioning of the entire CPNPP site, including the proposed two new units.
Water Use	MODERATE	None	Increased surface water use from Lake Granbury because of the addition of Units 3 and 4.
Water Quality	SMALL to MODERATE	Implement BMPs and Stormwater Management Plan and maintain compliance with State permit limits and requirements.	Increased naturally occurring total dissolved solids (TDS) and chlorides above ambient concentrations and potential to contaminate surface and groundwater through inadvertent spills.
Ecological (Terrestrial)	MODERATE	Use salt fence and unidirectional arrangement of misters to reduce salt drift on adjoining terrestrial habitat. Consider relocating existing transmission line away from evaporation ponds. Implement BMPs to limit potential impacts from vegetation control, road maintenance, and other corridor activities.	Impacts to vegetation due to the BDTF due to salt deposition could occur. Transmission line maintenance would prevent forest succession. New project features, especially the evaporation pond under an existing transmission line, would represent an incremental increase in the risk of bird collisions. Impacts due to cooling system operation to shoreline vegetation on Lake Granbury and Possum Kingdom Reservoir would be noticeable

1

Table 10-2. (contd)

Resource Area	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Ecological (Aquatic and Wetlands)	SMALL to MODERATE	Manage water releases from PKL and Lake Granbury to maintain higher base flows and to periodically provide episodic high flows that would better simulate the natural in-stream flow regime of the river.	Changes in biota abundance, species diversity, and habitat availability the aquatic community of the Brazos River system (including Possum Kingdom Lake and Lake Granbury) as a result of hydrological changes due to increased water withdrawals and losses and associated alterations in water management in the Brazos River Basin.
Socioeconomic			
Physical Impacts	SMALL	Implement BMPs and comply with Federal, State, and local regulations.	None
Demography	SMALL	None	None
Economic Impacts	None	None	None
Community Services and Infrastructure	SMALL to MODERATE	None	Operating CPNPP Units 3 and 4 could reduce Possum Kingdom's water level by as much as 14.8 ft during drought conditions and would have a noticeable impact on recreational use of the lake, especially on the ability to use boat ramps and boat docks.
Environmental Justice	SMALL	None	None
Historic and Cultural Resources	SMALL	Formal inadvertent discovery procedures are in place to minimize impacts to potential onsite historic and cultural resources	None
Air Quality	SMALL	Comply with Federal, State, and local air quality permits and regulations	Plumes and drift deposition from cooling towers
		Implement existing CPNPP industrial safety program	Occupational injuries and illnesses

Table 10-2. (contd)

Resource Area	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Impacts
Nonradiological Health	SMALL to MODERATE	<p>Adhere to permits and authorizations issued by State and local agencies</p> <p>Finding low-noise-producing pump motors, mounting the motors on sound-dampening material, relocating the motors away from the water, or enclosing the pump motors in a sound-absorbing structure.</p> <p>Conform with Federal codes</p> <p>Stagger arrival and departure times, as well as outage schedules, to minimize impacts to transportation routes</p>	<p>Discharge thermal plume could encourage growth of etiological agents in Lake Granbury</p> <p>Noise from onsite systems (including cooling towers) would be about 55 dBA at exclusion area boundary</p> <p>Electrical shock from energized equipment and transmission lines</p> <p>Accidents associated with transportation of operation and outage workers</p>
Radiological Health	SMALL	<p>Doses to members of the public would be maintained below NRC and EPA standards; workers' doses would be maintained below NRC limits and As Low As Reasonably Achievable (ALARA); mitigative actions instituted for members of the public would also ensure that doses to biota other than humans would be well below National Council on Radiation and Measurements (NCRP) and International Atomic Energy Agency (IAEA) guidelines</p>	<p>Small radiation doses to members of the public below NRC and EPA standards; ALARA doses to workers; and biota doses less than NCRP and IAEA guidelines</p>
Nonradiological Wastes	SMALL	<p>Maintain compliance with NPDES permit requirements; adhere to local, State and Federal permits and regulations regarding the classification and disposition of wastes.</p>	<p>Consumption of landfill space for disposition of wastes (especially the anticipated large quantities of salt residue from the BTDF) would occur, as would the consumption of fuels for the transportation and disposition of these wastes.</p>

10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

Section 102(2)(C)(iv) of NEPA requires that an EIS include information on the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

The local use of the human environment by the proposed project can be summarized in terms of the unavoidable adverse environmental impacts of construction and operation and the irreversible and irretrievable commitments of resources. With the exception of the consumption of depletable resources as a result of plant construction and operation, these uses may be classed as short-term. The principal short-term benefit of the plant is represented by the production of electrical energy. The economic productivity of the site, when used for this purpose, would be extremely large compared to the productivity from agriculture or from other probable uses for the site.

The maximum long-term impact to productivity would result if the plant is not immediately dismantled at the end of the period of plant operation, and consequently the land occupied by the plant structures would not be available for any other use. However, the enhancement of regional productivity resulting from the electrical energy produced by the plant is expected to result in a correspondingly large increase in regional long-term productivity that would not be equaled by any other long-term use of the site. In addition, most long-term impacts resulting from land-use preemption by plant structures can be eliminated by removing these structures or by converting them to other productive uses. Once the plants cease operation and are shut down, they would be decommissioned according to NRC regulations. Once decommissioning is complete and the NRC license is terminated, the site would be available for other uses.

The NRC staff concludes that the negative aspects of plant construction and operation as they affect the human environment would be outweighed by the positive long-term enhancement of regional productivity through the generation of electrical energy.

10.4 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA requires that an EIS include information on any irreversible and irretrievable commitments of resources that would occur if the proposed action is implemented. The term "irreversible commitments of resources" refers to environmental resources that would be irreparably changed by the building or operation activities authorized by the Corps permit or NRC licensing decisions where the environmental resources could not be restored at some later time to the resource's state before building or operation. "Irretrievable commitments of resources" refers to materials that would be used for or consumed by the proposed new units in such a way that they could not, by practical means, be recycled or restored for other uses. The environmental resources summarized in this section are discussed in Chapters 4, 5, and 6. Irretrievable commitments of resources during building of the proposed new units generally would be similar to that of any major construction project.

10.4.1 Irreversible Commitments of Resources

Irreversible commitments of environmental resources resulting from construction, preconstruction, and operation of Units 3 and 4, in addition to the materials used for the nuclear fuel, include those discussed in the following subsections.

1 10.4.1.1 Land Use

2 The review team considers that the proposed preconstruction activities would result in the loss,
3 through infilling, of approximately 1 ac of wetland habitat and about 0.3 mi of intermittent
4 streams. This loss would be irreversible. Land committed to the disposal of radioactive and
5 nonradioactive wastes is committed to that use and cannot be used for other purposes. The
6 land used for Units 3 and 4, with the exception of any filled wetlands, is not irreversibly
7 committed because once Units 3 and 4 cease operations and the plant is decommissioned in
8 accordance with NRC requirements, the land supporting the facilities could be returned to other
9 industrial or nonindustrial uses.

10 10.4.1.2 Water Use

11 Approximately 62,700 ac-ft/yr of water from Lake Granbury would be lost through consumptive
12 use (i.e., evaporative cooling) during operation of CPNPP Units 3 and 4. The use of these
13 water resources could likely be restored after decommissioning of the proposed reactors. Thus,
14 no irreversible loss of hydrologic resources would be expected.

15 10.4.1.3 Ecology

16 Construction, preconstruction, and operation activities would cause temporary and long-term
17 changes to both the aquatic and terrestrial biota at the plant site and facilities. These activities
18 would change the abundance and distribution of local terrestrial flora and fauna on the CPNPP
19 site. However, despite localized permanent loss of habitat associated with the construction
20 footprint for Units 3 and 4, because enough suitable habitat exists elsewhere in the area, such
21 changes would not result in adverse impacts on the regional populations. The majority of
22 terrestrial and aquatic habitat losses are due to preconstruction activities. No irretrievable loss
23 of terrestrial, aquatic or wetland habitats would be expected on the site or in conjunction with the
24 construction of new transmission line and pipeline ROWs as a result of operations and any
25 impacts as a result of operations would cease when the plant ceases operations. Terrestrial,
26 aquatic and wetland habitats likely could be restored after decommissioning of the proposed
27 reactors. .

28 10.4.1.4 Socioeconomic Resources

29 The review team expects that no irreversible socioeconomic commitments would be made to
30 socioeconomic resources since they would be reallocated for other purposes once the plant is
31 decommissioned.

32 10.4.1.5 Historic and Cultural Resources

33 The review team does not expect irreversible commitments to historic and cultural resources to
34 occur during construction, preconstruction, and operations of the proposed CPNPP Units 3 and
35 4. Inadvertent discovery procedures are in place to minimize potential impacts.

36 10.4.1.6 Air and Water

37 Dust and other emissions such as vehicle exhaust would be released to the air during
38 construction and preconstruction. During operations, vehicle exhaust emissions would continue
39 and other air pollutants and chemicals, including very low concentrations of radioactive gases
40 and particulates, would be released from the facility to the air and surface water. Because these
41 releases would conform to applicable Federal and State regulations, their impact to the public
42 health and the environment would be limited. The review team expects no irreversible

1 commitment to air or water resources because all Unit 3 and 4 releases would be made in
2 accordance with duly issued permits.

3 **10.4.2 Irretrievable Commitments of Resources**

4 Irretrievable commitments of resources during the building of the proposed new units generally
5 would be similar to that of any major construction project. A study by the U.S. Department of
6 Energy (DOE 2004) on new reactor construction estimated that approximately 12,239 yd³ of
7 concrete, 3107 tons of steel reinforcement (i.e., rebar), 13,000,000 ft of cable, and 275,000 ft of
8 piping would be required for the reactor building of a typical new 1300 MW(e) nuclear power
9 plant. Historical records of operating reactors suggest a total of approximately 182,900 yd³ of
10 concrete and 20,512 tons of structural steel would be required to construct the reactor building,
11 major auxiliary buildings, turbine generator building, and turbine generator pedestal
12 (DOE 2005). Therefore, about twice these amounts would be needed for the proposed CPNPP
13 Units 3 and 4, and considerably more would be required for all the other site structures.

14 The review team expects that the use of construction materials in the quantities associated with
15 those expected for Units 3 and 4 at the CPNPP site, while irretrievable, would be of small
16 consequence with respect to the availability of such resources.

17 The main resource that would be irretrievably committed during operation of the new nuclear
18 units would be uranium. The availability of uranium ore and existing stockpiles of highly
19 enriched uranium in the United States and Russia that could be processed into fuel is sufficient
20 (OECD, NEA, and IAEA 2008), so that the irreversible and irretrievable commitment would be
21 negligible.

22 **10.5 Alternatives to the Proposed Action**

23 Alternatives to the proposed actions are discussed in Chapter 9. Alternatives considered are
24 the no-action alternative, energy production alternatives, system design alternatives, and
25 alternative sites. For the purposes of the Corps' evaluation, onsite alternatives are also
26 addressed in Section 9.5.

27 The no-action alternative, as described in Section 9.1, refers to a scenario in which the NRC
28 would deny Luminant's request for the COLs or the Corps would take no action or deny the
29 Section 404 Clean Water Act permit. If such actions were to occur,, the construction and
30 operation of two new nuclear units at the CPNPP site in accordance with 10 CFR Part 52 would
31 not occur and the predicted environmental impacts associated with the project would not occur.
32 If no other power plant were built or electrical power supply strategy implemented to take its
33 place, the electrical capacity to be provided by the project would not become available, and the
34 benefits (electricity generation) associated with the proposed action would not occur and the
35 need for power would not be met.

36 Alternative energy sources are described in Section 9.2. Alternatives that would not require
37 additional generating capacity are described in Section 9.2.1. Detailed analyses of coal-fired
38 and natural-gas-fired alternatives are provided in Section 9.2.2. Other energy sources are
39 discussed in Section 9.2.3. A combination of energy alternatives is discussed in Section 9.2.4.
40 The NRC staff concluded that none of the alternative energy options were both (1) consistent
41 with Luminant's objective of building baseload generation units, and (2) environmentally
42 preferable to the proposed action.

43 Alternative sites are discussed in Section 9.3. The cumulative impacts of building and operating
44 the proposed facilities at the alternative sites are compared to the impacts at the proposed
45 CPNPP site in Section 9.3.5. Table 9-24 contains the review team's characterization of

1 cumulative impacts at the proposed and alternative sites. Based on this review, the NRC staff
 2 concludes that while there are differences in cumulative impacts at the proposed and alternative
 3 sites, none of the alternative sites would be environmentally preferable or obviously superior to
 4 the proposed CPNPP site. The NRC staff's determination is independent of the Corps'
 5 determination of a Least Environmentally Damaging Practicable Alternative pursuant to Clean
 6 Water Act Section 404(b)(1) guidelines. The Corps will conclude its analysis of both offsite and
 7 onsite alternatives in its Record of Decision.

8 In Section 9.4, the NRC staff considered alternative systems designs including three alternative
 9 heat dissipation systems and alternative intake, discharge, and water supply systems. The
 10 NRC staff identified no alternative that was environmentally preferable to the proposed plant
 11 systems design.

12 **10.6 Benefit-Cost Balance**

13 NEPA (42 U.S.C. 4321 et seq.), as amended, implemented by Executive Orders 11514
 14 (35 FR 4247) and 11991 (42 FR 26967) and the CEQ's Guidelines (40 CFR Parts 1500-1508),
 15 requires that all agencies of the Federal Government prepare detailed environmental
 16 statements on proposed major Federal actions that can significantly affect the quality of the
 17 human environment. A principal objective of NEPA is to require each Federal agency to
 18 consider, in its decision-making process, the environmental impacts of each proposed major
 19 action and the available alternative actions, including alternative sites that can achieve the
 20 purpose and need for the action. In particular, Section 102 of NEPA requires all Federal
 21 agencies to the fullest extent possible:

22 “(B) identify and develop methods and procedures, in consultation with the Council on
 23 Environmental Quality established by title II of this Act, which will insure that presently
 24 unquantified environmental amenities and values may be given appropriate
 25 consideration in decision making along with economic and technical considerations.”
 26 (42 USC 4321)

27 However, neither NEPA nor CEQ requires the totality of costs and benefits of a proposed action
 28 be quantified in terms of dollars or any other common metric.

29 The intent of this section is not to identify and quantify all of the potential societal benefits of the
 30 proposed actions and compare these to a monetized estimate of the potential costs of the
 31 proposed actions. Instead, this section focuses on monetized values for only those activities
 32 closely related to the building and operation of the proposed new units. For other benefits and
 33 costs of such magnitude or importance that their inclusion in this analysis can inform the NRC's
 34 and Corps' decision-making processes, the review team quantified assessments. This section
 35 compiles and compares the pertinent analytical conclusions reached in earlier chapters of this
 36 EIS. It gathers all of the expected impacts from building and operations of the proposed Units 3
 37 and 4 and aggregates them into two final categories: the expected environmental costs and the
 38 expected benefits to be derived from the approval of the proposed actions. The benefit-cost
 39 balancing for the NRC action will be based on a balancing of the benefits and costs of
 40 construction and operation.

41 Although the analysis in this section is conceptually similar to a purely economic benefit-cost
 42 analysis, which determines the net present dollar value of a given project, this section will
 43 identify potential societal benefits of the proposed actions and compare these to the potential
 44 internal (i.e., private) and external (i.e., societal) costs of the proposed actions. It is not possible
 45 to quantify and assign a value to all benefits and costs associated with the proposed actions.
 46 The analysis attempts to identify, quantify and provide monetary values for benefits and costs

1 when reasonable estimates are available. The purpose is to inform the COL process by
2 gathering and reviewing information that demonstrates the likelihood that the benefits of the
3 proposed actions outweigh the aggregate costs.

4 General issues related to Luminant's financial viability are outside the scope of NRC's EIS
5 process and, thus, are not considered in this EIS. Issues related to Luminant's financial
6 qualifications will be addressed in the NRC's safety evaluation report.

7 Section 10.6.1 discusses the benefits associated with the proposed actions, and Section 10.6.2
8 discusses the costs associated with CPNPP Units 3 and 4. These analyses are supported by
9 the information and data provided in Tables 10-3 and 10-4. In accordance with NUREG-1555,
10 internal costs of the proposed project are presented in monetary terms. Internal costs include
11 all of the costs included in a total capital cost assessment: the direct and indirect cost of
12 construction and preconstruction plus the annual costs of operation and maintenance. Section
13 10.6.3 summarizes the overall benefit-cost balance.

14 **10.6.1 Benefits**

15 The most apparent benefit from a power plant is that it generates power and provides
16 thousands of residential, commercial, and industrial consumers with electricity. Maintaining an
17 adequate supply of electricity in any given region has social and economic importance because
18 adequate electricity is the foundation for economic stability and growth and fundamental to
19 maintaining our current standard of living. Because the focus of this EIS is on the proposed
20 expansion of the CPNPP site's generating capacity, this section focuses primarily on the relative
21 benefits of the proposed Comanche Peak option rather than the broader, more generic benefits
22 of electricity supply. The benefits associated with construction and operation of the proposed
23 project are listed in Table 10.3.

24 **10.6.1.1 Monetary Benefits**

25 The following subsections consider the monetary benefits of constructing and operating CPNPP
26 Units 3 and 4.

Table 10-3. Monetary and nonmonetary benefits from constructing and operating CPNPP Units 3 and 4

Net Electrical Generating Benefits		
Generating Capacity [MW(e)]	3200	
Annual Electricity Capacity (MW-h), assuming .95 capacity factor	About 26,630,000	
Taxes and Revenue		
Sales Tax	Construction (cumulative over seven years)	Operating per year
A sales tax of 8.25 percent is levied on eligible sales in most of the study area. Of this, 6.25 percent is levied by the state and up to 2 percent additional is levied by other qualifying jurisdictions.	91–105 million	3,754,000
Property Taxes by Jurisdiction 2006 (\$)		
Hood County	25,785	5,595
Tolar	111	37
Granbury ISD	56,202	18,734
Tolar ISD	45,219	15,073
Hood County Library District	765	255
Hood County total	128,082	39,649
Somervell County	15,370,812	5,124,604
Glenn Rose	105	35
Somervell County Water District	5,646,612	1,882,099
Glenn Rose ISD	52,065,513	17,355,171
Somervell County total	73,083,042	24,361,909
Improvements to Local Facilities		
Road repairs and improvements and bridge repairs and improvements in the vicinity of CPNPP		
Socioeconomics		
Increased tax revenue supports incremental public services to meet need due to worker influx and supports other improvements to public infrastructure and social services. The increased revenue could spur future growth and development. Increased employment opportunities for local workers would likely occur.		
Effects on Regional Productivity		
Construction workers	About 5,000 workers employed during construction, 70% of whom live locally	
Operational workers	About 500 people employed during operation of whom about 50% live locally	
Indirect jobs ^(a)	A temporary incremental increase in indirect jobs up to 1,680 at construction peak and 530 permanent indirect jobs during operation	

Table 10-3. (contd)

Electric Reliability		
Enhances electric reliability through fuel source diversity and high projected capacity factors		
Electricity Price Volatility		
Dampens potential for system-wide price volatility owing to relatively small cost share for nuclear fuel		
Hazardous Wastes		
Compared with fossil-fueled plants, particularly coal-fired plants, nuclear plants produce significantly less nonradioactive hazardous effluents and waste products.		
Aesthetics		
With the exception of a steam and vapor plume, nuclear plants do not produce negative viewshed aesthetics that are associated with fossil-fueled plants		
Avoided Air Pollutant Emissions, English Tons per Year^(b)		
Pollutant	Luminant estimates for 3180-MW plants ^(c)	
	Gas-fired	Coal-fired
SO ₂	253	3933
NO _x	2676	2610
CO	1115	3625
CO ₂	8,200,000	35,000,000
PM _{2.5}	142	18,886
PM ₁₀	NIA	4344

(a) RIMS construction multiplier of 1.48 and operating multiplier of 2.41 used to calculate indirect jobs.

(b) Assumes use of current standard air pollution mitigation technology.

(c) Estimates based on information presented in Section 9.2.3.

Table 10-4. Internal and external costs of constructing and operating CPNPP Units 3 and 4

Cost category	Cost
Internal	
Overnight capital costs per kilowatt (\$)	3,600–4,000
Construction costs (two units based on industry studies) (\$)	11.520–12.800 billion
Operation cost per kWh, in cents (two units, based on industry studies)	3.2–7.4
Fuel costs per kWh in cents	1.3-1.7
Decommissioning cost	Approximately 0.1 to 0.2 cents per kWh.
External	
Land and land use	<p>MODERATE. Approximately 675 ac would be committed to the project throughout preconstruction and construction, of which 125 ac would be available for other use after construction is complete. Offsite transmission and pipelines would commit approximately 1217 ac. During project operations, offsite land uses, including private property, could be affected by salt drift from the proposed BDTF and the disposal of waste salts (Sections 4.1 and 5.1).</p>
Water Use and Water Quality	<p>MODERATE for water use. There are costs associated with providing water from Lake Granbury and Wheeler Branch Reservoir for various needs during construction and operation. SMALL to MODERATE for water quality. Discharges to Lake Granbury from the proposed units could decrease the water quality during periods of low flow or drought. Relatively small levels of non-hazardous and/or radioactive effluents are introduced into SCR or Lake Granbury (Sections 5.2 and 5.2).</p>
Terrestrial and aquatic ecology	<p>MODERATE for terrestrial ecology. Some wildlife mortality during preconstruction and construction is anticipated; however, these costs are expected not to affect long-term populations of terrestrial and aquatic biota. A total of 570 ac of terrestrial habitat would be disturbed, of which approximately 125 ac would be revegetated. New transmission and pipeline ROWs would modify an additional 1217 ac of terrestrial habitat. Impacts to vegetation due to the BDTF and to salt deposition could occur. Transmission line maintenance would prevent forest succession. New project features, especially the evaporation pond under an existing transmission line, would represent an increase in the risk of bird collisions (Section 4.3 and 5.3).</p> <p>SMALL to MODERATE for aquatic ecology. Water availability changes could cause increased mortality of rare species in the affected water bodies; the impact may be even more substantial (Section 4.3 and 5.3).</p>
Radioactive effluents and emissions	<p>SMALL. Radioactive waste and minor amounts of radioactive air emissions are generated. Relatively small levels of radioactive effluents are introduced into SCR. Effects of these effluents on SCR are negligible (Sections 4.9 and 5.9).</p>

Table 10-4. (contd)

Cost category	Cost (\$)
	External
Hazardous and radioactive waste	<p>SMALL. Management and disposal of small amounts of hazardous wastes pursuant the Resource Conservation Recovery Act, 42 U.S.C. 6901 et seq.</p> <p>Storage, packaging for shipment, and disposal of low-level radioactive waste and high-level radioactive spent nuclear fuel.</p> <p>Commitment of geological resources for disposal of radioactive spent fuel (Sections 4.9, 4.10, 5.9, and 5.10).</p>
Air emissions	<p>SMALL. Air emissions from gas and diesel generators, auxiliary boilers and equipment, and vehicles that have a negligible impact on workers and local residents.</p> <p>Cooling tower drift deposits some salt on the surrounding vicinity, but the level is unlikely to result in any measureable impact on plants and vegetation. Cooling tower produces atmospheric plume discharge. Impacts are negligible (Sections 4.7 and 5.7).</p>
Materials, energy, and uranium	SMALL. Irreversible and irretrievable commitments of materials and energy, including depletion of uranium.
Potential nuclear accident	SMALL. The costs of potential nuclear accidents could be large; however, the probability of such accidents is very small. Therefore, the overall probably-weighted costs of potential nuclear accidents are negligible (Section 5.11).
Socioeconomic	SMALL to MODERATE. Construction of CPNPP may pose additional costs to public and social services in the area. Construction-related costs tend to be temporary and conclude with the completion of the building phase of the project. Operations-related costs tend to be much smaller and continue for the life of the project. There may be some mismatches between jurisdictions experiencing increased revenues and increased public service demands (Sections 4.4 and 5.4).

1 Tax Payments

2 Luminant would make tax payments and ad valorem tax payments to the State of Texas, as well
 3 as several school districts and other special taxing districts within Somervell and Hood
 4 Counties. Regional taxes and the political structure within the CPNPP region are discussed in
 5 Section 2.5.2.2 of this EIS. Taxes related to construction and preconstruction of the proposed
 6 CPNPP Units 3 and 4 are discussed in Section 4.4.3 of this EIS. Section 5.4.3 of this EIS
 7 discusses regional and annual taxes related to the operation of the proposed new nuclear units.
 8 The primary Economic Impact Area (EIA) would be the six-counties in which more than 96
 9 percent of the current CPNPP workforce resides: Somervell, Hood, Bosque, Erath, Johnson,
 10 and Tarrant Counties. Table 10-3 provides further details on taxes and revenues during
 11 construction and operation of the proposed new units.

1 Building activities and purchases at CPNPP Units 3 and 4 and personal expenditures made by
 2 construction and operations workers would generate several types of taxes, including income
 3 taxes on corporate profits, wages, and salaries; sales and use taxes on corporate and employee
 4 purchases; real property ad valorem taxes related to the CPNPP facilities; and personal
 5 property taxes associated with employees.

6 The review team expects that the amount of ad valorem taxes paid would increase each year as
 7 building progresses and property improvements are completed. Local tax revenues, especially
 8 from ad valorem taxes and sales and use taxes, would increase in the EIA. These increased
 9 tax revenues would be particularly beneficial for the local jurisdictions in Somervell and Hood
 10 counties. During the operations period, local tax revenues, especially from ad valorem taxes
 11 and sales and use taxes would likely remain high in Somervell County and, to a lesser extent,
 12 Hood County.

13 ***Local and State Economy***

14 The in-migration of construction workers will create indirect jobs in the area and increase the
 15 amount of income used to purchase goods and services. Section 4.4.3 discusses the economic
 16 benefits in the EIA related to construction of the proposed project. Based on Bureau of
 17 Economic Analysis multipliers, every construction job at CPNPP could provide an additional
 18 0.48 indirect jobs to the economies of Somervell and Hood Counties. During peak construction,
 19 the proposed project is expected to employ about 5,000 workers. Operations workers
 20 contribute to the local economy during the overall lifetime of the facilities once construction is
 21 complete. Subsection 5.4.3 discusses the economic benefits in the EIA related to operating the
 22 proposed project starting in 2017. Every operations job is expected to provide an additional
 23 1.41 indirect jobs to the 50-mi region. Operations are expected to require approximately 248
 24 full-time workers per unit and would generate about 250 direct jobs and 602 indirect jobs.

25 **10.6.1.2 Non-Monetary Benefits**

26 The following subsections consider the non-monetary benefits including technical benefits from
 27 construction and operation of CPNPP.

28 **Net Electrical Generating Benefits.** Chapter 8 describes the need for power. As discussed in
 29 Chapter 8, over time there is a growing baseload demand and there are decreasing electric
 30 power reserve margins within the Electric Reliability Council of Texas (ERCOT) region. Each
 31 turbine generator at CPNPP has a rated and design net output of approximately 1,600 MW(e)
 32 for each unit with a thermal output of 4,451 MW(t) (Section 3.2). Assuming an average capacity
 33 factor of 95 percent, the plant average annual electrical-energy generation over a 3-year
 34 average is approximately 26,630,000 MW-h (3,200 x 8,760 x .95).

35 **Fuel Diversity, Dampened Price Volatility, and Enhanced Reliability.** Energy diversity is
 36 fundamental to the objective of achieving a reliable and affordable electric power supply system
 37 and should reduce the risk of future fuel disruptions, price fluctuations, and adverse
 38 consequences that result from changes in regulatory practices (EEI 2006). Maintaining fuel
 39 diversity means maintaining a balance of fuel mixes. High natural gas prices and intense,
 40 recurring periods of price volatility experienced in recent years have been driven, at least in part,
 41 by demand for natural gas used in the electric generation sector. At present the U.S. imports
 42 large quantities of crude oil and petroleum products from a world oil market characterized by
 43 regional instability. In contrast, the U.S. has sizable domestic uranium reserves (ENS 2010).
 44 The proposed project would reduce reliance on the world oil market. Nuclear plants provide
 45 forward price stability that is not available from generating plants fueled with natural gas.
 46 Although nuclear plants are capital-intensive to build, the operation costs are stable and

1 dampen the price volatility from volatile fuel prices elsewhere in the electricity market (NEI
2 2005). For example nuclear power plants are generally not subject to fuel price volatility like
3 natural gas and oil power plants. In addition, uranium fuel constitutes only 3 percent to 5
4 percent of the cost of a kilowatt-hour of nuclear-generated electricity. Doubling the price of
5 uranium increases the cost of electricity by about 9 percent; while doubling the price of gas
6 would add about 66 percent to the price of electricity, and doubling the cost of coal would add
7 about 31 percent to the price of electricity (WNA 2010).

8 **Air Pollution and Emissions Avoidance.** Coal-fired plants generate most of the power
9 industry's emissions (USHR 2006). In contrast, beyond steam and water vapor, modern nuclear
10 reactors produce minimal air emissions, and thus avoid local and regional air quality impacts.
11 For example, smog is a form of air pollution produced by the photochemical reaction of sunlight
12 with volatile organic compounds (VOCs) and nitrogen oxides that have been released into the
13 atmosphere (AHD 2000). Major sources of nitrogen oxides and VOCs that produce ozone
14 include emissions from industrial facilities, electrical utilities, motor vehicle exhaust, gasoline
15 vapors, and chemical solvents (EPA 2007). Substituting nuclear power for fossil fuel-generated
16 power would therefore reduce these forms of pollution.

17 Section 9.2 analyzes coal- and gas-fired alternatives to the proposed project. The beneficial
18 impacts of avoided air pollutant emissions from building CPNPP Units 3 and 4 instead of
19 equivalent fossil fuel plants are summarized in Table 10-4. Some of the benefits of reduced
20 emissions from nuclear power generation are offset by emissions related to the uranium fuel
21 cycle, see Section 5.7 (e.g., emissions from mining and processing the fuel). However, similar
22 types of emissions are associated with mining and production of coal and, to some extent,
23 drilling for natural gas. Therefore, a nuclear generating facility the size of CPNPP Units 3 and 4
24 provides substantial emissions avoidance over coal- or gas-powered generation alternatives.

25 **Waste Products.** Nuclear plants typically do not produce the volumes of nonradioactive
26 hazardous effluents and waste products that are associated with fossil fuel plants, particularly
27 coal fired plants. Coal fired plants produce a large volume of ash waste, which must be either
28 stored or disposed of, and which can pose threats to local environments if containment is
29 breached.

30 **10.6.2 Costs**

31 This subsection describes the internal and external costs associated with construction and
32 operation of CPNPP. "Internal" generally refers to the monetary costs associated with a project;
33 "external" refers to the non-monetary environmental costs of constructing and operating the
34 CPNPP Units 3 and 4. These costs are outlined in Table 10.4 and are described in more detail
35 in the following subsections.

36 **10.6.2.1 Internal Costs**

37 This subsection describes the monetary costs of constructing and operating CPNPP. Internal
38 costs include capital costs of the plant and transmission lines; operating costs (staffing,
39 maintenance, fuel); and decommissioning costs.

40 **Construction.** This subsection describes projected internal monetary costs related to
41 construction of CPNPP Units 3 and 4 based on published literature. Many cost studies with a
42 wide range of cost estimates are available. The following seven studies are among the most
43 authoritative sources because of the depth of their analyses; other studies tend to draw on
44 these as sources.

- 1 • Organization for Economic Co-operation and Development (OECD) study of projected
2 electricity generating costs (OECD 2005).
- 3 • Massachusetts Institute of Technology (MIT) study on the future of nuclear power (MIT
4 2003) and its update (MIT 2009).
- 5 • University of Chicago (UC) study on the economic future of nuclear power (UC 2004).
- 6 • Energy Information Administration (EIA) annual energy outlook (EIA 2006).
- 7 • Southern Nuclear Operating Company (Southern 2008).
- 8 • Tennessee Valley Authority study of projected Bellefonte costs (TVA 2008).
- 9 • The Keystone Center Study (KC 2007)

10 Capital costs are incurred during construction when actual outlays for equipment, construction,
11 and engineering are expended. Capital costs represent about 60 percent of total nuclear energy
12 generation costs (OECD 2005). Capital costs are reported as overnight costs, which do not
13 include interest or inflation factors, but do include engineering, procurement and construction
14 costs, owner's costs, and contingencies. Owner's costs typically include the costs of site work
15 and preparation, cooling water intake structures, and cooling towers; import duties on
16 components; insurance; spare parts costs; development costs; project management costs;
17 owners' engineering, state and local permitting, legal fees; and operations staffing and training.

18 In the first four studies (excepting the MIT update), estimates of overnight capital costs for
19 constructing a nuclear reactor range from \$1100 to \$2500 per kW, with \$1500 to \$2000 per kW
20 (in 2002 dollars) being the most representative range. Many factors account for the range in
21 values: the specific technology and assumptions about the number of like units built, allocations
22 of first-of-a-kind costs, site location and parity adjustments to allow comparison between
23 countries, and allowances for contingencies are common examples. These cost estimates are
24 based on nuclear plant construction outside the U.S. Construction costs overseas have
25 generally been less than the most recent domestic construction, suggesting that the industry
26 has learned how to reduce costs. An assumption in these studies is that the overseas
27 experience can be applied domestically (UC 2004).

28 The Keystone study estimated that actual construction costs would fall in the range of \$3600 to
29 \$4000 per kW (in 2007 dollars, including financing costs, for a 5- to 6-year construction period)
30 (KC 2007). Considering the cost range from this study and a combined installed capacity of
31 3250 MW (e), the total "capital cost" for the CPNPP Units 3 and 4 could range from \$11.3 to
32 \$12.5 billion.

33 For the remaining three studies:

- 34 • Tennessee Valley Authority estimated its per kW cost of construction for two new proposed
35 AP1000 units at its Bellefonte site in Alabama between \$2850 and \$3200 per kW
36 (TVA 2008), which, if applied to proposed Units 3 and 4 at CPNPP [installed capacity of
37 3200 MW(e)], would yield an overnight capital cost of \$9.1 to \$10.2 billion.
- 38 • Southern Nuclear Operating Company estimated the overnight cost of construction for two
39 AP1000 units at its Vogtle site in Georgia between \$3,200 and \$3,500 kW (Southern 2008),
40 which, if applied to proposed Units 3 and 4 at CPNPP, would yield an overnight capital cost
41 of \$10.2 billion to \$11.2 billion.
- 42 • The MIT Update (MIT 2009) estimated the overnight construction cost at \$4,000 per kW in
43 2007 dollars (about \$4100 per kW in 2008 dollars) or about \$12.8 billion for 3200 MW(e) in
44 2008 dollars.

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All of these estimates include the cost of both preconstruction and construction activities. Thus, they overestimate the costs of the proposed NRC action and provide a conservative estimate of the costs for the benefit-cost analysis.

Actual project cost for CPNPP Units 3 and 4 would depend on such things as

- actual duration of construction,
- actual interest rates during construction,
- transmission upgrades or improvements that may be required to support the project, which are not included in these calculations, and
- Allowed cost recovery during construction.

Relative construction costs for the proposed site and alternative plant and transmission systems are discussed in Section 9.4. For example, the cost of constructing a system that uses a mechanical draft cooling tower (MDCT) is \$232 million less than a natural draft cooling tower, \$86 million less than an MDCT open cycle, and \$338 million less than an air-to-air system (in 2007 dollars, Table 9.4-3).

Based on this review the NRC review team has determined the \$11.3 to \$12.5 billion cost for constructing the proposed units at CPNPP, the value contained in Luminant's application (Luminant 2009a) was reasonable and applied that estimate in this EIS.

Operation. Operational expenses are incurred throughout the life of the plant and include costs for operations and maintenance (O&M), fueling, and decommissioning (MIT 2003). These costs are frequently expressed as levelized cost of electricity, which is the lowest price per kilowatt-hour of producing electricity that covers operating costs, annualized capital costs, and a reasonable profit. According to the OECD study (OECD 2005), O&M costs reported in the United States include operation, site monitoring, maintenance, engineering support staff, administrative staff, waste management and disposal, general expenses, insurance, support to regulatory bodies, and safeguards. The same study reports that fuel cycle costs include the costs involved with fuel preparation (mining, processing, enrichment, and fabrication), and those involved with handling spent fuel (transportation, encapsulation, and disposal). The UC study (UC 2004) lists fixed O&M costs at \$60 per kW and variable O&M costs at \$2.10 per MWh (in 2003 dollars). Fuel costs are listed at \$4.35 per MWh. The OECD study (OECD 2005) reports O&M costs at \$8.50 per MWh (in 2003 dollars) and fuel costs at \$4.70, with a discount rate of 10 percent. The MIT study (MIT 2003) reported O&M and fuel costs combined at \$13 per MWh, in 2002 dollars. Escalating these values to 2007 dollars results in estimates of O&M costs of \$9.90 per MWh and fuel costs of \$6.21 per MWh. The Keystone Study (KC 2007) provides O&M and fuel costs in 2007 dollars. According to this study, fixed O&M costs may be expected to range from \$19 to \$27 per MWh, with variable O&M costs at \$5 per MW (~ \$24 to \$32 per MWh total). The Keystone study also reports nuclear fuel costs (in 2007 dollars) ranging from \$13 to \$17. Combining the earlier studies with the recent Keystone study yields a range of estimated O&M cost and fuel costs of \$16 to \$37 per reactor, in 2007 dollars. The updated MIT Study produced a value of \$8.4 MWh. The NRC Staff has determined that the range of costs contained in Luminant's application of \$32 to \$74 per MWh is reasonable and has used these values in this EIS. (Luminant 2009a). This converts to 3.2–7.4 cents per kWh.

Decommissioning. The NRC has requirements for licensees at 10 CFR 50.75 to provide reasonable assurance that funds will be available for the decommissioning process. Because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the localized cost of electricity generated

1 by a nuclear power plant. Decommissioning costs are about 9 to 15 percent of the initial capital
 2 cost of a nuclear power plant. However, when discounted, they contribute only a few percent to
 3 the investment and even less to the generation cost. In the United States, they account for 0.1
 4 to 0.2 cents per kWh, which is no more than 5 percent of the cost of the electricity produced
 5 (WNA 2010).

6 **10.6.2.2 External Costs**

7 The impacts of building and operating proposed CPNPP Units 3 and 4 have been identified and
 8 analyzed in Chapters 4 and 5, and a significance level of potential adverse impacts (i.e.,
 9 SMALL, MODERATE, or LARGE) has been assigned. Such impacts cannot be universally
 10 monetized. Chapter 6 similarly addresses the environmental impacts from (1) the uranium fuel
 11 cycle and solid waste management, (2) the transportation of radioactive material, and (3) the
 12 decommissioning of nuclear units at the CPNPP site. A summary of project internal and
 13 external costs is shown in table 10-4. Because Table 10-4 includes cost from preconstruction
 14 activities, it overestimates the costs for the proposed NRC action.

15 Unlike generation of electricity from coal and natural gas, normal operation of a nuclear power
 16 plant does not result in significant emissions of criteria air pollutants (e.g., oxides of nitrogen or
 17 sulfur dioxide), methyl mercury, or greenhouse gases associated with global warming and
 18 climate change. Combustion-based power plants are responsible for at least 70 percent of the
 19 sulfur dioxide, at least 21 percent of nitrogen oxides, and 51 percent of the mercury emissions
 20 from industrial sources in the United States (EPA 2009) and 40 percent of the carbon dioxide
 21 (DOE/EIA 2008). Eighty-two percent of the electric power industry's emissions are from coal
 22 fired plants (DOE/EIA 2008). Chapter 9 of this EIS analyzes coal- and natural gas-fired
 23 alternatives to building and operating the proposed Units 3 and 4. Air emissions from these
 24 alternatives and nuclear power are summarized in Chapters 4, 5, and 9.

25 As mentioned previously, Table 10-4 summarizes the external costs (i.e., environmental
 26 impacts) associated with the preconstruction, construction, and operation of Units 3 and 4.
 27 Table 4-11 summarizes the impacts from construction and preconstruction. Impacts from
 28 construction and preconstruction to land use, water use and quality, aquatic ecology, historic
 29 and cultural resources, air quality, radiological and nonradiological health, and nonradiological
 30 waste would all be SMALL. Because the overall impact to these resources from the proposed
 31 project in its entirety would be SMALL, the NRC-authorized action of the project (i.e.,
 32 construction as defined in 10 CFR 51.4) would also be SMALL.

33 For land use, the impact from construction and preconstruction activities would be MODERATE.
 34 However, the impact of the NRC-authorized action would be small. For terrestrial ecology, the
 35 combined construction and preconstruction impacts would be SMALL to MODERATE. The
 36 NRC-authorized activities' impact to terrestrial resources would be SMALL.

37 The review team determined that the overall impact and NRC-authorized action's impact to
 38 resources of socioeconomics would be SMALL to MODERATE and include resources such as:
 39 physical impacts, demography, infrastructure and community services. Additionally, the overall
 40 impact and NRC-authorized action's impact to environmental justice would be SMALL to
 41 MODERATE.

42 Table 5-28 summarizes the impacts from the operation of the proposed new nuclear units at the
 43 CPNPP site. For land use, water use, and terrestrial ecology, the impacts of operating two new
 44 units on the site would be MODERATE. For water quality, aquatic ecology, and recreation the
 45 impacts associated with operating the proposed new units would be SMALL to MODERATE.
 46 The socioeconomic physical, demography, transportation, housing public services, and
 47 education impacts from operating the two proposed nuclear units would be SMALL.

1 Additionally, the impacts associated with operating the proposed new units on environmental
2 justice, historical and cultural resources, air quality, nonradiological and radiological health,
3 nonradioactive waste, and impacts associated with postulated accidents would be SMALL.

4 **10.6.3 Summary of Benefits and Costs**

5 Luminant's business decision to pursue expansion of the Comanche Peak Nuclear Power Plant
6 site's capacity by adding two additional nuclear reactors is an economic decision based on
7 private financial factors. Overall, this analysis has found that the planning and execution of the
8 construction activity outlined by the applicant should provide significant benefits at minimal
9 costs. The principal benefit would be the additional power generation resources. The overall
10 benefit-cost balance, based upon the proposed plant, would not be significantly improved by the
11 selection of an alternative site or by use of an alternative generating system.

12 Table 10-3 and Table 10-4 include summaries of the internal and the external costs of the
13 proposed activities at the CPNPP site, as well as the identified benefits. The tables include
14 references to the other sections of this EIS when impact assessments or more detailed analysis
15 are available for specific topics.

16 On the basis of the assessments in this EIS, the construction and operation of the proposed
17 CPNPP Units 3 and 4 would accrue benefits that outweigh the project's associated economic,
18 environmental, and social costs. For the NRC proposed action (NRC-authorized construction
19 and operation) the accrued benefits would also outweigh the costs of construction,
20 preconstruction, and operation of Units 3 and 4.

21 **10.7 Staff Conclusions and Recommendations**

22 The NRC staff's preliminary recommendation to the Commission related to the environmental
23 aspects of the proposed action is that the COLs should be issued. The NRC staff's evaluation
24 of the safety and emergency preparedness aspects of the proposed action will be addressed in
25 the staff's safety evaluation report that is anticipated to be published in 2012.

26 The NRC staff's preliminary recommendation is based on (1) the ER submitted by Luminant
27 (Luminant 2009a); (2) consultation with Federal, State, Tribal, and local agencies, (3) the review
28 team's own independent review, (4) the NRC staff's consideration of public scoping comments,
29 and (5) the assessments summarized in this EIS, including the potential mitigation measures
30 identified in the ER and in the EIS. In addition, in making its preliminary recommendation, the
31 staff determined that none of the alternative sites assessed is obviously superior to the CPNPP
32 site.

33 The NRC's determination is independent of the Corps' determination of a Least Environmentally
34 Damaging Practicable Alternative pursuant to Clean Water Act Section 404(b)(1) Guidelines.
35 The Corps will conclude its analysis of both offsite and onsite alternatives in its Record of
36 Decision.

1 10.8References

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BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

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10. SUPPLEMENTARY NOTES

Docket Nos. 52-034 and 52-035

11. ABSTRACT (200 words or less)

This Environmental Impact Statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by Luminant Generation Company LLC (Luminant), acting for itself and as agent for Nuclear Project Company LLC (subsequently renamed Comanche Peak Nuclear Power Company LLC), for combined licenses (COLs). The U.S. Army Corps of Engineers (Corps) is a cooperating agency on this EIS. This EIS includes the analysis by the NRC and Corps staff that considers and weighs the environmental impacts of constructing and operating two new nuclear units at the Comanche Peak Nuclear Power Plant site and at alternatives sites and mitigation measures available for reducing or avoiding adverse impacts.

After considering the environmental aspects of the proposed NRC action, the NRC staff's preliminary recommendation to the Commission is that the COL be issued as requested. This recommendation is based on (1) the application, including the Environmental Report (ER), submitted by Luminant, and responses to request for additional information; (2) consultation with Federal, State, Tribal and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process; and (5) the assessments summarized in the EIS, including the potential mitigation measures identified in the ER and this EIS.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Comanche Peak Nuclear Power Plant Units 3 and 4
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Draft Environmental Impact Statement/DEIS
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