



NUREG-1910  
Supplement 3

# **Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming**

Supplement to the  
Generic Environmental  
Impact Statement for  
In-Situ Leach Uranium  
Milling Facilities

**Draft Report for Comment**

U.S. Nuclear Regulatory Commission  
Office of Federal and State Materials and  
Environmental Management Programs



## AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

### NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Public Electronic Reading Room at <http://www.nrc.gov/reading-rm.html>.

Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and *Title 10, Energy*, in the Code of *Federal Regulations* may also be purchased from one of these two sources.

1. The Superintendent of Documents  
U.S. Government Printing Office  
Mail Stop SSOP  
Washington, DC 20402-0001  
Internet: [bookstore.gpo.gov](http://bookstore.gpo.gov)  
Telephone: 202-512-1800  
Fax: 202-512-2250
2. The National Technical Information Service  
Springfield, VA 22161-0002  
[www.ntis.gov](http://www.ntis.gov)  
1-800-553-6847 or, locally, 703-605-6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:

Address: U.S. Nuclear Regulatory Commission  
Office of Administration  
Reproduction and Mail Services Branch  
Washington, DC 20555-0001

E-mail: [DISTRIBUTION@nrc.gov](mailto:DISTRIBUTION@nrc.gov)

Facsimile: 301-415-2289

Some publications in the NUREG series that are posted at NRC's Web site address <http://www.nrc.gov/reading-rm/doc-collections/nuregs> are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

### Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—

The NRC Technical Library  
Two White Flint North  
11545 Rockville Pike  
Rockville, MD 20852-2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—

American National Standards Institute  
11 West 42<sup>nd</sup> Street  
New York, NY 10036-8002  
[www.ansi.org](http://www.ansi.org)  
212-642-4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor-prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG-XXXX) or agency contractors (NUREG/CR-XXXX), (2) proceedings of conferences (NUREG/CP-XXXX), (3) reports resulting from international agreements (NUREG/IA-XXXX), (4) brochures (NUREG/BR-XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG-0750).

# **Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming**

Supplement to the  
Generic Environmental  
Impact Statement for  
In-Situ Leach Uranium  
Milling Facilities

## **Draft Report for Comment**

Manuscript Completed: November 2009  
Date Published: December 2009

Prepared by:

**U.S. Nuclear Regulatory Commission  
Office of Federal and State Materials and  
Environmental Management Programs**

## COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff.

Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1910, Supplement 3, draft, in your comments, and send them by February 01, 2010 to the following address:

Chief, Rulemaking and Directives Branch  
U.S. Nuclear Regulatory Commission  
Mail Stop TWB-05-B01  
Washington, DC 20555-0001

Electronic comments may be submitted to the NRC by e-mail at [lostcreekisrseis@nrc.gov](mailto:lostcreekisrseis@nrc.gov)

For any questions about the material in this report, please contact:

A. Bjornsen  
TWFN 8F5  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
Phone: 301-415-1195  
E-mail: [abb5@nrc.gov](mailto:abb5@nrc.gov)

---

**NUREG-1910, Supplement 3, has been  
reproduced from the best available copy.**

---

## ABSTRACT

The U.S Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source material provided that proposed facilities meet NRC regulatory requirements and would be operated in a manner that is protective of public health and safety and the environment. Under NRC's environmental protection regulations in the Code of Federal Regulations (CFR), Title 10, Part 51, which implement the National Environmental Policy Act (NEPA) of 1969, issuance of a license to possess and use source material for uranium milling requires an environmental impact statement (EIS) or a supplement to an environmental impact statement.

In June 2009, NRC issued NUREG-1910, "*Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*" (the GEIS). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an in-situ leach uranium recovery facility (also known as an in-situ recovery (ISR) facility) located in four specified geographic regions of the western United States. As part of this assessment, NRC determined which potential impacts would be essentially the same for all ISR facilities and which would result in varying levels of impacts for different facilities, thus requiring further site-specific information to determine potential impacts. The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses.

By letter dated March 20, 2008, Lost Creek ISR, LLC (LCI) submitted a license application to NRC for a new source material license for the Lost Creek Project. The Lost Creek Project would be located in Sweetwater County, Wyoming, which is in the Wyoming West Uranium Milling Region identified in the GEIS. The NRC staff prepared this SEIS to evaluate the potential environmental impacts from LCI's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium milling facility at the Lost Creek Project site. This SEIS also describes the environment potentially affected by LCI's proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes LCI's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings and conclusions in the GEIS that could be incorporated by reference, and areas that needed additional analysis. Based on its environmental review, the NRC staff preliminarily finds that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Lost Creek Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

### Paperwork Reduction Act Statement

This SEIS covers information about only one site, does not contain information collection requirements and, therefore, is not subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

### Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.



# CONTENTS

1		
2	ABSTRACT .....	iii
3	CONTENTS .....	v
4	FIGURES.....	xi
5	TABLES.....	xii
6	EXECUTIVE SUMMARY .....	xiii
7	ABBREVIATIONS/ACRONYMS.....	xxvii
8	SI* (MODERN METRIC) CONVERSION FACTORS.....	xxxi
9	1 INTRODUCTION .....	1-1
10	1.1 Background .....	1-1
11	1.2 The Proposed Action .....	1-1
12	1.3 Purpose of and Need for the Proposed Action.....	1-1
13	1.4 Scope of the Supplemental Environmental Analysis .....	1-2
14	1.4.1 Relationship to the GEIS.....	1-4
15	1.4.2 Public Participation Activities.....	1-5
16	1.4.3 Issues Studied in Detail.....	1-5
17	1.4.4 Issues Outside the Scope of the SEIS .....	1-6
18	1.4.5 Related NEPA Reviews and Other Related Documents .....	1-6
19	1.5 Applicable Regulatory Requirements.....	1-7
20	1.6 Licensing and Permitting .....	1-8
21	1.6.1 NRC Licensing Process .....	1-8
22	1.6.2 Status of Permitting with Other Federal, Tribal, and State Agencies .....	1-8
23	1.7 Consultations.....	1-9
24	1.7.1 Endangered Species Act of 1973 Consultation .....	1-10
25	1.7.2 National Historic Preservation Act of 1966 Consultation.....	1-10
26	1.7.3 Coordination with Other Federal, Tribal, State, and Local Agencies.....	1-10
27	1.7.3.1 Coordination with the Bureau of Land Management .....	1-11
28	1.7.3.2 Coordination with the Bureau of Indian Affairs .....	1-11
29	1.7.3.3 Interactions with Tribal Governments.....	1-11
30	1.7.3.4 Coordination with the Wyoming Department of Environmental Quality .....	1-12
31	1.7.3.5 Coordination with the Wyoming Game and Fish Department.....	1-12
32	1.7.3.6 Coordination with the Wyoming State Engineer's Office .....	1-13
33	1.7.3.7 Coordination with the Wyoming Governor's Planning Office .....	1-13
34	1.7.3.8 Coordination with the Wyoming Community Development Authority.....	1-13
35	1.7.3.9 Coordination with Localities .....	1-13
36	1.8 Structure of the SEIS.....	1-13
37	1.9 References.....	1-14
38	2 In-Situ Uranium Recovery and ALTERNATIVES.....	2-1
39	2.1 Alternatives Considered for Detailed Analysis .....	2-1
40	2.1.1 The Proposed Action (Alternative 1).....	2-1
41	2.1.1.1 Site Description .....	2-1
42	2.1.1.2 Construction Activities .....	2-5
43	2.1.1.3 Operation Activities.....	2-15
44	2.1.1.4 Aquifer Restoration Activities .....	2-20
45	2.1.1.5 Decontamination, Decommissioning, and Reclamation Activities .....	2-22
46	2.1.1.6 Effluents and Waste Management.....	2-24
47	2.1.1.7 Transportation .....	2-28
48	2.1.1.8 Financial Surety.....	2-30
49	2.1.2 No-Action (Alternative 2).....	2-31

## Table of Contents

---

1	2.1.3 Dry Yellowcake (Alternative 3) .....	2-31
2	2.2 Alternatives Eliminated from Detailed Analysis .....	2-32
3	2.2.1 Conventional Mining and Milling at the Lost Creek Project .....	2-32
4	2.2.2 Conventional Mining and Heap Leaching at the Lost Creek Project .....	2-33
5	2.2.3 Alternate Lixiviants .....	2-33
6	2.2.4 Alternate Waste Disposal Methods .....	2-33
7	2.3 Comparison of the Predicted Environmental Impacts .....	2-34
8	2.4 Preliminary Recommendation .....	2-39
9	2.5 References .....	2-40
10	<b>3 AFFECTED ENVIRONMENT .....</b>	<b>3-1</b>
11	3.1 Introduction .....	3-1
12	3.2 Land Use .....	3-1
13	3.2.1 Rangeland .....	3-2
14	3.2.2 Hunting and Recreation .....	3-2
15	3.2.3 Minerals and Energy .....	3-4
16	3.3 Transportation .....	3-4
17	3.4 Geology and Soils .....	3-8
18	3.4.1 Geology .....	3-8
19	3.4.2 Soils .....	3-11
20	3.5 Water Resources .....	3-13
21	3.5.1 Surface Waters and Wetlands .....	3-13
22	3.5.1.1 Drainage Basins .....	3-13
23	3.5.1.2 Surface Water Features .....	3-16
24	3.5.1.3 Surface Water Flow .....	3-16
25	3.5.1.4 Surface Water Quality .....	3-16
26	3.5.1.5 Wetlands .....	3-17
27	3.5.2 Groundwater .....	3-17
28	3.5.2.1 Regional Groundwater Resources .....	3-17
29	3.5.2.2 Local Groundwater Resources .....	3-18
30	3.5.2.3 Uranium-Bearing Aquifers .....	3-18
31	3.5.2.4 Surrounding Aquifers .....	3-29
32	3.6 Ecology .....	3-30
33	3.6.1 Terrestrial Ecology .....	3-30
34	3.6.1.1 Vegetation .....	3-30
35	3.6.1.2 Wildlife .....	3-31
36	3.6.2 Aquatic Ecology .....	3-41
37	3.6.3 Protected Species .....	3-42
38	3.7 Meteorology, Climatology, and Air Quality .....	3-48
39	3.7.1 Meteorology and Climatology .....	3-48
40	3.7.1.1 Temperature .....	3-48
41	3.7.1.2 Wind .....	3-49
42	3.7.1.3 Precipitation .....	3-52
43	3.7.1.4 Evaporation .....	3-52
44	3.7.2 Air Quality .....	3-53
45	3.8 Noise .....	3-54
46	3.9 Historical, Cultural, and Paleontological Resources .....	3-55
47	3.9.1 Cultural History .....	3-55
48	3.9.1.1 Prehistoric Era .....	3-56
49	3.9.1.2 Protohistoric/Historic Era .....	3-56
50	3.9.2 Historic and Cultural Resources Identified and Places of Cultural Significance .....	3-57
51	3.9.2.1 Previous Cultural Resources Investigations .....	3-57

1	3.9.3 Historic Properties Listed in the National and State Registers.....	3-59
2	3.9.4 Tribal Consultation.....	3-59
3	3.9.5 Paleontological Resources.....	3-60
4	3.10 Visual and Scenic Resources.....	3-60
5	3.11 Socioeconomics.....	3-62
6	3.11.1 Demographics.....	3-63
7	3.11.2 Income.....	3-63
8	3.11.3 Housing.....	3-64
9	3.11.4 Employment Structure.....	3-64
10	3.11.4.1 State Data.....	3-64
11	3.11.4.2 County Data.....	3-64
12	3.11.5 Local Finance.....	3-65
13	3.11.6 Education.....	3-65
14	3.11.7 Health and Social Services.....	3-65
15	3.12 Public and Occupational Health and Safety.....	3-66
16	3.12.1 Background Radiological Conditions.....	3-66
17	3.12.2 Public Health and Safety.....	3-69
18	3.12.3 Occupational Health and Safety.....	3-69
19	3.13 Waste Management.....	3-70
20	3.13.1 Solid Waste.....	3-70
21	3.13.2 Liquid Waste.....	3-71
22	3.13.3 Radioactive Wastes.....	3-71
23	3.14 References.....	3-71
24	<b>4 ENVIRONMENTAL IMPACTS AND MITIGATIVE ACTIONS.....</b>	<b>4-1</b>
25	4.1 Introduction.....	4-1
26	4.2 Land Use Impacts.....	4-1
27	4.2.1 Proposed Action (Alternative 1).....	4-1
28	4.2.1.1 Construction Impacts.....	4-2
29	4.2.1.2 Operations Impacts.....	4-3
30	4.2.1.3 Aquifer Restoration Impacts.....	4-4
31	4.2.1.4 Decommissioning Impacts.....	4-4
32	4.2.2 No-Action (Alternative 2).....	4-5
33	4.2.3 Dry Yellowcake (Alternative 3).....	4-5
34	4.3 Transportation Impacts.....	4-6
35	4.3.1 Proposed Action (Alternative 1).....	4-6
36	4.3.1.1 Construction Impacts.....	4-6
37	4.3.1.2 Operation Impacts.....	4-8
38	4.3.1.3 Aquifer Restoration Impacts.....	4-10
39	4.3.1.4 Decommissioning Impacts.....	4-11
40	4.3.2 No-Action (Alternative 2).....	4-12
41	4.3.3 Dry Yellowcake (Alternative 3).....	4-16
42	4.3.3.1 Construction Impacts.....	4-16
43	4.3.3.2 Operation Impacts.....	4-16
44	4.3.3.3 Aquifer Restoration Impacts.....	4-17
45	4.3.3.4 Decommissioning Impacts.....	4-18
46	4.4 Geology and Soils Impacts.....	4-18
47	4.4.1 Proposed Action (Alternative 1).....	4-18
48	4.4.1.1 Construction Impacts.....	4-18
49	4.4.1.2 Operation Impacts.....	4-19
50	4.4.1.3 Aquifer Restoration Impacts.....	4-21
51	4.4.1.4 Decommissioning Impacts.....	4-22

## Table of Contents

---

1	4.4.2 No-Action (Alternative 2).....	4-23
2	4.4.3 Dry Yellowcake (Alternative 3).....	4-23
3	4.5 Water Resources Impacts.....	4-23
4	4.5.1 Surface Waters and Wetlands Impacts.....	4-23
5	4.5.1.1 Proposed Action (Alternative 1).....	4-24
6	4.5.1.2 No-Action (Alternative 2).....	4-27
7	4.5.1.3 Dry Yellowcake (Alternative 3).....	4-28
8	4.5.2 Groundwater Impacts.....	4-28
9	4.5.2.1 Proposed Action (Alternative 1).....	4-28
10	4.5.2.2 No-Action (Alternative 2).....	4-38
11	4.5.2.3 Dry Yellowcake (Alternative 3).....	4-38
12	4.6 Ecological Resources Impacts.....	4-38
13	4.6.1 Proposed Action (Alternative 1).....	4-38
14	4.6.1.1 Construction Impacts.....	4-38
15	4.6.1.2 Operation Impacts.....	4-50
16	4.6.1.3 Aquifer Restoration Impacts.....	4-52
17	4.6.1.4 Decommissioning Impacts.....	4-53
18	4.6.2 No-Action (Alternative 2).....	4-54
19	4.6.3 Dry Yellowcake (Alternative 3).....	4-54
20	4.7 Air Quality Impacts.....	4-55
21	4.7.1 Proposed Action (Alternative 1).....	4-55
22	4.7.1.1 Construction Impacts.....	4-55
23	4.7.1.2 Operation Impacts.....	4-56
24	4.7.1.3 Aquifer Restoration Impacts.....	4-57
25	4.7.1.4 Decommissioning Impacts.....	4-57
26	4.7.2 No-Action (Alternative 2).....	4-58
27	4.7.3 Dry Yellowcake (Alternative 3).....	4-58
28	4.7.3.1 Construction Impacts.....	4-59
29	4.7.3.2 Operation Impacts.....	4-59
30	4.7.3.3 Aquifer Restoration Impacts.....	4-60
31	4.7.3.4 Decommissioning Impacts.....	4-60
32	4.8 Noise Impacts.....	4-61
33	4.8.1 Proposed Action (Alternative 1).....	4-61
34	4.8.1.1 Construction Impacts.....	4-61
35	4.8.1.2 Operation Impacts.....	4-62
36	4.8.1.3 Aquifer Restoration Impacts.....	4-63
37	4.8.1.4 Decommissioning Impacts.....	4-63
38	4.8.2 No-Action (Alternative 2).....	4-64
39	4.8.3 Dry Yellowcake (Alternative 3).....	4-64
40	4.9 Historical, Cultural, and Paleontological Resources Impacts.....	4-65
41	4.9.1 Proposed Action (Alternative 1).....	4-65
42	4.9.1.1 Construction Impacts.....	4-65
43	4.9.1.2 Operation Impacts.....	4-67
44	4.9.1.3 Aquifer Restoration Impacts.....	4-68
45	4.9.1.4 Decommissioning Impacts.....	4-69
46	4.9.2 No-Action (Alternative 2).....	4-69
47	4.9.3 Dry Yellowcake (Alternative 3).....	4-70
48	4.10 Visual and Scenic Resources Impacts.....	4-70
49	4.10.1 Proposed Action (Alternative 1).....	4-70
50	4.10.1.1 Construction Impacts.....	4-71
51	4.10.1.2 Operation Impacts.....	4-72

1 4.10.1.3 Aquifer Restoration Impacts .....4-73

2 4.10.1.4 Decommissioning Impacts..... 4-74

3 4.10.2 No-Action (Alternative 2)..... 4-75

4 4.10.3 Dry Yellowcake (Alternative 3)..... 4-75

5 4.11 Socioeconomic Impacts..... 4-75

6 4.11.1 Proposed Action (Alternative 1)..... 4-76

7 4.11.1.1 Construction Impacts..... 4-76

8 4.11.1.2 Operation Impacts ..... 4-79

9 4.11.1.3 Aquifer Restoration Impacts ..... 4-82

10 4.11.1.4 Decommissioning Impacts..... 4-83

11 4.11.2 No-Action (Alternative 2)..... 4-83

12 4.11.3 Dry Yellowcake (Alternative 3)..... 4-84

13 4.12 Environmental Justice Impacts ..... 4-84

14 4.12.1 Proposed Action (Alternative 1)..... 4-84

15 4.12.2 No-Action (Alternative 2)..... 4-85

16 4.12.3 Dry Yellowcake (Alternative 3)..... 4-85

17 4.13 Public and Occupational Health and Safety Impacts..... 4-86

18 4.13.1 Proposed Action (Alternative 1)..... 4-86

19 4.13.1.1 Construction Impacts..... 4-86

20 4.13.1.2 Operation Impacts ..... 4-87

21 4.13.1.3 Aquifer Restoration Impacts ..... 4-94

22 4.13.1.4 Decommissioning Impacts..... 4-94

23 4.13.2 No-Action (Alternative 2)..... 4-95

24 4.13.3 Dry Yellowcake (Alternative 3)..... 4-95

25 4.13.3.1 Construction Impacts..... 4-95

26 4.13.3.2 Operation Impacts ..... 4-96

27 4.13.3.3 Aquifer Restoration Impacts ..... 4-96

28 4.13.3.4 Decommissioning Impacts..... 4-96

29 4.14 Waste Management Impacts ..... 4-97

30 4.14.1 Proposed Action (Alternative 1)..... 4-98

31 4.14.1.1 Construction Impacts..... 4-98

32 4.14.1.2 Operation Impacts ..... 4-98

33 4.14.1.3 Aquifer Restoration Impacts ..... 4-100

34 4.14.1.4 Decommissioning Impacts..... 4-101

35 4.14.2 No-Action (Alternative 2)..... 4-102

36 4.14.3 Dry Yellowcake (Alternative 3)..... 4-102

37 4.15 References..... 4-102

38 5 CUMULATIVE impacts ..... 5-1

39 5.1 Introduction ..... 5-1

40 5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions..... 5-1

41 5.1.1.1 Uranium Recovery Sites ..... 5-2

42 5.1.1.2 Coal Mining ..... 5-3

43 5.1.1.3 Oil and Gas Production ..... 5-4

44 5.1.1.4 Wind Power ..... 5-4

45 5.1.1.5 EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

46 ..... 5-5

47 5.1.2 Methodology ..... 5-7

48 5.2 Land Use..... 5-8

49 5.3 Transportation ..... 5-9

50 5.4 Geology and Soils ..... 5-10

51 5.5 Water Resources..... 5-11

Table of Contents

1	5.5.1 Surface Water .....	5-11
2	5.5.2 Groundwater .....	5-11
3	5.6 Ecological Resources .....	5-12
4	5.7 Meteorology, Climatology, and Air Quality .....	5-13
5	5.8 Noise .....	5-15
6	5.9 Historical and Cultural Resources .....	5-16
7	5.10 Visual and Scenic Resources .....	5-17
8	5.11 Socioeconomics .....	5-17
9	5.12 Environmental Justice .....	5-18
10	5.13 Public and Occupational Health and Safety .....	5-19
11	5.14 Waste Management .....	5-20
12	5.15 References .....	5-23
13	<b>6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS .....</b>	<b>6-1</b>
14	6.1 Introduction .....	6-1
15	6.2 Radiological Monitoring .....	6-1
16	6.2.1 Airborne Radiation Monitoring .....	6-1
17	6.2.2 Soils and Sediment Monitoring .....	6-2
18	6.2.3 Vegetation, Food, and Fish Monitoring .....	6-2
19	6.2.4 Surface Water Monitoring .....	6-6
20	6.2.5 Groundwater Monitoring .....	6-7
21	6.3 Physiochemical Monitoring .....	6-7
22	6.3.1 Well Field Groundwater Monitoring .....	6-7
23	6.3.1.1 Pre-Operational Groundwater Sampling .....	6-7
24	6.3.1.2 Groundwater Quality Monitoring .....	6-8
25	6.3.2 Well Field and Pipeline Flow and Pressure Monitoring .....	6-10
26	6.3.3 Surface Water Monitoring .....	6-11
27	6.3.4 Meteorological Monitoring .....	6-11
28	6.4 Ecological Monitoring .....	6-11
29	6.4.1 Vegetation Monitoring .....	6-11
30	6.4.2 Wildlife Monitoring .....	6-13
31	6.4.2.1 Annual Report and Meetings .....	6-13
32	6.4.2.2 Annual Inventory and Monitoring .....	6-13
33	6.4.2.3 Raptors .....	6-13
34	6.4.2.4 Sage-grouse .....	6-13
35	6.4.2.5 Big Game .....	6-13
36	6.4.2.6 General Wildlife .....	6-14
37	6.4.2.7 Sensitive Species .....	6-14
38	6.4.3 Noise .....	6-14
39	6.4.4 Historic and Cultural Resources Monitoring .....	6-14
40	6.5 References .....	6-14
41	<b>7 COST-BENEFIT ANALYSIS .....</b>	<b>7-1</b>
42	7.1 No-Action Alternative .....	7-1
43	7.2 Benefits from the Proposed Action .....	7-1
44	7.2.1 Benefits from Potential Production .....	7-2
45	7.2.2 Costs to the Local Communities Associated with the Proposed Lost Creek Project	
46	Activities .....	7-2
47	7.3 Evaluation of Findings for the Proposed Lost Creek ISR Project .....	7-4
48	7.4 References .....	7-4
49	<b>8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES .....</b>	<b>8-1</b>
50	8.1 Proposed Action (Alternative 1) .....	8-1
51	8.2 No-Action (Alternative 2) .....	8-2

1	8.3 Dry Yellowcake (Alternative 3).....	8-2
2	8.4 References.....	8-8
3	9 LIST OF PREPARERS .....	9-1
4	9.1 U.S. Nuclear Regulatory Commission Contributors .....	9-1
5	9.2 Environet, Inc. (Environet) Contributors.....	9-2
6	9.3 Environet Subcontractor Contributors.....	9-3
7	10 DISTRIBUTION LIST .....	10-1
8	10.1 Federal Agency Officials.....	10-1
9	10.2 Tribal Government Officials .....	10-1
10	10.3 State Agency Officials .....	10-1
11	10.4 Local Agency Officials .....	10-2
12	10.5 Other Organizations and Individuals.....	10-2
13	APPENDIX A CONSULTATION CORRESPONDENCE .....	A-1

14

**FIGURES**

15	Figure 1-1. Project Location .....	1-3
16	Figure 2-1. Project Schedule.....	2-2
17	Figure 2-2. Land Ownership.....	2-3
18	Figure 2-3. Site Access.....	2-4
19	Figure 2-4. Process Facility Layout.....	2-6
20	Figure 2-5. Internal CPP Floor Plan .....	2-7
21	Figure 2-6. Project Well Fields .....	2-9
22	Figure 2-7. Solution Flow Patterns.....	2-11
23	Figure 2-8. Injection Well Construction.....	2-12
24	Figure 2-9. Production Well Construction.....	2-13
25	Figure 2-10. Typical ISR Layout.....	2-17
26	Figure 2-11. Process Flow Diagram.....	2-18
27	Figure 2-12. Ion Exchange Process Flow Diagram .....	2-19
28	Figure 2-13. Project Water Balance .....	2-27
29	Figure 3-1. BLM Grazing Allotments .....	3-3
30	Figure 3-2. Regional Road Network.....	3-6
31	Figure 3-3. On-site Roads.....	3-7
32	Figure 3-4. Project Geologic Cross-Section .....	3-9
33	Figure 3-5. Project Soils Map.....	3-12
34	Figure 3-6. Regional Drainage Map .....	3-14
35	Figure 3-7. Area Watershed Map .....	3-15
36	Figure 3-8. Hydrostratigraphic Units.....	3-20
37	Figure 3-9. Monitoring Wells .....	3-23
38	Figure 3-10. Domestic and Stock Wells within 5 Miles of Lost Creek Project Area .....	3-28
39	Figure 3-11. Site Vegetation Map.....	3-32
40	Figure 3-12. Sage Grouse Leks .....	3-38
41	Figure 3-13. Raptor Nests.....	3-41
42	Figure 3-14. Regional NOAA Weather Stations .....	3-50
43	Figure 3-15. Wind Rose (Lost Solider Station).....	3-51
44	Figure 4-1. Area Roads.....	4-13
45	Figure 4-2. Regional Roads to Sussex, WY .....	4-14
46	Figure 4-3. Interstate Roads to Falfurrias, TX .....	4-15
47	Figure 5-1. Nuclear Fuel Cycle Facilities within a 50-mile Radius of Lost Creek .....	5-22
48	Figure 6-1. In-Plant Radiological Monitoring Locations .....	6-3

1 Figure 6-2. Radon and Gamma Monitoring Locations ..... 6-4  
 2 Figure 6-3. Air (Particulate) Monitoring Locations ..... 6-5  
 3 Figure 6-4. Passive Radiological Monitoring Locations ..... 6-6  
 4 Figure 6-5. Surface Water Sampling Locations ..... 6-12

5

**TABLES**

6 Table 1-1. Summary of Expected Impacts in the Wyoming West Uranium Milling Region..... 1-4  
 7 Table 1-2. Environmental Approvals for the Lost Creek ISR Project ..... 1-8  
 8 Table 2-1. Projected Vehicle Needs: Lost Creek ISR Project ..... 2-30  
 9 Table 2-2. Summary of Impacts ..... 2-35  
 10 Table 3-1. Hunting Statistics for Hunt Areas that Include the Project Area ..... 3-2  
 11 Table 3-2. Average Pre-Operational Baseline Groundwater Quality for the Lost Creek License  
 12 Area Aquifers ..... 3-24  
 13 Table 3-3. Existing Wells within 5 Miles of Project Area ..... 3-27  
 14 Table 3-4. Wildlife Species Observed in the Project Area ..... 3-33  
 15 Table 3-5. Raptor Nest Status ..... 3-37  
 16 Table 3-6. Rare Plant Species Known to Occur in Sweetwater County ..... 3-44  
 17 Table 3-7. Wildlife Species of Special Concern ..... 3-46  
 18 Table 3-8. Climate Data for Jeffery City, Wyoming Climate Station, 2005 ..... 3-52  
 19 Table 3-9. Existing Conditions - 2007 Ambient Air Quality Monitoring Data ..... 3-54  
 20 Table 3-10. Archaeological Sites Located within the Area of Potential Effect ..... 3-57  
 21 Table 3-11. Demographics of Sweetwater County ..... 3-63  
 22 Table 4-1. Stripped and Disturbed Land by Vegetation Type ..... 4-40  
 23 Table 4-2. Seasonal Wildlife Stipulations ..... 4-45  
 24 Table 4-3. Percent Living in Poverty in 2000 ..... 4-85  
 25 Table 4-4. Estimated Radon-222 Releases (Ci yr-1) ..... 4-87  
 26 Table 4-5. Generic Accident Dose Analysis for ISR Operations for Lost Creek ..... 4-90  
 27 Table 5-1. Uranium Recovery Sites<sup>1</sup> in the Wyoming West (Great Divide Basin) Uranium Milling  
 28 Region ..... 5-2  
 29 Table 5-2. Coal Mines in the Wyoming West (Great Divide Basin)<sup>1</sup> ..... 5-4  
 30 Table 5-3. Wind Energy Projects in Wyoming<sup>1</sup> ..... 5-4  
 31 Table 5-4. Draft and Final National Environmental Policy Act (NEPA) Documents Related to the  
 32 Great Divide Basin ..... 5-6  
 33 Table 6-1. Baseline Water Quality Monitoring Parameters ..... 6-10  
 34 Table 7-1. Communities Closest to the Proposed Project ..... 7-3  
 35 Table 7-2. Estimated Project Costs to the Local Communities ..... 7-3  
 36 Table 8-1. Summary of Environmental Consequences of the Proposed Action ..... 8-3  
 37

# EXECUTIVE SUMMARY

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

## BACKGROUND

By letter dated March 20, 2008, Lost Creek ISR, LLC (LCI) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Lost Creek Project, located in Sweetwater County, Wyoming. LCI is proposing to recover uranium using the in-situ leach (also known as the in-situ recovery (ISR)) process. The proposed Lost Creek Project includes a central processing plant to produce yellowcake slurry, well fields, deep disposal well for liquid effluent wastes, and the attendant infrastructure (e.g., pipelines).

The Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978, authorizes the NRC to issue licenses for the possession and use of source material and byproduct material. The NRC must license facilities, including ISR operations, in accordance with NRC regulatory requirements to protect public health and safety from radiological hazards. Under the NRC's environmental protection regulations in the Code of Federal Regulations, Title 10, Part 51 (10 CFR Part 51), that implement the National Environmental Policy Act of 1969 (NEPA), preparation of an environmental impact statement (EIS) or supplement to an EIS is required for issuance of a license to possess and use source material for uranium milling (see 10 CFR 51.20(b)(8)).

In June 2009, the NRC staff issued NUREG-1910, "*Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*" (herein referred to as the "GEIS"). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed Lost Creek Project is located within the Wyoming West Uranium Milling Region identified in the GEIS. The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This draft Supplemental Environmental Impact Statement (SEIS) incorporates by reference from the GEIS and uses information from the applicant's license application and other independent sources to fulfill the requirements in 10 CFR 51.20(b)(8).

## PURPOSE AND NEED OF THE PROPOSED ACTION

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." LCI is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Lost Creek site. The purpose and need for the proposed action is to provide an option that allows the applicant to use ISR technology to recover uranium and produce yellowcake slurry at the Lost Creek Project. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce fuel for commercially-operated nuclear power reactors. Based on the application, the NRC's federal action is the decision whether to issue the license to LCI.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, the NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

1 **THE PROJECT AREA**

2 The Lost Creek ISR Project is located in the northeast portion of Sweetwater County, in south-  
3 central Wyoming. The nearest population center, located approximately 24 kilometers (km) (15  
4 miles [mi]) northeast of the project site, is Bairoil, a small town with less than 100 people. The  
5 City of Rawlins is located approximately 61 km (38 mi) to the southeast; the City of Rock  
6 Springs is located approximately 129 km (80 mi) southwest; the City of Casper is located  
7 approximately 145 km (90 mi) northeast; and Jeffrey City is located approximately 40 km (25 mi)  
8 north of Lost Creek. Planned facilities associated with the proposed project include well fields  
9 with injection, production, and monitor wells, header houses, a central processing facility, an  
10 access road network, and pipeline system.

11 The Project Area consists of approximately 1,709 hectares (ha) (4,220 acres [ac]) and is  
12 remotely located on public land administered by the U.S. Department of the Interior, Bureau of  
13 Land Management (BLM) and the State of Wyoming. Of this land, 1,449 ha (3,580 ac), or 85  
14 percent, is administered by BLM, and 259 ha (640 ac), or 15 percent, is administered by the  
15 State of Wyoming.

16 **IN-SITU RECOVERY PROCESS**

17 During the ISR process, an oxidant-charged solution, called a lixiviant, is injected into the  
18 production zone aquifer (uranium ore body) through injection wells. The production zone is that  
19 portion of the aquifer that has been exempted by the EPA for potable water use. Typically, a  
20 lixiviant uses native ground water (from the production zone aquifer), carbon dioxide, and  
21 sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As it circulates  
22 through the production zone, the lixiviant oxidizes and dissolves the mineralized uranium, which  
23 is present in a reduced chemical state. The resulting uranium-rich solution is drawn to recovery  
24 wells by pumping, and then transferred to a processing facility via a network of pipes buried just  
25 below the ground surface. At the processing facility, the uranium is leached from the solution.  
26 The resulting barren solution is then recharged with the oxidant and re-injected to recover more  
27 uranium from the well field.

28 During production, the uranium recovery solution continually moves through the aquifer from  
29 outlying injection wells to internal recovery wells. These wells can be arranged in a variety of  
30 geometric patterns depending on ore body configuration, aquifer permeability, and operator  
31 preference. Well fields are often designed in a five-spot or seven-spot pattern, with each  
32 recovery (i.e., production) well being located inside a ring of injection wells. Monitoring wells  
33 would, then, surround the well field pattern area, terminating in the production zone aquifer as  
34 well as in both the overlying and underlying aquifers. These monitoring wells are screened in  
35 appropriate stratigraphic horizons to detect lixiviant in case it migrates out of the production  
36 zone. The uranium that is recovered from the solution would be processed, dried into  
37 yellowcake, and packaged into NRC- and U.S. Department of Transportation (USDOT)-  
38 approved 205-L (55-gal) steel drums, and trucked offsite to a licensed uranium conversion  
39 facility.

40 **ALTERNATIVES**

41 The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA, require  
42 NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed  
43 action before acting on a proposal. The NRC staff considered a range of alternatives that would  
44 fulfill the underlying purpose and need for the proposed action. From this analysis, a set of  
45 reasonable alternatives was developed, and the impacts of the proposed action were compared

1 with the impacts that would result if a given alternative were implemented. This draft SEIS  
 2 evaluates the potential environmental impacts of the proposed action and two alternatives,  
 3 including the No-Action alternative. Under the No-Action alternative, LCI would not construct or  
 4 operate an ISR facility at the proposed site. The other alternative considered is the production  
 5 of dry yellowcake at the Lost Creek Project. Alternatives considered but eliminated from  
 6 detailed analysis include conventional mining and milling at the Lost Creek site, and  
 7 conventional mining and heap leach processing at the Lost Creek site, alternate lixivants, and  
 8 alternate waste disposal methods.

## 9 **SUMMARY OF THE ENVIRONMENTAL IMPACTS**

10 This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental  
 11 impacts resulting from the construction, operation, aquifer restoration, and decommissioning of  
 12 an ISR facility at the proposed Lost Creek Project site and the two alternatives. The draft SEIS  
 13 also provides mitigation measures for the reduction or avoidance of potential adverse impacts  
 14 from the proposed action. The draft SEIS uses the assessments and conclusions reached in  
 15 the GEIS in combination with site-specific information to assess and categorize impacts.

16 As discussed in the GEIS and consistent with NRC's NUREG-1748 (NRC, 2003), the  
 17 significance of potential environmental impacts is categorized as follows:

18 **SMALL:** The environmental effects are not detectable or are so minor that they  
 19 will neither destabilize nor noticeably alter any important attribute of the resource.

20 **MODERATE:** The environmental effects are sufficient to alter noticeably, but not  
 21 destabilize, important attributes of the resource.

22 **LARGE:** The environmental effects are clearly noticeable and are sufficient to  
 23 destabilize important attributes of the resource.

24 Chapter 4 provides NRC's evaluation of the potential environmental impacts of the construction,  
 25 operation, aquifer restoration, and decommissioning of the proposed Lost Creek Project. A list  
 26 of the significance level of impacts by phase of the ISR facility lifecycle is provided below  
 27 followed by a brief summary of impacts by environmental resource area and ISR facility lifecycle  
 28 phase.

### 29 **Impacts by ISR Facility Phase and Significance Level**

#### 30 **Construction**

31 **SMALL impacts:** Land Use; Transportation; Geology and Soils; Surface Water and  
 32 Wetlands; Groundwater; Ecological Resources (Vegetation); Air  
 33 Quality; Noise; Visual and Scenic Resources; Socioeconomics  
 34 (Demographics, Income, Employment Structure, Housing, Local  
 35 Finance, Education, Health and Social Services); Public and  
 36 Occupational Health and Safety; Waste Management

37 **MODERATE impacts:** Ecological Resources (Wildlife); Historical and Cultural Resources

38 **LARGE impacts:** None

#### 39 **Operation**

40 **SMALL impacts:** Land Use; Transportation; Surface Water and Wetlands; Geology  
 41 and Soils; Ecological Resources (Vegetation); Air Quality; Noise;  
 42 Historical and Cultural Resources; Visual and Scenic Resources;

1 Socioeconomics (Income); Public and Occupational Health and  
2 Safety; Waste Management  
3 MODERATE impacts: Groundwater; Ecological Resources (Wildlife); Socioeconomics  
4 (Demographics, Housing, Employment Structure, Local Finance,  
5 Education, Health and Social Services)  
6 LARGE impacts: None

7 **Aquifer restoration**

8 SMALL impacts: Land Use; Transportation; Geology and Soils; Surface Water and  
9 Wetlands; Ecological Resources; Air Quality; Noise; Historical and  
10 Cultural Resources; Visual and Scenic Resources;  
11 Socioeconomics; Public and Occupational Health and Safety;  
12 Waste Management  
13 MODERATE impacts: Groundwater  
14 LARGE impacts: None

15 **Decommissioning**

16 SMALL impacts: Land Use; Transportation; Geology and Soils; Surface Water and  
17 Wetlands; Groundwater; Ecological Resources; Air Quality; Noise;  
18 Historical and Cultural Resources; Visual and Scenic Resources;  
19 Socioeconomics; Public and Occupational Health and Safety;  
20 Waste Management  
21 MODERATE impacts: None  
22 LARGE impacts: None

23 **Impacts by Resource Area and ISR Facility Phase**

24 **Land Use**

25 Construction: Impacts would be SMALL. An estimated 23 ha (57 ac) would be stripped of  
26 vegetation and topsoil, which is small in comparison to the 1,709 ha (4,220 ac) of the entire  
27 project area. The construction of the planned six production (well field) units would be  
28 completed in phases after the construction of the CPP and storage ponds.

29 Operation: Impacts would be SMALL. Impacts would be similar to, or less than, those during  
30 the construction phase. Infrastructure is already in place; for example, buildings and storage  
31 areas. Additional well drilling and new two-track roads would be made, but this is much less  
32 intensive than the construction phase.

33 Aquifer Restoration: Impacts would be SMALL. Impacts would be similar, or less than those  
34 during the operation phase. It is expected that as aquifer restoration proceeds and well fields  
35 are closed, some operational activities would diminish.

36 Decommissioning: Impacts would be SMALL. Land use impacts would be similar to those  
37 during the construction phase. Decontamination and dismantling of the project facilities and  
38 roads would occur, contouring the land to its natural state, and reseeded and placement of soils  
39 would also occur during this phase.

## 1 **Transportation**

2 Construction: Impacts would be SMALL. Low levels of traffic generated by construction  
3 activities (relative to local traffic counts) would not significantly increase traffic or accidents on  
4 the roads in the region. Due to the limited duration of construction activities the impact of  
5 construction traffic to the roadway network is expected to be short-term. In addition, access  
6 roads have been upgraded to BLM standards.

7 Operation: Impacts would be SMALL. Low levels of facility-related traffic would not noticeably  
8 increase traffic or accidents on most roads. Light truck traffic would be expected to decrease  
9 from the construction phase. Transportation of hazardous materials increases the probability of  
10 potential accidents, the risk would be minimized due to a small number of shipments,  
11 comprehensive regulatory controls, and best management practices (BMPs).

12 Aquifer Restoration: Impacts would be SMALL. Transportation impacts during this phase would  
13 be similar to those of the operations phase. As the rate of uranium recovery gradually  
14 decreases through the course of aquifer restoration, the number of yellowcake slurry shipments  
15 to offsite drying facilities would also decrease.

16 Decommissioning: Impacts would be SMALL. There would be reduced traffic volumes  
17 associated with this phase compared to the operations phase, resulting in a reduced risk of  
18 transportation accidents. Regional transportation impacts are expected to be short-term.

## 19 **Geology and Soils**

20 Construction: Impacts would be SMALL. Most potential impacts would occur during the  
21 construction phase with respect to geology and soils. Earth moving activities and well drilling  
22 would take place during this phase. Additionally, there would be a limited construction area as  
23 well as implementation of the BMPs to mitigate potential impacts.

24 Operation: Impacts could be potentially MODERATE. The removal of uranium from the target  
25 sandstone (aquifer) during ISR operations would result in a permanent change to the  
26 composition of uranium-bearing rock formations. The uranium mobilization and recovery  
27 process in the target sandstone, deep below the ground surface does not result in the removal  
28 of rock matrix or structure. No significant matrix compression or ground subsidence is  
29 expected. There would be a risk of spills/leaks at the project area, impacts to soils from spills  
30 and/or leaks would be mitigated by immediate response time, routine monitoring programs, and  
31 spill recovery actions, and impacts would be reduced to SMALL.

32 Aquifer Restoration: Impacts could be potentially MODERATE. Activities during aquifer  
33 restoration would not result in the removal of any rock matrix or structure. No significant matrix  
34 compression or ground subsidence is expected, as the net withdrawal of lixiviant would typically  
35 be one percent or less. Spill and leak detection would be implemented here in the same way  
36 they would during the operations phase, which would reduce impacts to SMALL.

37 Decommissioning: Impacts would be SMALL. Disruption and/or displacement of existing soils  
38 would occur during the decommissioning phase, but these reclamation activities would be short  
39 term. The land would be restored to its original condition/use.

## 40 **Water Resources (Surface Water and Wetlands)**

41 Construction: Impacts would be SMALL. Impacts to surface water would potentially be from  
42 construction involving road crossings, filling, erosion, runoff, and spills or leaks of fuels and  
43 lubricants for construction equipment. Impacts would be mitigated through proper planning,  
44 design, construction, and BMPs. Any construction disturbances such as well field drilling, road  
45 and facility construction, and pipeline installations would occur in a small area relative to the  
46 overall size of the project.

1 Operation: Impacts would be SMALL. Potential spills and/or leaks would be mitigated in the  
2 same way as the construction phase. The site would have permits (federal and state) for  
3 discharge of storm water runoff and process-related water; the licensee would be expected to  
4 operate within the conditions of the permit. Vehicles would cross ephemeral channels at right  
5 angles to access all well fields during oversight and maintenance of the injection, production,  
6 and monitoring wells. This may liberate limited amounts of sediment to downstream areas.

7 Aquifer Restoration: There would be no impacts for this phase and resource area. While the  
8 restoration of groundwater aquifers results in the production of wastewater; however, no  
9 wastewater would be released into surface waters, and therefore, no impacts are expected.

10 Decommissioning: Impacts would be SMALL. Impacts from decommissioning would be  
11 expected to be similar to, or less than impacts from construction. Activities to clean up, and re-  
12 contour and reclaim the land surface during decommissioning would be expected to mitigate  
13 potentially long-term impacts to surface waters. Sediment from loosened soil would be  
14 prevented from entering surface waters and downstream wetlands during this phase therefore  
15 would minimize impacts.

## 16 **Water Resources (Groundwater)**

17 Construction: Impacts would be SMALL. Potential impacts to groundwater could occur during  
18 consumptive use of groundwater, introduction of drilling fluids and muds into the environment  
19 during well installation, discharge of pumped water to the surface during hydrologic testing and  
20 surface spills of fuels and lubricants. These impacts would be mitigated due to the expected  
21 limited use of consumptive groundwater during this phase and implementation of BMPs to  
22 protect groundwater.

23 Operation: Impacts would be MODERATE. During ISR operations, potential environmental  
24 impacts to shallow (near-surface) aquifers are the result of leaks of lixiviant from pipelines,  
25 wells, or header houses and to waste management practices such as the use of evaporation  
26 ponds and disposal of treated wastewater by land application. Potential environmental impacts  
27 to groundwater resources in the production and surrounding aquifers include consumptive water  
28 use (drawdown) and changes to water quality. Drawdown impacts could be MODERATE, but  
29 water levels would recover once ISR operations and restoration activities are completed. Water  
30 quality changes would result from normal operations in the production aquifer and from possible  
31 horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing  
32 wastes by deep well injection during ISR operations also can potentially impact groundwater  
33 resources.

34 Aquifer Restoration: Impacts would be MODERATE. Three steps take place will occur during  
35 restoration: groundwater sweep, groundwater treatment, and recirculation. During all processes  
36 hydraulic control of the former production zone must be maintained; this is accomplished by  
37 maintaining an inward hydraulic gradient through a production bleed. During groundwater  
38 sweep, water is pumped from the mine unit (without re-injection), resulting in an influx of 'fresh'  
39 baseline water into the affected (mined) portion of the aquifer, but also resulting in large  
40 drawdown of wells occurring near the project area. The water removed from the aquifer during  
41 the sweep first is passed through an ion-exchange system to recover the uranium and then  
42 disposed either in evaporation ponds or via deep well injection in accordance with the limits in a  
43 UIC permit. This would result in drawdown in nearby surrounding wells. During this phase,  
44 disposal of waste fluids via deep well injection of waste is planned in much the same manner as  
45 operation.

46 Decommissioning: Impacts would be SMALL. Potential impacts during this phase would be  
47 similar to those during the construction phase. Groundwater consumptive use would be less

1 than that of the operation and restoration-phase. All monitoring wells, injection, and production  
2 wells would be plugged and abandoned in accordance with the Wyoming underground injection  
3 control (UIC) program requirements. Wells would be filled with cement and clay and then cut  
4 below plough depth to ensure groundwater does not flow through the abandoned wells.  
5 Abandoned wells would be properly isolated from the flow domain.

## 6 **Ecological Resources (Wildlife)**

7 Construction: Impacts would be MODERATE. Habitat fragmentation, temporary displacement,  
8 and direct or indirect mortalities are possible at the Lost Creek site. Mitigation measures such  
9 as the standard management practices issued by the Wyoming Game and Fish Department  
10 (WGFD) would limit these impacts. Impacts to sage grouse and big game species could also be  
11 mitigated if BLM and WGFD guidelines are followed. Impacts to raptor species from power  
12 distribution lines could be mitigated by following the Avian Power Line Interaction Committee  
13 (APLIC) guidance. No federally- or state-listed sensitive plant species, endangered or  
14 threatened plant species, or designated critical habitats occur within the project area; therefore,  
15 no adverse impacts are anticipated.

16 Operation: Impacts would be SMALL. Wildlife habitats could be altered by operations (fencing,  
17 traffic, noise), and individual takes could occur due to conflicts between species habitat and  
18 operations. Contamination or alteration of soils would likely occur from operational leaks and  
19 spills and possible from transportation or land application of treated wastewater. Mitigation  
20 measures such as perimeter fencing, netting, leak detection and spill response plans, and  
21 periodic wildlife surveys would likely reduce the significance of overall impacts. In addition, the  
22 applicant would follow seasonal guidelines for wildlife exclusionary periods.

23 Aquifer Restoration: Impacts would be SMALL. Impacts could include incomplete habitat  
24 disruption. Existing infrastructure would already to be in place, during aquifer restoration  
25 activities, which would produce potential ecological impacts similar to during facility operation.  
26 Therefore, would produce little additional ground disturbance. Migratory birds could be affected  
27 by exposure to constituents in evaporation ponds, but perimeter fencing and netting would  
28 reduce impacts.

29 Decommissioning: Impacts would be SMALL. Wildlife would be temporarily displaced, but are  
30 expected to return after decommissioning and reclamation are completed and vegetation and  
31 habitat are reestablished.

## 32 **Ecological Resources (Vegetation)**

33 Construction: Impacts would be SMALL. Approximately 23.5 ha (58 ac) would be stripped of  
34 vegetation of the total project area of 1,709 ha (4,220 ac). Based on the disturbed land area  
35 compared to the total project area, some individual plants would be affected, but impacts would  
36 not generally affect a sizeable segment of the plant species' population over a relatively large  
37 area. The construction of the CPP, main access roads, surface impoundments, and mine units  
38 would involve removal of vegetation and soil to create level ground for building construction.  
39 Topsoil would be removed and temporarily stockpiled on the site for future decommissioning  
40 and habitat restoration efforts. To stabilize soils and support the ecosystem, vegetation would  
41 be established at disturbed areas with the approved BLM and WDEQ native seed mixture as  
42 soon as conditions allow.

43 Operation: Impacts would be SMALL. Surface disturbance increases the susceptibility of the  
44 project area to invasive and noxious weeds; this would be minimized and vehicular access  
45 would be restricted to specific roads. Additionally, disturbed areas would be reseeded with  
46 WDEQ and BLM approved seed mixture, as soon as conditions allow, preventing the  
47 establishment of competitive weeds. Potential impacts to vegetation from facility operations

1 resulting from spills around well heads and leaks from pipelines would be SMALL and would be  
2 handled using BMPs.

3 Aquifer Restoration: Impacts would be SMALL. Existing infrastructure would already be in  
4 place, aquifer restoration activities would produce potential ecological impacts similar to facility  
5 operation. Adherence to seasonal guidelines established by the WGFD and BLM with respect to  
6 noise, vehicular traffic, and human proximity would mitigate potential impacts to affected  
7 species.

8 Decommissioning: Impacts would be SMALL. Impacts from decommissioning would, in part, be  
9 similar to those discussed for construction of the facility in terms of increased noise and traffic.  
10 The main difference between the decommissioning phase and the construction phase includes  
11 the actual loss of vegetation and habitat during construction, whereas decommissioning would  
12 restore these systems. These impacts would be temporary and also decrease with time, as  
13 reclamation activities preceded.

#### 14 **Air Quality**

15 Construction: Impacts would be SMALL. Air emissions during the construction phase of the  
16 Lost Creek ISR project would consist primarily of fugitive dust and emissions from equipment  
17 running diesel and gasoline-fueled combustion engines such as drill rigs, water trucks,  
18 bulldozers, and light-duty passenger trucks. The site conditions, and proposed activities, at the  
19 Lost Creek site are consistent with the conclusions stated in the GEIS for air quality. The air  
20 quality within the proposed Lost Creek study area would not be substantially affected by project  
21 construction because of: 1) the temporary nature of the activity; 2) the limited footprint of the  
22 construction area relative to the project area; 3) the relatively low volume of traffic and heavy  
23 equipment compared with conventional uranium mining activities and 4) the low background  
24 concentrations of pollutants. Best management practices (BMPs), following BLM and WDEQ  
25 guidelines, would ensure that the construction equipment would minimize fugitive dust  
26 emissions.

27 Operation: Impacts would be SMALL. Operating ISR facilities are not major point source  
28 emitters and are not expected to be classified as major sources during the operation phase.  
29 Potential non-radiological emissions during operations include fugitive dust and exhaust from  
30 equipment, maintenance, transport trucks, and other vehicles. NAAQS attainment areas, non-  
31 radiological air quality impacts would be SMALL

32 Aquifer Restoration: Impacts would be SMALL. Air quality impacts from aquifer restoration are  
33 expected to be similar to, but less than, those during operations because the same  
34 infrastructure is used for aquifer restoration as during operations. Additionally, fugitive dust and  
35 exhaust emissions from vehicles and equipment during this phase is expected to be similar to,  
36 but less than, the dust and exhaust emissions during operations. A small number of vehicles  
37 would be used, and fugitive dust from restoration equipment would be short-term.

38 Decommissioning: Impacts would be SMALL. Decommissioning activities would be similar to  
39 those of construction. Emissions levels would be expected to decrease as decommissioning  
40 proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with  
41 construction, would be short-term, and would be reduced through BMPs (e.g., dust  
42 suppression).

#### 43 **Noise**

44 Construction: Impacts would be SMALL. The use of drill rigs, heavy trucks, bulldozers, and  
45 other equipment used to construct and operate the well fields, drill the wells, develop the  
46 necessary access roads, and build the production facilities would generate noise that would be

audible above the undisturbed background levels. The construction phase sound levels were based upon the reference sound levels, which were projected to receptor locations by established relationships of sound propagation over distance. Construction noise is not expected to be available at the nearest receptor. Administrative and engineering controls would be expected to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection.

Operation: Impacts would be SMALL. Well field equipment (e.g., pumps, compressors) would be contained within structures (e.g., header houses, satellite facilities), reducing potential offsite sound levels. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be expected to be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. This would be relatively short term increase in noise levels. Overall noise impacts within the project area during the operation phase would be compounded based on the overlapping nature of the each of the phases with respect to noise, but would still remain a SMALL impact due to the distance to the nearest receptor.

Aquifer Restoration: Impacts would be SMALL. Sound levels generated during the restoration phase include cement mixers, compressors, and pumps used for the plugging and abandonment of production and injection wells. Noise impacts from aquifer restoration activities would be expected to be similar to, or lower than, the operation phase activities at the site. Equipment and traffic were assumed to be similar to those of the operation phase, the degree of noise impact is the same as the operation phase.

Decommissioning: Impacts would be SMALL. General noise levels during decommissioning and reclamation would be expected to be similar, or less than, those levels experienced during construction. Noise levels would be temporary; once decommissioning and reclamation activities were complete, noise levels would return to ambient, with occasional vehicle traffic for any longer term monitoring activities. The nearest receptor, which is located approximately 24 km (15 mi) northeast of the project area, would not experience any change in sound levels due to decommissioning activities, resulting in no impact.

## Historical and Cultural Resources

Construction: Impacts could be MODERATE. Potential impacts during ISR facility construction could include loss of, or damage to, historic and cultural resources due excavation activities as a part of construction. Three archaeological sites have been recommended as eligible to the NRHP. One of the sites is located within one of the proposed well fields. It is recommended that the site be avoided. If avoidance is not possible, then mitigation measures outlined in a formal treatment plan should be implemented. NRC, BLM, SHPO, and LCI have developed a memorandum of agreement (MOA) to address the implementation of the treatment plan. Implementation of the Treatment Plan, as well as monitoring would reduce the potential for impact from MODERATE to SMALL.

Operation: Impacts would be SMALL. It is expected that potential impacts to historical, cultural, and archaeological resources from operations would be less than during construction, because less land disturbance occurs during the operations phase.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration impacts to historic and cultural resources are expected to be similar to, or less than, potential impacts from operations. Activities during this phase are generally limited to the existing infrastructure and previously disturbed areas.

1 Decommissioning: Impacts would be SMALL. It is expected that decommissioning and  
2 reclamation activities would focus on previously disturbed areas, and that historic and cultural  
3 resources within the potential area of effect would already be known.

#### 4 **Visual/Scenic Resources**

5 Construction: Impacts would be SMALL. During construction, visual resources would be  
6 affected to some degree by vegetative disturbance, road building, drilling, piping, and facility  
7 construction and placement. Most visual and scenic impacts associated with earth-moving  
8 activities during construction would be temporary. Process facility construction and drill rigs  
9 could be visible; however most of these modifications would not be visible from the public road  
10 network, which is lightly traveled. Dust suppression and coloration of well covers would further  
11 reduce overall visual and scenic impacts of project construction so that total impacts would be  
12 SMALL.

13 Operation: Impacts would be SMALL. Visual impacts during operations would be expected to  
14 be less than those associated with construction. The CPP, storage ponds, ancillary buildings,  
15 and pump houses would be the main operational facilities affecting the visual landscape;  
16 however, potential impacts would be short-term. Mitigation through BMPs (e.g., dust  
17 suppression) as well as limiting building height and painting buildings to blend into the natural  
18 landscape would further reduce overall visual and scenic impacts of operations.

19 Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities are expected to  
20 take place some years after the facility had been in operation and that restoration activities  
21 would use in-place infrastructure. As a result, potential visual impacts would be similar to, or  
22 less than, those experienced during operations. Visual Resource impacts from aquifer  
23 restoration would be similar to those seen in the operations phase.

24 Decommissioning: Impacts would be SMALL. Similar equipment would be used and activities  
25 conducted, potential visual impacts during decommissioning would be similar to, or less than,  
26 those experienced during construction. Reclamation efforts are intended to return the visual  
27 landscape to baseline contours and should result in reducing the impacts from operations and  
28 minimizing permanent impacts to visual resources. Mitigation through BMPs (e.g., dust  
29 suppression) would further reduce overall visual and scenic impacts of aquifer restoration so  
30 that total impacts would be SMALL.

#### 31 **Socioeconomics**

32 Construction: Overall, impacts would be SMALL. It is anticipated that construction workers  
33 would only relocate to the region, temporarily, as construction would take less than a year.  
34 Housing would not be affected, as the workers would probably stay in hotels or in trailer parks.  
35 Public service systems, such as schools, utilities, and health care, would not be affected, as  
36 construction workers are not likely to relocate their families for such a short period. The  
37 relatively small workforce, while contributing to the economy of the region, is likely to have only  
38 a SMALL impact, as they would be commuting to the work site from larger communities, such  
39 as Casper, Rawlins and Rock Springs.

40  
41 Operation: Overall, impacts would be MODERATE, especially if the workforce was to reside in  
42 the smaller communities of the region, such as Bairoil, Jeffrey City and Wamsutter. Unlike  
43 construction, which is short-term, operation of the ISR facility would take place over a longer (9-  
44 10 year) period. In addition, operation would require different skills that may only be gotten from  
45 outside the region. It is likely that much of the workforce would relocate their families to the  
46 region, resulting in increased needs for public services (schools, health care and utilities). The  
47 smaller communities could experience a MODERATE impact. There would, however, be a

1 positive impact to the region as income from the workforce and taxes from the ISR facility would  
2 benefit the local economies.

3  
4 Aquifer Restoration: Overall, impacts would be SMALL, primarily because this phase of the ISR  
5 facility lifecycle is similar to the operation phase. The workforce would already be in place, but  
6 would be smaller, as yellowcake would no longer be produced. The potential impacts of this  
7 phase would be substantially reduced, because of the reduction in workforce.

8  
9 Decommissioning: Impacts would be SMALL. This phase of the ISR lifecycle is somewhat  
10 similar to the construction phase, in that it is short-term, and the workforce would not be  
11 'settling' into the region as would the operation/restoration workforce. Potential impacts,  
12 therefore, would be similar to, but slightly less than, those of the construction phase.

### 13 **Environmental Justice**

14 All phases: There would be no adverse disproportionate impacts. Within the area potentially  
15 affected by the Project, minimal minority populations are affected. Since the economic base of  
16 the study area is largely ranching and resource extraction, low-income areas are dispersed  
17 within the study area. No concentration of people living below the poverty level and no  
18 concentrated minority populations are located near the Lost Creek project; therefore, no  
19 adverse environmental impacts would result to minority populations or those living below the  
20 poverty level.

### 21 **Public and Occupational Health and Safety**

22 Construction: Impacts would be SMALL. Other than during well construction, the only significant  
23 radiation exposure pathway during the construction period would be through worker's potential  
24 direct exposure to, inhalation of, or ingestion of high concentrations of radionuclides within and  
25 emanating from (in the case of radon) the disturbed soil. Impacts from inhalation of fugitive dust  
26 would be SMALL due to the fact that radionuclide concentrations are expected to be low.

27 Operation: Impacts could be potentially MODERATE. Radiological impacts during normal  
28 operations would be SMALL. Worker doses at Lost Creek would be determined with the use of  
29 radiation dosimeters and bioassay sampling. All radioactive and potentially toxic liquid waste  
30 from the processing operations is to be disposed of by deep well injection. No routine releases  
31 of radioactive liquids are anticipated at the proposed facility. Radiological and non-radiological  
32 impacts from accidents would be reduced to SMALL (assuming accident procedures are  
33 followed), appropriate measures would be taken to ensure the safety of the workers and the  
34 public.

35 Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities involve activities  
36 similar to those during operations (e.g., operation of well fields, waste water treatment and  
37 disposal) the types of impacts on public and occupational health and safety are expected to be  
38 similar to operational impacts. Some operational activities would be discontinued during this  
39 phase; which would decrease impacts further.

40 Decommissioning: Impacts would be SMALL. The degree of potential impact decreases as  
41 hazards are reduced or removed, soils and facility structures are decontaminated, and lands are  
42 restored to pre-operational conditions. To ensure the safety of the workers and the public during  
43 decommissioning, the NRC requires licensed facilities to submit a decommissioning plan for  
44 review. During all phases, the plan would also need to show that workers and public doses  
45 would be compliant with 10 CFR Part 20 limits. An approved plan would also provide ALARA  
46 provisions to further ensure that best safety practices are being use to minimize radiation  
47 exposures.

1 **Waste Management**

2 Construction: Impacts would be SMALL. Construction activities at the ISR facility would be  
3 relatively small-scale, and sequential well field development would generate low volumes of  
4 construction waste. Most of the wastes expected to be disposed of at Lost Creek during the  
5 construction phase would be solid wastes, such as building materials and piping. No radioactive  
6 wastes are anticipated during this phase; the relatively small amounts of waste generated  
7 during construction would include solid municipal wastes such as paper, wood, plastic, scrap  
8 metal, municipal sludge, and general construction debris.

9 Operation: Impacts would be SMALL. Operational wastes are primarily liquid waste streams  
10 consisting of process bleed (1 to 3 percent of the process flow rate). Additionally, liquid wastes  
11 would also be generated from well development, flushing of depleted eluent to limit impurities,  
12 resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant wash  
13 down water. State permitting actions, NRC license conditions, and NRC inspections ensure that  
14 proper practices, as well as obtain appropriate permits, would be used to comply with safety  
15 requirements to protect workers and the public. LCI is proposing to dispose of the 11e.(2) by  
16 product liquid wastes through deep well injection, at a depth of greater than 2,440 m (8,000 ft).  
17 Proper installation and operating procedures would be used and compliance with WDEQ  
18 requirements for disposal would ensure adequate protection of public and environmental health  
19 and safety.

20 Aquifer Restoration: Impacts would be SMALL. Waste management activities during aquifer  
21 restoration utilize the same treatment and disposal options implemented during normal  
22 operations. Some increase in wastewater volumes may be experienced, but most often this  
23 increase is offset by the decrease in the uranium production capacity.

24 Decommissioning: Impacts would be SMALL. The goal of decommissioning is to reduce  
25 potential impacts by removing contaminants to allowable (regulatory) levels and restoring the  
26 property and lands to pre-operational conditions. LCI has committed to having an agreement  
27 for disposal of 11e.(2) radioactive waste materials in-place before construction of the Lost Creek  
28 project commences. Due to the size of the Lost Creek project and the intent of LCI to  
29 decontaminate and reuse equipment and components, the impact from decommissioning waste  
30 would be SMALL. LCI would utilize well field monitoring instrumentation and routine well field  
31 visual inspections for timely identification and remediation of well and pipeline leaks and spills,  
32 and effectively minimize the potential impact of any well field soil contamination.

33 **CUMULATIVE IMPACTS**

34 The cumulative impact on the environment that results from the incremental impact of the  
35 proposed licensing action when added to other past, present, and reasonably foreseeable future  
36 actions was also considered, regardless of what agency (Federal or non-Federal) or person  
37 undertakes such other actions. The NRC staff determined that the SMALL to MODERATE  
38 impacts from the proposed Lost Creek Project are not expected to contribute perceptible  
39 increases to cumulative impacts, due primarily to the extensive exploration taking place for not  
40 only uranium, but oil and gas, as well.

41 **SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION**

42 The implementation of the proposed action would generate primarily regional and local costs  
43 and benefits. The regional benefits of building the proposed project would be increased  
44 employment, economic activity, and tax revenues in the region around the proposed site. Costs  
45 associated with the proposed Lost Creek Project are, for the most part, limited to the area  
46 surrounding the site.

## 1 **COMPARISON OF ALTERNATIVES**

2 NRC's analysis indicates that the adverse impacts of the reasonable alternatives that were  
3 evaluated would differ from those of the proposed action.

4 For the No-Action alternative, LCI would not construct and operate ISR facilities at the proposed  
5 site. As a result, no uranium ore would be recovered or yellowcake slurry produced from the  
6 Lost Creek proposed site. This alternative would result in neither positive nor negative impacts  
7 to any resource area.

8 The other alternative NRC considered is for LCI to product dried yellowcake at the Lost Creek  
9 Project site. The potential environmental impacts for this alternative are similar to, or smaller  
10 than, the impacts from the proposed action. With the production of dry yellowcake, the number  
11 of trucks leaving the facility with final product would be less. The addition of the yellowcake  
12 dryer would not change the facility's footprint, as the facility, as designed, would have space  
13 allocated for the dryer. Potential air quality impacts would be SMALL as the dryer would  
14 operate under a negative pressure.

## 15 **PRELIMINARY RECOMMENDATION**

16 After weighing the impacts of the proposed action and comparing the alternatives, the NRC  
17 staff, in accordance with 10 CFR 51.71(f), sets forth its preliminary NEPA recommendation  
18 regarding the proposed action. The NRC staff finds that, unless safety issues mandate  
19 otherwise, environmental impacts of the proposed action (issuing a source material license for  
20 the proposed Lost Creek Project) are not so great as to make issuance of a source material  
21 license an unreasonable licensing decision. Additionally, the NRC staff has concluded that the  
22 applicable environmental monitoring program described in Chapter 6 would further reduce  
23 potential adverse environmental impacts associated with the proposed action.

24 The NRC staff has concluded that the overall benefits of the proposed action outweigh the  
25 environmental disadvantages and costs based on consideration of the following:

- 26 • Potential impacts to all environmental resource areas are expected to be  
27 SMALL, with the exception of
  - 28 1) groundwater during operation
  - 29 2) socioeconomics (specifically, demographics, housing, employment structure,  
30 local finance, education, health and social services) during operation, and
  - 31 3) wildlife and cultural resources during constructionwhere such impacts would be MODERATE.
- 32 • ISR operations would take place in ore zone aquifers previously exempted by  
33 the U.S. Environmental Protection Agency as potential public drinking water  
34 sources. Additionally, the applicant would be required to monitor for  
35 excursions of lixiviant from the production zones and to take corrective  
36 actions in the event of an excursion. Finally, the applicant would be required  
37 to restore groundwater parameters affected by ISR operations to levels that  
38 are protective of public health and safety.
- 39 • The applicant has agreed to adhere to the guidelines provided by the  
40 Wyoming Game & Fish Department for species of concern, such as the sage  
41 grouse during construction and operations of the ISR facility.
- 42

- 1       • The regional benefits of building the proposed project would be increased  
2       employment, economic activity, and tax revenues in the region.
- 3       • The costs associated with the proposed project are, for the most part, limited  
4       to the area surrounding the site.
- 5       • A Memorandum of Agreement (MOA) has been developed for the  
6       implementation of a Treatment Plan for a pre-historic site on the Lost Creek  
7       Project Area that is eligible for the National Register. The MOA is currently in  
8       the process of being executed. Signatories include the applicant (LCI), the  
9       Wyoming State Historic Preservation Office, the Bureau of Land  
10       Management, the Wyoming State Attorney General's Office, and the NRC.  
11       This MOA will implement a Treatment Plan for the Excavation of Prehistoric  
12       Site 48SW16604. Terms of this agreement will be negotiated through  
13       consultation between the parties.

## ABBREVIATIONS/ACRONYMS

1		
2	AADT	annual average daily traffic count
3	ADAMS	Agency Wide Documents Access and Management System
4	ACL	Alternate Concentration Limit
5	AEA	Atomic Energy Act
6	ALARA	as low as reasonably achievable
7	AMSL	above mean sea level
8	APE	area of potential effect
9	APLIC	Avian Power Line Interaction Committee
10	AQD	Air Quality Division
11	ARPA	Archaeological Resources Protection Act of 1979
12		
13	bgs	below ground surface
14	BIA	Bureau of Indian Affairs
15	BLM	U.S. Bureau of Land Management
16	BMP	best management practice
17		
18	CAA	Clean Air Act
19	CEQ	Council on Environmental Quality
20	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
21		
22	CESQG	Conditionally Exempt Small Quantity Generator
23	CFR	Code of Federal Regulations
24	CO	carbon monoxide
25	CR	County Route
26	CWA	Clean Water Act
27		
28	dB	decibels
29		
30	EA	Environmental Assessment
31	EIS	Environmental Impact Statement
32	ENSR	ENSR Corporation
33	E.O.	Executive Order
34	EPA	U.S. Environmental Protection Agency
35	ER	Environmental Report
36	ERP	emergency response plan
37	ESA	Endangered Species Act of 1973
38	ESTHPO	Eastern Shoshone Tribal Historic Preservation Office
39		
40	FHWA	Federal Highway Administration
41	FONSI	finding of no significant impact
42	FR	Federal Register
43	FSME	Office of Federal and State Materials and Environmental Management Programs
44		
45	FWS	U.S. Fish and Wildlife Service
46		
47	GEIS	Generic Environmental Impact Statement
48	gpm	gallons per minute
49		

## Abbreviations/Acronyms

---

1	HDPE	high-density polyethylene
2		
3	I	Interstate
4	ISR	in-situ recovery
5		
6	kph	kilometers per hour
7		
8	LCI	Lost Creek ISR, LLC
9	LQD	Land Quality Division
10	Lpm	liters per minute
11		
12	MBHFI	Migratory Birds of High Federal Interest
13	MCL	Maximum Contaminant Level
14	MIT	mechanical integrity test
15	MOA	Memorandum of Agreement
16	MOU	Memorandum of Understanding
17	mph	miles per hour
18	MSDS	material safety data sheets
19		
20	NAAQS	National Ambient Air Quality Standards
21	NCDC	National Climatic Data Center
22	NCRP	National Council for Radiation Protection
23	NATHPO	Northern Arapaho Tribal Historic Preservation Office
24	NEPA	National Environmental Policy Act
25	NHPA	National Historic Preservation Act of 1966, as amended
26	NMSS	Nuclear Materials Safety and Safeguards
27	NOAA	National Oceanographic and Atmospheric Association
28	NOI	Notice of Intent
29	NPDES	National Pollutant Discharge Elimination System
30	NRC	U.S. Nuclear Regulatory Commission
31	NRCS	Natural Resource Conservation Service
32	NRHP	National Register of Historic Places
33	NWI	National Wetlands Inventory
34		
35	OSHA	Occupational Safety and Health Administration
36		
37	PA	Programmatic Agreement
38	PDR	Public Document Room
39	PSD	Prevention of Significant Deterioration
40	psig	pounds per square inch gauge
41	PVC	plastic polyvinyl chloride
42		
43	RAI	Request for Additional Information
44	RCRA	Resource Conservation and Recovery Act
45	RFFA	reasonably feasible future action
46	ROD	Record of Decision
47	ROI	region of influence
48	RTV	Restoration Target Value
49		
50	SDWA	Safe Drinking Water Act
51	SEIS	Supplemental Environmental Impact Statement

1	SER	Safety Evaluation Report
2	SHPO	State Historic Preservation Office
3	SR	State Route
4	SWCSWD	Sweetwater County Solid Waste District
5		
6	T&E	Threatened and Endangered
7	TCP	Traditional Cultural Property
8	TEDE	Total Effective Dose Equivalent
9	TDS	total dissolved solids
10	THPO	Tribal Historic Preservation Office
11	TPQ	Threshold Planning Quantity
12	TQ	Threshold Quantity
13	TR	Technical Report
14	TSCA	Toxic Substances Control Act
15	TSS	total suspended solids
16		
17	UCL	upper control limits
18	UIC	underground injection control
19	UMTRCA	Uranium Mill Tailings Radiation Control Act
20	U.S.	United States (or) United States Highway
21	USACE	U.S. Army Corps of Engineers
22	USDA	U.S. Department of Agriculture
23	USDOT	U.S. Department of Transportation
24	USFS	U.S. Forest Service
25	USC	United States Code
26	USCB	U.S. Census Bureau
27	USGS	U.S. Geological Survey
28		
29	VRM	Visual Resource Management
30		
31	WDE	Wyoming Department of Education
32	WDEQ	Wyoming Department of Environmental Quality
33	WDOE	Wyoming Department of Employment, Research, and Planning
34	WDOR	Wyoming Department of Revenue
35	WGFD	Wyoming Game and Fish Department
36	WNDD	Wyoming Natural Diversity Database
37	WQD	Water Quality Division
38	W.S.	Wyoming Statute
39	WSEO	Wyoming State Engineer's Office
40	WYDOT	Wyoming Department of Transportation
41	WYNDD	Wyoming Natural Diversity Database
42	WYPDES	Wyoming Pollutant Discharge Elimination System
43		



# SI\* (MODERN METRIC) CONVERSION FACTORS

1  
2

Approximate Conversions From SI Units				
Symbol	When You Know	Multiply By	To Find	Symbol
<b>Length</b>				
cm	centimeters	0.39	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
<b>Area</b>				
mm <sup>2</sup>	square millimeters	0.0016	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	10.764	square feet	ft <sup>2</sup>
m <sup>2</sup>	square meters	1.195	square yards	yd <sup>2</sup>
ha	hectares	2.47	acres	ac
km <sup>2</sup>	square kilometers	0.386	square miles	mi <sup>2</sup>
<b>Volume</b>				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m <sup>3</sup>	cubic meters	35.314	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.307	cubic yards	yd <sup>3</sup>
m <sup>3</sup>	cubic meters	0.0008107	acre-feet	acre-feet
<b>Mass</b>				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
<b>Temperature (Exact Degrees)</b>				
°C	Celsius	1.8C + 32	Fahrenheit	°F
<p>*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM E380 (ASTM International. "Standard for Metric Practice Guide." West Conshohocken, Pennsylvania: ASTM International. Revised 2003.).</p>				



# 1 INTRODUCTION

## 2 1.1 Background

3 The U.S. Nuclear Regulatory Commission (NRC) prepared this Supplemental Environmental  
4 Impact Statement (SEIS) in response to an application submitted by Lost Creek ISR, LLC (LCI)  
5 on March 20, 2008, to develop and operate the Lost Creek Project located in Sweetwater  
6 County, Wyoming (Figure 1-1), by the in-situ leach (ISL) uranium recovery process (also known  
7 as the in-situ recovery (ISR) process) (LCI, 2008a, 2008b). LCI is a wholly owned subsidiary of  
8 UR-Energy USA, Inc. This SEIS supplements the Generic Environmental Impact Statement for  
9 In-Situ Leach Uranium Milling Facilities (referred to herein as the GEIS) in accordance with the  
10 process described in Section 1.8 of the GEIS (NRC, 2009) and as detailed in Section 1.4.1 of  
11 this chapter. The NRC's Office of Federal and State Materials and Environmental Management  
12 Programs prepared this SEIS as required by Title 10, "Energy," of the U.S. Code of Federal  
13 Regulations (10 CFR) Part 51. These regulations implement the requirements of the National  
14 Environmental Policy Act of 1969 (NEPA), as amended (Public Law 91-190) which requires the  
15 Federal Government to assess the potential environmental impacts of major federal actions that  
16 may significantly affect the human environment.

17 Subsequently, by letter dated July 2, 2009, LCI submitted an exemption request to the NRC.  
18 LCI is seeking an exemption from the "commencement of construction" provisions of 10 CFR  
19 Part 40.32(e) for certain activities that were described in its request. The NRC staff is  
20 considering granting LCI the request, but at the time of this draft, has not fulfilled the  
21 requirements to issue the exemption.

## 22 1.2 The Proposed Action

23 On March 20, 2008, LCI initiated the proposed federal action by submitting an application for an  
24 NRC source material license to construct and operate an ISR facility at the Lost Creek Project  
25 site and to conduct the consequent aquifer restoration and site decommissioning and  
26 reclamation activities. Based on the application, the NRC's federal action is the decision  
27 whether to issue the license to LCI. LCI's proposal is discussed in detail in Section 2.1.1 of this  
28 SEIS.

## 29 1.3 Purpose of and Need for the Proposed Action

30 NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic  
31 Licensing of Source Material." LCI is seeking an NRC source material license to authorize  
32 commercial-scale ISR uranium recovery at the Lost Creek Project site. The purpose and need  
33 for the proposed action is to provide an option that allows for the applicant to use ISR  
34 technology to recover uranium and produce yellowcake slurry at the Lost Creek Project Site.  
35 Yellowcake is the uranium oxide product of the ISR milling process that is used to produce fuel  
36 for commercially-operated nuclear power reactors.

37 This definition of purpose and need reflects the Commission's recognition that, unless there are  
38 findings in the safety review required by the Atomic Energy Act or findings in the NEPA  
39 environmental analysis that would lead the NRC to reject a license application, the NRC has no  
40 role in a company's business decision to submit a license application to operate an ISR facility  
41 at a particular location.

1 **1.4 Scope of the Supplemental Environmental Analysis**

2 The NRC prepared this SEIS to analyze the potential environmental impacts (i.e., direct,  
3 indirect, and cumulative impacts) of the proposed action and of reasonable alternatives to the  
4 proposed action. The scope of this SEIS considers both radiological and non-radiological  
5 (including chemical) impacts associated with the proposed action and its alternatives. This  
6 SEIS also considers unavoidable adverse environmental impacts, the relationship between  
7 short-term uses of the environment and long-term productivity, and irreversible and irretrievable  
8 commitments of resources.

9

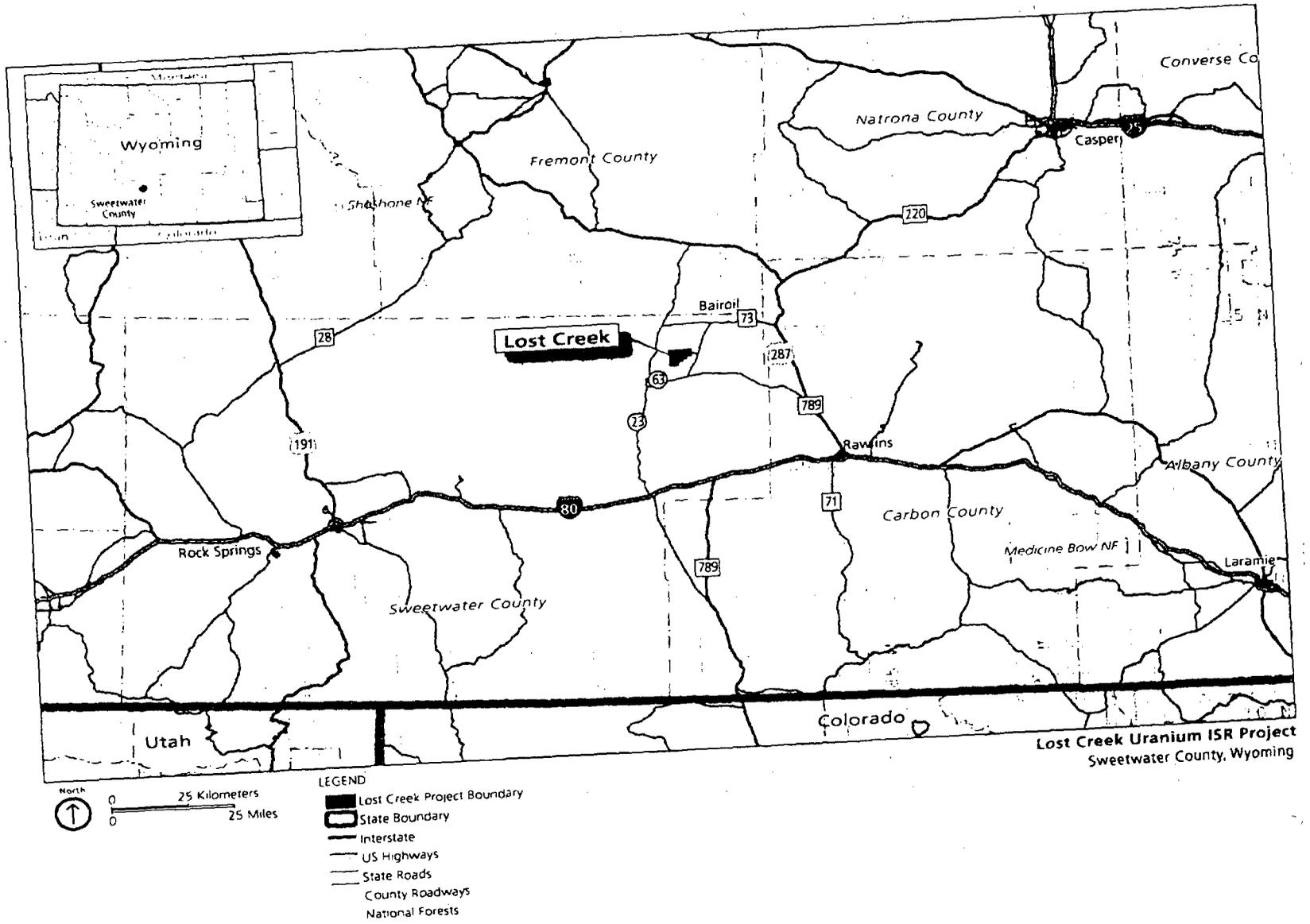


Figure 1-1. Project Location

1 **1.4.1 Relationship to the GEIS**

2 As discussed previously, this SEIS will supplement the GEIS, published as a final report in  
 3 June 2009 (NRC, 2009). The final GEIS assessed the potential environmental impacts  
 4 associated with the construction, operation, aquifer restoration, and decommissioning of an ISR  
 5 facility located in four specific geographic regions of the western United States. The proposed  
 6 Lost Creek is located in one such region, the Wyoming West Uranium Milling Region. Table 1-1  
 7 summarizes the expected environment impacts by resource area in the Wyoming West Uranium  
 8 Milling Region based on the GEIS analyses.

**Table 1-1. Summary of Expected Impacts in the Wyoming West Uranium Milling Region**

Resource Area	Construction	Operation	Aquifer Restoration	Decommissioning
Land Use	S to L	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S	S to M	S	S
Groundwater	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S to L	S	S
Air Quality	S	S	S	S
Noise	S to M	S	S to M	S
Historical and Cultural Resources	S to L	S to L	S to L	S to L
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S to M	S to M
Public and Occupational Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

S: SMALL impact M: MODERATE impact L: LARGE impact  
 Source: NRC, 2009

9

1. In defining the scope of this SEIS, the NRC staff considers the scope of the GEIS to be  
2 sufficient for this purpose. NRC accepted public comments on the scope of the GEIS from  
3 July 24 to November 30, 2007, and held three public scoping meetings, one of which was in the  
4 State of Wyoming, to aid in this effort. Additionally, NRC held eight public meetings to receive  
5 comments on the draft GEIS, published in July 2008. Three of these meetings were held in the  
6 State of Wyoming. Comments on the draft GEIS were accepted between July 28 and  
7 November 8, 2008. Comments received during scoping and on the draft GEIS are available  
8 through NRC's Agency-wide Documents Access and Management System (ADAMS) database  
9 on the NRC's website (<http://www.nrc.gov/reading-rm/adams.html>). Transcripts of the scoping  
10 meeting and draft GEIS comment meetings in Wyoming are available at  
11 <http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html>. A scoping  
12 summary report is provided as Appendix A to the GEIS (NRC, 2009).

13 The SEIS was prepared to fulfill the requirement at 10 CFR 51.20(b)(8) to prepare either an EIS  
14 or supplement to an EIS for the issuance of a source material license for an ISR uranium  
15 recovery facility (NRC, 2009). The GEIS provides a starting point for NRC's NEPA analyses for  
16 site-specific license applications for new ISR facilities, as well as for applications to amend or  
17 renew existing ISR licenses. This SEIS tiers from the GEIS by incorporating by reference  
18 relevant information, findings and conclusions concerning potential environmental impacts. The  
19 extent to which NRC incorporates GEIS impact conclusions depends on the consistency  
20 between LCI's proposed facility and activities and conditions at the proposed Lost Creek Project  
21 site and the reference facility description and activities and information or conclusions in the  
22 GEIS. NRC's determinations regarding potential environmental impacts and the extent to which  
23 GEIS impact conclusions were incorporated by reference are discussed in Chapter 4 of this  
24 SEIS. Section 1.8.3 of the GEIS describes in more detail the relationship between the GEIS  
25 and the conduct of site-specific reviews as documented in this SEIS.

#### 26 **1.4.2 Public Participation Activities**

27 As part of the preparation of this SEIS, NRC staff met with federal, state, and local agencies and  
28 authorities during the course of an expanded visit to the Lost Creek site and vicinity in January  
29 2009. The purpose of these meetings was to gather additional site-specific information to assist  
30 in the NRC staff's environmental review and to aid the staff in its determination of the  
31 consistency between site and local information and similar information in the GEIS. As part of  
32 this effort to gather additional site-specific information, the NRC staff also contacted potentially  
33 interested Native American tribes and local authorities, entities, and public interest groups in  
34 person and via e-mail and telephone.

35 NRC published a Notice of Opportunity for Hearing in the *Federal Register* on July 10, 2008  
36 related to the Lost Creek license application (73 FR 39728). NRC also published a Notice of  
37 Intent to prepare this SEIS on September 3, 2009 (74 FR 45656).

#### 38 **1.4.3 Issues Studied in Detail**

39 To meet its NEPA obligations related to its review of the Lost Creek license application, the  
40 NRC staff has conducted an independent, detailed, comprehensive evaluation of the potential  
41 environmental impacts from construction, operation, aquifer restoration, and decommissioning  
42 of an ISR facility at the Lost Creek site. As discussed in Section 1.8.3 of the GEIS, the GEIS  
43 (1) provided an evaluation of the types of environmental impacts that may occur from ISL  
44 uranium milling facilities, (2) identified and assessed impacts that are expected to be generic  
45 (the same or similar) at all ISL facilities (or those with specified facility or site characteristics),  
46 and (3) identified the scope of environmental impacts that needed to be addressed in site-

1 specific environmental reviews. Therefore, although all of the environmental resource areas  
2 identified in the GEIS will be addressed in site-specific reviews, certain resource areas would  
3 require a more detailed analysis, because the GEIS analysis found that a range in the  
4 significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result given  
5 site-specific conditions (see Table 1-1).

6 In this SEIS, the following resource areas have received a more detailed analysis:

- 7 • Land Use
- 8 • Historic and Cultural Resources
- 9 • Transportation
- 10 • Surface Water
- 11 • Groundwater
- 12 • Terrestrial Ecology
- 13 • Threatened and Endangered Species
- 14 • Noise
- 15 • Socioeconomics
- 16 • Public Health and Safety

17 Furthermore, certain site-specific analyses not conducted in the GEIS (e.g., assessment of  
18 cumulative impacts, analysis of environmental justice concerns) were considered in this SEIS.  
19 In addition, the applicant (LCI) submitted an Environmental Report (ER) as part of its license  
20 application. This document is available for review from NRC's public web site under ADAMS,  
21 and contains detailed site information that is referenced throughout this document.

#### 22 **1.4.4 Issues Outside the Scope of the SEIS**

23 Some issues and concerns raised during the scoping process on the GEIS (NRC, 2009;  
24 Appendix A) were determined to be outside the scope of the GEIS. These issues and concerns,  
25 (e.g., general support or opposition for uranium milling, potential impacts associated with  
26 conventional uranium milling, comments regarding the alternative sources of uranium feed  
27 material, comments regarding energy sources, requests for compensation for past mining  
28 impacts, and comments regarding the credibility of NRC) are also found to be outside the scope  
29 of this SEIS.

#### 30 **1.4.5 Related NEPA Reviews and Other Related Documents**

31 A number of NEPA documents (EAs and EISs), primarily prepared by the Bureau of Land  
32 Management (BLM) were reviewed and used in the development of this SEIS. They are  
33 presented in Table 5-4 of the Cumulative Impact Chapter of this document. Most deal with  
34 proposed energy-related projects (oil, gas, coal extraction), but some were prepared for regional  
35 plans (e.g., Great Divide Resource Management Plan).

36 Also reviewed, and used extensively, were the following:

- 37 • **NUREG-1910, Generic Environmental Impact Statement for In-Situ Leach Uranium**  
38 **Milling Facilities, Final Report (June 2009).** As discussed previously, this GEIS was  
39 prepared to assess the potential environmental impacts from the construction, operation,  
40 aquifer restoration, and decommissioning of an ISR facility located in four different

1 geographic regions of the western United States, including the Wyoming West Uranium  
2 Milling Region where the Lost Creek Project is located. The environmental analysis in this  
3 SEIS tiers from the GEIS.

- 4 • **NRC's Safety Evaluation Report.** The NRC staff is preparing an SER for the Lost Creek  
5 ISR project. In the SER, the NRC staff evaluates whether the licensee's proposed action  
6 can be accomplished in accordance with the applicable provisions in 10 CFR Part 20 10  
7 CFR Part 40, and 10 CFR Part 40, Appendix A. The SER evaluates the licensee's proposed  
8 facility design, operational procedures, and radiation protection program to ensure that the  
9 applicable requirements in 10 CFR Part 20 and 10 CFR Part 40 would be met by the  
10 applicant. The SER also provides the staff's analysis of the initial estimate from the  
11 applicant of the funding needed to complete site decommissioning and reclamation.
- 12 • **BLM, EA, Wind Dancer Natural Gas Development Project (WDNGDP) (BLM, 2004).**  
13 This EA was prepared for the Wind Dancer Natural Gas Development Project that would  
14 explore and develop natural gas resources within the jurisdiction of the RFO. This EA was  
15 prepared to analyze impacts associated with the construction, drilling, production,  
16 maintenance, and reclamation of natural gas wells northwest of Rawlins, Wyoming.
- 17 • **BLM, Stewart Creek-Lost Creek Excess and Stray Wild Horses Removal (BLM, 2006).**  
18 The Great Divide Resource Management Plan (RMP), as amended, identifies three wild  
19 horse herd management areas (HMAs) within which wild, free-roaming horses will be  
20 managed in a humane, safe, efficient, and environmentally sound manner. This EA  
21 analyzed the impacts associated with the BLM's proposal to remove excess and stray wild  
22 horses from the Stewart Creek and Lost Creek Wild Horse HMAs and nearby areas (North  
23 of I-80 and West of Hwy 287, EA# WY030-06-EA-165).
- 24 • **BLM, Final EIS, Rawlins Field Office Planning Area Resource (BLM, 2008).** This  
25 Management Plan, Addresses the Comprehensive Analysis of Alternatives for the Planning  
26 and Management of Public Land and Resources Administered by BLM, Albany, Carbon,  
27 Laramie, and eastern Sweetwater Counties, WY, WY-030-07-1610-DQ.
- 28 • **BLM, Red Desert Complex Wild Horse Gather (BLM, 2009).** (Antelope Hills,  
29 Crooks Mountain, Green Mountain, Stewart Creek and Lost Creek Wild Horse Herd  
30 Management Areas HMAs), 4700 (WYD03), BLM Rawlins and Lander Offices  
31 prepared this EA to disclose and analyze the environmental consequences of  
32 gathering excess wild horses in the Red Desert Wild Horse Herd Management Area  
33 (HMA) Complex. The HMAs included in this complex are Lost Creek, Stewart Creek,  
34 Green Mountain, Crooks Mountain and Antelope Hills.

## 35 1.5 Applicable Regulatory Requirements

36 The *National Environmental Policy Act of 1969, as amended* (NEPA) establishes national  
37 environmental policy and goals to protect, maintain, and enhance the environment. NEPA  
38 provides a process for implementing these specific goals for those Federal agencies  
39 responsible for an action. This SEIS was prepared in accordance with NEPA requirements and  
40 NRC's implementing regulations in 10 CFR Part 51. Sections 1.6.3.1 and 1.7.5.1 of the GEIS  
41 provide a summary of the State of Wyoming's statutory authority pursuant to the ISR process,  
42 relevant state agencies that are involved in the permitting of an ISR facility, and the range of  
43 state permits that would be required.

**1.6 Licensing and Permitting**

NRC has statutory authority through the *Atomic Energy Act*, as amended by the *Uranium Mill Tailings Radiation Control Act* (UMTRCA) to regulate uranium ISR facilities. In addition to obtaining an NRC license, uranium ISR facilities must also obtain the necessary permits from the appropriate federal, state, local and tribal governmental agencies. The NRC licensing process for ISR facilities was described in Section 1.7.1 of the GEIS. Sections 1.7.2 through 1.7.5 of the GEIS describe the role of the other Federal, tribal, and state agencies in the ISR permitting process.

This section of the SEIS summarizes the status of the NRC licensing process at the Lost Creek site and the status of LCI's permitting with respect to other applicable Federal, tribal, and state requirements.

**1.6.1 NRC Licensing Process**

By letter dated March 20, 2008, LCI submitted a final (revised) license application to NRC for the Lost Creek project (LCI, 2008a, 2008b). As discussed in Section 1.7.1 of the GEIS, NRC initially conducts an acceptance review of a license application to determine whether the application is complete enough to support a detailed technical review. The NRC staff accepted the Lost Creek license application for detailed technical review by letter dated June 10, 2008 (NRC, 2008).

The NRC's detailed technical review of the Lost Creek license application is comprised of both a safety review and an environmental review. These two reviews are conducted in parallel (see Figure 1.7-1 of the GEIS). The focus of the safety review is to assess compliance with the applicable regulatory requirements in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51.

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with the proposed licensing actions. No request for a hearing was received on the Lost Creek license application.

**1.6.2 Status of Permitting with Other Federal, Tribal, and State Agencies**

In addition to obtaining a source material license from NRC prior to conducting ISR operations at the Lost Creek site, LCI is also required to obtain necessary permits and approvals from other federal, tribal, and state agencies. These permits and approvals would address issues such as (1) the underground injection of solutions and wastewater associated with the ISR process; (2) the exemption of all or a portion of the mining zone aquifer from regulation under the Safe Drinking Water Act; and (3) the discharge of stormwater during construction and operation of the ISR facility.

Table 1-2 provides the status of LCI's efforts to obtain these necessary permits and approvals.

**Table 1-2. Environmental Approvals for the Lost Creek ISR Project**

License or Permit	Issuing Agency	Status
Source and By Product Material License	U.S. Nuclear Regulatory Commission	Application under review

<b>Table 1-2. Environmental Approvals for the Lost Creek ISR Project</b>		
<b>License or Permit</b>	<b>Issuing Agency</b>	<b>Status</b>
Plan of Operation	U.S. Bureau of Land Management	To be submitted
Permit to Mine	Wyoming Department of Environmental Quality	Application submitted Dec. 2007, under review
Mineral Exploration Permit	Wyoming Department of Environmental Quality	Drill Notice received
License to Mine	Wyoming Department of Environmental Quality	Application submitted Dec. 2007, under review
Underground Injection Control Permit Class I (Deep Disposal Wells)	Wyoming Department of Environmental Quality	Submitted Jun. 2009, under review
Aquifer Exemption Permit for Class I Injection Wells	Wyoming Department of Environmental Quality U.S. Environmental Protection Agency	Not required since receiving aquifer is not a SWDA classified
Underground Injection Control Permit Class III (ISR Wells)	Wyoming Department of Environmental Quality	Application submitted Dec. 2007, under review
Aquifer Exemption Permit for Class III Injection Wells	Wyoming Department of Environmental Quality U.S. Environmental Protection Agency	TBD
Permit to Construct Waste Ponds	Wyoming Department of Environmental Quality And State Engineer's Office	Application submitted Dec. 2007 to WDEQ, under review. Application to State Engineer is pending
Permit to Appropriate Groundwater for Mine Units	Wyoming State Engineer's Office	Applications for permits submitted as needed
Permit to Construct Sanitary Leach Field	Sweetwater County	Application submitted Jun. 2009, under review
Air Quality Permit	Wyoming Department of Environmental Quality	Application submitted Jun. 2008, under review
Storm Water Discharge Permit	Wyoming Department of Environmental Quality	
County Development Permits	Sweetwater County Planning Commission	

1 Source: (LCI, 2009)

2 **1.7 Consultations**

3 As a Federal agency, the NRC is required to comply with consultation requirements in Section 7  
 4 of the *Endangered Species Act of 1973*, as amended, and Section 106 of the *National Historic*  
 5 *Preservation Act of 1966*, as amended. The GEIS took a programmatic look at the

1 environmental impacts of ISL uranium mining on four distinct geographic regions and  
2 acknowledged that each site-specific review would include its own consultation process with  
3 relevant agencies. Section 7 and Section 106 consultation conducted for the Lost Creek is  
4 summarized in Sections 1.7.1 and 1.7.2 below. Copies of the correspondence for this  
5 consultation are provided in Appendix A of this SEIS. Section 1.7.3 discusses NRC  
6 coordination with other federal, state, and local agencies that was conducted during the  
7 development of the SEIS.

### 8 **1.7.1 Endangered Species Act of 1973 Consultation**

9 The Endangered Species Act was enacted to prevent the further decline of endangered and  
10 threatened species and to restore those species and their critical habitats. Section 7 of the Act  
11 requires consultation with the U.S. Fish and Wildlife Service (USFWS) to ensure that actions  
12 they authorize, permit or otherwise carry out will not jeopardize the continued existence of any  
13 listed species or adversely modify designated critical habitats.

14 By letter dated October 3, 2008, NRC staff initiated consultation with the USFWS, requesting  
15 information on endangered or threatened species or critical habitat in the Lost Creek area. NRC  
16 received a response from the Ecological Services Wyoming Field Office of the USFWS, dated  
17 November 12, 2008, that: 1) provided a list of the T&E species that may occur in the project  
18 area, 2) discussed obligations to protect migratory birds, 3) noted the negative impacts that can  
19 result from the land application of ISR wastewater, and 4) recommended avoidance of wetland  
20 and riparian areas and protection of sensitive species, such as the mountain plover and sage  
21 grouse (USFWS, 2008).

22 NRC staff also met with the USFWS Rawlins office on January 13, 2009 to discuss site-specific  
23 issues. The main concern expressed by the Rawlins office was potential impacts to sage  
24 grouse and typical mitigation measures were discussed.

### 25 **1.7.2 National Historic Preservation Act of 1966 Consultation**

26 Section 106 of the NHPA requires that federal agencies take into account the effects of their  
27 undertakings on historic properties and allow the Wyoming SHPO to comment on such  
28 undertakings.

29 NRC initiated consultation with the Wyoming SHPO via a letter dated October 3, 2008,  
30 requesting information from the SHPO to facilitate the identification of historic and cultural  
31 resources that could be affected by the proposed project. NRC staff also met with a member of  
32 the SHPO's office on January 12, 2009 to discuss site-specific issues, including Wyoming  
33 SHPO's review process, cumulative impacts to historic sites, and best management practices  
34 (BMPs). The staff also met with the SHPO on June 25, 2009 to discuss protocol for  
35 archaeological sites found eligible for inclusion in the *National Register of Historic Places*. The  
36 NRC staff will continue to consult with the Wyoming SHPO throughout the environmental review  
37 process regarding a determination of effects on cultural and historic resources.

### 38 **1.7.3 Coordination with Other Federal, Tribal, State, and Local Agencies**

39 The NRC staff interacted with multiple federal, tribal, state, and local agencies and/or entities  
40 during preparation of this SEIS to gather information on potential issues, concerns, and  
41 environmental impacts related to the proposed ISR facility at the Lost Creek site. The  
42 consultation and coordination process included, but was not limited to, discussions with the  
43 BLM, the Bureau of Indian Affairs (BIA), tribal governments (Eastern Shoshone and Northern

1 Arapaho), the WDEQ (Land Quality Division [LQD]), the WSEO, and local organizations  
2 (Sweetwater County, Town of Bairoil).

### 3 *1.7.3.1 Coordination with the Bureau of Land Management*

4 The BLM is responsible for administering the National System of Public Lands and the federal  
5 minerals underlying these lands. The BLM is also responsible for managing split estate  
6 situations where federal minerals underlie a surface that is privately held or owned by state or  
7 local government. In these situations, operators on mining claims, including ISR uranium  
8 recovery operations, must submit a plan of operations and obtain BLM approval before  
9 beginning operations beyond those for casual use (for surface disturbance of more than 5  
10 acres). Currently, the NRC and the BLM are finalizing a Memorandum of Understanding  
11 (MOU), such that the BLM and NRC would offer each other cooperating agency status for  
12 environmental reviews of ISR licensing projects involving BLM-managed lands. NRC staff  
13 coordinated with the BLM during preparation of this Draft SEIS, and the BLM has provided  
14 information and guidance on energy-related activities in the region, such as coal leases, oil and  
15 gas leases, wind energy, and uranium extraction. The BLM conducted EISs for many of these  
16 activities and has prepared resource management plans to manage their own lands. The BLM  
17 also has a Cooperating Agency agreement with the WDEQ and a programmatic agreement with  
18 the Wyoming SHPO.

19 The NRC met with the staffers from several BLM offices in January 2009, including the State  
20 Office in Cheyenne, Rawlins Field Office, and the Casper Field Office. The BLM provided  
21 clarification on how mineral leases are administered on BLM lands, and expressed concerns  
22 related to water quality and hydrology at ISR sites, cumulative effects due to the other energy  
23 operations (coal, oil and gas, wind energy, and operating ISR facilities) in the vicinity of the  
24 proposed ISR sites, and the potential impacts to socioeconomic in the communities  
25 surrounding the proposed ISR sites. The BLM also provided guidance on typical mitigation  
26 measures to protect cultural resources and sage grouse.

27 In addition to the January 2009 meetings, the NRC staff consults with the Wyoming BLM offices  
28 on a regular basis regarding the progress on the staff's environmental review for the Lost Creek  
29 Project. The NRC shared its preliminary and draft sections of the SEIS, and ensured that the  
30 BLM is copied on all NRC correspondence with LCI.

### 31 *1.7.3.2 Coordination with the Bureau of Indian Affairs*

32 The Bureau of Indian Affairs' (BIA's) mission is to enhance the quality of life, to promote  
33 economic opportunity, and to carry out the responsibility to protect and improve the trust assets  
34 of American Indians, Indian tribes, and Alaska Natives. BIA is responsible for the administration  
35 and management of 66 million acres of land held in trust by the United States for American  
36 Indian, Indian tribes, and Alaska Natives.

37 The NRC staff met with staff from the BIA in Fort Washakie, Wyoming on January 15, 2009.  
38 The NRC staff briefed the BIA on potential IRS facilities proposed in Wyoming, and the two  
39 staffs discussed how the BIA and Indian tribes would be involved in the environmental review  
40 process. The BIA stated that tribal governments should be consulted for any projects in the  
41 state. BIA also recommended that tribal elders be involved in cultural and historic surveys.

### 42 *1.7.3.3 Interactions with Tribal Governments*

43 In response to guidance from Wyoming SHPO and to carry out E.O. 13175, "Consultation and  
44 Coordination with Indian Tribal Governments," the NRC staff initiated discussions with  
45 potentially affected Native American tribes. Letters dated December 24, 2008, were sent to the

1 following nine Tribes to solicit their comments or concerns regarding cultural resources on ISR  
2 projects:

- 3 • Eastern Shoshone
- 4 • Northern Arapaho
- 5 • Northern Cheyenne
- 6 • Blackfeet
- 7 • Three Affiliated Tribes
- 8 • Ft. Peck Assinboine/Sioux
- 9 • Oglala Sioux
- 10 • Crow
- 11 • Cheyenne River Sioux

12 No responses from these Tribes were received on the general inquiry. For reference, only one  
13 letter is presented within Appendix A. However, with specific regard to the Lost Creek project,  
14 several communications have taken place with the Eastern Shoshone and Northern Arapaho  
15 Tribal Historic Preservation Officers concerning an eligible pre-historic site discovered in the  
16 project area. Tribal Historic Preservation Officers (THPOs) from each of these two Tribes have  
17 been informed on the progress of the Lost Creek project. The THPO from the Eastern  
18 Shoshone visited the Lost Creek site and determined that it held no interest to the tribe.

19 *1.7.3.4 Coordination with the Wyoming Department of Environmental Quality*

20 NRC staff met with the WDEQ in Cheyenne on January 12, 2009 to discuss the WDEQ's role in  
21 NRC's environmental review process for ISR facilities. Issues discussed during the meeting  
22 included the WQD storm water program, air quality review and permitting, and noise quality.  
23 The WDEQ also provided clarification on the classification of deep well injections. The WDEQ  
24 expressed concern related to reclamation and restoration, and noted that groundwater quality  
25 should be returned to baseline conditions. The WDEQ requested early involvement in the  
26 NRC's review of applications for proposed ISR projects in the State. They also emphasized  
27 coordination with the BLM when ISR projects are located on BLM lands.

28 NRC staff also met with District 2 personnel of the WDEQ-LQD on January 14, 2009. The  
29 WDEQ-LQD explained the UIC Class III well application process, and noted that the WDEQ  
30 would require well field packages and groundwater restoration standards for future ISR  
31 operations. They expressed concern about potential excursions and unconfined aquifers.  
32 WDEQ-LQD staff also stated their position that the parameters in groundwater affected by ISR  
33 operations need to be restored to original background levels. Two meetings were held with  
34 NRC and WDEQ staff (June and September 2009) to discuss groundwater issues.

35 *1.7.3.5 Coordination with the Wyoming Game and Fish Department*

36 The WGFD is responsible for controlling, propagating, managing, protecting, and regulating all  
37 game and non-game fish and wildlife in Wyoming under Wyoming Statute (W.S.) 23-1-301-303  
38 and 23-1-401. Regulatory authority given to WGFD allows for the establishment of hunting,  
39 fishing, and trapping seasons, as well as the enforcement of rules protecting non-game and  
40 state listed species.

41 NRC staff met with a representative of the Lander Regional WGFD office on January 14, 2009.  
42 The main issue discussed centered on the sage grouse. The project area includes habitat for a  
43 variety of big game animals, raptors, migratory birds, and small mammals that may be affected

1 by the project. In addition, the property is part of a larger region of the state dedicated as a  
2 “core breeding area” for the greater sage-grouse. The WGFD’s interest includes impacts to  
3 migratory behavior patterns, long-term population sustainability, and the effects on local hunting  
4 on big game; impacts to nesting raptors; and the loss of nesting habitat for the greater sage-  
5 grouse.

6 *1.7.3.6 Coordination with the Wyoming State Engineer’s Office*

7 NRC staff met with the Wyoming State Engineer’s Office (WSEO) on January 12, 2009 to  
8 discuss well permitting. The WSEO was primarily concerned that proposed ISR facilities do not  
9 degrade the water quality, and that potential groundwater contamination be maintained onsite.  
10 They also expressed the need for applicants to ensure that there was close, professional  
11 supervision of well construction.

12 *1.7.3.7 Coordination with the Wyoming Governor’s Planning Office*

13 NRC staff met with the Wyoming Governor’s Planning Office on January 13, 2009 and again on  
14 June 25, 2009. The Wyoming Governor’s Planning Office briefed the NRC on the BLM  
15 Resource Management Plan for the Buffalo region. They stated that they are a cooperating  
16 agency with the BLM and are involved with anything related to natural resources, particularly  
17 BLM resource management plans, and with the Wyoming SHPO and WDEQ. They informed  
18 NRC of the statewide conservation and management efforts for sage grouse and noted that the  
19 governor has created a management plan for the protection of sage grouse. They emphasized  
20 that potential ISR facilities need to be geographically flexible to protect the core sage grouse  
21 areas.

22 *1.7.3.8 Coordination with the Wyoming Community Development Authority*

23 NRC staff met with the Wyoming Community Development Authority on January 13, 2009 to  
24 discuss housing availability for employees of future potential ISR facilities. They noted that  
25 employees would typically look for housing in the surrounding communities and this might  
26 include hotels, apartments, or single-family homes.

27 *1.7.3.9 Coordination with Localities*

28 The NRC staff interacted with several local county and city entities in the vicinity of the project  
29 area. This has included phone calls as well as face-to-face meetings. NRC met with several  
30 local county and city entities on January 13 and 14, 2009 to discuss site-specific issues for the  
31 Lost Creek project. Meetings held in the county offices of both Sweetwater and Fremont  
32 Counties focused on local economies, housing availability, and community services.  
33 Representatives from the Town of Bairoil were also present at the Sweetwater County meeting.

34 **1.8 Structure of the SEIS**

35 As noted in Section 1.4.1 of this document, the GEIS (NRC, 2009) evaluated the broad impacts  
36 of ISR projects in a four-state region where such projects are common, but did not reach site-  
37 specific decisions for new ISR projects. In this SEIS, the NRC staff evaluated the extent to  
38 which information and conclusions in the GEIS could be incorporated by reference. The NRC  
39 staff also determined whether any new and significant information existed that would change the  
40 expected environmental impact beyond what was discussed in the GEIS.

41 Chapter 2 of this SEIS describes the proposed action and reasonable alternatives considered  
42 for the Lost Creek site, Chapter 3 describes the affected environment for the Lost Creek site,  
43 and Chapter 4 evaluates the environmental impacts from implementing the proposed action and  
44 alternatives. Cumulative impacts are discussed in Chapter 5, while Chapter 6 provides details

1 on the environmental measurement and monitoring programs proposed for the Lost Creek. A  
2 cost-benefit analysis is provided in Chapter 7, and a summary of environmental consequences  
3 from the proposed action is tabulated in Chapter 8.

#### 4 **1.9 References**

5 10 CFR Part 2. Code of Federal Regulations, Title 10, *Energy*, Part 2, "Rules of Practice for  
6 Domestic Licensing Proceedings and Issuance of Orders."

7 10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for  
8 Protection Against Radiation."

9 10 CFR Part 40. Appendix A. Code of Federal Regulations, Title 10, *Energy*, Part 40, Appendix  
10 A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or  
11 Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed  
12 Primarily from their Source Material Content."

13 10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental  
14 Protection Regulations for Domestic Licensing and Related Regulatory Functions."

15 40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part  
16 1508, "Terminology and Index."

17 Atomic Energy Act of 1954, as amended. 42 USC 2011 et seq.

18 BLM, 2004. U.S. Department of the Interior, Bureau of Land Management, *Environmental*  
19 *Assessment for the Wind Dancer Natural Gas Development Project, Sweetwater County,*  
20 *Wyoming*, December 2004.

21 BLM, 2006. U.S. Department of the Interior, Bureau of Land Management, *Removing Excess*  
22 *and Stray Wild Horses from the Area North of Interstate 80 and West of U.S. Highway 287 in*  
23 *the Rawlins Field Office EA#WY030-06-EA-165*, August 2006.

24 BLM, 2008. U.S. Department of the Interior, Bureau of Land Management, *Proposed Resource*  
25 *Management Plan and Final Environmental Impact Statement for Public Lands Administered by*  
26 *the Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming*, January 2008.

27 BLM, 2009. U.S. Department of the Interior, Bureau of Land Management, *Wild Horse*  
28 *Gathering for the Red Desert Complex Wild Horse Herd Management Areas (Lost Creek,*  
29 *Stewart Creek, Green Mountain, Crooks Mountain, Antelope Hills)*, June 2009.

30 Endangered Species Act of 1973. 16 USC 1531–1544.

31 Executive Order 13175. 2000. *Consultation and Coordination with Indian Tribal Governments*.  
32 65 FR 67249. (November 9).

33 LCI, 2008a. Lost Creek ISR, LLC. *Submittal of License Application for the Lost Creek ISR*  
34 *Project*, (Docket No. 40-9068). March 20, 2008.

35 LCI, 2008b. Lost Creek ISR, LLC. *Lost Creek Project Environmental Report, Volumes 1*  
36 *through 3 (Revision 1)*, South-Central Wyoming. Application for US NRC Source Material  
37 License (Docket No. 40-9068). March 2008.

38 LCI, 2009. Lost Creek ISR, LLC. *Lost Creek ISR, LLC Exemption Request to Allow Limited*  
39 *Pre-License Activities at the Lost Creek ISR Uranium Recovery Site*, (Docket No. 40-9068).  
40 July 2, 2009.

41 National Environmental Policy Act of 1969 (NEPA). 42 USC 4321 et seq.

- 1 National Historic Preservation Act of 1966, as amended (NHPA). 16 USC 470aa et seq.
- 2 NRC. NUREG-1910, "Generic Environmental Impact Statement for Uranium Milling Facilities.  
3 2009. <<http://www.nrc.gov/materials/fuel-cycle-fac/licensing/geis.html>> (May 2009).
- 4 NRC. "Notice of License Application of Lost Creek ISR, LLC, for a New In-situ Leach Uranium  
5 Recovery Facility at the Lost Creek Site, Sweetwater County, Wyoming, and Opportunity to  
6 Request a Hearing and Order Imposing Procedures for Access to Sensitive Unclassified Non-  
7 Safeguards Information (SUNSI) for Contention Preparation." *Federal Register*. Vol. 73. pp.  
8 39728–39731. July 10, 2008.
- 9 NRC. "Lost Creek ISR, LLC; Lost Creek In-Situ Recovery Project; New Source Material License  
10 Application; Notice of Intent to Prepare a Supplemental Environmental Impact Statement."  
11 *Federal Register*: Vol. 74. p. 45656. September 3, 2009.
- 12 USFWS, 2008. Letter from B. Kelly, U.S. Department of the Interior, Fish and Wildlife Service to  
13 G. Suber, NRC, Re: Threatened and Endangered Species. November 12, 2008.
- 14 Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). 42 USC 7901 et seq.
- 15 Wyoming Statute (W.S.) 23-1-301-303 and 23-1-401



## 2 IN-SITU URANIUM RECOVERY AND ALTERNATIVES

This chapter describes the proposed action and alternatives for issuance of a U.S. Nuclear Regulatory Commission (NRC) license to Lost Creek ISR, LLC (LCI) for the construction, operation, aquifer restoration, and decommissioning of the Lost Creek ISR Project. These alternatives include a consideration of the No-Action alternative as required by the National Environmental Policy Act (NEPA). Section 2.1 provides details on the alternatives considered for detailed analysis, including the proposed action. Section 2.2 discusses those alternatives that were considered but eliminated from detailed analysis. Section 2.3 compares the predicted environmental impacts of the proposed action and other alternatives. Lastly, Section 2.4 provides a preliminary NEPA recommendation on the proposed action.

### 2.1 Alternatives Considered for Detailed Analysis

NRC staff used a variety of sources to determine the range of alternatives to consider for detailed analysis in this draft SEIS. Those sources included the application, including the Environmental Report (ER) submitted by LCI, the scoping and draft comments on NUREG-1910, the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS), the information gathered during the NRC staff's site visit in January 2009, and interdisciplinary discussions held between NRC staff and various stakeholders.

#### 2.1.1 The Proposed Action (Alternative 1)

Under the proposed action, LCI is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of the ISR facilities at the Lost Creek ISR Project as described in the license application. The Lost Creek ISR Project includes several facilities and well fields, which are described in the following sections. The general ISR process is described in Chapter 2 of the GEIS. The schedule for the proposed action is shown in Figure 2-1. The information contained in the following sections was obtained either from the application (LCI, 2008a,b) or from the GEIS (NRC, 2009) unless otherwise stated.

##### 2.1.1.1 Site Description

The Lost Creek ISR Project is located in the Great Divide Basin in the northeastern corner of Sweetwater County, Wyoming, within Township 25N, Range 92 West, Sections 16-19, and Range 93W, Sections 13, 14 & 25 (Figure 1-1). The project site covers approximately 1,709 ha (4,220 ac), of which approximately 1,449 ha (3,580 ac) are federally-owned Bureau of Land Management (BLM) land, and the State of Wyoming, Office of State Lands and Investment owns 259 ha (640 ac) (Figure 2-2).

The project area is located approximately 113 km (70 mi) southeast of the City of Lander, 145 km (90 mi) southwest of the City of Casper, and approximately 65 km (40 mi) northwest of the City of Rawlins (Figure 1-1). The nearest population center, located 25 km (15 mi) northeast of the project area, is Bairoil, a small town with less than 100 people. The principal access to the Lost Creek site from the northwest is via U.S. Highway 287 (U.S. 287) / Wyoming Highway 789 (State Route [SR] 789) to Jeffrey City, then south on Wamsutter – Crooks Gap Road (County Road [CR] 23). Access from Casper to the northeast is via SR 220 through Alcova to join U.S. 287 / SR 789 south at Muddy Gap to the settlement of Lamont. From this point on US 287 the project area can be accessed by following SR 73 west to Bairoil Road and then south on Sooner Road (BLM Road 3215) or to the Wamsutter – Crooks Gap Road. Access from the south is via Wamsutter – Crooks Gap Road north from Interstate 80 at Wamsutter on (Figure 2-3).

Lost Creek Project Development, Production and Restoration Schedule

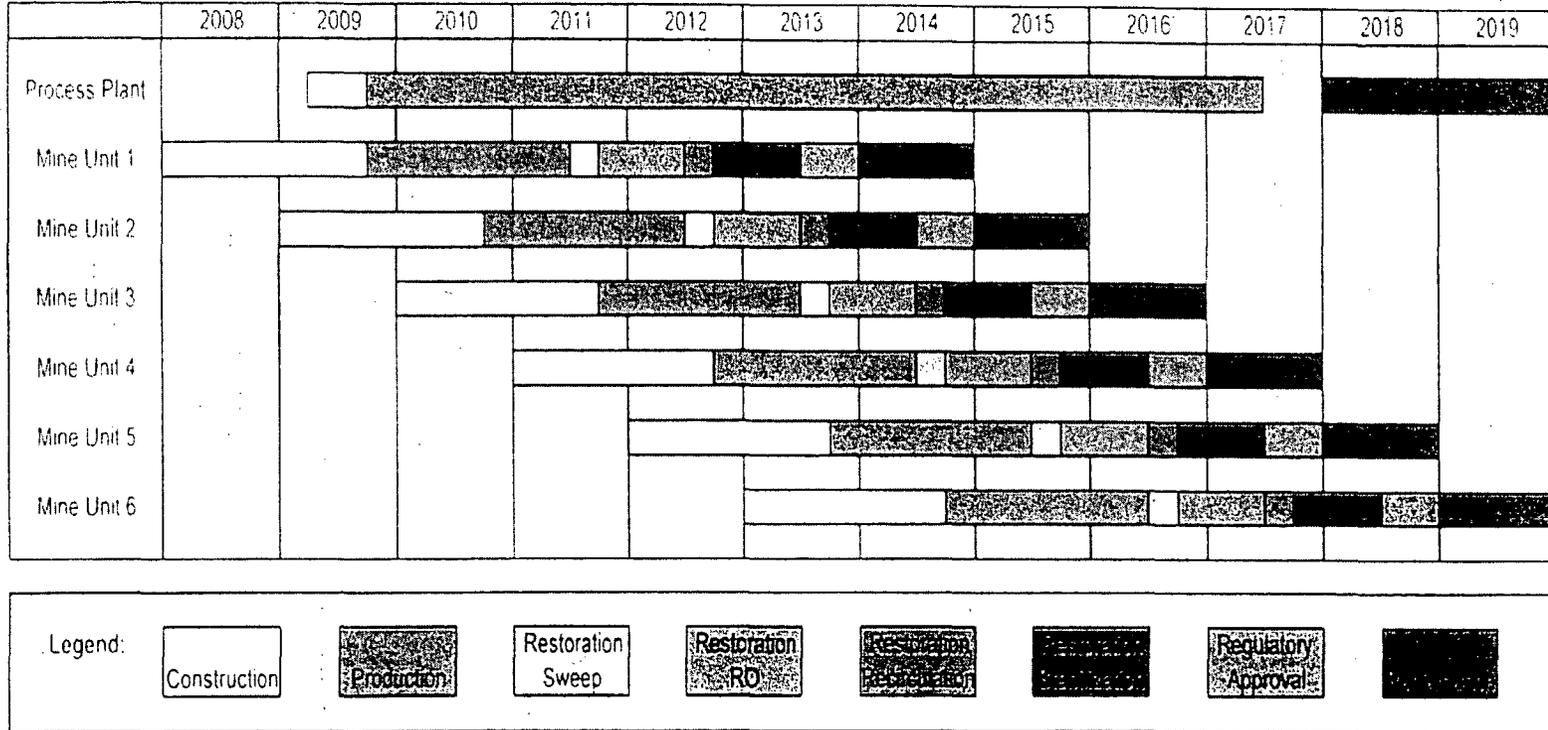


Figure 2-1. Project Schedule

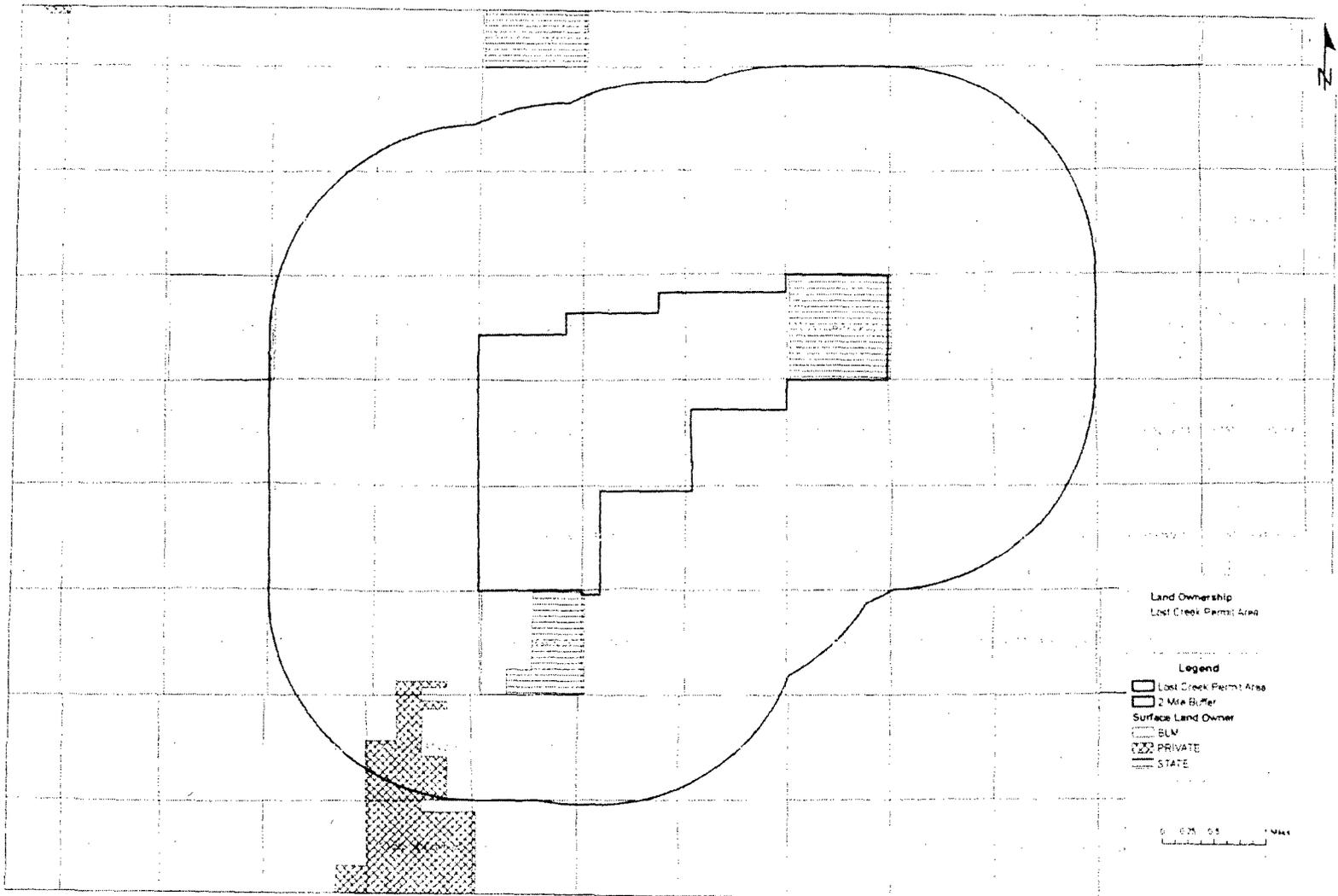


Figure 2-2. Land Ownership



1 The proposed ISR project is situated near Battle Spring Draw, which drains to Battle Spring Flat,  
2 approximately 15 km (9 mi) southwest of the site. Topography at the site is relatively flat,  
3 sloping about 20 m per km (100 ft per mi) southeast toward Battle Creek Draw, which is  
4 oriented northeast-southwest along the southeast side of the site. Elevations at the site range  
5 from about 2,150 to 2,070 m (7,050 to 6,790 ft) above mean sea level (AMSL). Additional detail  
6 describing the existing environment surrounding the proposed site is contained in Chapter 3,  
7 Affected Environment.

#### 8 2.1.1.2 Construction Activities

9 Construction activities necessary for the development of the Lost Creek ISR include: 1) site  
10 preparation; 2) buildings; 3) access roads; 4) well fields; 5) other structures and systems; 6)  
11 workers; 7) equipment; and schedule.

##### 12 2.1.1.2.1 Site Preparation

13 The majority of site preparation is related to the central processing plant (CPP). An area  
14 approximately 90 meters by 170 meters (300 feet by 550 feet), comprising approximately 1.5  
15 hectares (3.8 acres), would need to be leveled and surfaced for the CPP and its appurtenant  
16 structures (maintenance building, storage areas, parking, etc.) Vegetation would be removed,  
17 and topsoil stripped to a depth a one foot over this area. The topsoil would be stockpiled for  
18 reuse in accordance with WDEQ guidelines. All suitable material removed from excavations  
19 would be used, to the extent practicable to level fill areas in the construction of the 3.8-acre pad  
20 area. All 'placed' materials would be compacted in accordance with engineering specifications,  
21 and pad surfacing would be compacted gravel, a minimum of 3 inches thick.

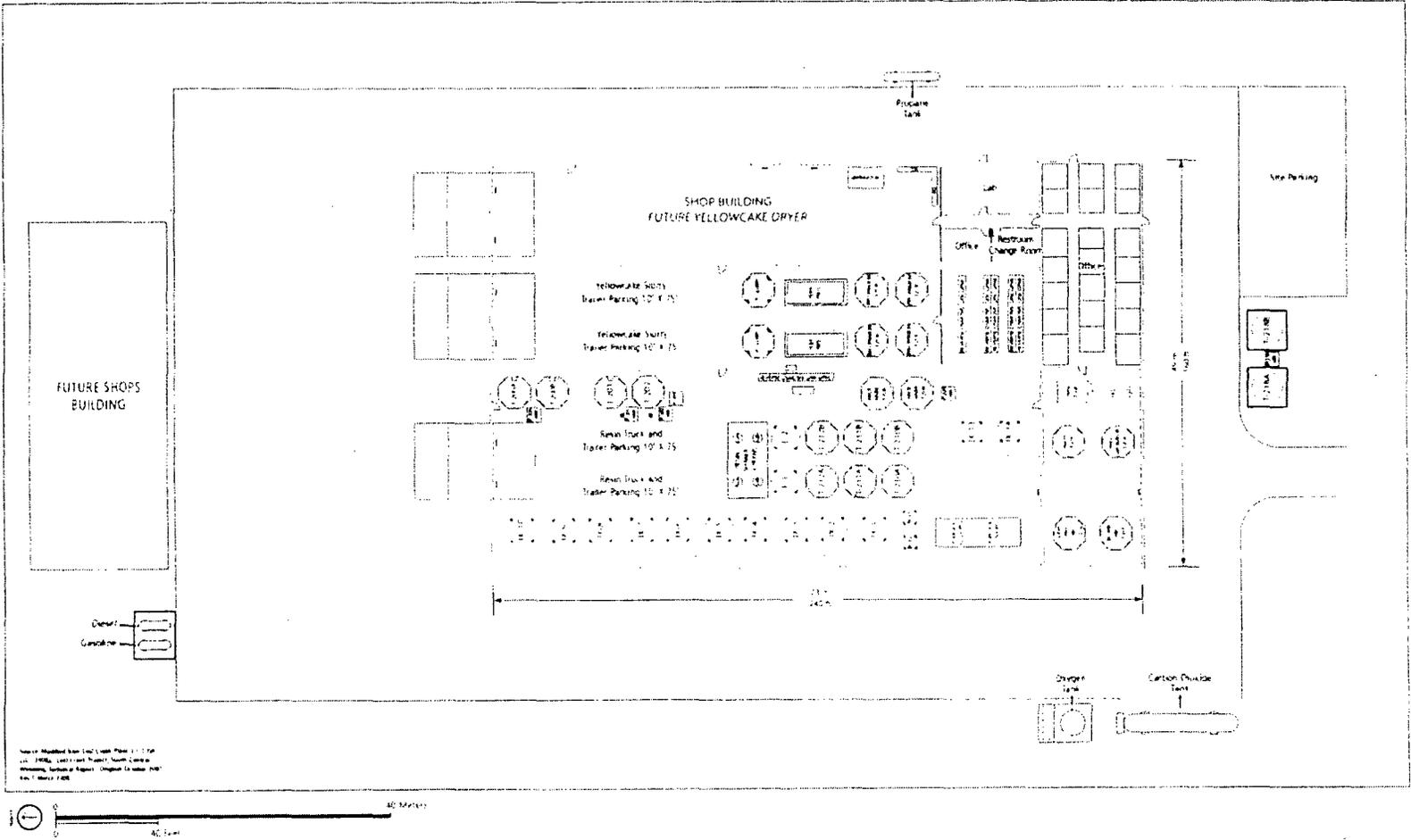
22 LCI estimates that approximately 115 ha (285 ac) of surface area would be disturbed during the  
23 project life. Earth-moving equipment such as rubber tire scrapers and front end loaders would  
24 be used during construction. Topsoil, as well as subsoil, salvaged during construction activities  
25 would be stored in designated topsoil stockpiles located onsite, just northeast of the proposed  
26 plant site and done so in such a way to minimize loss of material. Topsoil from building sites,  
27 permanent storage areas, main access roads, and chemical storage areas prior to construction  
28 would also be salvaged in accordance with Wyoming Department of Environmental Quality-  
29 Land Quality Division (WDEQ- LQD) requirements (LCI, 2008b).

30 Heavy equipment expected to be used during construction include forklifts, backhoes,  
31 geophysical logging trucks, flat bed trailers, reel trailers, water trucks, a mechanical integrity  
32 testing truck, and cementers. The workforce is expected to commute from such towns and  
33 cities as Rawlins, Casper, Wamsutter, and/or Lander.

##### 34 2.1.1.2.2 Buildings

35 The central processing plant (CPP) and storage ponds are shown in Figure 2-4. The CPP  
36 generates a wet yellowcake slurry by concentrating the well field recovery solution and  
37 processing the uranium-loaded resins. The structure would be a 49 by 79m (160 by 260ft) metal  
38 building with a ridge height of 12.5 m (41 ft), and eave heights of 6.9 m (22 ft). The building  
39 would house both uranium processing and office space. Major process equipment housed in  
40 the CPP would include the ion exchange circuit, the lixiviant make-up circuit, the  
41 elution/precipitation circuit, and would include space for the addition (but, currently not being  
42 proposed) of a yellowcake drying facility. Bulk chemical storage tanks containing hydrogen  
43 peroxide, hydrochloric acid, sodium chloride, soda ash mix, and a bicarbonate mix, would be  
44 contained inside the CPP. Oxygen and carbon dioxide tanks would be located outside the CPP  
45 (Figure 2-5). An office area would be physically separated from the processing area, and would  
46 consist of two floors. Other space (12.2 x 24.4 m, 40 x 80 ft) in the CPP would include change  
47 rooms, restrooms, and an on-site laboratory.





1 LCI proposes to have at least two auxiliary buildings: 1) a maintenance building consisting of a  
2 pre-engineered steel structure (16.8 x 41.2 m, 55 x 135 ft with a 15-foot outside wall height)  
3 located adjacent to the CPP; and 2) a driller's shed for storage of control equipment and tools,  
4 and storage of inventories (12.2 x 12.2m, 40 x 40 ft, with a 14-foot outside wall height).

5 The CPP would be constructed on a concrete slab with curbs to contain spills and prevent liquid  
6 releases to the environment. The concrete slab (floors) would be designed to support the full  
7 weight of any vessel and its contents, and would be designed to meet all building codes and  
8 standards. Outside vessel storage locations, including fuel (gasoline and diesel) would be  
9 constructed with concrete curbed secondary containment for tanks. LCI's proposed engineering  
10 and controls, and operational monitoring program are designed to allow spills and leaks to be  
11 quickly detected and minimized. Leaks from vessels and equipment, including water from  
12 equipment wash down, would drain to a sump where the liquid effluent would collect for  
13 appropriate treatment and disposal (LCI, 2007).

#### 14 2.1.1.2.3 Access Roads

15 The proposed Lost Creek ISR project area lies equidistant between Wamsutter – Crooks Gap  
16 Road (CR 23) on the west, and Sooner Road (BLM Road 3215) to the east (Figure 2-3). These  
17 are currently maintained gravel roads. Principal site access would be provided by upgrading an  
18 existing two-track dirt road that bisects the project area and joins these two roads, resulting in  
19 an all-season, gravel-surfaced road. Called Lost Creek Road, this primary access road would  
20 run from Wamsutter – Crooks Gap Road at the boundary between T25N-R93W Sections 16 and  
21 21, easterly for approximately 7.6 km (4.7 mi) to the plant site. It would then continue east for  
22 approximately 7.2 km (4.5 mi) to join BLM 3215 (Sooner Road) between T25N-R92W Sections  
23 13 and 24. Lost Creek Road would be crowned-and-ditched with a 6-m (20-ft) wide driving  
24 surface consisting of 15.4 cm (6 in) of compacted road base. The grade from the centerline to  
25 the road edge would be developed at 2 percent. Each ditch would be approximately 1.5 m (5 ft)  
26 in width with 3:1 side slopes, resulting in an overall cross-sectional width of about 9 m (30 ft).  
27 Approximately 20 acres of land surface would be disturbed to develop these two main access  
28 roads. At least three culverts would be required, one at the intersection with CR 23, and two  
29 near the plant site where the road crosses ephemeral channels. The need for culverts between  
30 the plant and Sooner Road has not yet been ascertained, though at least two culverts are  
31 anticipated: at the crossings of Battle Spring Draw and Stratton Draw. Also, eastern portion of  
32 Lost Creek Road to Sooner Road may not be improved as extensively as the western section to  
33 Wamsutter – Crooks Gap Road, as traffic from Sooner road would be chiefly that of commuting  
34 site workers in light duty vehicles. The maximum distance that these commuters would travel  
35 before reaching a paved surface would be 31 km (19 mi) to SR 73 at Bairoil. All access (main  
36 roads into the site) and maintenance roads (site roads) would be constructed in accordance with  
37 the BLM's, county's, or state's standards.

#### 38 2.1.1.2.4 Well Fields

39 Well fields are the areas at the surface above the ore zones that are delineated by LCI to reach  
40 the desired production. Disturbed area (well fields and access roads) is estimated to be  
41 approximately 103 ha (254 ac) for the total Lost Creek project. The ore zones, at depth, where  
42 the leaching solutions (lixiviant) would be injected and recovered have been divided into six  
43 (overlying) surface areas (Figure 2-6). The ore zones lie approximately 91 to 213 m (300 to 700  
44 ft) below the ground surface in long, narrow trends varying from a few hundred to several  
45 thousand feet long, and from 15 to 76 m (50 to 250 ft) wide. LCI estimates that the yellowcake  
46 (uranium oxide –  $U_3O_8$ ) content is approximately 500,000 kg (1.1 million pounds), at an ore  
47 grade of 0.076 percent.

48

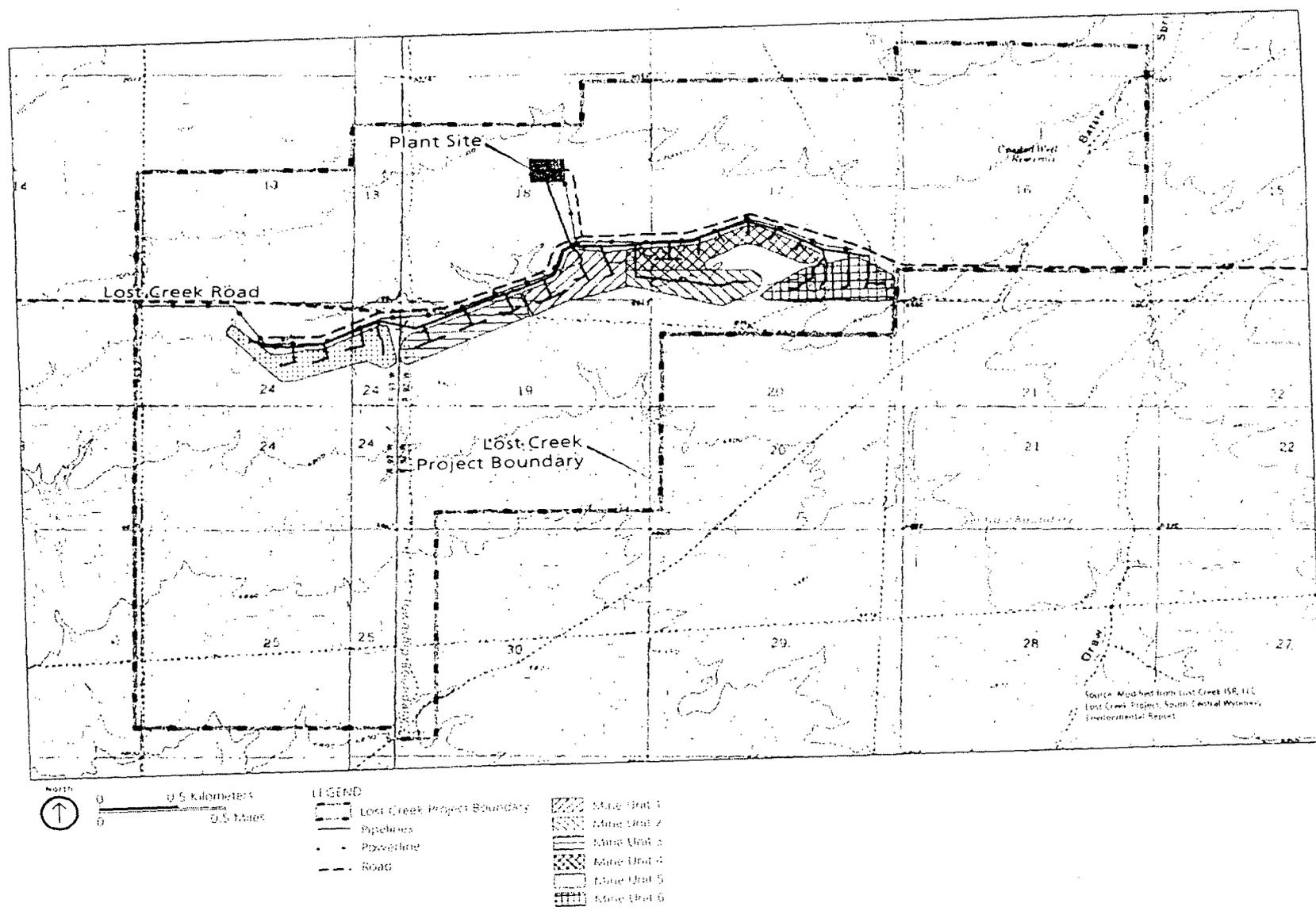


Figure 2-6 Project Well Fields

1                   2.1.1.2.4.1 *Injection and Production Wells*

2 Injection and production well patterns would be based on conventional five-spot patterns and  
3 would be modified, as necessary, to accommodate the characteristics of the ore body (Figure 2-  
4 7). While the conventional five-spot pattern consists of four injection wells surrounding a central  
5 production well, cell dimensions vary depending on the characteristics of the formation and the  
6 ore body. LCI is anticipating the spacing of the injection wells to range from 23 to 46 m (75 to  
7 150 ft).

8 The injection and production wells (Figures 2-8 and 2-9), when completed, may be used for  
9 either injection or production. LCI considers that such a design allows for changes in the  
10 solution flow patterns to improve uranium recovery, and to restore groundwater by the most  
11 efficient means. The actual number of wells for each given well field is not known at this time.

12                   2.1.1.2.4.2 *Monitoring Wells*

13 Horizontal and vertical excursion monitoring wells would be installed at each well field, as  
14 dictated by geologic and hydrogeologic characteristics. Horizontal monitoring wells would be  
15 situated in a ring around the well field, and completed in the targeted mineralized (ore body)  
16 zone. Vertical monitoring wells for overlying and underlying aquifers would be installed at a  
17 density of about one for every four acres of well field area. LCI proposes the spacing between  
18 the mineralized zone monitoring wells at about 152 m (500 ft). It should be understood,  
19 however, that actual distances would be based on the actual aquifer characteristics of the mine  
20 unit (well field).

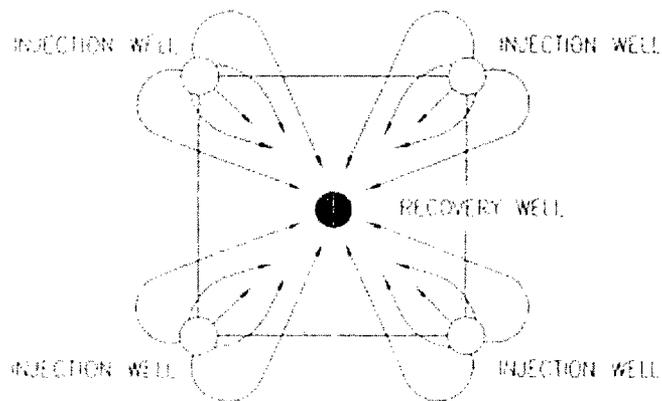
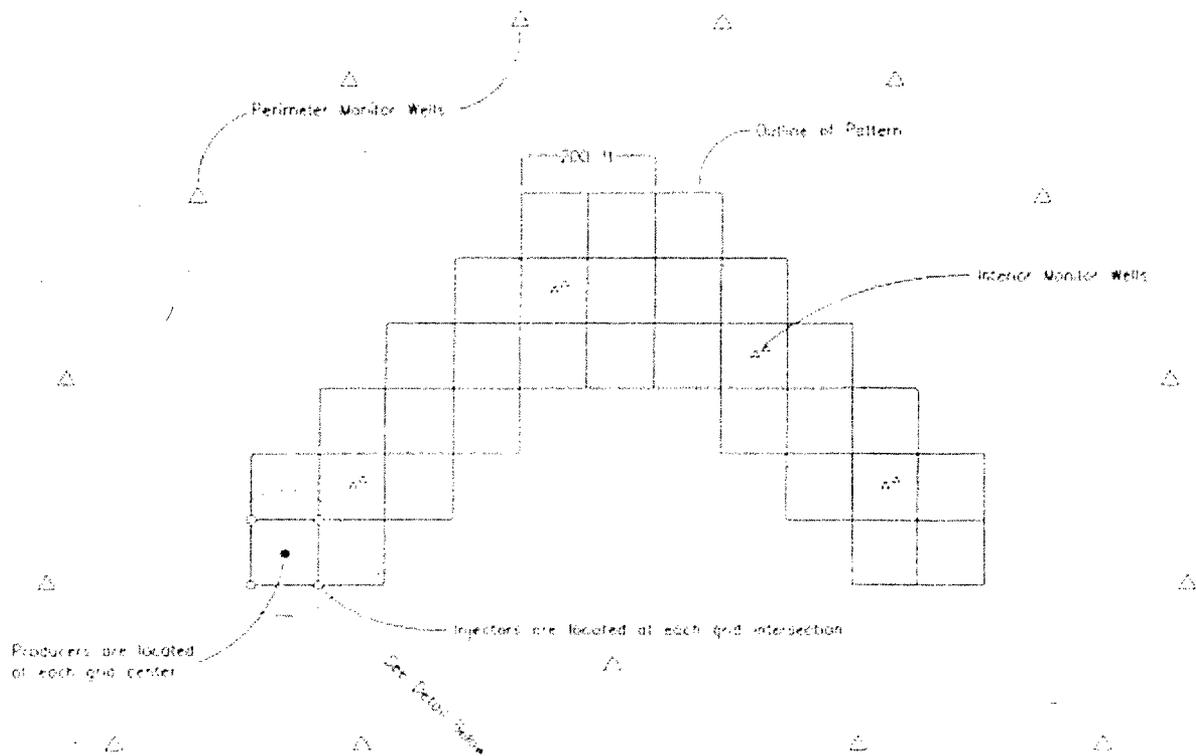
21                   2.1.1.2.4.3 *Well Construction and Testing*

22 Both the materials and methods used in the construction of the three types of wells (injection,  
23 production and monitoring) would follow the requirements and guidelines of the WDEQ. All well  
24 casings would be constructed of polyvinyl chloride (PVC) pipe. Casing centralizers would be  
25 used to make sure casings are centered in the drill hole, and cement would be used to stabilize,  
26 strengthen, and prevent the vertical migration of solutions. The well is finally completed by  
27 under-reaming the desired interval (mineralized zone) and fitted with a slotted liner or screen  
28 assembly.

29 After completion, and before operation, each well is tested for mechanical integrity. The  
30 purpose of the mechanical integrity test (MIT) is to verify that the well casing does not fail,  
31 causing water loss during injection or recovery operations. The test is designed to detect  
32 imperfections in the casing sections and inadvertent damage resulting from under-reaming, and  
33 to ensure the completeness of the connections between casing sections and sealing materials.  
34 The test involves sealing off the bottom and top of the casing with an inflatable packer or some  
35 other suitable device and pressurizing to a specified pressure the column for 10 minutes.  
36 Results would be recorded and submitted to both the NRC and WDEQ for approval. Any well  
37 that fails (cannot hold at least 95 percent of the pressure) would be repaired, and if irreparable,  
38 the well would be plugged and abandoned.

39                   2.1.1.2.4.4 *Pipelines*

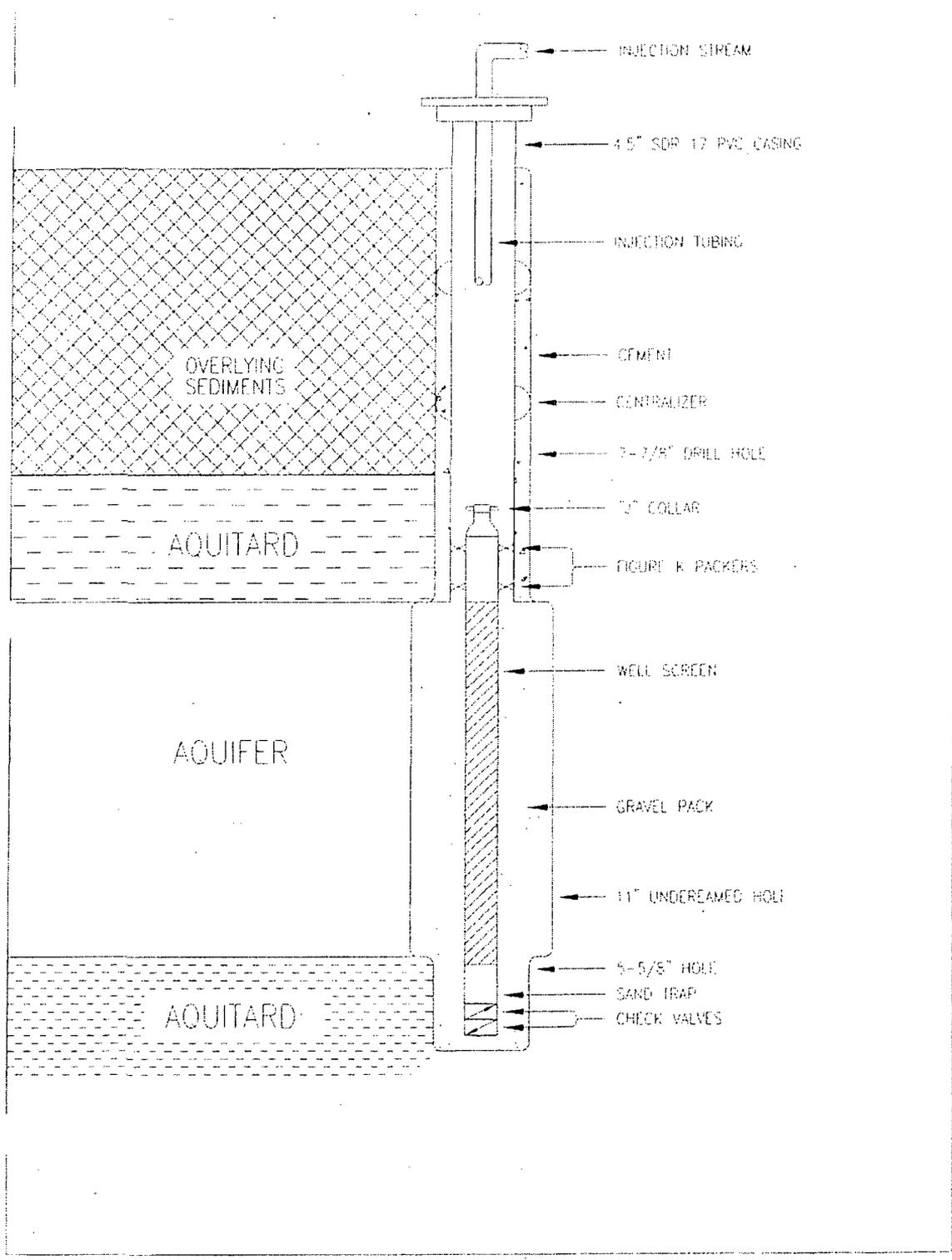
40 A network of process pipelines and cables are typically installed as part of the underground  
41 infrastructure: 1) between the central uranium processing facility or the satellite facility and the  
42 header houses for transporting lixiviant; 2) between the header houses and well fields for  
43 injecting and recovering lixiviant; and 3) between the central processing facility and wastewater  
44 disposal sites (e.g., deep injection wells, evaporation ponds).



TYPICAL WELLFIELD PATTERN

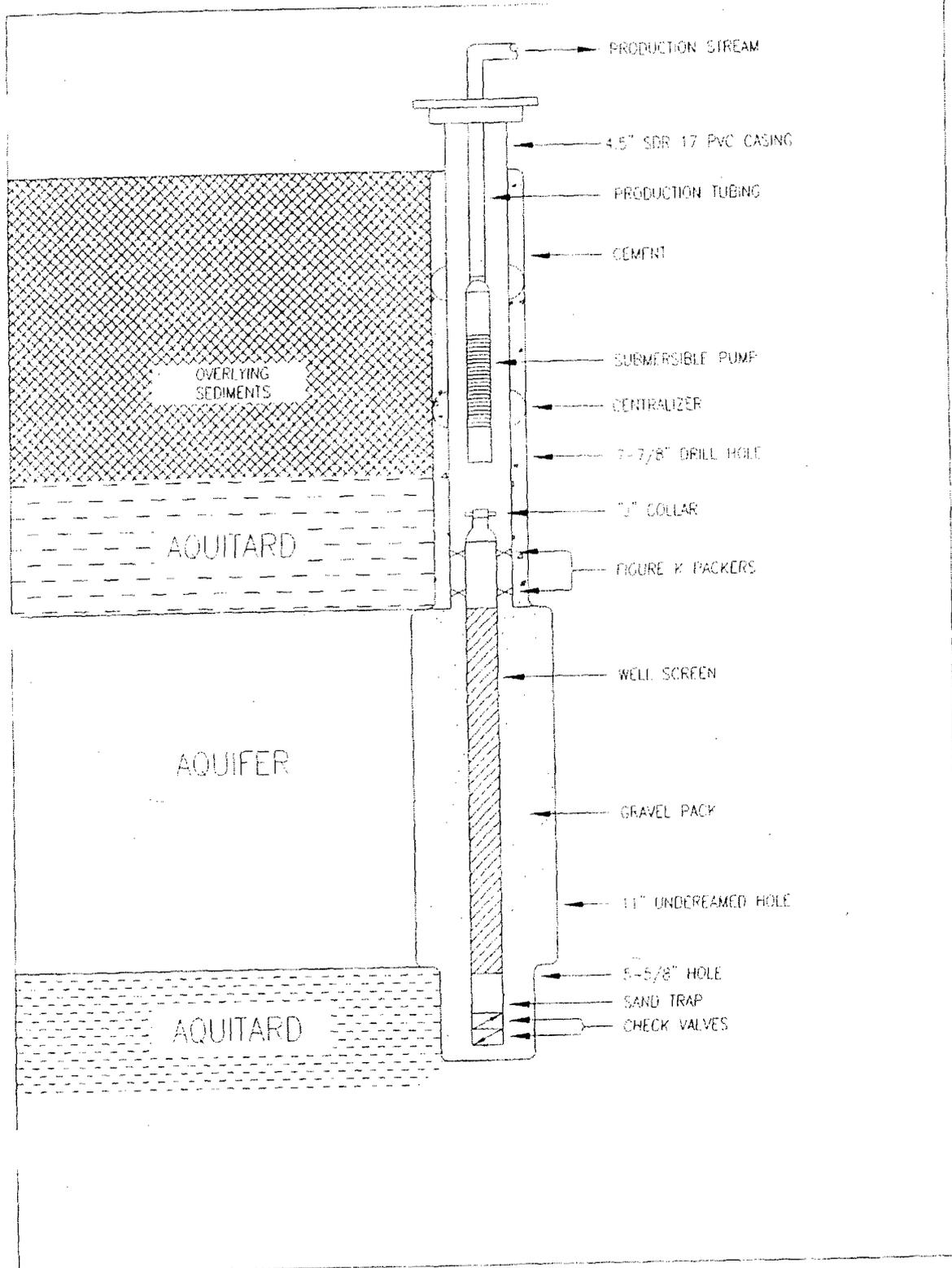
Figure 2-7 Solution Flow Patterns

1  
2



1  
2  
3

Figure 2-8. Injection Well Construction



1  
2  
3

Figure 2-9 Production Well Construction

1 LCI proposes to use high-density polyethylene (HDPE) pipe, PVC pipe, stainless steel pipe, or  
2 an equivalent in its mine unit piping system. While the typical pressure rating for HDPE and  
3 PVC piping materials proposed for use is between 160 and 200 psig (pounds per square inch  
4 gauge), LCI would operate its mine unit piping at 150 psig. Individual well lines and the trunk  
5 lines to the CPP would be buried to prevent freezing. Flow meters and control valves would be  
6 installed in individual well lines and linked to the CPP and header houses to monitor and control  
7 the individual well flow rates and pressures.

#### 8 2.1.1.2.4.5 *Header Houses*

9 A structure called a header house would be constructed in each well field. Their main purpose  
10 is to monitor and control (using meters, valves and pumps) the amounts of lixiviant (both  
11 injected and recovered) through a system of pipes connected to the injection and recovery  
12 wells. These would all be linked back to the CPP for overall monitoring and control. The  
13 header houses merely contain these meters and control valves. There may be one or more for  
14 any given well field.

#### 15 2.1.1.2.5 Other Structures and Systems

16 The proposed CPP and maintenance buildings would be constructed with individual septic  
17 systems, with tanks and leach fields. The tanks would consist of a minimum of one chamber  
18 providing primary treatment. The septic systems would be for domestic wastes, only, with no  
19 process wastes disposal. Both systems were designed according to percolation tests and  
20 submitted to the Sweetwater County Engineer's Office.

21 The Lost Creek facility would be serviced by electric power from a transmission line off the  
22 Crooks Gap-Wamsutter Road. A 3,300 m (10,800 ft) long 34.5 kV overhead line would connect  
23 the Rocky Mountain Power line to a metering point on the western boundary of the project area,  
24 along the proposed western access road. The line would service the CPP, maintenance  
25 building and drillers shed, as well as the well field header houses.

26 A fence is proposed to enclose the entire CPP and maintenance building compound (230 x 260  
27 m, 750 x 850 ft). There would be three main components to the fence: 1) two gates (one  
28 remotely operated); 2) 100 x 8 ft chain link fence either side of the main gate; and 3) standard  
29 livestock fence for the remaining portion of the CPP and maintenance compound. Security at  
30 the Lost Creek facility would involve: 1) maintaining control of NRC-licensed material; 2)  
31 providing a safe and secure workplace; 3) managing records that contain sensitive and/or  
32 confidential information; and 4) ensuring safe and secure transportation of NRC-licensed  
33 material. Security cameras would be placed at strategic locations throughout the CPP,  
34 particularly at the security gate and locations where source and by-product material are stored.  
35 Signage would warn site personnel and the general public of the potential for exposure to  
36 radionuclides prior to entering.

37 In addition, each mine unit and storage pond would be fenced and have signage to prevent  
38 inadvertent entry by people and animals. During production, active mine units would be  
39 inspected by site personnel at least once per shift. Visitors to mine units would be required to  
40 register and receive training, in addition to being supervised.

#### 41 2.1.1.2.6 Construction Workers and Equipment

42 Approximately 30-40 people would be employed by the proposed project during construction. It  
43 is anticipated that most would commute from larger communities in Wyoming, such as Casper,  
44 Rawlins and Rock Springs, but some (if they are specialized in a particular trade) could come  
45 from out-of-state.

1 The equipment necessary to construct the ISR facility would include both company-owned and  
2 contractor-owned equipment. Company-owned equipment would include forklifts, graders,  
3 backhoes, geophysical logging trucks, generators, water trucks and cement mixers. Contractor-  
4 owned equipment would include mostly drill rigs, but could also include erection cranes and  
5 trenching equipment.

#### 6 2.1.1.2.7 Schedule

7 It is estimated that construction would take approximately 21 months to construct each mine  
8 unit. The CPP and supporting facilities would take about 6 months to construct. A complete  
9 schedule showing all of the phases for the development of Lost Creek is presented in Figure  
10 2-1.

#### 11 2.1.1.3 *Operation Activities*

12 As discussed in Section 2.4 of the GEIS, the ISR process as part of the Lost Creek ISR Project  
13 would involve two operations. First would be the injection of barren lixiviant (new or recharged  
14 leaching solution prior to injection into the well field and that has no or low concentrations of  
15 dissolved uranium) to mobilize uranium in the underground aquifer and second would be the  
16 extraction and processing of the pregnant lixiviant in surface facilities to recover the uranium  
17 and prepare it for shipment. Figure 2-10 depicts a typical ISR operation.

#### 18 2.1.1.3.1 Uranium Mobilization

19 During the Lost Creek ISR operation, chemicals would be added to the groundwater pumped to  
20 the surface from the ore-bearing aquifer to produce a leaching solution or lixiviant. Chemicals  
21 used to oxidize the uranium would include oxygen or hydrogen peroxide. Carbon dioxide and  
22 sodium bicarbonate would also be added to complex the uranium in the solution. The lixiviant  
23 would then be injected into the production zone to dissolve uranium from the underground  
24 formation, remove it from the deposit, and transport it to the processing facility where uranium  
25 would be removed from solution via ion exchange.

#### 26 2.1.1.3.1.1 *Lixiviant Chemistry*

27 The uranium, in the (ore body) aquifer, exists in a reduced insoluble form. As such, to recover it  
28 through the ISR process, it must be oxidized and dissolved by the lixiviant solution injected into  
29 the ore zone. Once uranium is oxidized, it easily complexes with bicarbonate anions in the  
30 groundwater and becomes mobile. The uranium-bearing solution would migrate through the  
31 pore spaces in the sandstone and be recovered by production wells.

32 LCI proposes to use a lixiviant solution composed of a dilute carbonate/bicarbonate aqueous  
33 solution because of its selectivity for uranium and minor reaction with the gangue minerals.  
34 During injection, oxygen or hydrogen peroxide would be added to oxidize the uranium  
35 underground. Carbon dioxide would be provided to both keep the pH around neutral and to  
36 provide another source of carbonate and bicarbonate ions. The oxidized uranium would react  
37 with the lixiviant to form either a soluble uranyl tricarbonat complex or a bicarbonat complex.

#### 38 2.1.1.3.1.2 *Lixiviant Injection and Recovery*

39 LCI estimates that the production flow rates are approximately 22,700 Lpm (6,000 gpm). LCI  
40 would pump uranium-enriched pregnant solution from production wells to the CPP for uranium  
41 extraction by ion exchange. The resulting barren lixiviant would then be chemically refortified  
42 with carbonate/bicarbonate and oxidant and re-injected into the well field to repeat the leaching  
43 cycle.

44 Uranium mobilization at the proposed Lost Creek ISR Project would produce excess water  
45 containing 11e.(2) byproduct material that must be properly managed. The production wells

1 extract slightly more water than is re-injected into the host aquifer, which creates a net inward  
2 flow of groundwater into the well field. Production rates would be controlled by withdrawing a  
3 small portion of the barren solution from the ion exchange circuit which is then disposed of via  
4 the deep disposal wells.

5           2.1.1.3.1.3 *Excursion Monitoring*

6 LCI proposes an operational groundwater monitoring program to detect and correct for any  
7 condition that could lead to an excursion affecting groundwater quality near the well fields.  
8 These excursions can be caused by improper water balance between injection and recovery  
9 rates, undetected high permeability strata or geological faults, improperly abandoned  
10 exploration of drill holes, discontinuity within the confining layers, poor well integrity, or hydro  
11 fracturing of the ore zone or surrounding units. The program would include monitoring process  
12 variable such as flow rates and operating pressures of operating wells (injection, production,  
13 and monitoring) and the main pipelines going to and from the CPP and satellite facility.

14 The monitoring wells in the ore zone and overlying and underlying aquifers would be sampled  
15 twice a month, and samples from these wells analyzed for conductivity, chloride, and total  
16 alkalinity (indicator parameters). These data would be compared to the upper control limits  
17 (UCLs) for those parameters. LCI would also collect static water level data prior to each  
18 sampling event, and would adequately maintain all of the analytical data from the monitoring  
19 wells and submit the data to the WDEQ quarterly. If an excursion is suspected, LCI would have  
20 to notify the NRC and WDEQ verbally within 24 hours and in writing within 7 days of a verified  
21 excursion. Corrective actions such as adjusting the injection and recovery flow rates in the  
22 affected area would be implemented as soon as practical and as long as it takes the excursion  
23 to be mitigated. Within 60 days of the confirmed excursion, LCI would have to file a written  
24 report describing the event and corrective actions taken to the NRC.

25           2.1.1.3.2 Uranium Processing

26 Uranium would be recovered from the pregnant lixiviant and processed as yellowcake in a multi-  
27 step process. These steps include ion exchange, elution, precipitation, drying, and packaging.  
28 These uranium processing activities are shown graphically in Figure 2-11.

29           2.1.1.3.2.1 *Ion Exchange*

30 At the proposed Lost Creek ISR, the pregnant lixiviant, estimated to be about 40-50 ppm of  
31 uranium concentration, would be pumped from the well fields to the ion exchange systems at  
32 the CPP for the extraction of uranium. The Lost Creek CPP would be designed to process up to  
33 22,700 Lpm (6,000 gpm) of lixiviant through the ion exchange circuit. The ion exchange system  
34 proposed for Lost Creek would consist of pressurized, 'down-flow' vessels (columns) that are  
35 internally screened to maintain resin in-place, but allow the lixiviant to flow through the vessel.  
36 Once the resins in the ion exchange columns become saturated with uranium, the column would  
37 be taken offline for the elution circuit. The solution leaving the ion exchange circuit would  
38 normally contain less than 5 ppm of uranium. Sodium carbonate, sodium bicarbonate, oxidants,  
39 and carbon dioxide would be added to this 'barren' solution prior to re-injection, and the process  
40 is repeated. The ion exchange process is shown graphically in Figure 2-12.

41  
42  
43  
44  
45

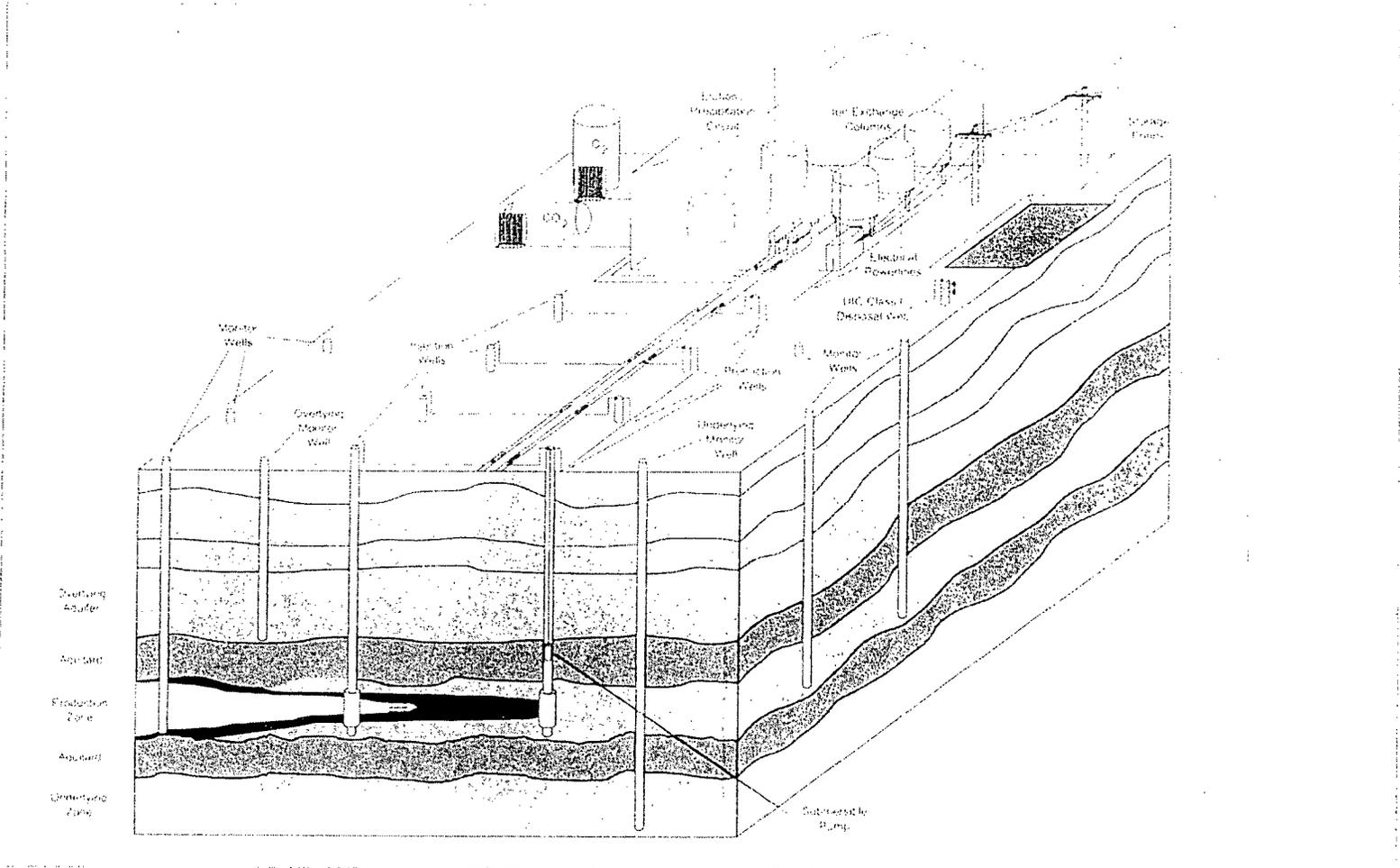


Figure 2-10. Typical ISR Layout

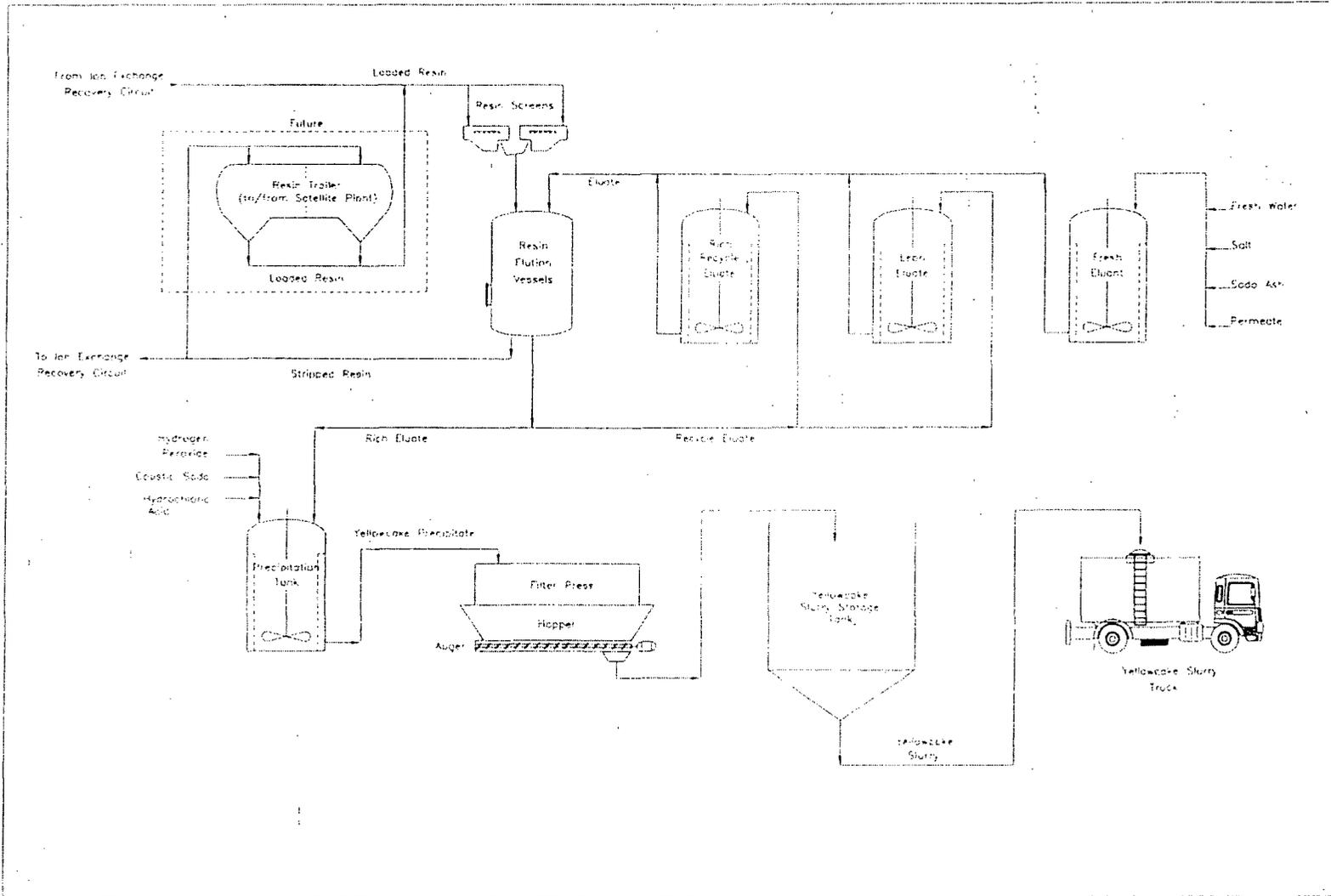


Figure 2-11. Process Flow Diagram

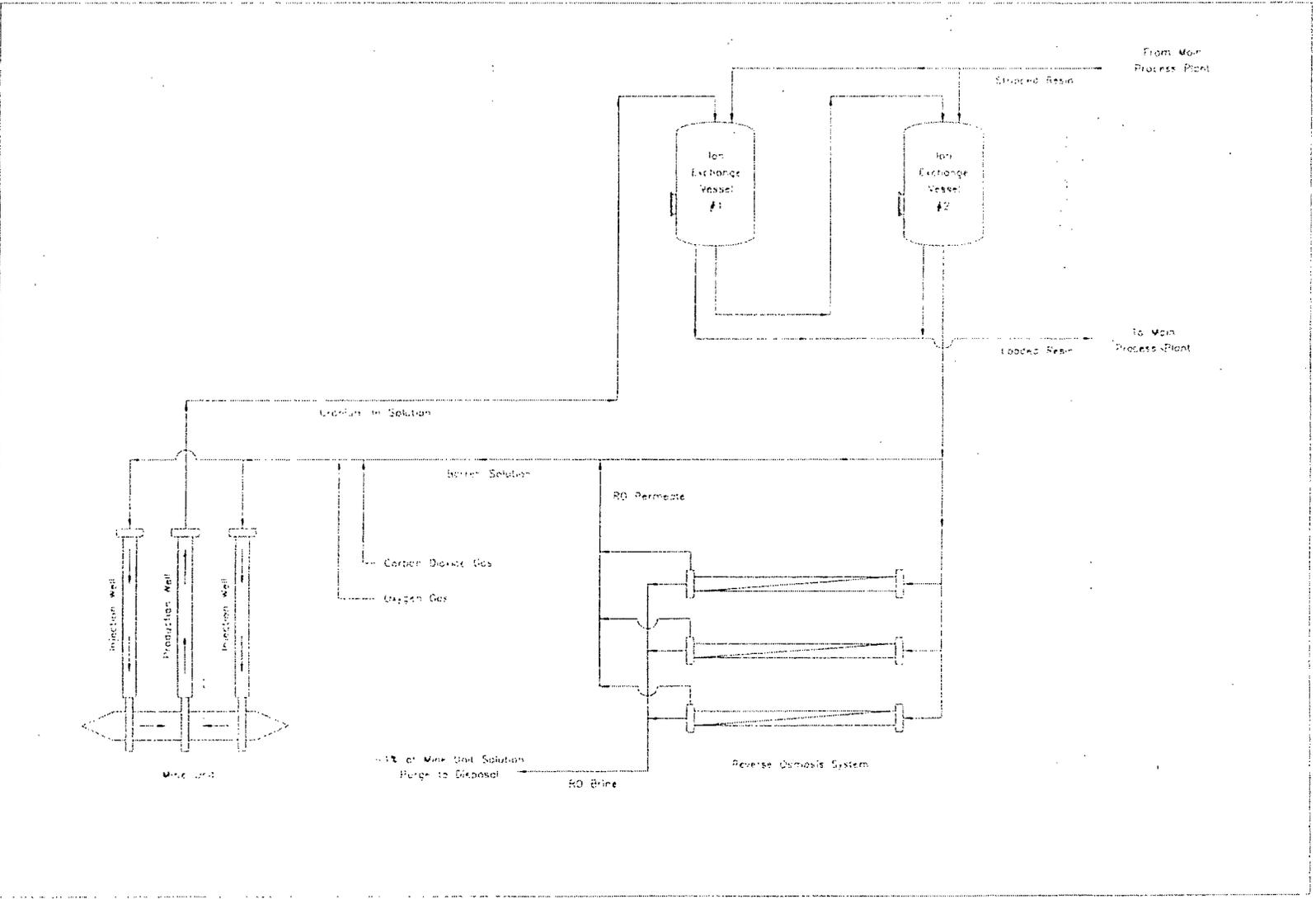


Figure 2-12 Ion Exchange Process Flow Diagram

1                   2.1.1.3.2.2 *Elution*

2   In the elution circuit, the loaded resin from the ion exchange vessel: 1) passes over vibrating  
3   screens with wash water to remove entrained sand particles and other fine 'trash', and 2) moves  
4   by gravity from the screens down into 'down-flow' elution vessels for uranium recovery and resin  
5   regeneration. The uranium would be released from the loaded ion exchange resin in the  
6   dedicated elution vessel by applying an aqueous solution or brine composed of sodium chloride  
7   (90 g/L) and sodium carbonate (20 g/L). The process generates an 'eluate' that has a  
8   concentration of 10-20 g/L of U<sub>3</sub>O<sub>8</sub>. The three-stage process is depicted in Figure 1.5-2b of the  
9   TR.

10                   2.1.1.3.2.3 *Precipitation/Filtration Circuit*

11   The precipitation/filtration circuit at the CPP would be initiated when the eluant is treated slowly  
12   with hydrochloric or sulfuric acid to break the carbonate portion of the dissolved uranium  
13   complex. Hydrogen peroxide would be used to precipitate out the uranium as uranyl peroxide.  
14   A caustic soda solution (sodium hydroxide or ammonia) would then be added to elevate the pH,  
15   promoting the growth of uranyl peroxide crystals and making the slurry safer to handle in  
16   subsequent process steps. Following precipitation, the precipitated uranium would be washed  
17   to remove excess chlorides and other soluble contaminants, and dewatered and filtered to form  
18   yellowcake slurry (30-50 percent solids). The yellowcake slurry would then be stored in holding  
19   tanks (inside the CPP) or in transport tanks parked in a secure (fenced) area of the facility, for  
20   ultimate shipment off-site, via authorized transport to a NRC-licensed processing facility.

21                   2.1.1.3.3 Schedule

22   LCI anticipates operating the Lost Creek project for eight years, based upon the data they have  
23   collected in the six mine units proposed. The mine units, while individually operated, would  
24   overlap in time, as they come 'on-line' sequentially (Figure 3.1-3 of the TR; LCI, 2008b). There  
25   never would be more than two units operating at one time, however. The operation of Mine Unit  
26   1 is anticipated to begin operation in early in 2012 and continue through late 2013 when Mine  
27   Unit 6 ceases to become productive. LCI anticipates the workforce requirements during  
28   operation to be 50 people, which includes mine unit, as well as CPP personnel. It is anticipated  
29   that most of the operations workforce would commute from larger communities in the state,  
30   such as Casper, Rawlins and Rock Springs, with some more specialized workers potentially  
31   relocating from out-of-state.

32                   2.1.1.4 *Aquifer Restoration Activities*

33   As described in Section 2.5 of the GEIS, aquifer restoration is necessary to return well field  
34   water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5). After  
35   the uranium is recovered, the groundwater in the well field contains constituents that were  
36   mobilized by the lixiviant. The process whereby groundwater constituents are selected for  
37   monitoring throughout the life of the project is described in Section 6.3.1.2 (Groundwater Quality  
38   Monitoring) of this SEIS. LCI plans to begin aquifer restoration in each well field as the uranium  
39   recovery no longer becomes economically feasible and operations end. Consistent with current  
40   ISR restoration practices, LCI proposes that restoration criteria or restoration target values  
41   (RTVs) be established on a parameter-by-parameter basis and that the primary goal of  
42   restoration be to return all parameters to pre-ISR baseline conditions. Prior to operation,  
43   background (baseline) groundwater quality would be determined. Baseline water quality data  
44   would be collected from the monitoring wells before any ISR operations take place. Restoration  
45   must demonstrate that it meets the requirements of 10 CFR Part 40 Appendix A.

46   Prior to the operation of each mine unit, background (baseline) groundwater quality would be  
47   determined. Baseline water quality data would be collected from the monitoring wells in the

1 perimeter ring, the pattern area (of the mine unit), and in the overlying and underlying aquifers  
2 before any ISR operations take place. A minimum of four samples would be collected from  
3 each well, 14 days apart, and at least one sample from each well would be sent to WDEQ for  
4 analysis. Baseline and restoration parameters are presented in Table 6.2-1 of the TR (LCI,  
5 2008b).

6 The aquifer restoration program for Lost Creek would include three stages: groundwater sweep,  
7 groundwater treatment, and recirculation. These three stages would be designed to effectively  
8 and efficiently restore the groundwater so that groundwater loss is minimized and restoration  
9 equipment is optimized. LCI would monitor the quality of selected wells during restoration to  
10 determine the efficiency of the operation, and whether additional, or alternate, techniques may  
11 be necessary. Aquifer restoration is presented graphically in Figure 6.2-1 of the TR (LCI,  
12 2008b).

#### 13 2.1.1.4.1 Groundwater Transfer

14 Groundwater transfer involves moving groundwater between the well field entering restoration  
15 and another well field where uranium leach operations are beginning, or alternately, within the  
16 same well field, if one area is in a more advanced state of restoration than another (NRC, 2009).  
17 This technique displaces mining-affected waters in the restoration well field with baseline quality  
18 waters from the well field beginning leach operations. As a result, the groundwater in the two  
19 well fields becomes blended until the waters are similar in conductivity and therefore similar in  
20 the amount of dissolved constituents. Because water is transferred from one well field to  
21 another, groundwater transfer typically does not generate liquid effluents.

#### 22 2.1.1.4.2 Groundwater Sweep

23 During groundwater sweep, water is pumped from the mine unit (without re-injection), resulting  
24 in an influx of 'fresh' baseline water into the affected (mined) portion of the aquifer. The water  
25 removed from the aquifer during the sweep first is passed through an ion-exchange system to  
26 recover the uranium and then disposed either in evaporation ponds or via deep well injection in  
27 accordance with the limits in a UIC permit. The pumping rates used will depend on the  
28 hydrologic conditions at a given site, and the duration of the aquifer sweep and volume of water  
29 removed depend on the volume of the aquifer affected by the ISR process (NRC, 2009). The  
30 number of pore volumes of groundwater sweep is dependent on the capacity of the wastewater  
31 disposal system and the effectiveness of the sweep in lowering the amount of total dissolved  
32 solids (TDS). Pore volume is the term used by the ISR industry to define an indirect  
33 measurement of a unit volume of aquifer water affected by ISR recovery. It represents the  
34 volume of water that fills the void space in a certain volume of rock or sediment. A detailed  
35 description of pore volume is presented in the GEIS (NRC, 2009). Typically, one pore volume,  
36 or less, is recovered during the sweep, before moving into the groundwater treatment phase.

#### 37 2.1.1.4.3 Groundwater Treatment

38 During the groundwater treatment stage of the Lost Creek project, ion exchange and reverse  
39 osmosis treatment circuits would be used to treat groundwater before it is re-injected into the  
40 affected aquifer. The ion exchange columns would remove most of the soluble uranium and  
41 replace it with chloride or sulfate. (A detailed description of this process is contained in Section  
42 2.5.3 of the GEIS (NRC, 2009). After uranium removal, a small amount of reductant may be  
43 introduced to reduce any other oxidized minerals. The purpose of this addition is to reduce  
44 those minerals that are solubilized by carbonate complexes.

45 A portion of the restoration recovery water can also be sent to the reverse osmosis unit. The  
46 reverse osmosis unit serves the following purposes: 1) reduces the total dissolve solids (TDS)  
47 in groundwater being restored, 2) reduce the quantity of water needed to be removed from the

1 aquifer to achieve the RTVs, 3) concentrates the dissolved contaminants in a smaller volume of  
2 brine to facilitate waste disposal, and 4) enhances ion exchange. About 60 to 75 percent of  
3 water passes through the reverse osmosis membranes, leaving approximately 25 to 40 percent  
4 of the dissolved salts in the resulting brine water. The clean water or permeate would either be  
5 re-injected into the well field, stored for use in the mining process, or sent to the deep disposal  
6 wells. The permeate may also be de-carbonated prior to re-injection into the well field. The  
7 brine water contains most of the dissolved salts and is sent to the deep disposal wells. Make-up  
8 water coming from a number of sources may be added prior to reverse osmosis or well field  
9 injection stream to control the amount of bleed into the restoration area. These sources would  
10 include water from a well field in a more advanced state of restoration, water being exchanged  
11 with a new well field production area, water from a different aquifer, or the purge of an operating  
12 well field.

#### 13 2.1.1.4.4 Recirculation

14 Recirculation consists of pumping from the mine unit and re-injecting the recovered solution to  
15 recirculate and homogenize groundwater conditions. Once active restoration activities are  
16 complete, LCI would collect groundwater samples to determine if restoration requirements have  
17 been met. Documentation would include an evaluation of the water quality data and a  
18 description of the techniques used.

#### 19 2.1.1.4.5 Monitoring and Stabilization

20 This is the final stage of the aquifer restoration phase of ISR development. Upon demonstrated  
21 (NRC and WDEQ approved) completion of aquifer restoration LCI would begin a groundwater  
22 stabilization monitoring program. Wells would be sampled once a month for a period of six  
23 months. To evaluate stability, sampling parameters would be based on the overall condition of  
24 the aquifer at the end of the restoration period, pending WDEQ approval. A well field has to be  
25 designated by both the WDEQ and NRC as being restored. The six-month stability period would  
26 begin to ensure that RTVs were met. At the end of the six-month stabilization period, LCI would  
27 prepare a report documenting data results and methods. If, at the end of this period, the  
28 analytical results continue to meet the appropriate standards for each mine unit, and do not  
29 exhibit any increasing trends, a request would be made to declare the mine unit restored.  
30 Following NRC and WDEQ approval, plugging and abandonment of wells can be performed.

#### 31 2.1.1.4.6 Schedule

32 LCI anticipates the restoration of each mine unit to take approximately 30 months (from the  
33 beginning of the groundwater sweep through the regulatory approval stage). LCI anticipates  
34 aquifer restoration phase of Mine Unit 1 to begin late 2013, and Mine Unit 6 to be completed  
35 mid 2016.

#### 36 2.1.1.5 *Decontamination, Decommissioning, and Reclamation Activities*

37 Once the Lost Creek project is complete (all the uranium that has been economically extracted  
38 and the groundwater restored), all surface structures would be decontaminated and  
39 decommissioned, and the land surface reclaimed. Decommissioning of the Lost Creek ISR  
40 Project would be based on an NRC-approved decommissioning plan. Unless otherwise  
41 specified, LCI would be required under 10 CFR 40.42 to complete site decommissioning within  
42 two years from the time the decommissioning plan had been approved. In addition to the CPP  
43 and associated structures, all disturbed lands restored to their pre-mining land use of livestock  
44 grazing and wildlife habitat. The facilities that would require decommissioning and reclamation  
45 include: 1) all processing and water treatment equipment; 2) buildings and structures, including  
46 offices; 3) waste storage, treatment, and disposal facilities, including deep disposal wells; 4)  
47 buried pipes; 5) control structures, such as impoundments and culverts; and 6) roads. Only

1 those structures and roads that are required (and approved) for post-operational use would  
2 remain.

3       2.1.1.5.1 Well Fields

4           2.1.1.5.1.1 *Well Plugging and Abandonment*

5 Once the NRC and WDEQ have reviewed and approved LCI's assessment that the  
6 groundwater restoration is complete for a mine unit, the wells can then be abandoned (usually  
7 plugged using a bentonite [clay] slurry). All wells, except those needed for continued monitoring  
8 purposes, would be abandoned in accordance with appropriate Wyoming statutes and  
9 regulations. Once a well is fully abandoned, any disturbed area would be reclaimed and  
10 reseeded, and a written report sent to the State Engineer.

11           2.1.1.5.1.2 *Buried Piping and Engineering Control Structures*

12 Any contaminated piping would be disposed of at an NRC-licensed facility, and non-  
13 contaminated piping would be removed for salvage, or for disposal in accordance with  
14 applicable regulations. Topsoil, along the pipeline route would be re-spread and the disturbed  
15 area reseeded with a seed mixture prescribed by the BLM and WDEQ.

16           2.1.1.5.1.3 *Header Houses*

17 With the exception of any facilities, access roads, or utility corridors required for future  
18 operation, all of the features associated with a header house would be removed once  
19 groundwater restoration in that header house and mine unit has been deemed complete. The  
20 header houses and pump stations would be moved to new locations in other areas of the Permit  
21 Area, or dismantled and disposed of in accordance with applicable regulations.

22           2.1.1.5.1.4 *Soils and Materials*

23 Soils would be replaced where excavated, whenever possible. Due to the relatively uniform soil  
24 characteristics across the site, the similarity of the topsoil and subsoil, and the relative thinness  
25 of the topsoil and subsoil, separate handling of the topsoil and subsoil would not be done. The  
26 replacement will be along the contour, where necessary to prevent soil erosion. To avoid clods,  
27 soils will not be replaced when the ground is wet or frozen. The replaced topsoil will be disked  
28 to create an adequate seed bed.

29           2.1.1.5.1.5 *Access Roads*

30 Unless approval for leaving a specific road is obtained for post-mine use, all roads would be  
31 reclaimed. Improved or constructed roads would be reclaimed by removal of culverts, removal  
32 of road surfacing materials, re-contouring, as necessary, preparation of the seed bed, and  
33 reseeded in accordance with the procedures outlined in the BLM Plan of Operation.

34       2.1.1.5.2 Process Buildings and Equipment and Other Structures

35 Following completion of groundwater restoration in the final production area, the Lost Creek  
36 CPP and associated structures would be decommissioned. All process equipment associated  
37 with the CPP would be dismantled and either sold to another NRC-licensed facility or  
38 decontaminated in accordance with NRC regulations and guidance documents. Materials  
39 unable to be decontaminated would be disposed of at one of the approved facilities mentioned  
40 earlier. Materials able to be decontaminated would be reused, sold, or removed and disposed  
41 of off-site. Once the buildings have been removed, the former building sites would be contoured  
42 to blend in with the surrounding terrain. Gamma surveys would be conducted to verify that  
43 radiation levels are within acceptable NRC limits. As mentioned earlier, LCI would provide a  
44 land reclamation plan to the NRC and BLM for review and approval within 12 months prior to  
45 commencing reclamation of a well field. Soils (topsoil and subsoil) would be replaced at sites

1 where structures are removed according to the BLM's Plans of Operations regulations (43 CFR  
2 3809 Part 400 et seq.). The plan would include a description of the areas to be reclaimed, a  
3 description of the planned reclamation activities, a description of methods to be used to protect  
4 workers and environment against radiation hazards, a description of the planned final radiation  
5 survey, and a cost estimate.

#### 6 2.1.1.5.3 Engineered Structures and Site Roads

7 Any site roads, as well as roads accessing the Lost Creek ISR site, would be removed and the  
8 surface re-contoured, except those required for post-operational activities. Culverts, as well as  
9 road surface and roadbed materials, would be removed, and the land surface reclaimed  
10 following BLM regulations and guidelines (from the Plan of Operations).

#### 11 2.1.1.5.4 Final Contouring and Re-Vegetation

12 Areas in which reclamation would be required within the Permit Area include the mine units, in  
13 particular where the header houses and roads have been removed, and the CPP area.  
14 Disturbed areas will be reclaimed to the BLM/WDEQ-approved post-operations land use by re-  
15 grading the surface to the approximate pre-operations contour, re-establishing drainages,  
16 replacing salvaged soil, and re-vegetating the areas.

#### 17 2.1.1.5.5 Schedule

18 Decommissioning is the final step in the ISR process, and takes place in approximately the  
19 seventh year (Figure 2-1). Once the aquifer has been restored to the standards established by  
20 the WDEQ, the activities described in the previous five sections can begin. The time frame for  
21 decommissioning and land surface reclamation is estimated by LCI to be approximately one  
22 year.

#### 23 2.1.1.6 Effluents and Waste Management

24 The ISR process at Lost Creek would generate effluents and waste streams, all of which must  
25 be handled and disposed of properly. These would include gaseous emissions, liquid wastes  
26 (classified as 11e.(2) byproduct material), and solid wastes. These effluents would be reduced,  
27 to the extent practicable, by minimizing disturbance and reusing or recycling materials. In  
28 addition, spill prevention and spill response plans would be in-place to prevent and minimize the  
29 potential impacts of an accidental release.

#### 30 2.1.1.6.1 Gaseous or Airborne Particulate Emissions

31 During the four stages of Lost Creek (construction, operation, aquifer restoration, and  
32 decommissioning), gaseous emissions from the ISR process would primarily consist of fugitive  
33 dusts (from unpaved roads), combustion engine exhausts (from vehicles and on-site  
34 equipment), and radon gas emissions (from well drilling) during various stages of the processing  
35 system.

#### 36 2.1.1.6.1.1 Fugitive Dust and Diesel Emissions

37 Fugitive dusts and engine exhausts would be generated primarily from vehicle traffic within the  
38 Lost Creek site and on and off the project site during construction, transportation, and  
39 decommissioning activities. The fugitive dust would be generated by travel on unpaved roads  
40 and from disturbed land associated with the construction of well fields, roads, and auxiliary  
41 facilities. LCI expects that negligible amounts of fugitive dust would be generated from the soil  
42 disturbance during construction of the wells. With the prevailing wind direction out of the west-  
43 northwest during the daytime, dust produced during operation Lost Creek would generally blow  
44 in the east direction. In addition, access roads would be maintained via motorized patrol and  
45 LCI would minimize disturbance to natural vegetation when possible to minimize wind erosion.

1 In addition, combustion engine exhausts would also be generated by: 1) workers' vehicles  
2 commuting to and from the project site, 2) trucks transporting construction materials and  
3 product, 3) drill rigs, 4) diesel-powered water trucks, and 5) other construction equipment.

#### 4 2.1.1.6.1.2 *Radioactive Emissions*

5 Radioactive airborne emissions would be minimal at the Lost Creek facility because yellowcake  
6 drying and packaging would not occur on-site. In addition, the storage ponds would be kept wet  
7 (sediment would maintained as moist), and not allowed to dry, to prevent having sediments  
8 exposed to wind action. Radon gas is the most likely emission to occur, as it is present in the  
9 ore body and concentrated in the lixiviant. Radon can be released when the pregnant lixiviant is  
10 brought to the surface from the ore zone aquifer, as well as when ion exchange columns are  
11 taken offline for resin transfer and opened to the atmosphere. The use of general area and  
12 local ventilation systems would aid in controlling the buildup of radon within the onsite facilities.  
13 General area ventilation may involve forced air ventilation of work areas in process buildings.  
14 Local ventilation for process vessels where radon releases are more likely may involve ducting  
15 or piping near the point of release and fans that exhaust to the outside (to the atmosphere).

#### 16 2.1.1.6.2 Liquid Wastes

17 Liquid wastes would be generated during all phases of uranium recovery at Lost Creek. Such  
18 wastes include well development water, pumping test water, storm water runoff, waste  
19 petroleum products and chemicals, wash down water, and domestic (sanitary) wastewater. In  
20 addition, three 11e.(2) by-product material liquid wastes (10 CFR Part 40, Appendix A, Crit.6)  
21 would be generated: 1) liquid process wastes, including chemicals; 2) 'affected' groundwater  
22 generated during well development; and 3) groundwater generated during aquifer restoration.  
23 Liquid effluents generated during well development and pumping tests would be expected to at  
24 least satisfy WDEQ-WDQ Class IV (groundwater clean-up) standards. Based on a Staff  
25 Requirements Memorandum on "Recommendations on Ways to Improve the Efficiency of NRC  
26 Regulation at In-Situ Leach Uranium Recovery Facilities", dated March 12, 1999, any waste  
27 water generated during, or after, the uranium extraction phase of site operations, and all  
28 evaporation pond sludge derived from such waste waters, are classified as 11e.(2) byproduct  
29 material.

30 Uranium mobilization and processing at Lost Creek would produce excess water that must be  
31 properly managed. The production wells extract slightly more water (approx. 1.0-1.5 percent)  
32 than is re-injected into the host aquifer, which creates a net inward flow of groundwater into the  
33 well field. During normal operations, production rates would be controlled by withdrawing a  
34 small portion of the barren solution (called production bleed) from the ion exchange circuit which  
35 is then disposed via the deep disposal (Class I) wells. These wells would be located in the  
36 southwestern portion of the site and would be similar in depth and design to deep wells found at  
37 other ISR sites. In addition, two 49- x 79-m (160- x 260-ft) storage ponds would be constructed  
38 adjacent (to the east) of the CPP for the purpose of shut down of the Class1 wells (Figure 2-3).  
39 The ponds would be designed to handle the maximum facility waste generation flow rate (227  
40 liters per minute [Lpm]; 60 gallons per minute [gpm]). The redundant design is in case a leak is  
41 detected in one of the ponds. At maximum design-rated production 22,700 Lpm (6,000 gpm),  
42 approximately 230-340 Lpm (60-90 gpm) would be diverted as production bleed. If the Class I  
43 deep disposal wells become inoperable, or are shut down for maintenance, two 49- x 79-m  
44 (160- x 260-ft) storage ponds would be used to dispose of production bleed.

45 Other liquid waste streams would be produced during the operation of Lost Creek. These  
46 include liquids from storm water, domestic wastewater (sewage), pumping test water, elution  
47 circuit bleed, and wash down water (containing waste petroleum products and chemicals). Only

- 1 the elution circuit bleed would be sent to the deep disposal wells. The project water balance for
- 2 Lost Creek is shown graphically in Figure 2-13.
- 3

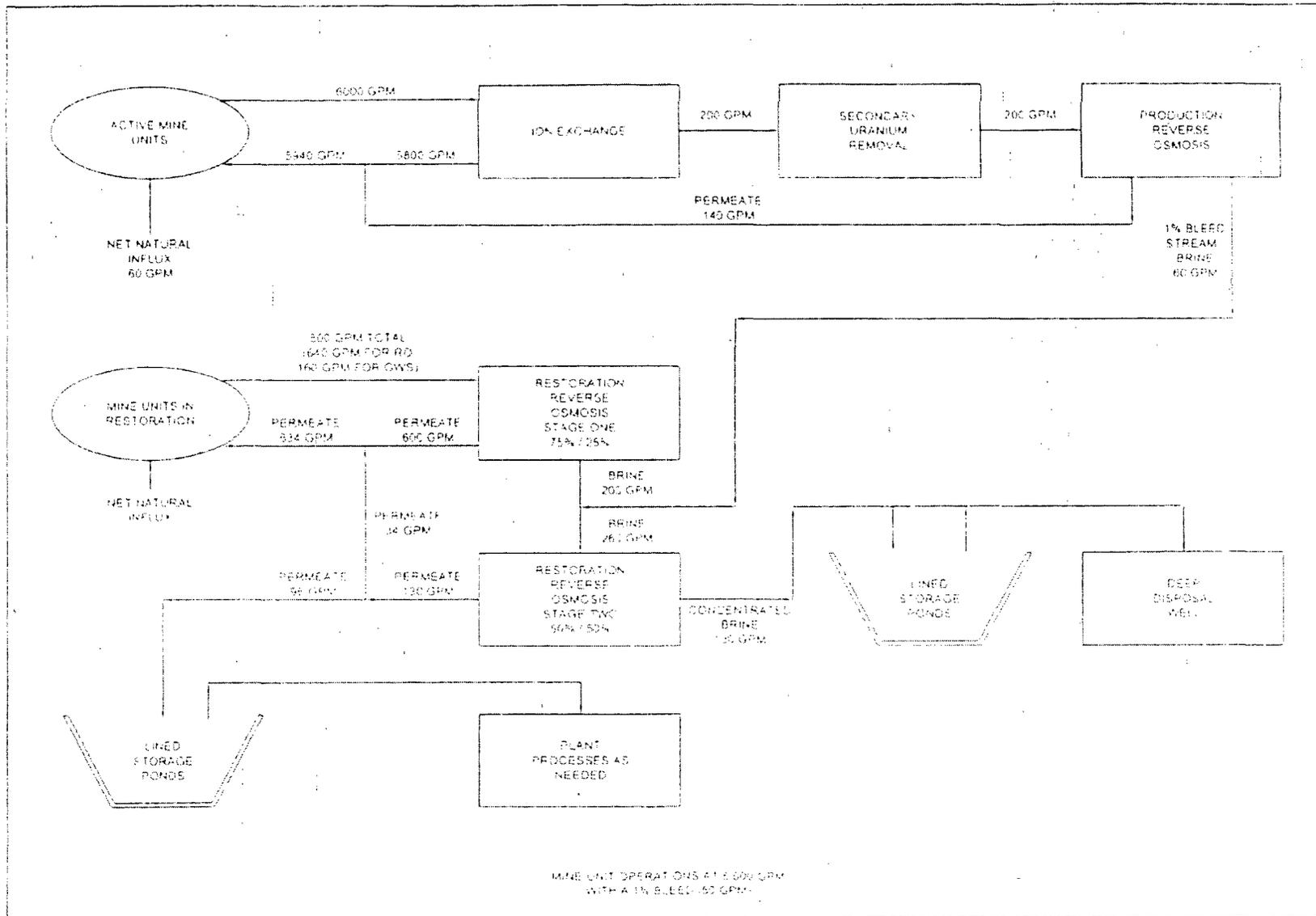


Figure 2-13. Project Water Balance

1 The restoration water would be treated by reverse osmosis and then re-injected into the  
2 production area undergoing restoration. Restoration water bleed would be transferred to the  
3 deep disposal wells. Sanitary wastes would also be generated from restrooms and lunchrooms.  
4 Sanitary wastes would be disposed of in an onsite septic system.

#### 5 2.1.1.6.3 Solid Wastes

6 Solid wastes would be generated during all phases of the Lost Creek project. The storage,  
7 treatment, and eventual disposal of these wastes would differ according to their characteristics.

##### 8 2.1.1.6.3.1 *Non-11e.(2) By-Product Materials*

9 These materials would include non-hazardous materials such as paper, wood, plastic, steel,  
10 biodegradable, and sewage sludge, and hazardous materials such as waste petroleum products  
11 and batteries. Materials that can be decontaminated would fall in this category. Non-hazardous  
12 waste materials, with the exception of sewage sludge, would be recycled, where possible, or  
13 temporarily stored in bins prior to off-site disposal at a licensed solid waste facility. Hazardous  
14 wastes would be stored in clearly labeled sealed containers in a secure location, and  
15 periodically collected by a commercial hauler for recycling or energy recovery. LCI estimates  
16 that the following amounts of solid wastes would be generated annually: 1) 227-318 kg (500-  
17 700 lb) of non-11e.(2) by-product material; 2) about 2.3-3.8 m<sup>3</sup> (3-5 yd<sup>3</sup>) of sewage sludge; and  
18 3) 4.5-9.1 kg (10-20 lb) of batteries and other hazardous wastes.

##### 19 2.1.1.6.3.2 *Solid 11e.(2) By-Product Materials*

20 These materials would include process wastes (spent ion exchange resin, filter media, and tank  
21 sludge) and equipment (tanks, vessels, and piping) that becomes contaminated during the ISR  
22 process. To the extent practicable, these materials would be decontaminated for disposal or  
23 reuse. For equipment and materials that cannot be decontaminated, they would be properly  
24 packed, sealed, and labeled for disposal at a licensed facility. LCI estimates that approximately  
25 77 m<sup>3</sup> (100 yd<sup>3</sup>) of 11e.(2) by-product material would be generated annually.

#### 26 2.1.1.7 *Transportation*

27 Transportation to, from, and within the boundaries of the Lost Creek ISR Project would primarily  
28 encompass the use of both light duty and heavy trucks. Light duty trucks and automobiles  
29 would transport construction contractors and the operations workforce, as well as deliver  
30 smaller equipment and office supply products. During all phases of the project, heavy duty  
31 trucks would transport construction equipment and materials, operational processing supplies,  
32 ion exchange resins, yellowcake product, and waste materials. Transportation to and from the  
33 Lost Creek project area would include shipment of yellowcake slurry from the processing plant  
34 to an offsite dryer, delivery of construction-related materials, process chemicals, and  
35 maintenance equipment from suppliers, shipments of unrestricted solid waste to local landfills,  
36 transfer of 11e.(2) byproduct material to a licensed facility for disposal, and the transport of  
37 employees to and from the site.

38 A final destination for outgoing shipments of yellowcake slurry has not been determined at this  
39 time. Construction-related materials, process chemicals, and maintenance supplies would be  
40 delivered on varying schedules depending on production rate, usage, time of year, and other  
41 needs. Projections of solid waste generation are similarly dependent on production rate. LCI  
42 estimates that vehicle traffic would commence at 30 to 35 light trucks and 2 to 5 heavy trucks  
43 per day entering and leaving the site during the construction phase. During operation, light  
44 truck traffic would diminish slightly to about 20 light trucks with heavy truck traffic remaining  
45 constant (and including 1 to 2 trucks per week carrying yellowcake slurry offsite).

1 Within the Project area, there would be about 15 light trucks traveling to and from the mine units  
2 for monitoring and maintenance, and 10 drill rigs operating for well installation and ore  
3 delineation. These vehicles would reside on the site and not routinely leave as would the  
4 commuting workforce, incoming shipments of supplies, or outgoing yellowcake slurry. The  
5 projected types and numbers are provided in Table 2-1.

1

<b>Table 2-1. Projected Vehicle Needs: Lost Creek ISR Project</b>				
<b>Vehicle Type</b>	<b>Company Owned (On Site Only)</b>	<b>Company Owned (On and Off Site)</b>	<b>Contractor Owned (On and Off Site)</b>	<b>Total</b>
Pickup Truck (½, ¾, 1 ton)	24	3	10	37
Van		4		4
Tractor Trailer		1		1
All Wheel Drive Forklift	3			3
Hard Surface Forklift	2			2
Motor Grader	1			1
Backhoe	2			2
Geophysical Logging Truck	3			3
All Terrain Vehicle	1			1
Flat Bed Trailer	3			3
Reel Trailer	3			3
High-Density Polyethylene (HDPE) Fusion Cart	1			1
Generator	9			9
Water Truck	2		10	12
Mechanical Integrity Testing Truck	1			1
Cementers	6			6
Side Dump or End-Dump Trailer		1		1
Truck Mounted Drill Rig			10	10

2 Source: LCI, 2008a,b

3

4 **2.1.1.8 Financial Surety**

5 As stated in Section 2.10 of the GEIS, NRC regulations (10 CFR Part 40, Appendix A, Criterion  
6 (9)) require that applicants cover the costs to conduct decommissioning, reclamation of  
7 disturbed areas, waste disposal, dismantling, disposal of all facilities including buildings and well  
8 fields, and groundwater restoration. LCI would maintain financial surety arrangements to cover  
9 such costs for the Lost Creek ISR Project. The initial surety estimate would be based on the  
10 first year of operation, which includes the construction of the Lost Creek central processing plant  
11 (CPP). Annual revisions to the surety estimate would be required by the NRC and WDEQ-LQD  
12 to reflect existing operations and planned construction or operation the following year. Once the  
13 NRC, WDEQ-LQD, and LCI have agreed to the estimate, LCI would submit a reclamation  
14 performance bond, irrevocable letter of credit, or other surety instrument to the NRC and

1 WDEQ-LQD. The NRC reviews financial surety in detail as part of its review for the Safety  
2 Evaluation Report (SER).

### 3 **2.1.2 No-Action (Alternative 2)**

4 The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA require  
5 NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed  
6 action before acting on a proposal. The No-Action alternative means that "the proposed activity"  
7 would not take place, although activities currently on-going or that would happen at the site over  
8 the proposed licensing period would still occur. The resulting environmental effects from taking  
9 No-Action would be compared with the effects of permitting the proposed activity or an  
10 alternative activity to go forward" (46 FR 18026). Under this alternative, LCI would not be  
11 issued a license to construct and operate ISR facilities at the proposed site. Existing activities  
12 such as grazing and herding operations would be expected to continue in the case of the No-  
13 Action alternative. The No-Action alternative is included to provide a basis for comparing and  
14 evaluating the potential impacts of the other alternatives, including the proposed action.

### 15 **2.1.3 Dry Yellowcake (Alternative 3)**

16 Under Alternative 3, NRC would issue LCI a license for the construction, operation, aquifer  
17 restoration, and decommissioning of an ISR facility at the Lost Creek site for uranium recovery  
18 and the production of dry yellowcake as the final product. By doing so, the project would differ  
19 from the proposed action in that additional equipment for the production of dry yellowcake would  
20 be needed. The additional equipment would be installed in the CPP located at the Lost Creek  
21 site. The dry yellowcake would be transported from the Lost Creek site directly to Metropolis,  
22 Illinois for the next step in the production of fuel for commercial nuclear reactors. This additional  
23 process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site  
24 to an intermediate dry processing facility before being shipped to Illinois.

25 As with the proposed action, yellowcake slurry (30 to 50 percent solids) would be produced.  
26 However, under this alternative, the slurry would be filter-pressed to remove additional water,  
27 dried, and packaged on-site. This is accomplished, in part, by drying the slurry in a yellowcake  
28 dryer. Historically, two kinds of yellowcake dryers have been used, multi-hearth dryers and  
29 vacuum dryers.

30 Older uranium ISL facilities used gas-fired multi-hearth dryers. These use high temperatures  
31 that burn all organic contaminants. A scrubber is used so that uranium particulates are removed  
32 before they are released to the atmosphere.

33 Newer ISR facilities usually use vacuum yellowcake dryers. In a vacuum dryer, the heating  
34 system is isolated from the yellowcake so that no radioactive materials are entrained in the  
35 heating system or its exhaust. The drying chamber that contains the yellowcake slurry is under  
36 vacuum, so that any potential leak would cause air to flow into the chamber. Drying takes place  
37 at relatively low temperatures.

38 Emissions from the drying chamber are normally treated through a bag filter to remove  
39 yellowcake particulates and any water vapor exiting the drying chamber is cooled and  
40 condensed. The dried product (yellowcake) is removed from the bottom of the dryer and  
41 packaged in drums for eventual shipping offsite, to Metropolis, Illinois. The packaging area also  
42 has a bag filter dust collection system to protect personnel and to minimize yellowcake release.  
43 Air from the bag filter dust collection system is typically routed to the dryer off-gas line and  
44 scrubber. During drum loading, the drum is also kept under negative pressure via a drum hood  
45 with a suction line. Parameters important to the effective operation of the dryer are monitored

1 per NRC regulations at 10 CFR Part 40, Appendix A, Criterion (8). The final, dried product is  
2 cooled, packaged and shipped in 208-L (55-gal) drums.

### 3 **2.2 Alternatives Eliminated from Detailed Analysis**

4 As described in Section 2.13 and Appendix C of the GEIS, alternate methods for uranium  
5 recovery include conventional mining/milling and mining/heap leaching at the Lost Creek  
6 Project. This section provides the rationale for why these two alternatives, in addition to two  
7 other alternatives (alternate lixivants and alternate waste disposal methods) were considered  
8 but not carried forward for detailed analysis. It should be noted that LCI did not consider any of  
9 these alternatives in its application. Additionally, the NRC cannot require an applicant to  
10 consider alternate methodologies.

#### 11 **2.2.1 Conventional Mining and Milling at the Lost Creek Project**

12 Uranium ore deposits at depth may be accessed either by open pit (surface) mining or by  
13 underground mining techniques. Open pit mining is used to exploit shallow ore deposits,  
14 generally deposits less than 170 m (550 ft) below ground surface (EPA, 2008a). To gain access  
15 to the deposit, the topsoil is first removed and may be stockpiled for later site reclamation, while  
16 the remainder of the material overlying the deposit (i.e., the overburden) can be removed via  
17 mechanical shovels and scrapers, trucks or loaders, or by blasting (EPA, 1995; 2008a). The  
18 depth to which an ore body is surface mined depends on the ore grade, the nature of the  
19 overburden, and the ratio of the amount of overburden to be removed to extract one unit of ore  
20 (EPA, 1995).

21 Underground mining techniques vary depending on size, depth, orientation, grade of the ore  
22 body, the stability of the subsurface strata, and economic factors (EPA, 1995, 2008). In  
23 general, underground mining involves sinking a shaft near the ore body and then extending  
24 levels from the main shaft at different depths to access the ore. Ore and waste rock would need  
25 to be removed through shafts by elevators or by using trucks to carry these materials up inclines  
26 to the surface (EPA, 2008a).

27 In addition, once the open pit or underground workings are established, the mine may need to  
28 be dewatered to allow the extraction of the uranium ore. Dewatering can be accomplished  
29 either by pumping directly from the open pit or through pumping of interceptor wells to lower the  
30 water table (EPA, 1995). The mine water likely will require treatment prior to discharge, due to  
31 contamination from radioactive constituents, metals, and suspended and dissolved solids.  
32 Discharge of these mine waters may have subsequent impacts to surface water drainages and  
33 sediments, as well as to near-surface sources of groundwater (EPA, 1995).

34 Following the completion of mining, either by open pit or underground techniques, reclamation  
35 of the mine is needed. Stockpiled overburden can be reintroduced into the mine, either during  
36 extraction operations or following and topsoil re-applied in an attempt to re-establish topography  
37 consistent with the surroundings. With the end of dewatering, the water table may rebound and  
38 fill portions of the open pit and underground workings. Historically, uranium mines have  
39 impacted local groundwater supplies and the waste materials from the mines have  
40 contaminated lands surrounding the mines (EPA, 2008b).

41 Ore extracted from the open pit or underground mine would be processed in a conventional mill.  
42 As discussed in Appendix C of the GEIS (NRC, 2009), ore processing at a conventional mill  
43 involves a series of steps (handling and preparation, concentration, and product recovery).  
44 While the conventional milling techniques recovers approximately 90 percent of the uranium  
45 content of the feed ore (NRC, 2009), the process does generate substantial wastes (known as

1 tailings) since roughly 95 percent of the ore rock is disposed as waste (NRC, 2006). This  
2 process also can consume large amounts of water (e.g., approximately 534 liters per minute  
3 (Lpm; 141 gallons per minute [gpm]) for the proposed Pinon Ridge mill in Colorado (EFRC,  
4 2009)).

5 Tailings are disposed in areally extensive lined impoundments, the design and construction of  
6 which are reviewed by NRC to ensure safe disposal of the tailings (NRC, 2009). Reclamation of  
7 the tailings pile generally involves evaporation of liquids in the tailings, settlement of the tailings  
8 over time, and covering the pile with a thick radon barrier and earthen material or rocks for  
9 erosion control. An area surrounding the reclaimed tailings piles would be fenced off in  
10 perpetuity, and the site transferred to either a State or Federal agency for long-term care (EIA,  
11 1995). The costs associated with final mill decommissioning and tailings reclamation can run  
12 into the tens of millions of dollars (EIA, 1995).

13 As discussed in section 2.1.1.2.4, the average ore grade of the uranium deposit at the Lost  
14 Creek Project is above 0.1 percent, while the depth to the deposit is approximately 91 to 213 m  
15 (300 to 700 ft) below ground surface (bgs). While the ore grade and depth to ore are consistent  
16 with deposits mined either by open pit or underground workings, the environmental impacts  
17 from mining and conventional milling are more substantial than impacts from the ISR process at  
18 this site (see Chapter 4). For these considerations, this alternative is not carried forward for  
19 detailed analysis.

## 20 **2.2.2 Conventional Mining and Heap Leaching at the Lost Creek Project**

21 Heap leaching is discussed in Appendix C of the GEIS. For low-grade ores, heap leaching is a  
22 viable alternative. Low-grade ore removed from open-pit or underground mining operations  
23 undergo further processing to remove and concentrate the uranium. Heap leaching is typically  
24 use when the ore body is small and situated far from the milling site. The low-grade ore is  
25 crushed to approximately 2.6 cm (1 in) in size and mounded above grade on a prepared pad. A  
26 sprinkler or drip system positioned over the top continually distributes leach solution over the  
27 mound. Depending on the lime content, an acid or alkaline solution can be used. The leach  
28 solution trickles through the ore and mobilizes the uranium, as well as other metals, into  
29 solution. The solution is collected at the base of the mound by a manifold and processed to  
30 extract the uranium. The uranium recovery from heap leaching is expected to range from 50 to  
31 80 percent, resulting in a final tailings material of around 0.01 percent U<sub>3</sub>O<sub>8</sub> content. Once heap  
32 leaching is complete, the depleted materials are AEA section 11e.(2) byproduct material that  
33 must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for  
34 disposal in place. While the impacts from heap leaching may be less than those from  
35 conventional milling, the impacts from the associated open pit or underground mining would still  
36 be substantial. For these considerations, similar to those listed in Section 2.2.1, this alternative  
37 is not carried forward for detailed analysis.

## 38 **2.2.3 Alternate Lixivants**

39 Alternate lixivants such as acid or ammonium carbonate solutions have been used in the past  
40 in ISR operations but are not currently used by NRC-licensed facilities because of the difficulties  
41 in restoring and stabilizing the affected aquifers (NRC, 2009a). For this reason, alternative  
42 lixivants were not carried forward for detailed analysis.

## 43 **2.2.4 Alternate Waste Disposal Methods**

44 Alternate waste disposal methods such as evaporation ponds or land application (typically spray  
45 irrigation) have been used in the past or are in use at currently licensed ISR operations. Both of

1 these disposal methods pose potential environmental impacts (NRC, 2009, section 4.2.12.2).  
2 The construction and operation of evaporation ponds involves both land disturbance and the  
3 potential for additional impacts to soils and near surface aquifers from pond leaks. These  
4 impacts would be expected to be mitigated through pond design features (e.g., double synthetic  
5 liners with a leak detection system) and best management practices (e.g., topsoil and erosion  
6 management controls). The land application of treated wastewater could potentially impact soils  
7 by allowing accumulation of residual radionuclide or chemical constituents in the irrigated soils  
8 over time. At NRC-licensed facilities, irrigation areas are monitored to maintain radionuclide  
9 and other constituents within allowable release standards. Additionally, licensees monitor the  
10 wastewater prior to application to ensure release limits would be met. As discussed in the  
11 GEIS, the potential environmental impacts of these waste disposal methods would be expected  
12 to be SMALL. Because the impact significance of these disposal methods is the same as would  
13 be expected for deep well injection of process-related wastewater (the disposal method  
14 proposed by the applicant), these alternate waste disposal methods were not carried forward for  
15 detailed analysis.

### 16 **2.3 Comparison of the Predicted Environmental Impacts**

17 NRC's NUREG-1748 (NRC, 2003) categorizes the significance of potential environmental  
18 impacts as follows:

19 **SMALL:** The environmental effects are not detectable or are so minor that they will neither  
20 destabilize nor noticeably alter any important attribute of the resource considered.

21 **MODERATE:** The environmental effects are sufficient to alter noticeably, but not  
22 destabilize, important attributes of the resource considered.

23 **LARGE:** The environmental effects are clearly noticeable and are sufficient to destabilize  
24 important attributes of the resource considered.

25 In this section, for each of the three alternatives, the potential environmental impacts to each  
26 resource area are summarized for all four of the ISR phases - construction, operation, aquifer  
27 restoration, and decommissioning. The significance levels (SMALL, MODERATE, and LARGE)  
28 are specific to each resource and are defined in Chapter 4.

29 The environmental resources found in the project area are discussed in Chapter 3. Based on  
30 the description of the ISR process and the historical information on ISR facilities in Chapter 2  
31 and in the GEIS, the potential environmental impacts are described and analyzed in Chapter 4.  
32 These impacts are listed in Table 2-2. For resource areas where two significance levels are  
33 shown (e.g., MODERATE/SMALL), the first level indicates the potential impact without any  
34 mitigation, and second indicates with mitigation.

1

<b>Table 2-2. Summary of Impacts</b>			
Section 4.2 - Land Use Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.2.1.1	NONE 4.2.2	SMALL 4.2.3
Operation	SMALL 4.2.1.2	NONE 4.2.2	SMALL 4.2.3
Aquifer Restoration	SMALL 4.2.1.3	NONE 4.2.2	SMALL 4.2.3
Decommissioning	SMALL 4.2.1.4	NONE 4.2.2	SMALL 4.2.3
Section 4.3 - Transportation Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.3.1.1	NONE 4.3.2.1	SMALL 4.3.3.1
Operation	SMALL 4.3.1.2	NONE 4.3.2.2	SMALL 4.3.3.2
Aquifer Restoration	SMALL 4.3.1.3	NONE 4.3.2.3	SMALL 4.3.3.3
Decommissioning	SMALL 4.3.1.4	NONE 4.3.2.4	SMALL 4.3.3.4
Section 4.4 - Geology and Soils Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.4.1.1	NONE 4.4.2	SMALL 4.4.3
Operation	SMALL 4.4.1.2	NONE 4.4.2	SMALL 4.4.3
Aquifer Restoration	SMALL 4.4.1.3	NONE 4.4.2	SMALL 4.4.3
Decommissioning	SMALL 4.4.1.4	NONE 4.4.2	SMALL 4.4.3
Section 4.5 - Water Resources Impacts (Surface Water and Wetlands)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.5.1.1.1	NONE 4.5.1.2	SMALL 4.5.1.3
Operation	SMALL 4.5.1.1.2	NONE 4.5.1.2	SMALL 4.5.1.3
Aquifer Restoration	NONE 4.5.1.1.3	NONE 4.5.1.2	NONE 4.5.1.3
Decommissioning	SMALL 4.5.1.1.4	NONE 4.5.1.2	SMALL 4.5.1.3
Section 4.5 - Water Resources Impacts (Groundwater)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)

<b>Table 2-2. Summary of Impacts</b>			
Construction	SMALL 4.5.2.1.1	NONE 4.5.2.2	SMALL 4.5.2.3
Operation	MODERATE/SMALL 4.5.2.1.2	NONE 4.5.2.2	MODERATE/SMALL 4.5.2.3
Aquifer Restoration	MODERATE/SMALL 4.5.2.1.3	NONE 4.5.2.2	MODERATE/SMALL 4.5.2.3
Decommissioning	SMALL 4.5.2.1.4	NONE 4.5.2.2	SMALL 4.5.2.3
<b>Section 4.6 - Ecological Resources Impacts (Vegetation)</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.6.1.1.1.1	NONE 4.6.2	SMALL 4.6.3
Operation	SMALL 4.6.1.2.1	NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration	SMALL 4.6.1.3	NONE 4.6.2	SMALL 4.6.3
Decommissioning	SMALL 4.6.1.4	NONE 4.6.2	SMALL 4.6.3
<b>Section 4.6 - Ecological Resources Impacts (Wildlife)</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL 4.6.1.1.1.2	NONE 4.6.2	MODERATE/SMALL 4.6.3
Operation	SMALL 4.6.1.2.2	NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration	SMALL 4.6.1.2.3	NONE 4.6.2	SMALL 4.6.3
Decommissioning	SMALL 4.6.1.2.4	NONE 4.6.2	SMALL 4.6.3
<b>Section 4.7 - Air Quality Impacts</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.7.1.1	NONE 4.7.2	SMALL 4.7.3.1
Operation	SMALL 4.7.1.2	NONE 4.7.2	SMALL 4.7.3.2
Aquifer Restoration	SMALL 4.7.1.3	NONE 4.7.2	SMALL 4.7.3.3
Decommissioning	SMALL 4.7.1.4	NONE 4.7.2	SMALL 4.7.3.4
<b>Section 4.8 - Noise Impacts</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.8.1.1	NONE 4.8.2	SMALL 4.8.3
Operation	SMALL 4.8.1.2	NONE 4.8.2	SMALL 4.8.3

<b>Table 2-2. Summary of Impacts</b>			
Aquifer Restoration	SMALL 4.8.1.3	NONE 4.8.2	SMALL 4.8.3
Decommissioning	SMALL 4.8.1.4	NONE 4.8.2	SMALL 4.8.3
<b>Section 4.9 - Historical and Cultural Resources Impacts</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL 4.9.1.1	SMALL 4.9.2	MODERATE/SMALL 4.9.3
Operation	SMALL 4.9.1.2	SMALL 4.9.2	SMALL 4.9.3
Aquifer Restoration	SMALL 4.9.1.3	SMALL 4.9.2	SMALL 4.9.3
Decommissioning	SMALL 4.9.1.4	SMALL 4.9.2	SMALL 4.9.3
<b>Section 4.10 - Visual and Scenic Resources Impacts</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.10.1.1	NONE 4.10.2	SMALL 4.10.3
Operation	SMALL 4.10.1.2	NONE 4.10.2	SMALL 4.10.3
Aquifer Restoration	SMALL 4.10.1.3	NONE 4.10.2	SMALL 4.10.3
Decommissioning	SMALL 4.10.1.4	NONE 4.10.2	SMALL 4.10.3
<b>Section 4.11 - Socioeconomics (Demographics)</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.1	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.1	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
<b>Section 4.11 – Socioeconomics (Income)</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.2	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.2	NONE 4.11.2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3

<b>Table 2-2. Summary of Impacts</b>			
<b>Section 4.11 - Socioeconomics (Housing)</b>			
	<b>Proposed Action (Alternative 1)</b>	<b>No-Action (Alternative 2)</b>	<b>Dry Yellowcake (Alternative 3)</b>
Construction	SMALL 4.11.1.1.3	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.3	NONE 4.11.2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
<b>Section 4.11 - Socioeconomics (Employment Structure)</b>			
	<b>Proposed Action (Alternative 1)</b>	<b>No-Action (Alternative 2)</b>	<b>Dry Yellowcake (Alternative 3)</b>
Construction	SMALL 4.11.1.1.4	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.4	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
<b>Section 4.11 - Socioeconomics (Local Finance)</b>			
	<b>Alternative 1—Proposed Action</b>	<b>No-Action (Alternative 2)</b>	<b>Dry Yellowcake (Alternative 3)</b>
Construction	SMALL 4.11.1.1.5	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.5	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
<b>Section 4.11 - Socioeconomics (Education)</b>			
	<b>Proposed Action (Alternative 1)</b>	<b>No-Action (Alternative 2)</b>	<b>Dry Yellowcake (Alternative 3)</b>
Construction	SMALL 4.11.1.1.6	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.6	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
<b>Section 4.11 - Socioeconomics (Health and Social Services)</b>			
	<b>Proposed Action (Alternative 1)</b>	<b>No-Action (Alternative 2)</b>	<b>Dry Yellowcake (Alternative 3)</b>
Construction	SMALL 4.11.1.1.7	NONE 4.11.2	SMALL 4.11.3

<b>Table 2-2. Summary of Impacts</b>			
Operation	MODERATE 4.11.1.2.7	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
<b>Section 4.12 - Environmental Justice</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Operation	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Aquifer Restoration	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Decommissioning	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
<b>Section 4.13 - Public and Occupational Health and Safety Impacts</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.13.1.1	NONE 4.13.2	SMALL 4.12.3.1
Operation	MODERATE/SMALL 4.13.1.2	NONE 4.13.2	MODERATE/SMALL 4.13.3.2
Aquifer Restoration	SMALL 4.13.1.3	NONE 4.13.2	SMALL 4.13.3.3
Decommissioning	SMALL 4.13.1.4	NONE 4.13.2	SMALL 4.13.3.4
<b>Section 4.14 - Waste Management Impacts</b>			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.14.1.1	NONE 4.14.2	SMALL 4.14.3
Operation	SMALL 4.14.1.2	NONE 4.14.2	SMALL 4.14.3
Aquifer Restoration	SMALL 4.14.1.3	NONE 4.14.2	SMALL 4.14.3
Decommissioning	SMALL 4.14.1.4	NONE 4.14.2	SMALL 4.14.3

1 **2.4 Preliminary Recommendation**

2 After weighing the impacts of the proposed action and comparing the alternatives, the NRC  
 3 staff, in accordance with 10 CFR 51.71(f), sets forth its preliminary NEPA recommendation  
 4 regarding the proposed action. The NRC staff recommends that, unless safety issues mandate  
 5 otherwise, environmental impacts of the proposed action (issuing a source material license for  
 6 the proposed Lost Creek ISR Project) are not so great as to make issuance of a source material  
 7 license an unreasonable licensing decision. Additionally, the NRC staff has concluded that the  
 8 applicable environmental monitoring program described in Chapter 6 and the proposed

1 mitigation measures discussed with the impacts in Chapter 4 would further reduce potential  
2 adverse environmental impacts associated with the proposed action.

3 The NRC staff has concluded that the overall benefits of the proposed action outweigh the  
4 environmental disadvantages and costs based on consideration of the following:

- 5 • Most of the potential impacts to environmental resource areas are expected to be  
6 SMALL, with the exception of geology and soils, groundwater, some areas of  
7 socioeconomics, and public and occupational health and safety during operation, and  
8 wildlife and cultural resources during construction, where such impacts would be  
9 MODERATE.
- 10 • ISR operations would take place in ore zone aquifers previously exempted by the U.S.  
11 Environmental Protection Agency as potential public drinking water sources.  
12 Additionally, the applicant would be required to monitor for excursions of lixiviant from  
13 the production zones and to take corrective actions in the event of an excursion. Finally,  
14 the applicant would be required to restore groundwater parameters affected by ISR  
15 operations to levels that are protective of public health and safety.
- 16 • Both construction and operations at the ISR facility would adhere to the guidelines  
17 provided by the WGFd for species of concern, such as the sage grouse.
- 18 • The regional benefits of building the proposed project would be increased employment,  
19 economic activity, and tax revenues in the region.

20 The costs associated with the proposed project are, for the most part, limited to the area  
21 surrounding the site.

## 22 **2.5 References**

23 10 CFR Part 40 Appendix A. *Code of Federal Regulations*, Title 10, Energy, Part 40  
24 Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of  
25 Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores  
26 Processed Primarily from their Source Material Content."

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 40 CFR Part 1508. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part  
30 1508, "Terminology and Index."

31 43 CFR Part 3809. *Code of Federal Regulations*, Title 43, *Public Lands - Interior*, Part 3809,  
32 "Surface Management."

33 EIA (Energy Information Administration). 1995. "Decommissioning of U.S. Uranium Production  
34 Facilities." Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0592. February 1995.

35 EIA (Energy Information Administration). 1995. "Decommissioning of U.S. Uranium Production  
36 Facilities." Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0592. February 1995.

37 EPA (Environmental Protection Agency). 2008a. "Technical Report on Technologically  
38 Enhanced Naturally Occurring Radioactive Materials from Uranium Mining: Mining and  
39 Reclamation Background." Volume 1. Office of Radiation and Indoor Air / Radiation Protection  
40 Division. EPA-402-R-08-005. April 2008.

- 1 EPA (Environmental Protection Agency). 2008b. "Health and Environmental Impacts of
- 2 Uranium Contamination in the Navajo Nation: Five-Year Plan." requested by House Committee
- 3 on Oversight and Government Reform. June 9, 2008.
- 4 LCI, 2008a. Lost Creek ISR, LLC. *Lost Creek Project Environmental Report, Volumes 1 through*
- 5 *3 (Revision 1)*, South-Central Wyoming. Application for US NRC Source Material License
- 6 (Docket No. 40-9068). March 2008.
- 7 LCI, 2008b. Lost Creek ISR, LLC. *Lost Creek Project Technical Report, Volumes 1 through 3*
- 8 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket
- 9 No. 40-9068). March 2008.
- 10 National Environmental Policy Act of 1969 (NEPA). 42 USC 4321 et seq.
- 11 NRC, 2009. *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling*
- 12 *Facilities*. NUREG-1910, Vol. 1 and 2. May 2009.
- 13 NRC, 2003. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated
- 14 With NMSS Programs—Final Report." Washington, DC: NRC. August 2003.



1

2

## 3 3 AFFECTED ENVIRONMENT

3

### 3.1 Introduction

4 The Lost Creek ISR Project is located in the Great Divide Basin, in a rural northeast area of  
5 Sweetwater County, Wyoming. The proposed project is about 113 km (70 mi) southeast of the  
6 City of Lander, and approximately 64 km (40 mi) northwest of the City of Rawlins (see Figure 1-  
7 1). The project area encompasses approximately 1,709 ha (4,220 ac) of semi-arid land with the  
8 area of direct land disturbance from proposed ISR construction and operations consisting of  
9 approximately 115 ha (285 ac) (LCI, 2008a).

10 This chapter describes the existing site conditions of the Lost Creek ISR Project. For the  
11 purposes of this SEIS, the term "study area" refers to the 1,709 ha (4,220 ac) project area plus  
12 an area extending 3.2 km (2 mi) as suggested in NUREG-1569 unless it is specified as a  
13 different radius for a particular resource (NRC, 2003). The resource areas described in this  
14 section include land use, transportation, geology and soils, water resources, ecology, noise, air  
15 quality, historical and cultural resources, visual and scenic resources, socioeconomics, and  
16 public and occupational health. Relevant impact topics were selected based on agency and  
17 public concerns, regulatory and planning requirements, and known resource issues. The  
18 information provided in this chapter would be used as context for comparing the potential  
19 impacts of each alternative, which are presented in Chapter 4: Environmental Impacts.

20

### 3.2 Land Use

21 The proposed Lost Creek ISR Project is located in the southeast quadrant of the Wyoming West  
22 Uranium Milling Region (GEIS, NRC 2009) in the rural northeast section of Sweetwater County,  
23 Wyoming, and encompasses approximately 1,709 ha (4,200 ac) of land. The project area is  
24 about 24 km (15 mi) southwest of the Town of Bairoil (population approximately 100), 61 km (38  
25 mi) northwest of Rawlins (population approximately 8,500), and about 144 km (90 mi) southwest  
26 of Casper (population approximately 50,000). The regional landscape consists of rolling plains  
27 with some draws, rock outcroppings, ridges, bluffs and some isolated mountainous areas.  
28 Vegetation is primarily sagebrush and rabbit brush. The area is sparsely populated, and the  
29 closest residence is approximately 24 km (15 mi) from the project area boundaries. The  
30 weather is dry and windy, with short, hot summers and cold winters. There is no perennial  
31 surface water, and only a few ephemeral drainages that could convey surface runoff during  
32 spring snowmelt and following intense rainstorms. Figure 1-1, Lost Creek Project Location Map,  
33 shows the location of the proposed project area within Sweetwater County, and within the State  
34 of Wyoming. Primary access to the proposed project area is currently from the west via  
35 Wamsutter-Crooks Gap Road on the proposed primary access road (Lost Creek Road). Land  
36 uses within the proposed project area include rangeland, pastureland, recreation, and mineral  
37 and natural resource extraction (Sweetwater County, 2005).

38 The entire project area is composed of public land, approximately 85 percent of which is owned  
39 by the U.S. Federal government and administered by the BLM, with the remaining 15 percent of  
40 the land owned by the State of Wyoming. Within the extended study area (3.2 km [2 mi]  
41 outward from the property borders of the proposed project area), 96 percent of the area is  
42 federally owned, three percent is owned by the State of Wyoming, and one percent is privately  
43 owned. Figure 2-2, Land Ownership, shows how the federal and state land ownership is divided  
44 within the project area. Their usage is described in the following sections.

1 **3.2.1 Rangeland**

2 Three BLM grazing allotments--Stewart Creek, Green Mountain, and Cyclone Rim encompass  
 3 the entire project area. The Cyclone Rim allotment occupies the largest land area within the  
 4 project area at approximately 1000 ha (2,500 ac). The Stewart Creek and Green Mountain  
 5 allotments occupy the remaining approximately 680 ha (1,700 ac) of land within the project  
 6 area. All three BLM grazing allotments continue outside the project area and the study area to  
 7 occupy a large portion of northeast Sweetwater County (Figure 3-1). The grazing allotments are  
 8 mostly used by cattle, with a small number of horses and sheep.

9 The productivity of the grazing lands is measured by animal unit months (AUMs). An AUM is  
 10 defined as the amount of forage to sustain one mature cow or the equivalent, based on an  
 11 average daily forage consumption of 11.7 kg (26 lb) of dry matter per day. The total AUMs for  
 12 the study area is 3,662. These grazing allotments are used for rangeland capable of supporting  
 13 approximately 305 head of cattle with year round grazing sustenance (LCI, 2008b). Large  
 14 expanses of open land used historically for grazing provide a valuable cultural resource in terms  
 15 of views and agricultural activity, as well as an economic source of income for ranchers and the  
 16 State of Wyoming (NRC, 2009).

17 Two herd management areas (HMAs) for wild horses also overlap the project area, the Stewart  
 18 Creek HMA and the Lost Creek HMA. These two HMAs cover the same area as the BLM  
 19 grazing allotments: the Lost Creek HMA coincides with the Cyclone Rim Allotment, and the  
 20 Stewart Creek HMA coincides with the Stewart Creek allotment.

21 **3.2.2 Hunting and Recreation**

22 Recreational activities that occur within 32 km (20 mi) of the project area include fishing, hiking,  
 23 river rafting, camping and wildlife viewing. Land within and surrounding the proposed project  
 24 area is also used for regulated hunting of certain animals that occur in the area. Antelope, deer,  
 25 elk, and mountain lion are the predominant types of game that are hunted within the region.  
 26 Both the number of licensed hunters, and the wildlife taken from the area are summarized in  
 27 Table 3-1.

**Table 3-1. Hunting Statistics for Hunt Areas that Include the Project Area**

Game	Hunter Days	Active Licenses	Total Harvest	Hunter Success (Percent)	Outfitters	Hunting Area
Antelope	683	233	229	98.30	19	Chain Lakes
Deer	544	126	12	9.50	7	Chain Lakes
Elk	496	82	42	51.20	3	Shamrock Hills
Mountain Lion	NA	NA	1	NA	5	Red Desert

28 Source: WGFD 2007                      NA= No Data

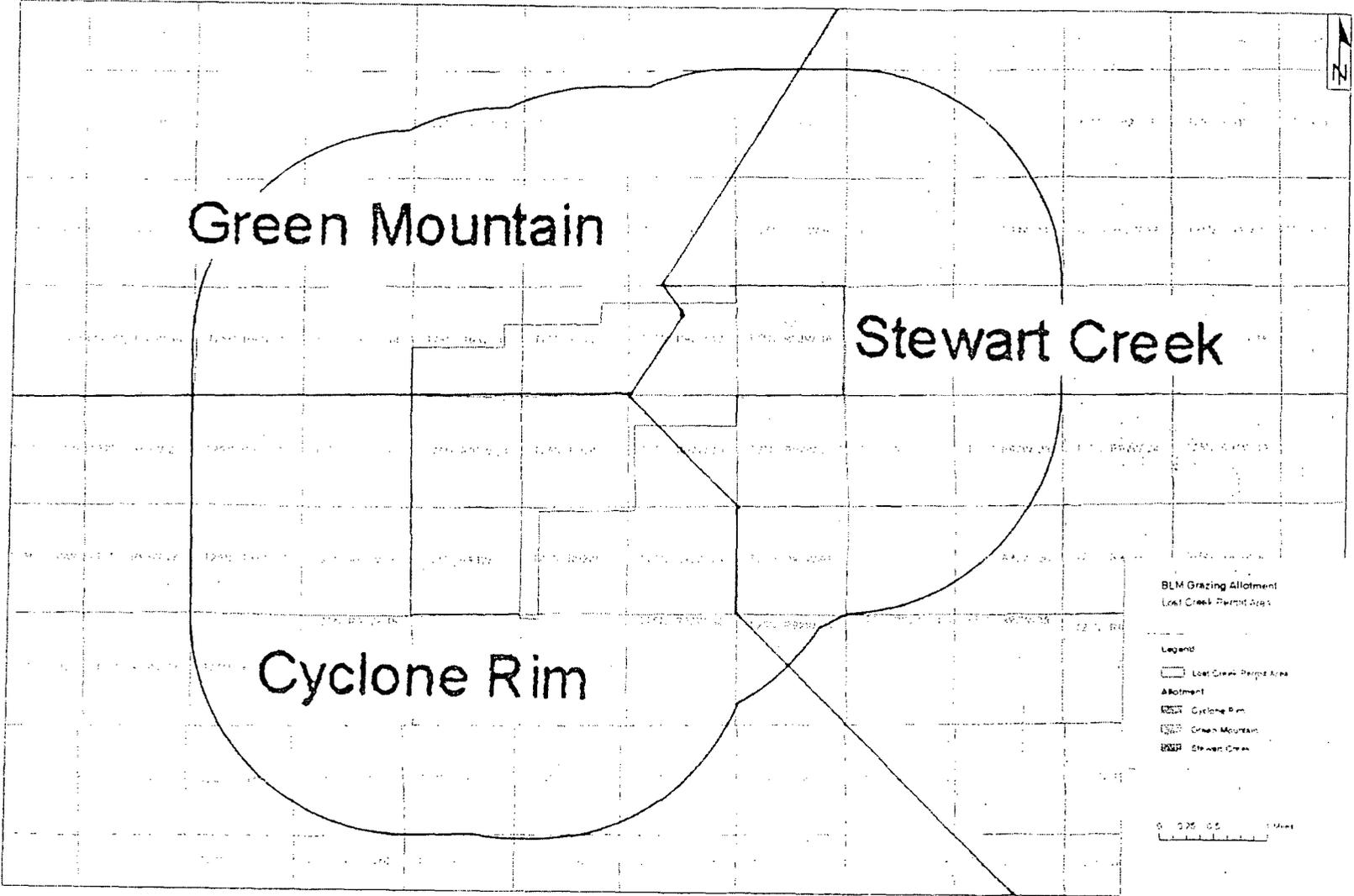


Figure 3-1. BLM Grazing Allotments

1 There are several fishing outfits that operate within 24 km (15 mi) of the project area. The  
2 closest known fishing areas to the project area are Lost Creek and Lost Creek Butte Lake,  
3 which are located approximately 16 km (10 mi) from the project area. There are also  
4 designated camping sites in the Green Mountains located 13 km (8 mi) to the north of the  
5 project area.

### 6 **3.2.3 Minerals and Energy**

7 While the lands encompassing the project area are occupied by the Stewart Creek, Green  
8 Mountain, and Cyclone Rim BLM grazing allotments, portions of these public lands are also  
9 used for natural resource extraction, which is classified as a subcategory use of pasturelands  
10 and rangelands. The mining industry accounts for approximately 20 percent of all economic  
11 activity conducted in Sweetwater County. The principal natural resources that are sought out  
12 within the vicinity of the project area are uranium, oil and gas, coal, and other minerals. Oil  
13 recovery operations via CO<sub>2</sub> injection are in the final stages in the Lost Soldier-Wertz Fields  
14 area, near the town of Bairoil. There are also several conventional and ISR uranium mining  
15 facilities that are located within the vicinity of the project area. The closest facility to the project  
16 area is the Sweetwater Mill operated by Kennecott Energy, which is a licensed conventional  
17 uranium mill located approximately 8 km (5 mi) south-southwest of the project area (NRC,  
18 2009).

### 19 **3.3 Transportation**

20 The Lost Creek ISR Project lies within the sparsely populated Great Divide Basin in the  
21 southern portion of the Wyoming West Uranium Milling Region. Interstate 80 (I-80) traverses  
22 the southern portion of the basin from east to west. The main north-south artery is U.S. 287,  
23 which traverses the eastern portion of the Great Divide Basin between Rawlins and Muddy Gap.  
24 The only other transportation routes in the basin are State Route (S.R.) 73 (Bairoil Road), the  
25 County Routes of Carbon, Sweetwater, and Fremont Counties, and BLM roads (Figure 2-5).  
26 Both county and BLM roads are maintained gravel surfaces. The maximum posted speed limit  
27 for rural portions of interstates is 120 kilometers per hour (kmph), or 75 miles per hour (mph),  
28 with urban postings of 96 kmph (60 mph). State highways have a maximum posted speed limit  
29 of 104 kmph (65 mph) (NRC, 2009).

30 Transportation to the project area would be predominantly from I-80 at Wamsutter, Wyoming,  
31 north on Wamsutter–Crooks Gap Road to the proposed primary access road (Lost Creek Road)  
32 entering the project area from the west (Figure 3-2). Alternate site access would be via I-80 at  
33 Rawlins, Wyoming, north for about 24 km (15 mi) on U.S. 287, west approximately 40 km (25  
34 mi) on Mineral Exploration Road (CR 63) then 9.6 km (6.0 mi) north on Sooner Road to the  
35 proposed access road entering the project area from the east (LCI, 2008a). Each of these  
36 roads is paved with the exception of Sooner Road. The distance from the location of the  
37 proposed plant facility to the nearest public road is 7.6 km (4.7 mi) west to Wamsutter – Crooks  
38 Gap Road and 7.2 km (4.5 mi) east to Sooner Road. The nearest paved, two-lane road is S.R.  
39 73 in Bairoil, 31 km (19 mi) to the northeast. Bairoil has a population of approximately 100, and  
40 is the location of the nearest airstrip, town offices (including a police station) and school.

41  
42  
43  
44

1 The primary interstate and U.S. highways are well maintained. The county roads providing  
2 access to the project area are generally maintained by the county biannually and are in fair  
3 condition, depending on the season and how recently maintenance occurred. These roads are  
4 infrequently plowed in the winter. Only two-track dirt roads are now present within the actual  
5 project area. These were installed for historical oil and gas and uranium exploration activities,  
6 and to support livestock and wildlife grazing. They are currently used for ranching, hunting, off-  
7 highway vehicle (OHV) use, antler collecting, and ongoing exploration. These roads have no  
8 drainage relief and are sometimes impassible during the winter months. Additional roadway  
9 data, such as the speed limit and average daily traffic, are provided in Table 3.3-1 of the ER  
10 (LCI, 2008a).

11 Two roads plan to be upgraded to access the project area. The primary access road would  
12 connect the Crooks Gap-Wamsutter Road to the west, while the secondary access road would  
13 connect the Sooner (BLM 3215) Road to the east. The western access road would carry the  
14 large, heavy-duty trucks carrying materials and supplies, while the majority of the workers (in  
15 light-duty trucks) would likely access from the east. It is estimated, during construction, that 30-  
16 35 light-duty trucks and 2-5 heavy-duty trucks would ingress and egress the site on a daily  
17 basis. During facility operation, activity would drop to about 20 light-duty and 2-5 heavy-duty  
18 trucks (including 1-2 trucks carrying yellowcake slurry), daily. These roads would be upgraded  
19 to BLM standards, as they involve BLM-administered land (min. 20-foot travelway, 2 percent  
20 crown, max. 10 percent grade). Other improvements would include: 1) 6-inch compacted road  
21 base; 2) ditch slopes 3:1, or greater; 3) BLM-approved cattle guards; and 4) culverts, posts and  
22 signage (LCI, 2009).

23 Access to the project area, as previously described, can be accomplished from several  
24 directions: 1) from Casper (105 miles) via WY 220, US 287, WY 73, CR 22, and BLM #3215; 2)  
25 from Rawlins (50 miles) via US 287, CR 63, and BLM #3215; 3) from Wamsutter (40 miles) via  
26 Wamsutter-Crooks Gap Road (CR 23); and 4) from Jeffrey City (30 miles) via CR 23.

27 On-site, approximately 15 light-duty trucks would travel among mine units for monitoring and  
28 maintenance, while about 10 drill rigs would be operating at any given time installing wells and  
29 delineating the ore body. These vehicles would utilize existing and new two-track roads. On-  
30 site roads and shown in Figure 3-3.

31 Crash data analysis on the regional roads was also conducted for the ER (LCI, 2008a). Data on  
32 truck crashes and truck volumes between 2002 and 2006 was used to calculate crash rates.  
33 For all of the study area roadways, the truck crash rates were negligible. In fact, on SR 73, no  
34 truck crashes occurred during the study period. Additional traffic information is available in  
35 Section 3.2.2 of the GEIS (NRC, 2009).

36  
37  
38  
39  
40  
41  
42  
43  
44

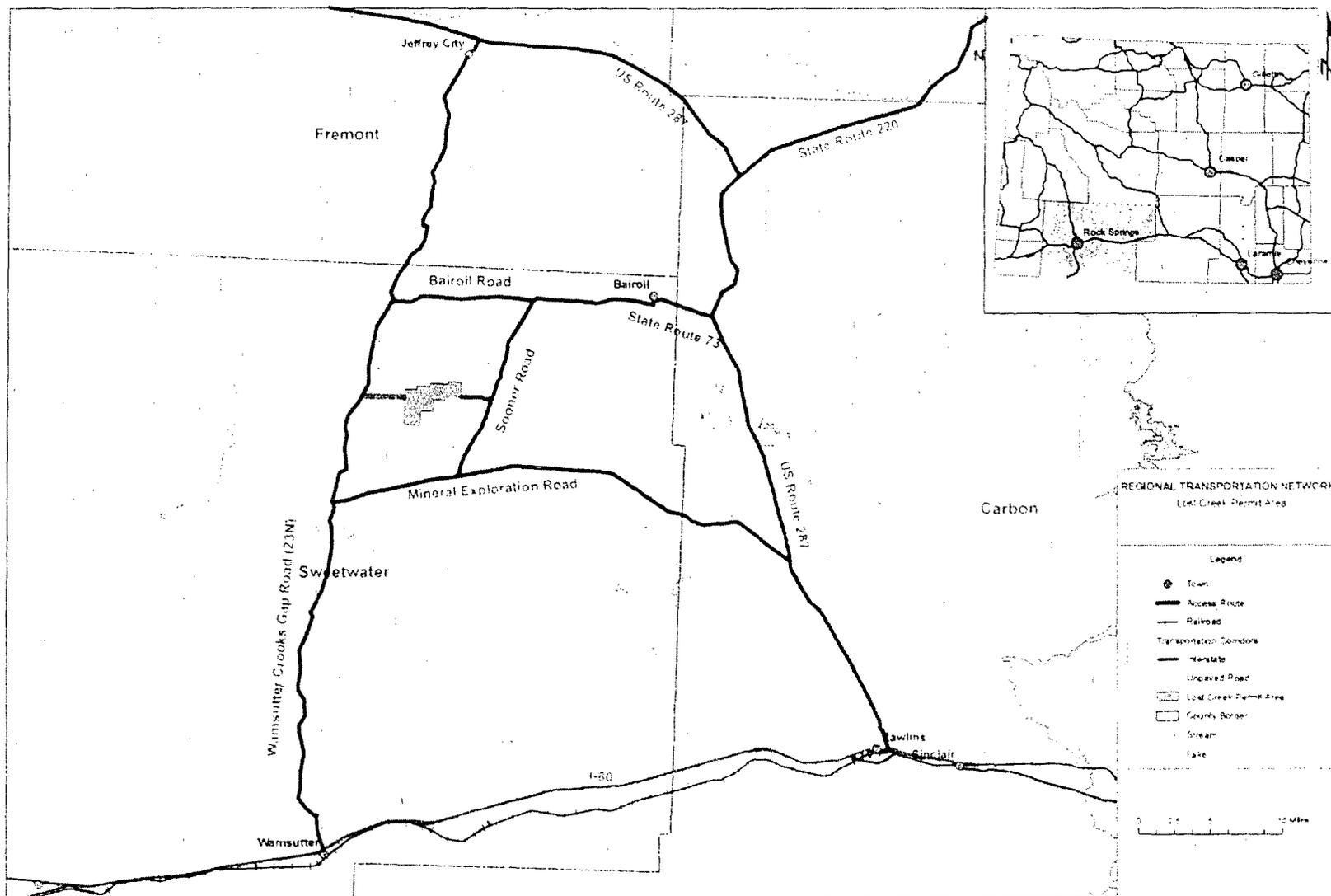


Figure 3-2. Regional Road Network

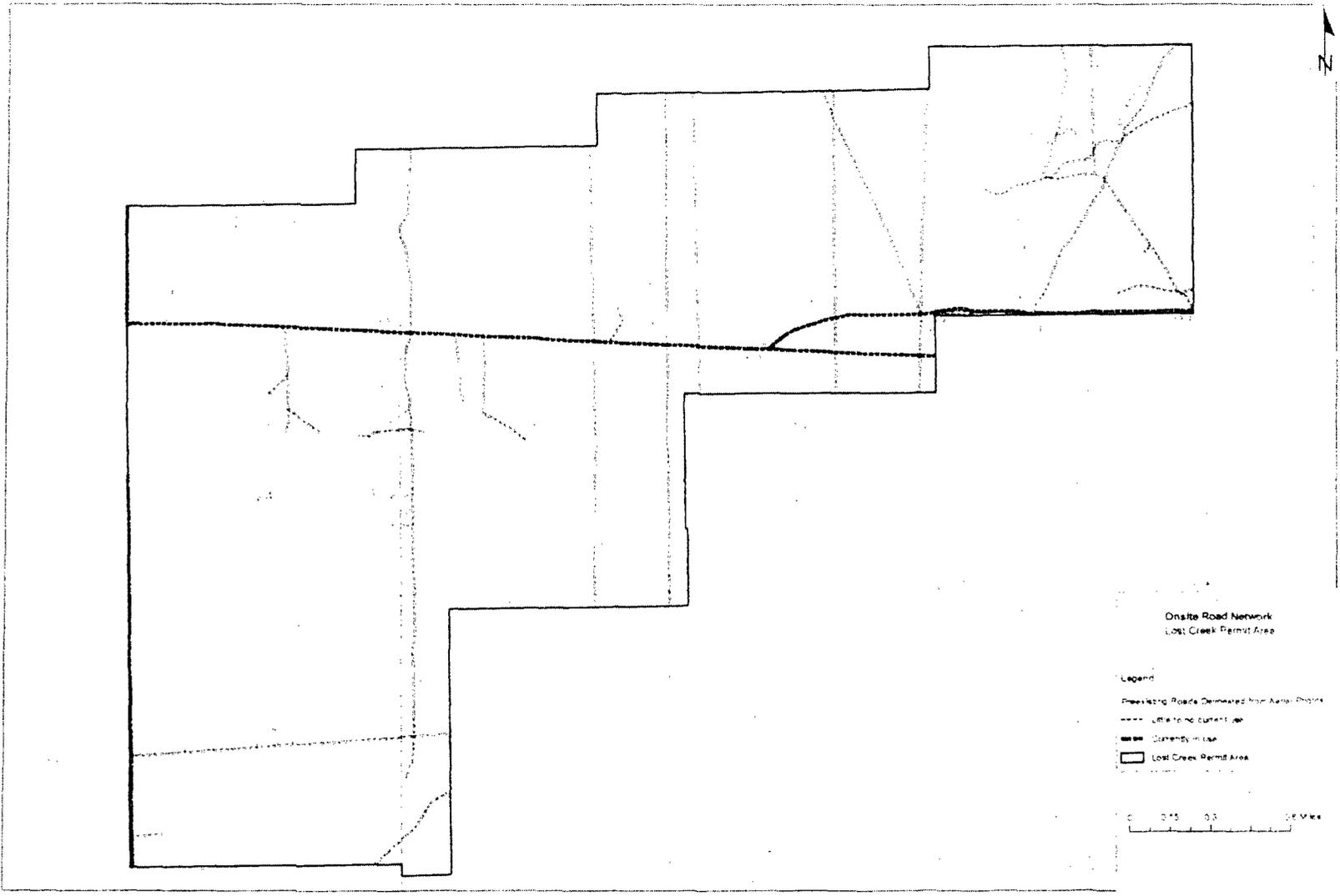


Figure 3-3. On-site Roads

1  
2

1 **3.4 Geology and Soils**

2 The description of Wyoming West Uranium Milling Region included in the GEIS provided a  
3 general description of the regional geology and soils for the project area (NRC, 2009). As  
4 indicated in the GEIS, two major uranium districts, the Crooks Gap area of the Great Divide  
5 Basin and the Gas Hills area of the Wind River Basin, are found in the Wyoming West Uranium  
6 Milling Region. The proposed Lost Creek facility is located in the south-central portion of the  
7 Crooks Gap area of the Great Divide Basin. The following is a discussion of the geology and  
8 soils of the Crooks Gap area and, more specifically, the Lost Creek project area.

9 **3.4.1 Geology**

10 The Crooks Gap Uranium District is located in the Great Divide Basin, an oval-shaped structural  
11 depression, encompassing some 8,960 km<sup>2</sup> (3,500 mi<sup>2</sup>) in south-central Wyoming (GEIS, NRC  
12 2009). The project area is located near the north-central part of the basin. The Basin is  
13 bounded on the north by the Green and Granite Mountains, on the east by the Rawlins Uplift, on  
14 the south by the Wamsutter Arch and on the west by the Rock Springs Uplift. As indicated in  
15 the GEIS, the dominant source of sediment in the Great Divide Basin was Precambrian (greater  
16 than 540-million-year-old) granitic rock of the Sweetwater Arch. Uplift of the Sweetwater Arch  
17 began to affect sedimentation in the adjacent Great Divide Basin in the Late Cretaceous time (65  
18 to 99 million years ago). Rapidly subsiding portions of the Basins received thick clastic wedges  
19 of predominant arkosic sediments, while more slowly subsiding portions of the basin received a  
20 greater portion of paludal (marsh) and lacustrine (lake) sediments. Sediment transported  
21 southward into the Great Divide Basin was deposited on an apron of alluvial fans. One of the  
22 major fans is centered near the Crooks Gap Uranium District. Deposition within the basins  
23 probably continued through the Miocene (5.3 to 23.8 million-year-old), but post-Miocene erosion  
24 has completely removed the Oligocene and Miocene units.

25 The formation hosting the major sandstone-type uranium deposits in the Great Divide Basin is  
26 the Battle Spring Formation. The Battle Spring Formation outcrops (surfaces) occur throughout  
27 the study area. Thus, the Battle Spring Formation lies at the surface of most of the project area,  
28 although thin deposits of Quaternary (as old as 2.6 million years) sediments are present within  
29 surface drainages in the project area. Generally, in the Great Divide Basin, Battle Spring and  
30 Wasatch Formations, which were deposited at equivalent times, inter-finger with one another.  
31 In the project area, the upper half of the lithologic units (rock units grouped according to  
32 similarity in characteristics such as color, mineralogic composition, and grain size) consists of  
33 Battle Spring Formation and the lower half is made up of Wasatch Formation. The applicant  
34 indicates that the total thickness of the Battle Spring and Wasatch Formations under the project  
35 area is about 1,890 m (6,200 ft). The Fort Union Formation is 1,417 m (4,650 ft) thick beneath  
36 the project area and unconformably underlies the Battle Spring/Wasatch Formations. Deeper in  
37 the Basin and lying unconformably are various Cretaceous, Jurassic, Triassic, Paleozoic, and  
38 Precambrian basement lithologic units (LCI, 2008b). A schematic geologic cross section across  
39 the project area is shown in Figure 3-4 depicting the entire lithologic units that are present under  
40 the project area (LCI, 2008b).

41 As indicated by the applicant, the Battle Spring Formation in the project area is part of a major  
42 alluvial system, consisting of thick beds of very fine- to coarse-grained arkosic sandstones  
43 separated by various layers of mudstones and siltstones. Conglomerate beds may exist locally.  
44 The uranium mineralization is associated with finer-grained sandstones and siltstones, which  
45 may contain minor organic matter in a few areas. The upper portion of the Battle Spring  
46 Formation is host to the uranium mineralization in the project area.

47

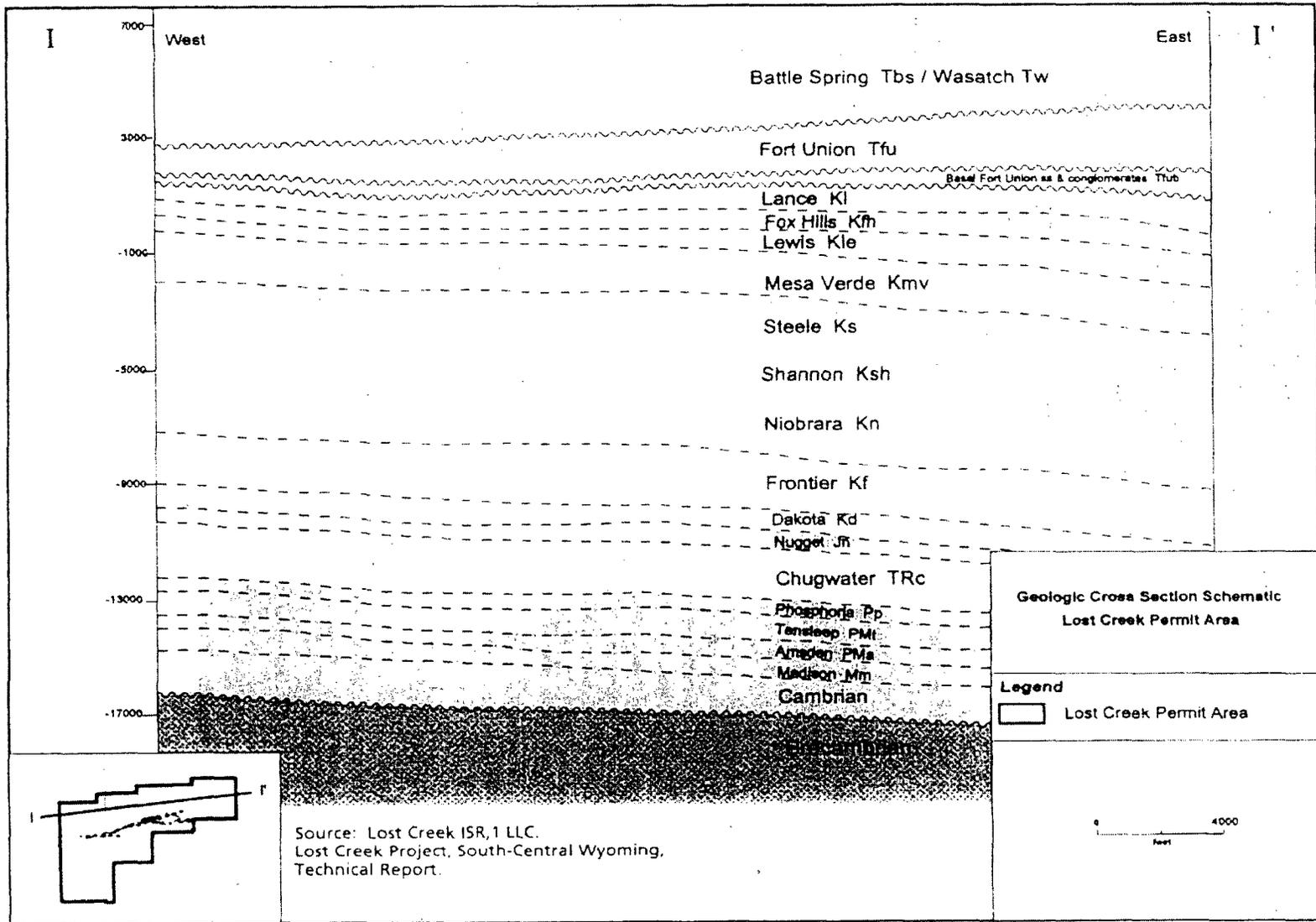


Figure 3-4. Project Geologic Cross-Section

1 The age of mineralization in the Battle Spring Formation is considered to be between 35 and 26  
2 million years before present. Uranium mineralization in the Basin generally occurs either as  
3 tabular or C-shaped roll-front deposits. Oxygen-rich ground water, carrying dissolved uranium,  
4 entered various sandstones in the Basin. The water percolated down dip, oxidizing the  
5 sandstones on its way down dip. Upon reaching sites rich in organic matter, the water lost its  
6 oxidizing potential and deposited the uranium, forming the two types of mineralization  
7 mentioned above. The presence of pyrite and carbonaceous material appear to be the major  
8 controlling factors for the precipitation of uranium mineralization. Thinning of sandstones and  
9 diminishing grain size probably slowed the advance of the uranium-bearing solutions and further  
10 enhanced the chances of precipitation in the location of the pumping tests.

11 The applicant has stated that known mineralized intervals are found at depths ranging from near  
12 surface down to 350.5 m (1,150 ft) below the surface in the project area. It is possible that  
13 deeper mineralization may exist as well. The main mineralization horizons trend in an east-  
14 northeast direction for at least 4.8 km (3 mi), and are up to 609.6 m (2,000 ft) wide. The  
15 thickness of individual mineralized beds at the project area ranges from five to 8.5 m (28 ft) and  
16 averages about 4.9 m (16 ft). The mineralization grade ranges from 0.03 percent to more than  
17 0.20 percent equivalent uranium oxide ( $U_3O_8$ ). Four main mineralized horizons, from depths of  
18 106.6 to 182.8 m (350 to 600 ft), have been identified. The richest mineralized zone occurs in  
19 the middle part of the HJ Horizon (MHJ Sand) and it is about 9 m (30 ft) thick, 122 to 137 m  
20 (400 to 450 ft) deep, and is believed to contain more than 50 percent of the total resource under  
21 the project area.

22 In the project area, the top 213 m (700 ft) of the Battle Spring Formation is divided by the  
23 applicant into at least five horizons marked from top to bottom as BC, DE, FG, HJ, and KM (see  
24 Figure 3-4). These horizons are sandstone layers separated from one another by various  
25 thicknesses of shale, mudstone and siltstone. Each of these sandstones may themselves  
26 contain some shale, mudstone, and/or siltstone lenses. The two horizons with most  
27 mineralization, the HJ and the KM, have been divided into upper, middle and lower sub-units of  
28 these sandstones (UHJ Sand, MHJ Sand, and LHJ Sand; and UKM Sand, MKM Sand, and LKM  
29 Sand).

30 The primary uranium production zone is identified as the HJ horizon, although the KM horizon  
31 may be considered for mining at a later date. The HJ horizon is bounded above and below by  
32 extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale,  
33 respectively. While these shales are aerially extensive, large sections of the Sage Brush Shale  
34 are less than 3.4 m (10 ft) thick in the proposed mine area, and several areas of the Lost Creek  
35 Shale are less than 3.4 m (10 ft) thick in the proposed project area. The FG sand directly  
36 overlies the Lost Creek Shale and the KM Sand directly underlies the Sage Brush Shale. The  
37 FG and DM sands are also composed of multiple sand units that are separated by  
38 discontinuous shales, mudstones, or siltstones. In a manner similar to HJ Horizon, the FG and  
39 KM Sands have been divided by the applicant into upper, middle, and lower subunits (UFG,  
40 MFG, LFG, UKM, MKM, and LKM). Geological cross sections through the mineralized zones in  
41 the project area are presented in Plates 2.6-1a, b, c, d, and e of the ER (LCI, 2008a).  
42 Thickness (isopach) maps of the HJ Horizon and UKM Sand, as well as the shales above HJ  
43 (Lost Creek Shale) and below HJ (Sage Brush Shale), are presented in Plates 2.6-2a, b, c, and  
44 d of the ER (LCI, 2008a).

45 The top of the HJ Horizon ranges from approximately 116 to 153 m (340 to 450 ft) below ground  
46 surface (bgs). The HJ Horizon is 37 to 44.3 m (110 to 130 ft) thick, averaging about 41 m (120  
47 ft). The thinner part of HJ is generally south of the Fault (see below). A thicker part of the HJ  
48 Horizon runs parallel to the Fault. The mineralization is mostly concentrated in the middle part  
49 of the HJ Horizon and occurs as both roll front and tabular deposits. The subdivided sand units

1 within the HJ horizon are separated by discontinuous shale, siltstone, and mudstone. The total  
2 thickness of the overlying FG Horizon is approximately 30 m (100 ft). The top of the FG Horizon  
3 occurs at depths approximately 61 m to 76 ft (200 to 250 ft) on the north side of the Fault and 91  
4 to 107 m (300 to 350 ft) bgs on the south side of the fault within the project area. Directly  
5 underlying the Sage Brush Shale, the UKM Sand is typically 9 m to 18 m (30 to 60 ft) thick but  
6 can reach over 23 m (75 ft) in thickness. The top of the UKM Sand is usually between 137 and  
7 183 m (450 and 600 ft) bgs within the project area.

8 The geologic structure in the project area is rather simple. The Battle Spring Formation dips  
9 gently to the west at three degrees and only one fault (e.g., the Fault) was identified in the study  
10 area. The Fault has previously been identified as a "scissor fault" that extends the length of the  
11 project area from the west-southwest to the east-northeast. A scissor fault is a fault in which  
12 the offset or displacement of the formations on either side of the fault increases in one direction  
13 from an initial point along and decreases in the other direction. However, the applicant (LCI)  
14 has recently indicated that the Fault may not actually be a scissor fault and that it may be  
15 eventually be reclassified. The Fault was initially interpreted to be a scissor fault, with a reversal  
16 of displacement direction occurring in the western third of the Permit Area. Recent  
17 interpretation has revealed that it is, instead, a sequence of sub-parallel faults with opposite  
18 displacement occurring in an en echelon configuration.

19 The fault runs through the mineralized area that is intended for mining, and solution mining is  
20 planned on both sides of the fault. As a result, the sandstones and alternating confining layers  
21 in the mining zone are off-set and not continuous through the mining area. The maximum  
22 displacement at the west end of the project area is around 13.7 m (45 ft), dropping down to the  
23 north; whereas the displacement on the east side of the project area is about 24 m (80 ft) the  
24 down-dropped side to the south, creating the scissor fault.

### 25 **3.4.2 Soils**

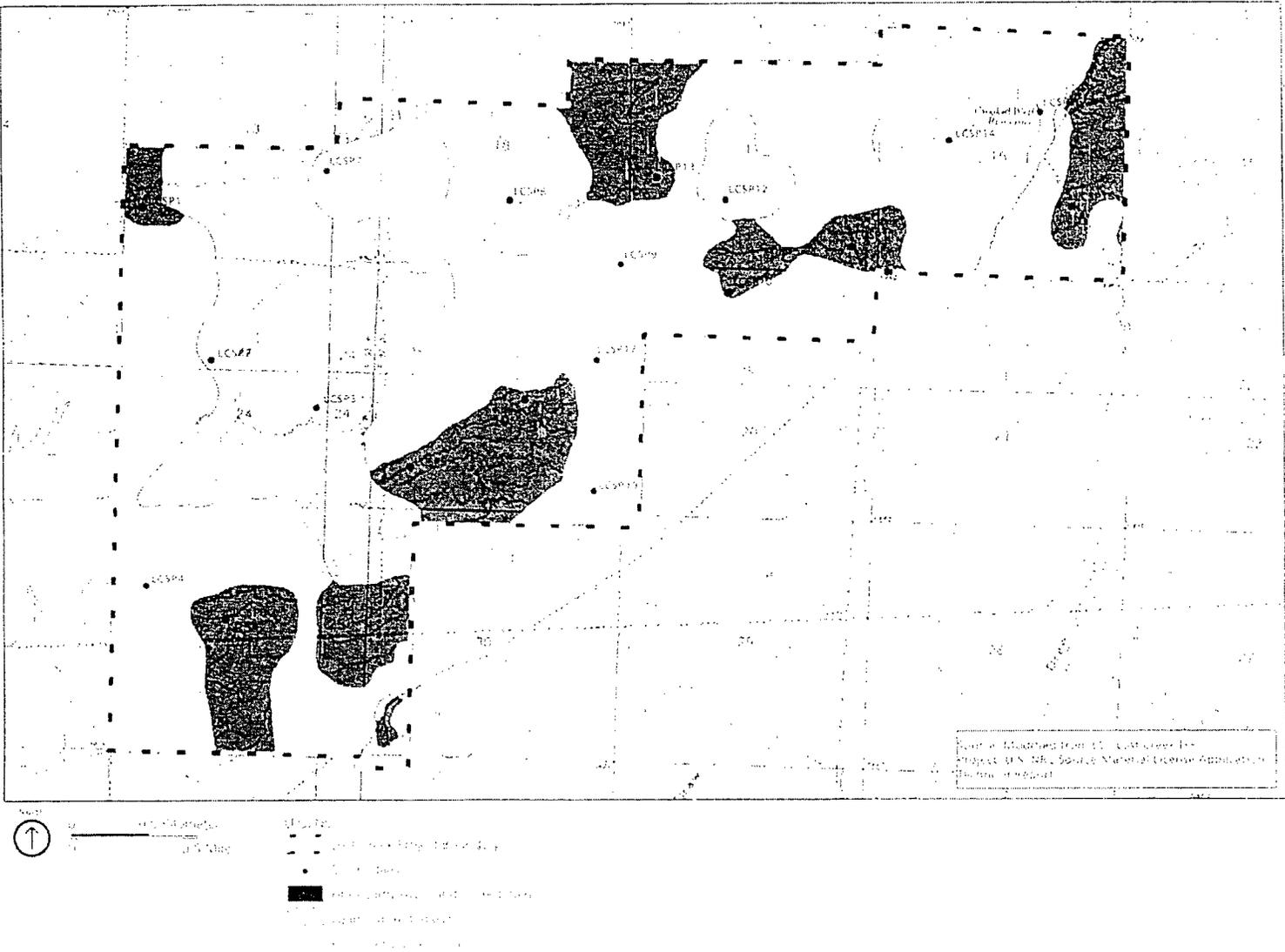
26 The project area has not been surveyed by the Natural Resource Conservation Service  
27 (formerly the Soil Conservation Service). The closest third-order soil survey to the project area  
28 was conducted in 1994 for the permitting of the Kennecott Uranium Company's Sweetwater Mill,  
29 which, at the time, was owned by Sweetwater Syndicate Inc. This survey used soil associations  
30 as the mapping unit and described six soil associations within a 31-km<sup>2</sup> (12-mi<sup>2</sup>) study area on  
31 the Sweetwater property.

32 A soil survey was conducted according to protocols in the National Soil Survey Handbook  
33 (1993), which provides major principles and practices for soil surveys. Data from the soil  
34 profiles were used to create soil map units (SMUs) on the base map. SMU boundaries were  
35 refined with surface soil pits excavated to a depth of 30.48 cm (12 in). SMUs were numbered  
36 from north to south. Because this was the first soil survey to be completed in the project area,  
37 the soils were classified to the family level instead of the series level.

38 The soils within the project area are typical of the semiarid areas of the western U.S. Most of  
39 the soil has developed from the sedimentary bedrock of the project area. The precipitation of  
40 the region is not enough to leach the majority of calcium and divalent cations from the soil  
41 profile. As a result, the soil pH tends to be slightly alkaline. Vegetation is also limited by the  
42 amount of precipitation in this region. As a result, the soils tend to have low organic matter.

43 The vertical relief of the project area is approximately 79 m (260 ft). Due to the relative lack of  
44 relief and uniform surficial geology, there are only three exposed soil types within the project  
45 area. The three units are very similar in color, depth of horizons, and geomorphic surface. The  
46 primary difference between the three soils is the texture; and, therefore, soil texture is the only  
47 difference in the three family names when separately designated.

- 1 Each of the three soil units is described below, and the distribution of the soil units is shown on
- 2 Figure 3-5.



**Figure 3-5. Project Soils Map**

1  
2 Thirty-four percent (581 ha [1,435 ac]) of the project area is *Typic Torriorthent*, loamy, mixed  
3 mesic. The soil is brown to yellowish-brown, and is typically five to 38 cm (15 in) thick. It  
4 generally occurs on the lower foot-slopes, where slopes are less than ten percent, but they can  
5 be as steep as 30 percent. The dominant vegetation is low-growing sagebrush with intermittent  
6 patches of grasses. The geomorphic surface ranges from bare loamy soil to pebbles and  
7 gravel-sized particles. A typical profile of this soil is brown to yellowish brown sandy loam; and  
8 the subsoil is a brown to pale-brown sandy loam that extends to depths greater than 76 cm (30  
9 in; LCI, 2008b).

10 Forty-six percent (786 ha [1,941 ac]) of the project area is *Typic Torriorthent*, fine-loamy, mixed  
11 mesic. This soil is abundant in the down-slope areas of the region, where slopes are very  
12 gradual. The dominant vegetation is sagebrush, with scattered grasses and cacti. The  
13 geomorphic surface consists of bare, fine sandy loam. The upper profile contains a dark,  
14 grayish-brown silt loam to loam that is about 23 cm (9 in) thick. The subsoil is a dark yellowish-  
15 brown to light yellowish-brown and extends to a depth of at least 68 cm (27 in; LCI, 2008b).

16 Twenty percent (342 ha [844 ac]) of the project area is *Typic Torriorthent*, fine-loamy over  
17 sandy, mixed mesic. The slopes are less than five percent and the dominant vegetation is low-  
18 growth sagebrush and scattered grasses. The geomorphic surface is bare loamy soil with  
19 approximately 25 percent gravel. The surface layer consists of a brown loam that is ten to 38  
20 cm (15 in) thick. The subsoil is a brown to a light yellowish-brown sandy loam that extends to a  
21 depth greater than 51 cm (20 in; LCI, 2008b).

22 All soil units within the project area support similar vegetation types. The Lowland Big  
23 Sagebrush Shrubland is present in and immediately surrounding the ephemeral channels; and  
24 the Upland Big Sagebrush Shrubland is present over the remainder of the project area. The  
25 uniformity in vegetation across the project area indicates that the three soil units are roughly  
26 equally productive, and that plant growth is limited by precipitation and not by soil fertility (LCI,  
27 2008b).

## 28 **3.5 Water Resources**

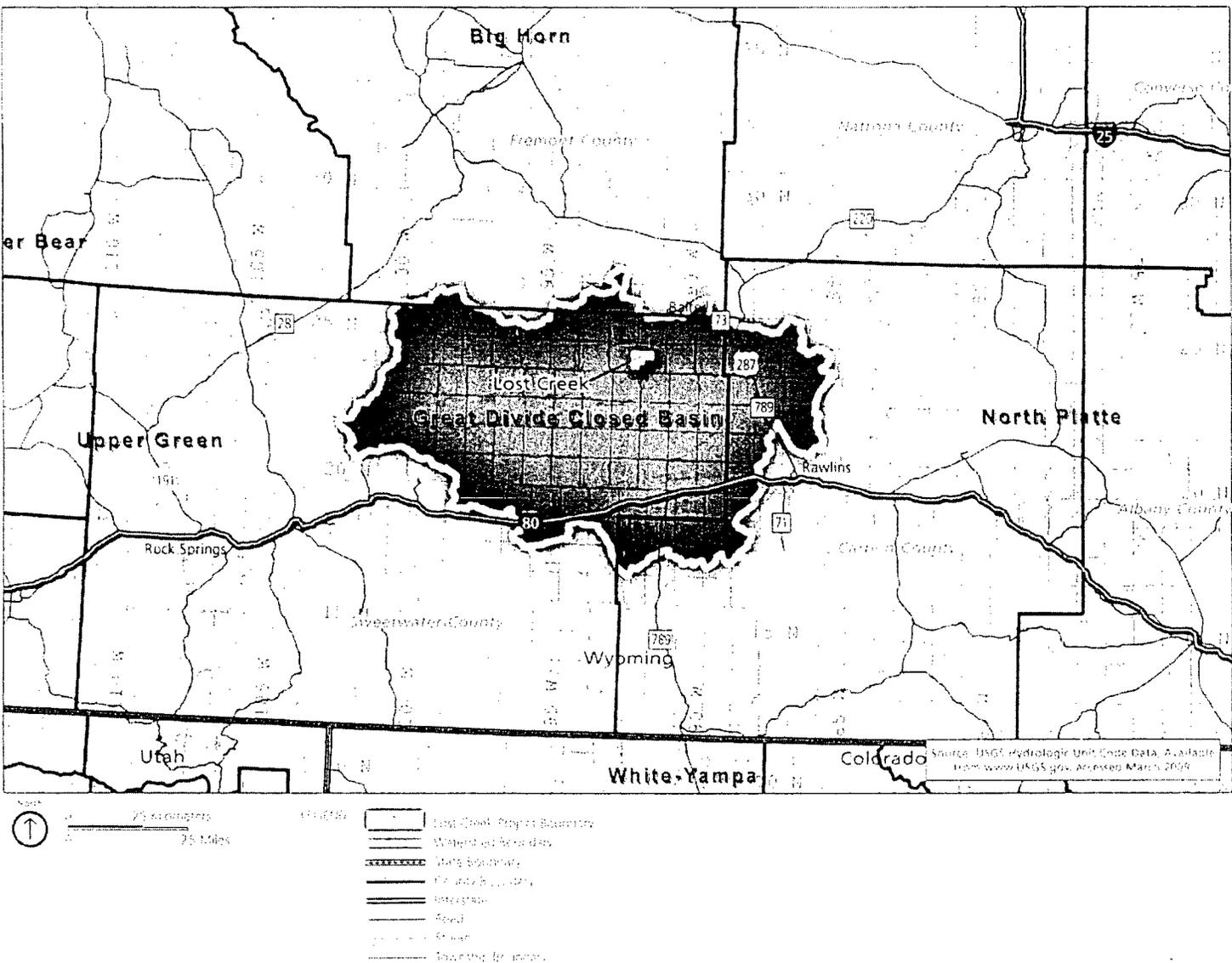
### 29 **3.5.1 Surface Waters and Wetlands**

30 The GEIS (NRC, 2009) cites the water bodies within the Wyoming West Uranium Milling Region  
31 as ranging between Class 2AB (drinking water) and Class 4C (unsuitable for aquatic life) in  
32 reference to the WDEQ classification system. The only channel within the Lost Creek project  
33 area classified for water quality by the WDEQ is Battle Spring Draw, achieving a rank of Class  
34 3B. It is presumed that the unnamed tributaries would also be classified as Class 3B water  
35 bodies based on the physical similarities those channels share with Battle Spring Draw. The  
36 Class 3B designation is given to surface waters that can be used for recreation, wildlife, "other  
37 aquatic life," agriculture, industry, and scenic value. Class 3B waters are unsuitable for drinking  
38 water, game fish, non-game fish, and fish consumption.

#### 39 **3.5.1.1 Drainage Basins**

40 The Lost Creek project area consists of 1,709 ha (4,220 ac) lying within the northeast  
41 headwaters of the Great Divide Basin (see Figure 3-6). The Great Divide Basin is a closed  
42 basin where surface waters drain to the basin center to feed seasonal playa lakes. Three sub-  
43 watersheds occur on the project site (see Figure 3-7). Battle Spring Draw comprises 239 ha  
44 (591 ac) in the far eastern end of the property; an unnamed tributary drains 802 ha (1,983 ac) in  
45 the center of the site; and another unnamed tributary drains 666 ha (1,646 ac) in the western

- 1 end of the property (LCI, 2008b). Each of these sub-watersheds conveys surface water towards
- 2 the south to the Battle Spring Flat, located approximately 14.5 km (9 mi) beyond the project
- 3 boundary. In most instances, surface water flow infiltrates into the soil before reaching Battle
- 4 Spring Flat. Any runoff that manages to reach Battle Spring Flat is eventually lost to soil
- 5 infiltration and evaporation.



**Figure 3-6. Regional Drainage Map**

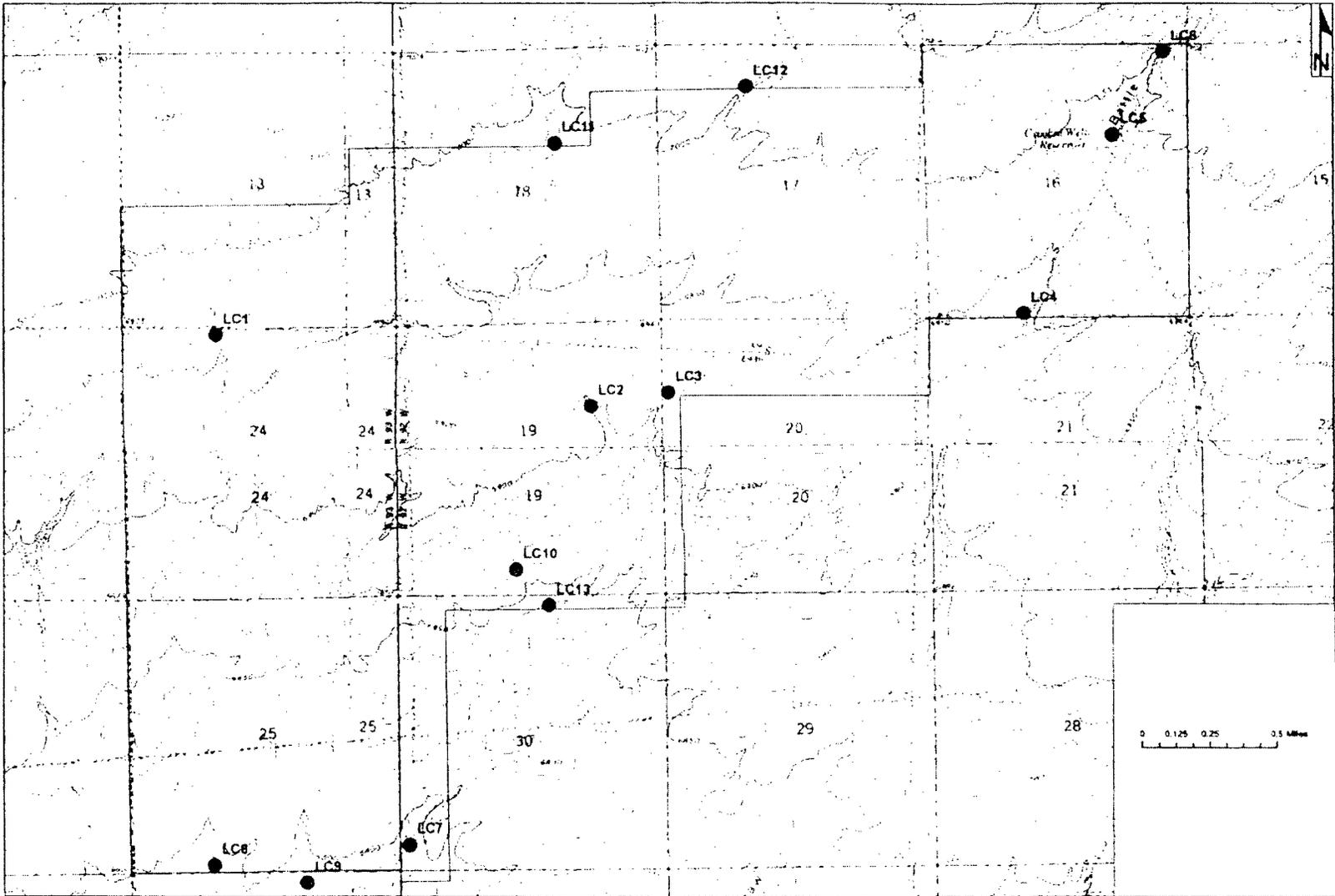


Figure 3-7. Area Watershed Map

1    3.5.1.2 *Surface Water Features*

2    Section 3.2.6.1 of the GEIS (NRC, 2009) provides general climate and precipitation information  
3    relative to the Lost Creek project area. This information is helpful in understanding the formation  
4    of stream channels and episodic nature surface water flow within the project area. In general,  
5    the arid conditions limit the formation of year round surface water and wetland features. Surface  
6    waters, particularly in the upper headwaters of the basin, are seasonal; associated with spring-  
7    time snow melt. Alternately, runoff may occur in ephemeral fashion in response to extreme  
8    rainfall events. Otherwise, rainfall is sparse and is normally absorbed into the soil.

9    The Lost Creek project area contains numerous such ephemeral and meandering channels and  
10   washes. The only named channel is Battle Spring Draw, occurring on the eastern side of the  
11   property. No perennial or intermittent streams are present within the project area. Channels are  
12   typically incised approximately 0.9 to 1.8 m (3 to 6 ft) bgs and possess U-shaped, trapezoidal  
13   cross sections and steep side slopes. The channels offer limited habitat for aquatic life; rather,  
14   the principal function of the surface water features is simply conveyance and groundwater  
15   recharge.

16   One seasonal pond can be found within the project limits, called the Crooked Well Reservoir  
17   (LCI, 2008b). This 0.1-ha (0.25-ac) pond is an isolated depression located in the northeastern  
18   section of the property. Water from snow melt accumulates in the depression, but during the  
19   summer and fall seasons, the pond is dry. The principal functional value of this pond is  
20   seasonal drinking water for local wildlife and livestock.

21   3.5.1.3 *Surface Water Flow*

22   No actual gauging data are available for any streams within the Lost Creek project area. The  
23   peak flood flow was estimated for Battle Spring Draw based on a model developed by Miller  
24   (2003). This model utilizes basin characteristics and correlates the calculated results with known  
25   flow measurements from data for hundreds of gauged watersheds in Wyoming. Similar  
26   outcomes are predicted for the other unnamed channels located within the project area. The  
27   results, presented in Table 3.5-1 of the ER, show the calculated peak flow ranges between 0.65  
28   cms (22.9 cfs) for the 2-year storm event to as high as 8.0 cms (282.8 cfs) for the 100-year  
29   storm event (LCI, 2008b). In general, the moderate stream channel gradients, rolling terrain,  
30   and steeply incised channels result in the containment and retention of peak surface flows  
31   within existing stream banks.

32   3.5.1.4 *Surface Water Quality*

33   Historic water quality data are available from samples taken in 1974 and 1975 (Table 3.5-2 of  
34   the ER). For the most part, the water quality from this period was good, although surface water  
35   sampling of Battle Spring Draw revealed high alkalinity (pH 9.5) and uranium concentrations  
36   (0.95 mg/l). In April 2006, twelve storm water samplers were installed at various locations  
37   upstream and downstream from the project area (Figure 3.5-4 of the ER). Another sampler was  
38   added in 2007. These storm water samplers were comprised of 1-L (0.26 gal) containers  
39   positioned in a manner that allowed the flow of surface water runoff to enter each container for  
40   unmanned collection. Samples were taken during snow melt in March and April. Seven of the  
41   twelve samplers were successful in collecting a full liter (0.26 gal) of water. The results from the  
42   samples are provided in Table 3.5-3 of the ER.

43   Most of the parameters measured were found to be below detectable limits, and the pH ranged  
44   from slightly acid to neutral (6.39 to 7.12). Wide variations in certain parameters were observed  
45   when the data collected in 1974/1975 were compared with that from 2006/2007, yet they remain  
46   unexplained. One possibility may be a difference in flow volumes during sampling, and hence,  
47   a difference in concentrations.

1 3.5.1.5 Wetlands

2 Wetlands include “those areas inundated or saturated by surface or ground water at a frequency  
3 and duration to support, and that under normal circumstances do support, a prevalence of  
4 hydrophytic vegetation typically adapted to life in saturated soil conditions” (33 CFR Part 328.3).  
5 Wetlands are important resources that provide habitat for aquatic fauna and flora, filter  
6 sediments and toxicants, and provide floodwater attenuation. For purposes of this document,  
7 wetlands are relegated to vegetated surface waters.

8 As part of the Lost Creek application, an assessment was performed by the applicant to  
9 determine if any vegetated wetlands exist within the project site, and none were found. Crooked  
10 Well Reservoir is dry the majority of the year, and wetland vegetation has not been observed  
11 around this water feature.

12 The USACE regulates all “waters of the United States,” the definition of which was recently  
13 influenced by the U.S. Supreme Court Decision *Rapanos v. United States* (04-1034, 376 F. 3<sup>rd</sup>  
14 629). Jurisdiction continues to be exerted for all traditional navigable waters, non-navigable  
15 tributaries of traditional navigable waters with relatively permanent flow, and wetlands directly  
16 abutting these systems. For systems that are isolated or tributaries that are not relatively  
17 permanent, the USACE requires a significant nexus determination to determine whether a  
18 particular water body is jurisdictional. A significant nexus determination is needed to evaluate  
19 whether the impact of a particular water body would result in more than a speculative or  
20 insubstantial effect on the chemical, physical, and biological integrity of a ‘traditional’ navigable  
21 water.

22 Due to the fact that all of the channels are ephemeral and that the project site lies within a  
23 closed, isolated basin, no surface water features on the property connect to a tributary of a  
24 navigable water body. As such, no surface waters within the Lost Creek project area are  
25 considered waters of the U.S. under the jurisdictional authority of the USACE (personal  
26 communication by A. Bjornsen with Omaha District, COE, 2009).

27 3.5.2 Groundwater

28 3.5.2.1 Regional Groundwater Resources

29 As indicated in the GEIS (Section 3.2.4.3), the Crooks Gap Uranium District, where the Lost  
30 Creek site is located, is part of the Wyoming West Milling Region (NRC, 2009). The Crooks  
31 Gap District lies within the Great Divide Basin, an internally closed drainage basin that contains  
32 uranium bearing aquifers and encompasses 10,250 km<sup>2</sup> (3,959 mi<sup>2</sup>). Hydrologic recharge areas  
33 are predominately along the topographically elevated margins of the basin, hence surface and  
34 groundwater flow is toward the center of the basin. As the Lost Creek project area is northeast  
35 of the basin center, groundwater flow at the site is towards the southwest. Regionally, the Great  
36 Divide Basin is part of the regional Upper Colorado River Basin aquifer system, a 51,800 km<sup>2</sup>  
37 (20,000 mi<sup>2</sup>) system that also includes the Green River and Washakie structural basins of  
38 southwestern Wyoming.

39 The Colorado River Basin aquifer system was subdivided by Whitehead (1996) into five  
40 principal aquifers; the Laney aquifer (Tertiary), the Wasatch/Battle Spring-Fort Union aquifer  
41 (Lower Tertiary), the Mesa Verde Aquifer (Cretaceous - Mesozoic), and Upper and Lower  
42 Paleozoic aquifers. In the project area the stratigraphic units that host the Laney aquifer, the  
43 Green River Formation, are not present. As such, at the Lost Creek site, the shallowest Lower  
44 Tertiary aquifers consist of sandstone units within the Wasatch/Battle Spring and Fort Union  
45 Formations. These formations are up to 3,350 m (11,000 ft) thick in Sublette County; about  
46 2,135 m (7,000 ft) thick near the center of the basin in south-central Wyoming and over 1,890 m

1 (6,200 ft) thick in the project area. These uppermost aquifers serve as regional water supplies  
2 for drinking water and livestock, and also host a series of uranium-rich sedimentary units. While  
3 these aquifers are identified as the most important and most extensively distributed and  
4 accessible groundwater source in the study area by Collentine et al. (1981), the waters typically  
5 contain high levels of radionuclides (greater than EPA MCLs) within the basin and locally contain  
6 saline water where they are deeply buried. Below these Tertiary units is the Upper Cretaceous  
7 Lance/Fox Hills Formation that consists of very fine-grained sandstone, siltstone, and coal beds,  
8 which are not considered to be important aquifer units in the project area. Beneath this  
9 hydrologic system is a regionally continuous aquitard, the Upper Cretaceous Lewis Shale, which  
10 is between about 191 - 381 m (625 -1250 ft) thick in the project area. Due to its low  
11 permeability nature and significant thickness, the Lewis Shale is considered the base of the  
12 hydrogeologic sequence of interest within the Great Divide Basin.

13 Units deeper than the Lewis Shale, the Mesa Verde aquifer system, the top of which is 2286 m  
14 (7500 ft) bgs in the project area, consists of interbedded sandstones and shales underlain by  
15 Permo-Triassic confining units approximately 5486 m (18,000 ft) bgs. The Mesa Verde aquifer  
16 is generally too deep to economically develop for water supply or have elevated TDS  
17 concentration that renders them unsuitable for human consumption. Below the Permo-Triassic  
18 confining units the principal aquifers in Paleozoic rocks are the Tensleep Sandstone of  
19 Pennsylvanian and Permian age and the Madison Limestone of Devonian and Mississippian  
20 age. Sandstone, limestone, and dolomite beds of Pennsylvanian to Cambrian age also are  
21 water bearing. Because they are the most deeply buried and contain saline water almost  
22 everywhere, the Paleozoic aquifers are rarely used for water supply in southwestern Wyoming.  
23 Locally, however, where aquifer units crop out near structural highs along the basin margin  
24 (e.g., the Rawlins Uplift and Rock Springs Uplift), water is less saline and contains lower  
25 concentrations of radionuclides due to their proximity to the recharge areas and shorter  
26 residence time in the formations.

### 27 3.5.2.2 *Local Groundwater Resources*

28 The Lost Creek Site is directly underlain by the Battle Spring Formation, the upper part of the  
29 shallow Lower Tertiary aquifer system that extends to a depth of over 1,890 m (6,200 ft). The  
30 formation is interpreted to represent a major alluvial system, consisting of thick beds of very  
31 fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and  
32 siltstones and finer grained beds, with conglomerate beds locally present. The multiple  
33 sandstone layers serve as the main water-bearing units and are typically under confined  
34 conditions between the finer grained units, but locally unconfined conditions exist. Regionally,  
35 the potentiometric surface within shallow aquifer units is usually within 61 m (200 ft) of the  
36 ground surface. Most wells drilled for livestock water supply in this unit are less than 305 m  
37 (1,000 ft) deep and draw water from the higher permeability sandstone units. Uranium  
38 mineralization in the Battle Spring Formation is associated with finer-grained sandstones and  
39 siltstones, which may contain minor organic matter in a few areas. This mineralization  
40 predominates in several horizons in the upper portion [top 213 m (700 ft)] of the Battle Spring  
41 Formation in the project area and its distribution described in more detail below.

### 42 3.5.2.3 *Uranium-Bearing Aquifers*

43 As discussed in Section 3.4.1, the top 213 m (700 ft) of the Battle Spring Formation was divided  
44 by the applicant into at least five horizons denoted from top to bottom as BC, DE, FG, HJ, and  
45 KM (see Figure 3-8). The primary uranium production zone for the Lost Creek project area is  
46 identified as the HJ Horizon. The HJ Horizon is subdivided into the Upper (UHJ), Middle (MHJ)  
47 and Lower (LHJ) Sands, which, based on pumping tests, appear to be hydraulically  
48 interconnected. As such, the applicant considers the combined HJ Sands as a single aquifer

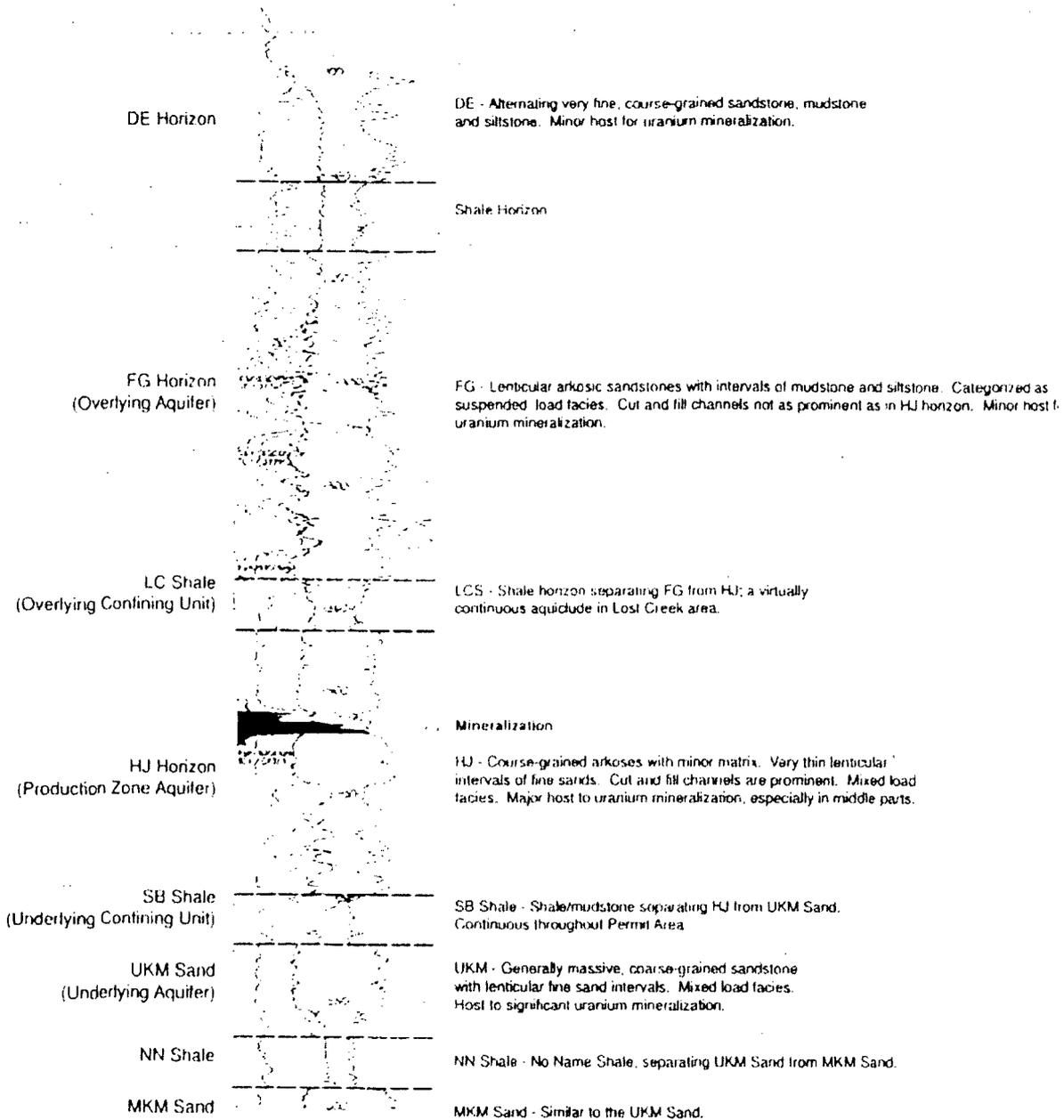
1 and has designated these sands as the production zone aquifer. The HJ sand units are  
2 bounded by areally extensive confining units identified as the Lost Creek Shale and the Sage  
3 Brush Shale, which respectively overlie and underlie the proposed production zone. The FG  
4 Horizon overlies the Lost Creek Shale and the KM occurs beneath the Sage Brush Shale. The  
5 Lower FG (LFG) sand has been designated by the applicant as the aquifer overlying the  
6 production zone, and the Upper KM (UKM) sand has been designated as the aquifer underlying  
7 the production zone. The UKM, however, is also identified as a potential future production  
8 zone. The shallowest occurrence of groundwater within the project area is within the DE  
9 Horizon, with the depth to water table varying from approximately 24 to 46 m (80 to 150 ft)  
10 below ground surface. The DE Horizon is separated from the FG Horizon below by an  
11 unnamed shale layer approximately 9 m (30 ft) thick.

12 Within the HJ Horizon the bulk of the uranium mineralization is present in the MHJ Sand. The  
13 total thickness of the HJ Horizon ranges from 30 to 49 m (100 to 160 ft), averaging  
14 approximately 36.5 m (120 ft). The top of the HJ Horizon ranges from approximately 91 to 137  
15 m (300 to 450 ft) bgs within the project area. The upper, middle and lower sand units are  
16 generally separated by discontinuous thin clayey units that do not act as confining units to  
17 prevent groundwater movement vertically between the HJ Sands horizons (LCI, 2008a).

18 Monitoring wells have been completed in HJ Horizon, the overlying aquifers (DE and LFG) and  
19 the underlying aquifer (UKM). Water levels have been measured in these wells to assess the  
20 potentiometric surface, groundwater flow direction, and hydraulic gradient of these units. Water  
21 level data is available from 2006 and 2007 monitoring events as well as from historical data  
22 taken in 1982. Based on 2007 data taken from wells screened in the HJ Horizon approximately  
23 30.5 m (100 ft) apart on each side on the Fault, the potentiometric surface on the north side of  
24 the Fault is 4.6 m (15 ft) higher than on the south side of the Fault. The difference between  
25 water levels on either side of the Fault suggests that the Fault is a barrier to groundwater flow.  
26 Pumping tests conducted on site seem to support this view. However, some hydraulic influence  
27 was noted across the Fault during these tests, indicating that while the Fault acts as a barrier to  
28 flow, it is not impervious to groundwater flow. Based on the potentiometric maps, groundwater  
29 is inferred to flow to the west-southwest, generally consistent with the regional flow system. The  
30 Fault may direct groundwater in a more westward direction than would be the case if the Fault  
31 were not present.

32 The horizon hydraulic gradient for the HJ Sand, determined from water level data from 1982,  
33 2006, and 2007, ranged from 0.0034 to 0.0056 m/m (ft/ft) (3.4 to 5.6 m/km [18.0 to 29.6 ft/mi]).  
34 The potentiometric surfaces developed from water level data for the LFG Sand are similar to  
35 those developed for the HJ Horizon. However, the data for the UKM Sand indicate that the  
36 difference in hydraulic heads across the Fault does not appear as pronounced for the UKM  
37 sand as for the other shallow sands. However, this observation may be influenced the limited  
38 number of monitoring wells in the UKM Sand. Horizontal hydraulic gradients calculated for the  
39 UKM Sand from available water level data ranged from 0.0053 to 0.0063 m/m (ft/ft) (5.3 to 6.3  
40 m/km [28 to 33.3 ft/mile]). The available water level data were also used to evaluate vertical  
41 gradients. The data indicate that vertical gradients range from 0.05 to 0.34 between the LFG,  
42 HJ, and UKM aquifers and consistently indicate decreasing hydraulic head with depth.

43  
44  
45  
46  
47



Source: Modified from ICI Lost Creek ISR Project, U.S. NRC Source Material License Application, Environmental Report.

W0112 SC013

1  
2

Figure 3-8 Hydrostratigraphic Units

1

2     3.5.2.3.1 Hydrogeologic characteristics

3     Aquifer properties for the Battle Spring aquifers within the project area have been estimated  
4     from historic and recent pumping tests. Hydro-Search Inc. performed a hydrologic evaluation in  
5     1982 to determine the feasibility of in-situ production of the Conoco uranium ore body at Lost  
6     Creek. More recently in October 2006, several short-term single-well pumping tests and three  
7     longer multi-well pumping tests were performed (Hydro-Engineering, Inc., 2007). The range of  
8     transmissivity values for the HJ aquifer calculated from the data collected during the 2006 tests  
9     was from 4.1 to 37.2 m<sup>2</sup>/day (44 to 400 ft<sup>2</sup>/day [330 to 3,000 gallons per day/ft]). Although the  
10    2006 testing was limited, none of the 2006 pumping tests of the HJ horizon indicates significant  
11    communication with the overlying or underlying aquifers. There was also no indication of  
12    hydraulic communication across the Fault in any of the 2006 pumping tests.

13    In June and July 2007, another long-term pumping test was conducted in the HJ aquifer at Well  
14    LC19M (Petrotek Engineering Corporation, 2007). While well LC19M had previously been  
15    tested during the 2006 pumping tests, the objectives of this test was to further develop aquifer  
16    characteristics of the HJ Horizon, to evaluate the hydraulic impacts of the Fault, and to  
17    demonstrate confinement of the production zone (HJ Horizon) aquifer. While LC19M is located  
18    on the north side of the Fault, HJ monitor wells were included on both sides of the Fault within  
19    distances likely to be impacted by the test were included as observation wells. The  
20    transmissivity calculated from five wells completed in the HJ aquifer on the north side of the  
21    Fault were similar, ranging from 2.8 to 7.0 m<sup>2</sup>/day (30.0 to 75.5 ft<sup>2</sup>/day) and averaging 6.3  
22    m<sup>2</sup>/day (68.3 ft<sup>2</sup>/day). Storativity calculated from those wells range from 6.6 x 10<sup>-5</sup> to 1.5 x 10<sup>-4</sup>  
23    and averaged 1.1 x 10<sup>-4</sup>.

24    In October 2007, an additional long-term pumping test was conducted in the HJ aquifer on the  
25    south side of the Fault in LC16M (LCI, 2008b). During the test, water levels were measured in  
26    monitoring wells in the HJ aquifer on both sides of the fault, as well as in the overlying and  
27    underlying aquifer on the south side of the Fault. The transmissivity calculated from five wells  
28    completed in the HJ aquifer on the south side of the Fault were similar, ranging from 5.6 to 9.3  
29    m<sup>2</sup>/day (60.3 to 100.5 ft<sup>2</sup>/day) and averaging 7.1 m<sup>2</sup>/day (76.2 ft<sup>2</sup>/day). Storativity calculated  
30    from those wells range from 3.5 x 10<sup>-5</sup> to 9.1 x 10<sup>-4</sup>.

31    The calculation of the transmissivity values in the two 2007 long-term pumping tests did not  
32    consider the effect of the fault, which limits groundwater flowing from the south in the first test  
33    and from the north in the second test, resulting in reduced estimates of transmissivity. As a  
34    result these transmissivities have been considered effective rather than actual transmissivities  
35    by the applicant. Actual transmissivities are likely to be larger than those calculated from the  
36    2007 test data.

37    Minor responses to pumping were also observed across the Fault during both pumping tests.  
38    This response suggests that the Fault, while not entirely sealing, significantly impedes  
39    groundwater flow, even under considerable hydraulic stress. Small responses in water levels in  
40    the overlying and underlying aquifers were also observed during the both 2007 long-term  
41    pumping tests. While their cause is not clear, these responses suggest some hydraulic  
42    communication between the proposed HJ production zone and the overlying FG and underlying  
43    UKM aquifers.

44     3.5.2.3.2 Level of confinement

45    As discussed in Section 3.4.1, the HJ horizon is bounded above and below by a really extensive  
46    confining units identified as the Lost Creek Shale and the Sage Brush Shale, respectively.  
47    While these shales are extensive, large sections of the Sage Brush Shale are less than 3.4 m

1 (10 ft) thick in the proposed project area, and several areas of the Lost Creek Shale are less  
2 than 3.4 m (10 ft) thick in the proposed project area. Data presented by the applicant indicate  
3 that in some locations within the mining units these confining units are only 1.5 m (5 ft) thick.  
4 These areas of thinning in the overlying and underlying confining layers suggest that there may  
5 be some hydraulic connection between the production aquifer and the overlying and underlying  
6 aquifers. These concerns are supported by the results of the 2007 pumping tests. Minor  
7 responses in the overlying and underlying aquifer were observed during these tests. A number  
8 of potential causes for these responses have been suggested in addition to leakage across the  
9 confining layers, including potential impacts from off-site pumping, leakage through abandoned  
10 boreholes, or communication across the Fault. However, the cause of these responses  
11 observed in the overlying and underlying aquifers during the 2007 pumping test have not been  
12 clearly identified. Thus, there remain some concerns regarding the degree of confinement of  
13 the HJ production aquifer. The applicant indicates that each mine unit would be subject to  
14 further extensive testing during the Mine Unit Test required before initiating solution extraction in  
15 each mine unit. This additional testing would employ a greater density of monitoring wells within  
16 the production zone aquifer and overlying aquifer on both sides of the fault. This additional  
17 hydrologic testing would provide better information regarding the cause of the drawdown  
18 response in overlying and underlying wells. These results will be provided in the Mine Unit Data  
19 Packages.

#### 20 3.5.2.3.3 Groundwater Quality

21 In Wyoming, the quality of groundwater is measured against either US EPA Drinking Water  
22 Standards (40 CFR Part 142 and 40 CFR Part 143) which establish Maximum Contaminant  
23 Levels (MCLs) for specific chemical constituents or Wyoming Ground Water Quality standards.  
24 The Wyoming standards are based on ambient water quality and are divided into three  
25 Classes: Class 1 is defined as suitable for domestic use, Class II is defined as suitable for  
26 agriculture, Class III is defined as suitable for livestock, Class IV is defined as suitable for  
27 industrial use, and Class Special (A) is defined as suitable for fish and aquatic life (WDEQ,  
28 2005).

29 Lost Creek ISR, LLC established the site pre-operational groundwater quality in the Lost Creek  
30 license area from well data collected by recent sampling in 2006 and 2007 and historical  
31 sampling performed by Conoco in the late 1970s and early 1980s. The recent data included  
32 four quarters of water sampling in fall and winter 2006 and spring and summer 2007. The  
33 groundwater quality was measured in three wells in the DE surficial aquifer, four wells in LFG  
34 overlying aquifer, six wells in HJ ore zone aquifer and four wells UKM underlying aquifer. The  
35 location of the wells is shown in Figure 3-9. The applicant presented the groundwater quality  
36 data for all four quarters for all wells in Table 2.7-13 of the TR. The groundwater quality  
37 parameters measured included all suggested analytes in Table 2.7.3-1 of the standard review  
38 plan except silver.

39 NRC staff determined the average ground water quality in the Lost Creek license area from  
40 wells in the surficial DE aquifer, overlying LFG aquifer, HJ ore zone aquifer and UKM underlying  
41 aquifer from the data. The results are shown in Table 3-2. The table indicates that the average  
42 water quality in the surficial DE aquifer exceeded the WDEQ Class I, II and III and EPA primary  
43 drinking water standards for gross alpha, uranium, and combined Ra 226 and 228. These  
44 standards were exceeded in all wells for all quarters. One well, LC 31M in the far southwest  
45 corner of the license area exceeded the WDEQ Class I and EPA primary drinking water  
46 standards for sulfate and selenium for all four quarters.

47  
48

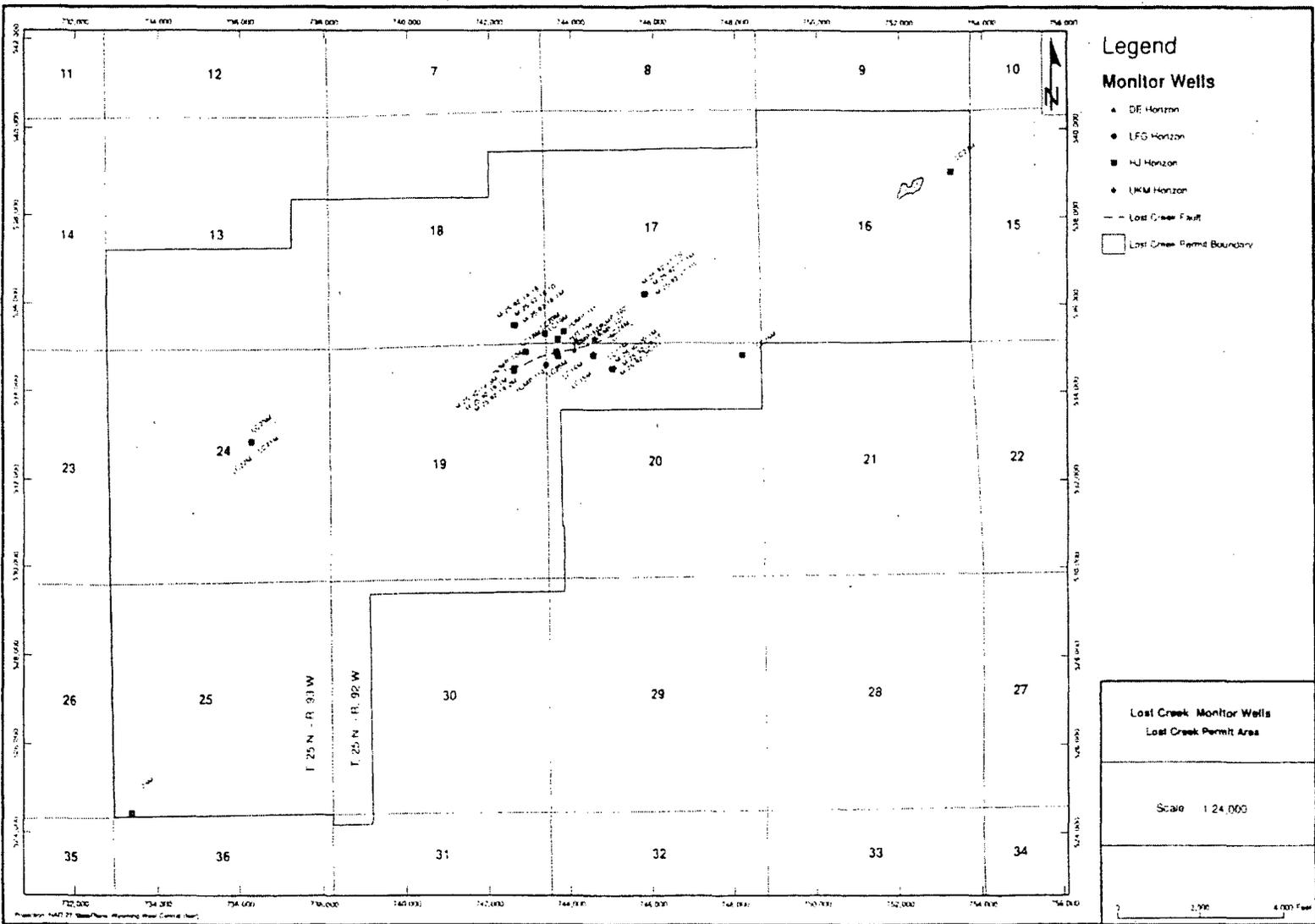


Figure 3-9. Monitoring Wells

1  
2

Table 3-2. Average Pre-Operational Baseline Groundwater Quality for the Lost Creek License Area Aquifers					
Water Quality Parameter	Lost Creek License Area				
	Water Quality Standards*	DE Surficial Aquifer	LFG Overlying Aquifer	HJ Ore zone Aquifer	UKM Underlying Aquifer
Bicarbonates as HCO <sub>3</sub> (mg/l)		150	114	111	82
Carbonates as CO <sub>3</sub> (mg/l)		ND	2.5	3.5	27.8
Alkalinity (mg/l)		104.5	102.2	105.5	84.5
Chloride (mg/l)	250	6.3	5.3	5.5	5.5
Conductivity (umhos/cm)		566.8	463	485.9	558
Fluoride (mg/l)	2.0 - 4.0	0.3	0.21	0.21	0.20
pH (s.u.)	6.5 - 8.5	7.68-8.07	<b>7.32-8.57</b>	<b>7.85-9.51</b>	<b>7.66-11.6</b>
Total Dissolved Solids (mg/l)	500	347	296	311	297
Sulfate (mg/l)	250	135.7	121.5	131.9	117.6
Radium 226 (pCi/l)	5	<b>2.8</b>	<b>26.6</b>	<b>143.3</b>	<b>9.1</b>
Radium 228 (pCi/l)	5	<b>2.4</b>	<b>3.8</b>	<b>6.6</b>	<b>3.49</b>
Uranium ( mg/l)	0.03	<b>0.74</b>	<b>0.41</b>	<b>0.17</b>	<b>0.031</b>
Gross Alpha (pCi/l)	0.01	<b>495.9</b>	<b>356</b>	<b>395.4</b>	<b>41.3</b>
Gross Beta (pCi/l)	2.0	157.7	107.9	117.5	23.1
Nitrogen, Ammonia as N (mg/l)	0.5	0.027	0.08	0.015	0.39
Nitrogen, Nitrate+Nitrite as N (mg/l)	10	0.7	0.6	ND	ND
Aluminum (mg/l)	0.05 to 0.2	ND	ND	ND	ND
Arsenic (mg/l)	0.1	0.003	0.003	0.006	0.006
Barium (mg/l)	2.0	ND	ND	ND	ND
Boron ( mg/l)		ND	ND	ND	ND
Cadmium ( mg/l)	0.005	ND	ND	ND	ND

**Table 3-2. Average Pre-Operational Baseline Groundwater Quality for the Lost Creek License Area Aquifers**

Calcium (mg/l)		68.1	58.8	67.7	51.5
Chromium (mg/l)	0.1 (total)	ND	ND	ND	ND
Copper (mg/l)	1.0	ND	ND	ND	ND
Iron ( mg/l)	0.3	0.21	<b>0.37</b>	0.09	0.12
Lead (mg/l)	0.015	ND	ND	ND	ND
Magnesium (mg/l)		4.3	3.31	3.65	2.45
Manganese (mg/l)	0.05	ND	ND	ND	ND
Mercury (mg/l)	0.002	ND	ND	ND	ND
Molybdenum ( mg/l)		ND	ND	ND	ND
Nickel ( mg/l)	0.1	ND	ND	ND	ND
Potassium ( mg/l)		2.3	3.1	4.4	10.9
Selenium ( mg/l)	0.05	<b>0.079</b>	0.024	0.002	0.002
Silica (mg/l)		15.6	14.1	14.9	14.4
Sodium ( mg/l)		40.3	32.3	31.5	36.2
Vanadium (mg/l)		ND	ND	ND	ND
Zinc ( mg/l)	5.0	ND	ND	ND	ND

10 CFR Part 141 and 10 CFR Part 143

*Wyoming Water Quality, Rules and Regulations, Chapter 8, Class 1, Domestic Ground Water*

Note: Numbers in bold exceeded Wyoming Class I or EPA drinking water standards.

1  
2 This well also had the highest values of uranium (1.4-2.1mg/l) and gross alpha (967-1430 pCi/L)  
3 of all wells at the site. The average water quality in the LFG overlying aquifer also exceeded the  
4 WDEQ Class I, II, and III and EPA primary drinking water standards for gross alpha, uranium,  
5 and combined Ra 226 and 228 in all of the wells over all four quarters. These standards were  
6 exceeded in all wells for all quarters. The four wells across the license ranged from 0.251-0.546  
7 mg/l uranium.

8 The average water quality in the HJ ore zone aquifer also exceeded the WDEQ Class I, II, and  
9 III and EPA primary drinking water standards for gross alpha and combined Ra 226 and 228 in  
10 all but two of the wells over all four quarters. The exceptions were wells LCM27M and  
11 LCM28M, whose uranium concentrations were below the MCL of 0.03 mg/l; averaging 0.002  
12 mg/l and 0.008 mg/l, respectively. Nonetheless, their gross alpha and combined Ra 226 and  
13 228 values exceeded the aforementioned standards, which is consistent with the presence  
14 uranium ore bodies in the aquifer unit. Uranium concentrations in the waters from the other HJ  
15 sands monitoring wells had an average range of 0.065 to 0.552 mg/l, which is between 2 and 18

1 times the MCL for uranium. One well, LC 26M, in the eastern part of the license area, exceeded  
2 the WDEQ Class I and EPA secondary drinking water standards for sulfate and TDS.

3 The average water quality in the UKM underlying ore zone aquifer also exceeded the WDEQ  
4 Class I, II, and III and EPA primary drinking water standards for gross alpha and combined Ra  
5 226 and 228 in all of the wells over all four quarters. Two of the wells, LC20M and LC24M,  
6 located in the ore zone area, also exceeded these standards for uranium.

7 The water quality data demonstrate that none of the aquifers tested near and within the ore  
8 zone in the Lost Creek license area meet WDEQ Class I, II, III or EPA primary drinking water  
9 standards for radionuclides. Nonetheless, for ISR operations to be conducted in an aquifer, it  
10 must be declared as an exempt aquifer by the EPA. An exempt aquifer is one that is not nor will  
11 ever be used for drinking water given its water quality. The water quality of the HJ sand  
12 production zone aquifer in the project area is Class VI under WDEQ standards, which under the  
13 State's classification means the groundwater can not be used for drinking, livestock or  
14 agricultural use as a consequence of its uranium and radium 226 concentrations. It would  
15 therefore be a candidate for an exempt aquifer declaration.

#### 16 3.5.2.3.4 Current Groundwater Uses

17 The applicant has identified the groundwater users within 3.2-km (2-mi) and 8-km (5-mi) radii of  
18 the project area using the WSEO Water Rights Database (WSEO, 2006) and correspondence  
19 with the BLM. The majority of the groundwater-use permitted in the vicinity of the project area is  
20 for monitoring or miscellaneous mining-related purposes, and do not represent consumptive use  
21 of groundwater. Many of these permits are associated with the Kennecott Sweetwater Mine,  
22 which is in standby mode. Within a 3.2-km (2-mi) radius of the project area, all water use  
23 permits are those of the BLM. Each of these permits is associated with a well that supplies a  
24 stock pond (or tank). In addition, there is a fourth BLM well supply; a stock pond for which no  
25 water-use permit was found. These aforementioned wells are depicted on Figure 3-10 of the  
26 ER and are represented by well numbers 6, 10, 11, and 15 in the table below.

27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41

1  
2  
3  
4

**Table 3-3. Existing Wells within 5 Miles of Project Area**

Well No. (Map)	Well Permit Number/Name.	Well Depth (ft.)	Depth (ft.) to Static Water	Projected Aquifer Horizons	Projected Drawdown
1	P6572W	216	60	DE, FG	15 ft
2	P8444P	280	250	FG, HJ	160 ft
3	P8461P	600	-1	DE, FG	16 ft
4	P8462P	600	60	DE, FG	16 ft
5	P10696P	237	-1	DE, FG, HJ	160 ft
6	P13834P/4451	900	104	DE, FG, HJ, KM	40 ft
7	P47137W	unknown	unknown	unknown	unknown
8	P55108W	220	138	DE, FG	15 ft
9	P5111W	300	199	KM	15 ft
10	P5112W/4775	280	155	HJ, KM	199 ft
11	P55113W/4777	220	109	DE, FG	22 ft
12	P55114W	320	237	KM	15 ft
13	P63765W	380	140	DE, FG	15 ft
14	P183470W	unknown	unknown	unknown	unknown
15	Eagle Nest Draw	370	269	DE, FG	15 ft

Source: LCI, 2008a

5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16

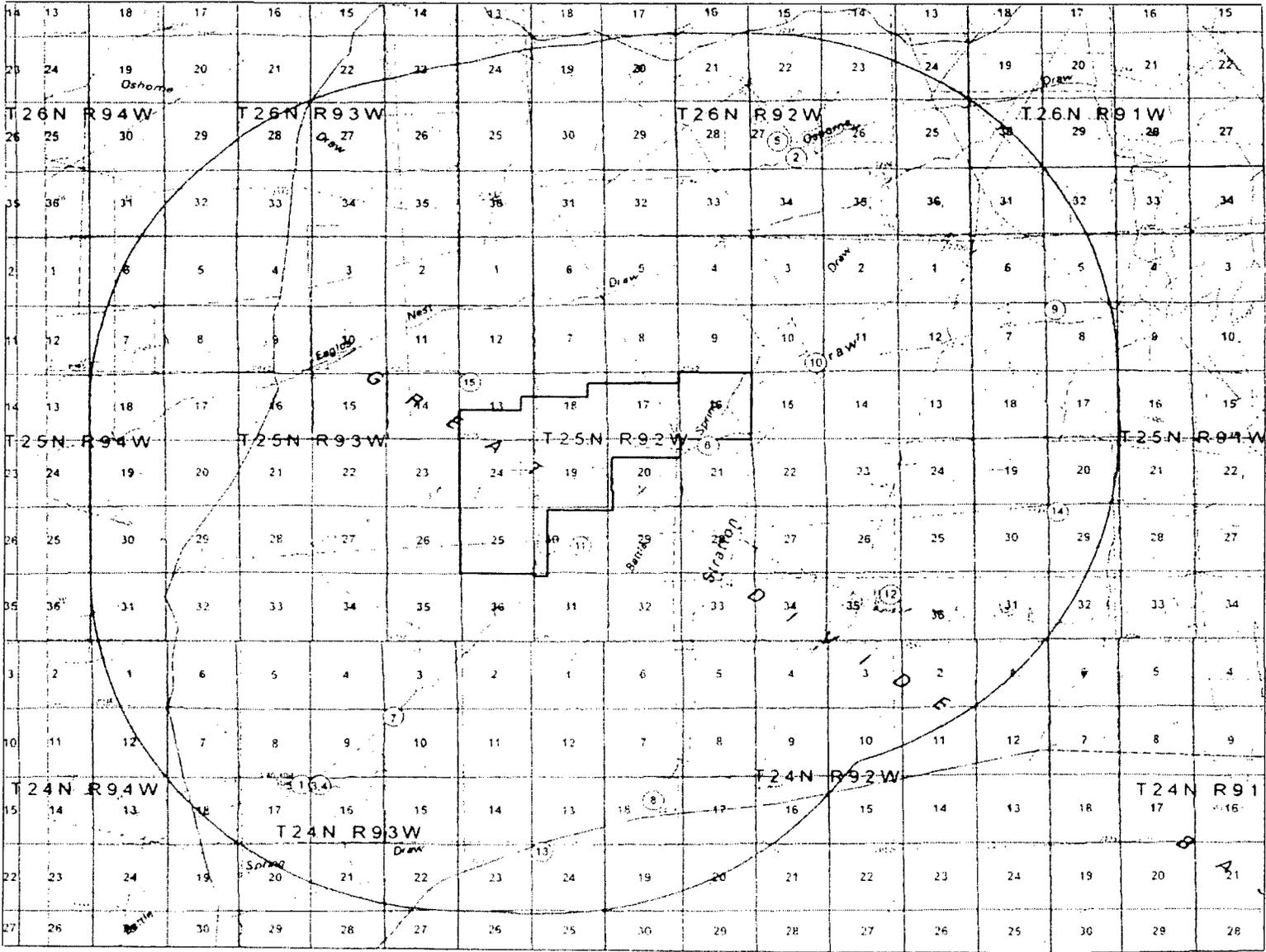


Figure 3-10. Domestic and Stock Wells within 5 Miles of Lost Creek Project Area

1  
2 Within an 8-km (5-mi) radius, the applicant has identified fifteen active domestic or stock wells  
3 (including the four stock wells within a 3.2-km [2-mi] radius). Of these fifteen wells, the BLM has  
4 ten active or potentially active wells (and four associated stock ponds), located outside of the  
5 project area, but within an 8-km (5-mi) radius of impact around the project area boundary (LCI,  
6 2008b). All of these wells are used for livestock watering. There are four other stock wells and  
7 one used by Kennecott Uranium within the 8-km (5-mi) radius of the project area. Eight of the  
8 BLM wells are at or shallower than the proposed the HJ Horizon production zone (~370 – 500  
9 ft.), however, because the Battle Spring formation is said to dip 3 degrees to the west (Section  
10 2.6.1.2, LCI TR, 2008), the HJ Horizon is expected to be progressively shallower to the east and  
11 deeper to the west of the site. As such, a projection of the HJ horizon would place three of the  
12 shallower wells to east and northeast (wells 2, 5 and 10) within the production horizon. The  
13 applicant has predicted potential drawdowns in the production zone aquifer of 54m (177 ft) at  
14 3.2-km [2-mi] and 45m (148 ft) at 8-km (5-mi) (LCI, 2008c – RAI responses). Consequently,  
15 wells 2, 5 and 10 could be potentially be affected out to 8-km (5-mi) by ISR operations at Lost  
16 Creek.

#### 17 3.5.2.4 *Surrounding Aquifers*

18 As indicated above, the Wasatch/Battle Spring Formation, the Fort Union Formation, and the  
19 Lance Formation are all of Tertiary age. They are considered part of the Tertiary aquifer  
20 system, which has been identified as the most important source of groundwater in the study  
21 area. Although some stock wells are known to be present in the Lance Formation along the  
22 formation's outcrop areas along the border of the Great Divide Basin, the groundwater in Lance  
23 Formation is largely undeveloped. Similarly, the Fort Union aquifer is largely undeveloped and  
24 unknown as a source of groundwater supply except in areas where it occurs at shallow depth  
25 along the margins of the basin. These surrounding aquifers are hydrologically upgradient of the  
26 proposed production zone at Lost Creek and are separated stratigraphically as well.

27 The most important aquifers within the Great Divide Basin are in the Wasatch and Battle Spring  
28 Formation. Most wells drilled for water supply in the Battle Spring Formation are less than 305  
29 m (1,000 ft) deep. (Collentine et al., 1981) reports that wells completed in the Battle Spring  
30 aquifers typically yield 114 to 152 Lpm (30 to 40 gpm); but that yields as high as 568 Lpm (150  
31 gpm) are possible. Water quality within the Battle Spring aquifer is generally good in the  
32 northeast portion of the basin with TDS levels usually less than 1,000 mg/L and frequently less  
33 than 200 mg/L. Sulfate levels are also generally low in the shallow aquifers of the Battle Spring  
34 aquifer. Notable exceptions to the relatively good water quality include waters with elevated  
35 radionuclides. The presence of high levels of uranium in Tertiary sediments and groundwater of  
36 the Great Divide Basin has been well documented.

37 Deep well injection has been proposed for the disposal of RO brines. Typically, deep well  
38 injection in the Great Divide Basin occurs in Upper Cretaceous formations several thousand feet  
39 below the Lower Tertiary production zones. The applicant has proposed four injection wells  
40 2560m (8400 ft) deep (LCI, 2009); which is at the level of the Mesa Verde formation under the  
41 project area. The Mesa Verde formation is beneath the Lewis Shale aquitard. The applicant  
42 has indicated that it will apply for the requisite Class I Underground Injection Control (UIC)  
43 permits through WDEQ. As required, the disposal well will be completed (i.e., screened) in an  
44 approved subsurface formation(s) and will be operated according to the permit requirements.

1 **3.6 Ecology**

2 This section describes the terrestrial and aquatic ecological environments of the Lost Creek ISR  
3 project area and addresses T&E species that may potentially be present. The project area is  
4 within the Rolling Sagebrush Steppe of the Wyoming Basin ecoregion of the U.S. (Chapman et  
5 al., 2004). The Wyoming Basin ecoregion is a broad arid intermontane basin interrupted by hills  
6 and low mountains and dominated by grasslands and shrublands. Surrounded by sparsely-  
7 vegetated mountains, the region is drier than the Northwestern Great Plains ecoregion to the  
8 northeast and does not have the extensive cover of pinyon-juniper woodland found in the  
9 Colorado Plateaus ecoregion to the south. Much of the region is used for livestock grazing,  
10 although many areas lack sufficient forage to support this activity (Chapman et al., 2004).

11 Overall, this region is less hilly than the Foothill Shrublands and Low Mountains ecoregion.  
12 Average annual precipitation is 15 to 41 cm (6 to 16 in) and varies with elevation and proximity  
13 to mountains. The region has a continental climate with cold winters and mild summers.  
14 Natural vegetation is mostly sagebrush steppe, with the eastern edge of the region having more  
15 mixed grass prairie. Wyoming big sagebrush is the most common shrub with silver and black  
16 sagebrush occurring in the lowlands and mountain big sagebrush in the higher elevations.  
17 Frequent fires have affected the sagebrush steppe and, in some places, European annual  
18 grasses have replaced it. Most of the land is in rangeland, cattle and sheep ranches, or wildlife  
19 habitat (Chapman et al., 2004).

20 The elevation of the project area is approximately 2,100 m (7,000 ft) AMSL. With approximately  
21 80 m (262 ft) of relief, sub-zero winter temperatures, and less than 25 cm (10 in) of annual  
22 precipitation, vegetation development and species diversity are limited.

23 **3.6.1 Terrestrial Ecology**

24 3.6.1.1 *Vegetation*

25 Vegetation surveys were conducted during the 2006 and 2007 growing seasons to obtain  
26 vegetative cover and species diversity data, with the study design being reviewed and accepted  
27 by the WDEQ (LCI, 2008b). Based on the vegetation surveys, two vegetation types were  
28 identified within the project area and mapped (Figure 3-11). The Upland Big Sagebrush  
29 Shrubland type dominates the flat upland areas and the gentle slopes, while the Lowland Big  
30 Sagebrush Shrubland type occurs in deeper soils along the gently sloped, south-facing  
31 ephemeral dry washes.

32 3.6.1.1.1 Upland Big Sagebrush Shrubland

33 The Upland Big Sagebrush Shrubland type covers most of the project area, occupying  
34 approximately 85 percent of the total land area (LCI, 2008b). Trees are sparsely scattered in  
35 this region, and grasses and sagebrush intermix with exposed ground. The only settings in the  
36 project area that do not support the Upland Big Sagebrush Shrubland habitat are in the deeper  
37 soils of the bottomlands and along the drainages, where the Lowland Big Sagebrush Shrubland  
38 type is found.

39 Big sagebrush (*Artemisia tridentate*) accounts for 54 percent of the cover by all species (LCI  
40 2008a). Some associated grass species that occur in the Upland Big Sagebrush Upland  
41 include Sandberg bluegrass (*Poa secunda*), needle-and-thread grass (*Stipa comata*), Indian  
42 ricegrass (*Oryzopsis hymenoides*), and thickspike wheatgrass (*Agropyron dasystachyum*).  
43 Cushion plants (compact, low growing, mat forming plants) are most common, but collectively  
44 account for only six percent of the cover by all species. The mean total vegetation cover in the  
45 Upland Big Sagebrush Shrubland was 26 percent; cover by litter and rock combined was 22

1 percent; bare soil cover was 52 percent; and the total ground cover (vegetation plus litter and  
2 rock) was 48 percent (LCI, 2008b). The percent cover by bare soil is a reflection of the  
3 sparseness of the vegetation in the Upland Big Sagebrush Shrubland type. Even though there  
4 is a considerable amount of bare soil, the vegetation development is very homogeneous across  
5 the upland parts of the project area. In general, vegetation development in the region is sparse  
6 due to the limited amount of annual precipitation. In all, 36 plant species were observed in the  
7 Upland Big Sagebrush Shrubland type.

#### 8 3.6.1.1.2 Lowland Big Sagebrush Shrubland

9 The Lowland Big Sagebrush Shrubland type occurs along and immediately adjacent to the  
10 ephemeral drainages that cross the project area from north to south. Overall, the Lowland Big  
11 Sagebrush Shrubland covers approximately 15 percent of the project area (LCI, 2008b). The  
12 soils along the drainages tend to be deeper than those on the adjacent uplands and, thereby,  
13 have the potential for holding more moisture than the upland areas. Individual big sagebrush  
14 shrubs along these drainages tend to be larger than the shrubs growing on the upland areas.

15 The major species in the Lowland Big Sagebrush Shrubland type is big sagebrush, accounting  
16 for 72 percent of the cover by all species. Rabbitbrush (*Chrysothamnus*) accounts for eight  
17 percent of the total vegetation cover (LCI 2008a). These two shrub species dominate the  
18 vegetation to an extent that herbaceous species account for limited amounts of cover.  
19 Combined, all native perennial grasses encompassed a mean cover of seven percent (16  
20 percent of the total vegetation cover) with Sandberg bluegrass (*Poa secunda*), thickspike  
21 wheatgrass (*Agropyron dasystachyum*), and squirreltail grass (*Sitanion longifolium*) occurring as  
22 the most prevalent perennial grass species. Forb species are present throughout the Lowland  
23 Big Sagebrush Shrubland, but all occurred at mean cover values that were less than one  
24 percent. As a group, all forbs and cushion plants accounted for approximately three percent of  
25 the total vegetation cover. The mean total vegetation cover in the Lowland Big Sagebrush  
26 Shrubland was 43 percent; with 34 percent cover by litter and rock; 23 percent bare soil cover;  
27 with a total ground cover (vegetation plus litter and rock) of 77 percent (LCI, 2008b). Overall,  
28 the vegetation cover in the Lowland Big Sagebrush Shrubland type was 17 percent greater than  
29 the cover in the Upland Big Sagebrush Shrubland type. In all, 43 plant species were observed  
30 in the Lowland Big Sagebrush Shrubland type.

#### 31 3.6.1.2 *Wildlife*

32 General ranges for wildlife species in the Wyoming West Uranium Milling Region are presented  
33 in the GEIS (NRC, 2009). However, detailed inventories of the project area were conducted by  
34 LCI in 2006 and 2007 (LCI, 2008b). Wildlife inventories were designed to provide baseline data  
35 for licensing the ISR Project and to ensure that wildlife species and habitats are afforded  
36 adequate protection during construction, operations, and restoration. Data collection included  
37 file searches of state and federal agency documents, as well as field surveys for raptors, sage-  
38 grouse, and breeding birds. Wildlife studies focused on T&E species, Migratory Birds of High  
39 Federal Interest (MBHFI), raptors, sage-grouse leks and nesting habitat, breeding bird surveys,  
40 and Pygmy rabbits, as well as a general wildlife inventory of the project area (LCI, 2008b).

41  
42  
43  
44  
45

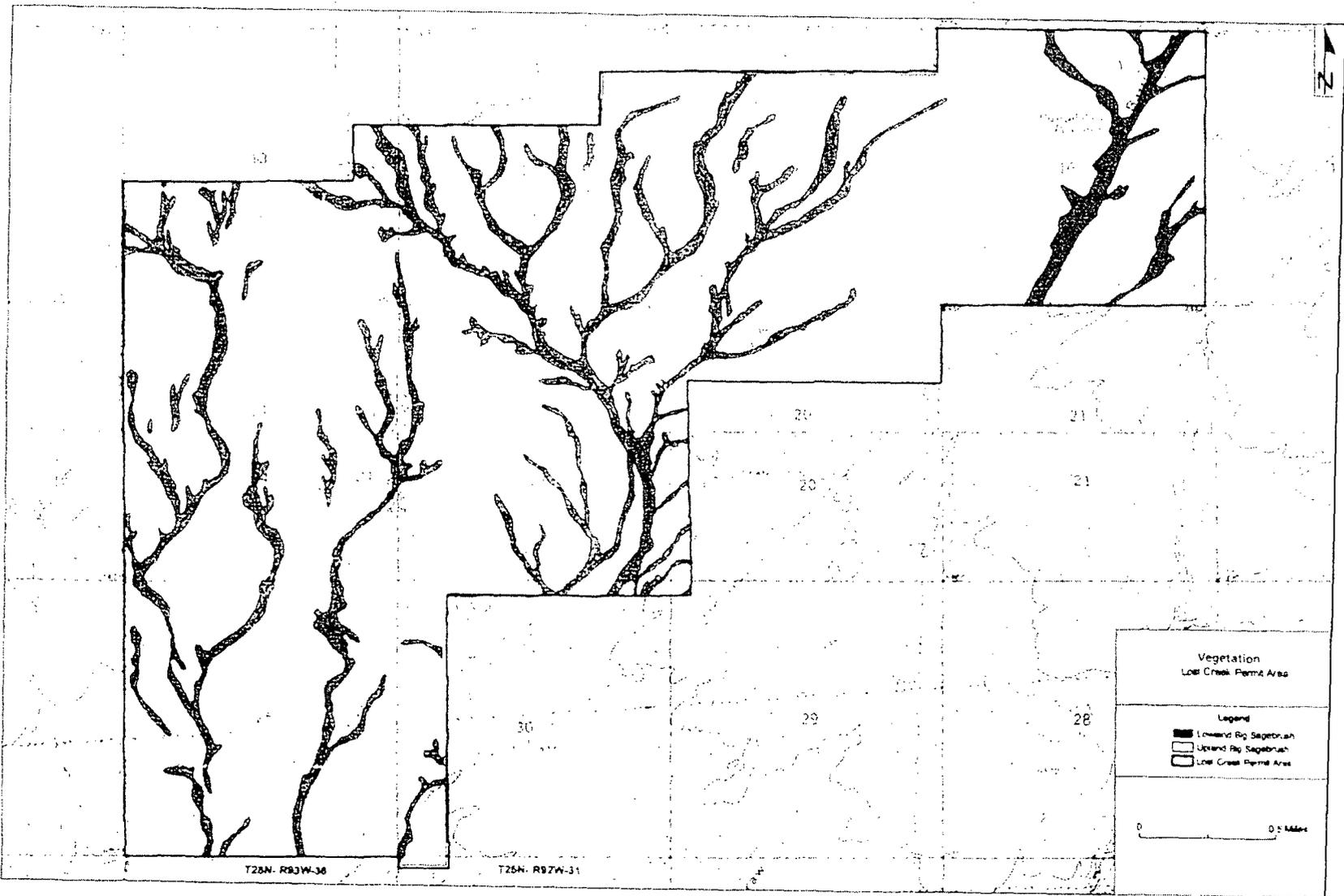


Figure 3-11. Site Vegetation Map

1  
2

3.6.1.2.1 Wildlife Habitat Description

1 The Upland Big Sagebrush Shrubland wildlife habitat is generally found on flat and rolling hills.  
 2 This habitat is important for pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus*  
 3 *hemionus*), sage-grouse (*Centrocercus urophasianus*), white-tailed prairie dogs (*Cynomys*  
 4 *leucurus*), and reptiles. Raptors, including eagles, falcons, hawks, harriers, and owls, often hunt  
 5 in big sagebrush shrubland habitat.

6 The Lowland Big Sagebrush Shrubland wildlife habitat is found along drainages. This habitat  
 7 type has significantly more vegetation cover than the Upland Big Sagebrush Shrubland and  
 8 provides important food and cover for resident and migratory birds, reptiles, and small  
 9 mammals. The taller big sagebrush provides nesting sites for raptors and critical forage for  
 10 ungulates and sage-grouse during winters with extreme snowfall.

11 A total of 224 wildlife species potentially occur in the Lost Creek project area. Of these, 164  
 12 species are birds; 51 species are mammals; four species are amphibians; and five species are  
 13 reptiles. Species that are known to exist in the study area, from observation or the presence of  
 14 identifying signs, are listed in Table 3-5.

15 3.6.1.2.2 Big Game

16 Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk  
 17 (*Cervus canadensis*) were the only big game animals recorded in the project area during field  
 18 surveys conducted by the applicant in 2006 and 2007. No crucial big game habitat occurs on or  
 19 within several kilometers of the Lost Creek project area (University of Wyoming, 2008).

20 According to Wyoming Game & Fish Department (WGFD) Wildlife Observations System Data,  
 21 pronghorn antelope are the most abundant big game species in the study area (LCI, 2008b).  
 22 The project area is classified as Winter/Yearlong Range; an area where a population of animals  
 23 makes general use of the habitat on a year-round basis. There is a significant influx of animals  
 24 between December and April. The study area comprises a portion of the Red Desert Pronghorn  
 25 Herd Unit (WGFD Hunt Area 61). Based on the 2007 Annual Big Game Herd Unit Job  
 26 Completion Report, the Red Desert Pronghorn Herd had a nine-year (1998 through 2007)  
 27 average population of 14,119 pronghorns (WGFD, 2007).

28 The project area is outside of any known mule deer range. Areas described as "out of range"  
 29 contain few animals or the available habitat is of limited importance to the species (LCI, 2008b).

30 Elk use of the study area is presented in the GEIS. Elk only use the project area as transitional  
 31 range while moving to other areas. The 2005 WGFD data defines the seasonal range of the elk  
 32 to be outside of the project area. The 2007 WGFD Herd Unit Data describes two herds, the  
 33 Shamrock Elk Herd Unit (#643) and the Steamboat Elk Herd Unit (#426), as being situated on  
 34 or near the project area (WGFD, 2007).

35

Table 3-4. Wildlife Species Observed in the Project Area			
Scientific Name	Common Name	Abundance Code <sup>1</sup>	Status <sup>2</sup>
<b>Birds</b>			
<i>Branta canadensis</i>	Canada Goose	Uncommon	
<i>Anas platyrhynchos</i>	Mallard	Fairly Common	
<i>Cathartes aura</i>	Turkey Vulture	Common	
<i>Circus cyaneus</i>	Northern Harrier	Common	

**Table 3-4. Wildlife Species Observed in the Project Area**

<b>Scientific Name</b>	<b>Common Name</b>	<b>Abundance Code<sup>1</sup></b>	<b>Status<sup>2</sup></b>
<i>Accipiter striatus</i>	Sharp-shinned Hawk	Uncommon	
<i>Buteo swainsoni</i>	Swainson's Hawk	Common	BCC, MBHFI, NSS4
<i>Buteo jamaicensis</i>	Red-tailed Hawk	Common	
<i>Buteo regalis</i>	Ferruginous Hawk	Common	BCC, MBHFI, SSS, NSS3
<i>Buteo lagopus</i>	Rough-legged Hawk	Common	
<i>Aquila chrysaetos</i>	Golden Eagle	Common	BCC
<i>Falco sparverius</i>	American Kestrel	Common	
<i>Falco mexicanus</i>	Prairie Falcon	Uncommon	BCC
<i>Centrocercus urophasianus</i>	Sage Grouse	Common	MBHFI, SSS, NSS2
<i>Charadrius vociferus</i>	Killdeer	Common	
<i>Zenaida macroura</i>	Mourning Dove	Abundant	
<i>Eremophila alpestris</i>	Horned Lark	Abundant	
<i>Corvus brachyrhynchos</i>	American Crow	Fairly Common	
<i>Corvus corax</i>	Common Raven	Abundant	
<i>Turdus migratorius</i>	American Robin	Common	
<i>Oreoscoptes montanus</i>	Sage Thrasher	Common	MBHFI, SSS, NSS4
<i>Lanius ludovicianus</i>	Loggerhead Shrike	Common	BCC, MBHFI, SSS
<i>Spizella arborea</i>	American Tree Sparrow	Uncommon	
<i>Spizella passerina</i>	Chipping Sparrow	Uncommon	
<i>Spizella pallida</i>	Clay-colored Sparrow	Rare	
<i>Spizella breweri</i>	Brewer's Sparrow	Common	BCC, MBHFI, SSS, NSS4
<i>Pooecetes gramineus</i>	Vesper Sparrow	Common	MBHFI
<i>Chondestes grammacus</i>	Lard Sparrow	Common	MBHFI
<i>Amphispiza belli</i>	Sage Sparrow	Fairly Common	MBHFI, SSS, NSS4
<i>Sturnella neglecta</i>	Western Meadowlark	Abundant	
<b>Mammals</b>			
<i>Brachylagus idahoensis</i>	Pygmy Rabbit	Common	SSS, NSS3
<i>Sylvilagus audubonii</i>	Desert Cottontail	Common	

**Table 3-4. Wildlife Species Observed in the Project Area**

Scientific Name	Common Name	Abundance Code <sup>1</sup>	Status <sup>2</sup>
<i>Sylvilagus nuttallii</i>	Mountain Cottontail	Fairly Common	
<i>Lepus townsendii</i>	White-tailed Jackrabbit	Common	
<i>Tamias minimus</i>	Least Chipmunk	Common	
<i>Spermophilus elegans</i>	Wyoming Ground Squirrel	Common	
<i>Spermophilus tridecemlineatus</i>	Thirteen-lined Ground Squirrel	Common	
<i>Dipodomys ordii</i>	Ord's Kangaroo Rat	Common	
<i>Peromyscus maniculatus</i>	Deer Mouse	Abundant	
<i>Canis latrans</i>	Coyote	Abundant	
<i>Vulpes vulpes</i>	Red Fox	Common	
<i>Procyon lotor</i>	Raccoon	Rare	
<i>Mastela frenata</i>	Long-tailed Weasel	Fairly Common	
<i>Taxidea taxus</i>	American Badger	Common	
<i>Mephitis mephitis</i>	Striped Skunk	Common	
<i>Lynx rufus</i>	Bobcat	Fairly Common	
<i>Cervus elaphus</i>	American Elk	Common	
<i>Odocoileus hemionus</i>	Mule Deer	Abundant	
<i>Antilocapra americana</i>	Pronghorn	Common	
<i>Equus caballus</i>	Feral Horse	Common	
<b>Reptiles</b>			
<i>Phrynosoma hernandesi</i>	Greater Short-horned Lizard	Common	
<i>Thamnophis elegans</i>	Western Terrestrial Garter Snake	Fairly Common	
<i>Crotalus viridis</i>	Prairie Rattlesnake	Uncommon	

Reference: LCI, 2008b

1 Abundance Codes

Abundant - A species that inhabits much of the preferred habitat within its range. The species or its sign is typically encountered while using survey techniques that could be expected to indicate its presence.

Common - A species that inhabits much of the preferred habitat within its range. The species or its sign is usually encountered while using survey techniques that could be expected to indicate its presence.

Uncommon - A species that is common only in limited areas within its range or is found throughout its range in relatively low densities. Intensive surveying is usually required to locate the species or its sign.

Rare - A species that occupies only a small percentage of the preferred habitat within its range or is found throughout its

Table 3-4. Wildlife Species Observed in the Project Area			
Scientific Name	Common Name	Abundance Code <sup>1</sup>	Status <sup>2</sup>

range in extremely low densities. The species or its sign is seldom encountered while using survey techniques that could be expected to indicate its presence.

2 Status

Federal - Migratory Bird Treaty Act

BCC - Birds of Conservation Concern species identified by the USFWS as those migratory non-game birds that without conservation actions are likely to become candidates for listing under the Endangered Species Act.

Federal - Migratory Birds of High Federal Interest in Wyoming

MBHFI - Listed utilized by the USFWS, Wyoming Field Office for reviews concerning existing or proposed coal mine leased land.

BLM - Special Status Species

SSS - BLM Special Status Species are species protected under the Endangered Species Act and those designated by the State Director as Sensitive. Sensitive species are those under status review by the FWS/National Marine and Fisheries Service (NMFS), or whose numbers are declining so rapidly that Federal listing may become necessary, or with typically small or widely dispersed populations, or those inhabiting ecological refugia or other specialized or unique habitats. The minimum level of policy protection for these designated sensitive species would be the same as policy for candidate.

State - Native Species Status

NSS1 - Native Species Status 1 - Populations are greatly restricted or declining, extirpation appears possible and on-going significant loss of habitat.

NSS2 - Native Species Status 2 - Populations are declining, extirpation appears possible, habitat is restricted or vulnerable but no recent on-going significant loss; species may be sensitive to human disturbance.

NSS3 - Native Species Status 3 - Populations are greatly restricted or declining, extirpation appears possible, habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

NSS4 - Native Species Status 4 - Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted.

1

2 3.6.1.2.3 Upland Game Birds

3 Sage-grouse and mourning doves (*Zenaida macroura*) were the only upland game birds noted  
 4 in the study area. Sage-grouse may inhabit the area year-long; but mourning doves are  
 5 migrants and only inhabit the area from spring into early fall.

6 According to the sage-grouse surveys conducted in 2006 and 2007, no active sage-grouse leks  
 7 were located in the project area (LCI, 2008b). The Crooked Well Lek, which is a known strutting  
 8 ground along the northeast boundary of the project area, was inactive during three site visits in  
 9 April 2006. Four males were observed on the lek on April 4, 2007, but no sage-grouse were

1 present in two additional lek surveys; therefore, it is considered inactive (LCI, 2008b). No other  
 2 birds were observed on the lek during 2007. According to LCI, no birds displaying lek behavior  
 3 have been observed on the Crooked Well Lek since 1994. LCI intends to request the WGFD to  
 4 reclassify the lek as Unoccupied/Abandoned based on this information. Six active leks were  
 5 located within 3.2-km (2.0 mi) of the project boundary. The locations of these leks with a 3.2-km  
 6 (2.0 mi) buffer are presented in Figure 3-12.

7 3.6.1.2.4 Raptors

8 Agency files were reviewed by LCI for data on raptor nests in the area. Raptors that are  
 9 monitored include: ferruginous hawk (*Buteo regalis*), great horned owl (*Bubo virginianus*), red-  
 10 tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), golden eagle (*Aquila*  
 11 *chrysaetos*), and short-eared owl (*Asio flammeus*). File searches identified 12 previously  
 12 documented raptor (ferruginous hawk) nests within a 1.6-km (1.0 mi) buffer zone of the project  
 13 area. The status and details are presented in the table below (Table 3-6).

14

Table 3-5. Raptor Nest Status					
Nest ID Number	Species	Nest Status	Nest Substrate	Nest Condition	Notes
AFH25921004	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Within 1-mile buffer
FH25922801	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
FH25923201/AF H25923203	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
No BLM ID Assigned	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer

Reference: LCI, 2008b

15

16

17

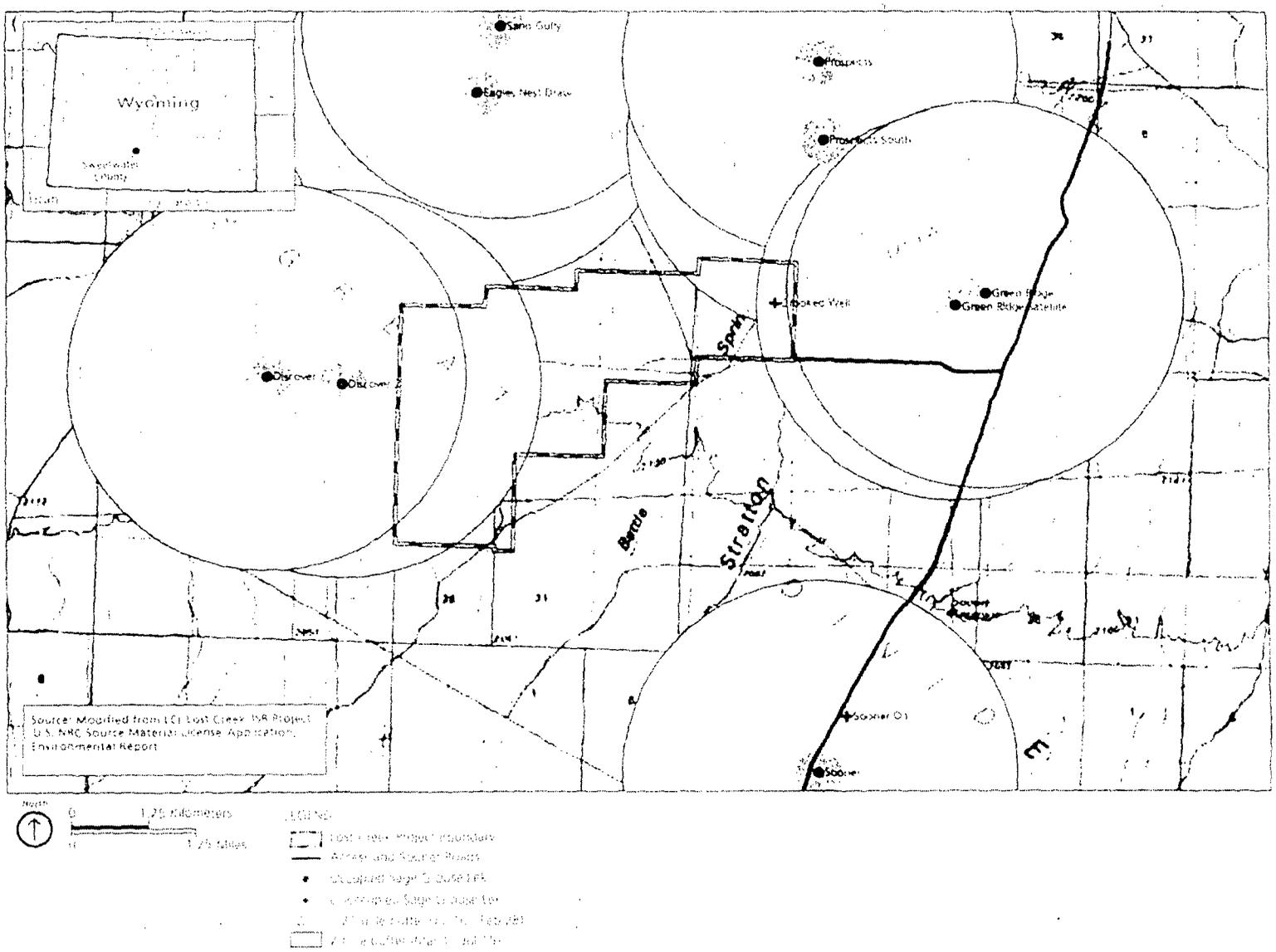


Figure 3-12. Sage Grouse Leks

1 Based on the 2006 and 2007 surveys conducted by LCI, no active raptor nests occur within the  
2 project area. Other nests previously documented by BLM in the 1.6-km (1.0 mi) buffer zone  
3 (Table 3-2 above and Figure 3-13) were not located during the 2006 and 2007 surveys. Global  
4 Positioning System (GPS) units were used to locate these nest sites; but none were found. No  
5 new raptor nests were identified during the 2006 or 2007 field surveys.

6 Several other raptor species were recorded within the study area; but nesting was not  
7 documented. These species include the Swainson's hawk, red-tailed hawk, northern harrier  
8 (*Circus cyaneus*), golden eagle, American kestrel (*Falco sparverius*), prairie falcon (*Falco*  
9 *mexicanus*), and turkey vulture (*Cathartes aura*). While the conditions are present for the  
10 northern harrier and American kestrel nests within the project area, specific nest sites were not  
11 located. Northern goshawk (*Accipiter gentilis*), merlin (*Falco columbarius*), and peregrine  
12 falcons (*Falco peregrinus*) were not observed in the study area.

#### 13 3.6.1.2.5 Waterfowl and Shorebirds

14 One shorebird species, the killdeer (*Charadrius vociferus*), was observed during bird and wildlife  
15 surveys, which is noted in the wildlife species table (Table 3-5). Most recorded waterfowl and  
16 shorebird species are designated "uncommon" to "fairly common" in the region.

17 In the study area, habitat for waterfowl and shorebirds is sparse. The man-made Crooked Well  
18 Reservoir was dry during the 2006 field survey and contained a small amount of water during  
19 the spring of 2007. Waterfowl and shorebird species would be expected in the project area  
20 during migrations in the spring and fall, with additional use in the summer months. Late fall and  
21 winter use of the project area by waterfowl and shorebirds is believed to be limited.

#### 22 3.6.1.2.6 Passerine and Breeding Birds

23 All avian species that were observed during the wildlife inventories are listed in Table 3-5. A  
24 total of 31 passerine species were recorded during surveys. The most common species in the  
25 project area were the horned lark (*Eremophila alpestris*), Brewer's sparrow (*Spizella breweri*),  
26 and sage sparrow (*Amphispiza belli*).  
27

28 Species observed in the Upland Big Sagebrush Shrubland habitat were similar to species  
29 observed in the Lowland Big Sagebrush Shrubland habitats. There were 12 breeding species  
30 seen in each of the big sagebrush habitats during breeding bird surveys.

#### 31 3.6.1.2.7 Migratory Birds of High Federal Interest

32 MBHFI and other wildlife species were inventoried during all site visits. This was accomplished  
33 by searching all suitable or potentially suitable habitats and recording all species encountered.  
34 Several MBHFI species are known to occur in the region (USFWS, 2002). Level I MBHFI  
35 species are described by the USFWS as in need of conservation, while Level II MBHFI species  
36 are described as in need of monitoring. Level I MBHFI species documented in the project area  
37 include the ferruginous hawk, sage-grouse, Brewer's sparrow, and sage sparrow; the mountain  
38 plover (*Charadrius montanus*) and burrowing owl (*Athene cunicularia*) have been noted in  
39 adjacent areas (LCI, 2008b). Level II species documented in the project area include the sage  
40 thrasher (*Oreoscoptes montanus*), loggerhead shrike (*Lanius ludovicianus*), vesper sparrow  
41 (*Pooecetes gramineus*), and lark sparrow (*Chondestes grammacus*).

42 The ferruginous hawk nests in the study area are discussed in Section 3.6.1.2.4. Sage-grouse  
43 observations and lek locations are discussed Section 3.6.1.2.3. The breeding Brewer's sparrow  
44 and sage sparrow were found throughout the big sagebrush habitats of the project area. The  
45 breeding sage thrasher, loggerhead shrike, vesper sparrow, and lark sparrow were also located  
46 within the project area.

1 No mountain plover were observed on or near the project area during spring and early summer  
2 of the 2006 and 2007 field studies. The extensive tall shrub cover and absence of grassland or  
3 open shrub habitats make the project area poorly suited to the mountain plover. Small open  
4 areas (grassland and disturbed blowouts) do occur in the project area, but are isolated.

#### 5 3.6.1.2.8 Other Mammals

6 All mammal species and identifying signs observed during the field studies were recorded and  
7 are documented on the species list in Table 3-5. A total of 19 mammal species were recorded  
8 in the study area (LCI, 2008b). The majority of mammalian species were observed in big  
9 sagebrush habitats. The most common species seen were the whitetailed jackrabbit (*Lepus*  
10 *townsendii*), desert cottontail (*Sylvilagus audubonii*), Wyoming ground squirrel (*Spermophilus*  
11 *elegans*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), deer mouse  
12 (*Peromyscus maniculatus*), and meadow vole (*Microtus pennsylvanicus*). The coyote (*Canis*  
13 *latrans*) was the most abundant predator.

14 Two wild horse (*Equus caballus*) Herd Management Areas (HMA) overlap with the project area.  
15 The project area is within the Stewart Creek HMA and the Lost Creek HMA (BLM, 2004). The  
16 Stewart Creek HMA encompasses 93,572 ha (231,124 ac), of which 87,194 ha (215,369 ac) are  
17 BLM-administered public lands (BLM 2008). The Continental Divide (eastern boundary of the  
18 Great Divide Basin) traverses the HMA in a north-south direction in its eastern portion along  
19 Lost Soldier and Bull Springs rims. The surrounding landscape transitions to gently rolling  
20 uplands which comprise the majority of the HMA.

21 The Lost Creek HMA lies within the Great Divide Basin and encompasses 101,215 ha (250,000  
22 ac), of which 95,140 ha (235,000 ac) are BLM-administered public lands (BLM 2008). Some  
23 vegetation desert playa and vegetated dune areas are interspersed throughout the HMA (BLM  
24 2008). Several sensitive desert wetland riparian areas also occur throughout the area, including  
25 both intermittent and perennial lakes and streams. Similar to the Stewart Creek horses, the  
26 present population has also interbred with domestic stock. Testing on the Lost Creek herd  
27 revealed that the horses are genetically related to the Spanish Mustang and other New World  
28 Iberian breeds (BLM 2008). This characteristic makes the Lost Creek herd unique among the  
29 wild horse herds of Wyoming (BLM 2008).

30 Prairie dog towns provide suitable habitat for the black-footed ferret (*Mustela nigripes*). Black-  
31 footed ferrets are members of the weasel family (Mustelidae) and are considered one of the  
32 most endangered mammals in the United States (FWS 2000). Typical wild ferret behavior  
33 revolves around prairie dog towns, and hunt prairie dogs mostly at night (FWS 2000). Main  
34 causes of the decline in the ferret population included habitat loss from farming; efforts to  
35 eliminate prairie dogs, which competed with livestock for available prairie forage; and sylvatic  
36 plague, a disease that wiped out large numbers of prairie dogs and has also killed ferrets (FWS  
37 2000).

#### 38 3.6.1.2.9 Reptiles and Amphibians

39 During the planning and coordination stages of the wildlife inventories, BLM wildlife biologists  
40 informed LCI that specific reptile and amphibian surveys were not required for the project (LCI,  
41 2008b). These included the greater short-homed lizard (*Phrynosoma hernandesi*), prairie  
42 rattlesnake (*Crotalus viridis*), and western terrestrial garter snake (*Thamnophis elegans*).

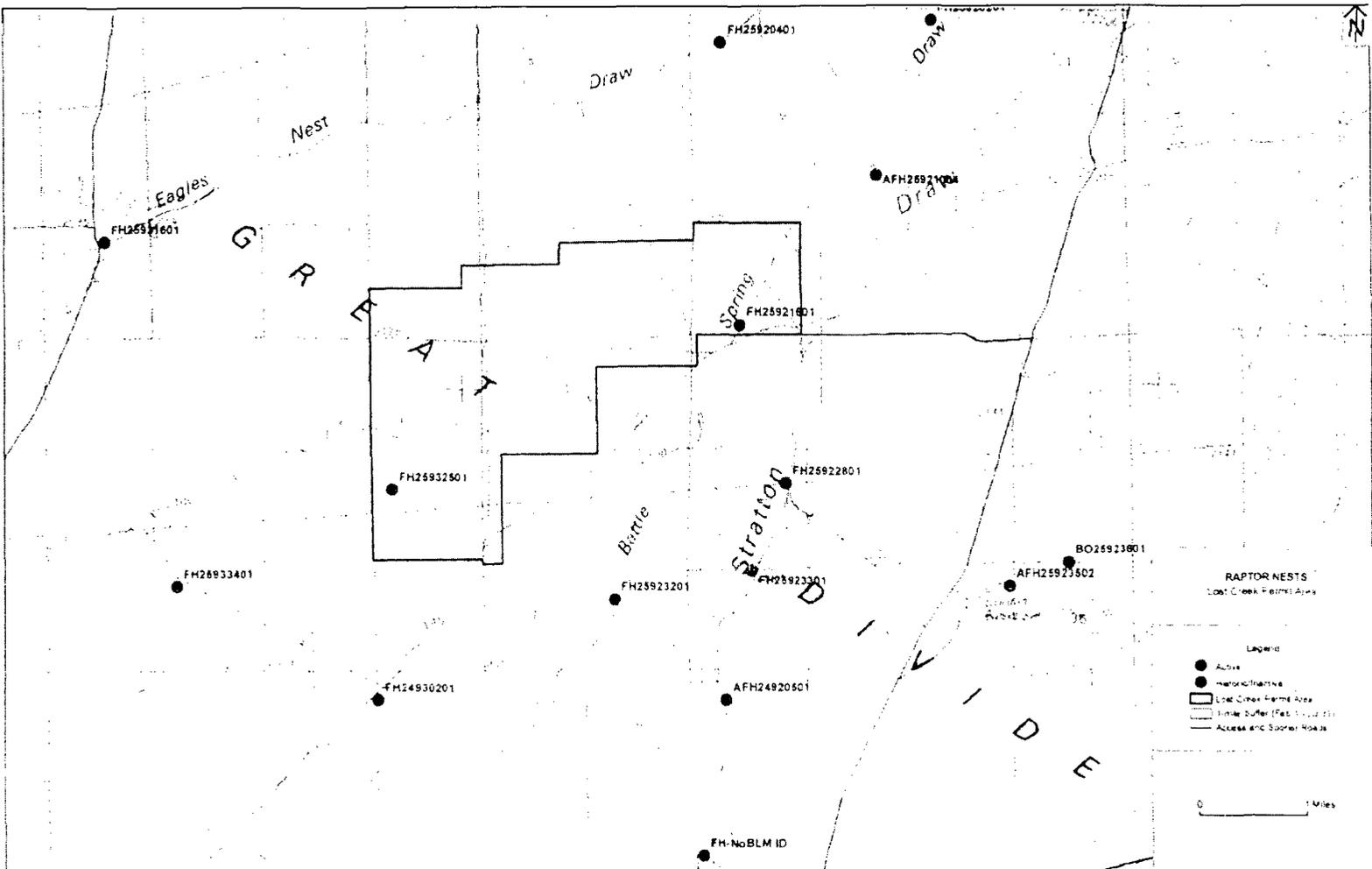


Figure 3-13. Raptor Nests

1  
2 3.6.2 Aquatic Ecology

1 After conducting field investigations and research, aquatic life and wetlands were determined to  
2 not exist within the boundaries of the project area. Surface water may be present seasonally  
3 depending on precipitation, but does not sustain aquatic life or wetland species. A more  
4 detailed discussion of surface water features and wetlands can be found in Sections 3.5.1 and  
5 3.5.2, respectively.

### 6 **3.6.3 Protected Species**

7 Based on consultation with the USFWS, federally listed T&E species (or their designated  
8 habitat) that may potentially be present in the project area include the following:

- 9 • The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is listed as a threatened  
10 species, which is endemic to moist soils near wetland meadows, springs,  
11 lakes, and perennial streams where it colonizes early successional point bars  
12 or sandy edges.

13 The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is Federally-listed as threatened. The  
14 species is a perennial, terrestrial orchid that occurs in Nebraska, Wyoming, Colorado, Utah,  
15 Idaho, Montana, and Washington. Within Wyoming, it inhabits moist meadows with moderately  
16 dense, but short vegetative cover. The species is found at elevations of 1,280 to 2,130 m  
17 (4,200 to 7,000 ft), though no known populations occur in Wyoming above 1,680 m (5,500 ft)  
18 (FWS, 2008). Generally, this orchid is found in low densities of four to eight flowering plants per  
19 square meter (Fertig, 2000). The species is likely to inhabit silt, sand, or gravelly soils in areas  
20 with ample sunlight (FWS, 2008). It is characterized by 12- to 50-cm (4.7- to 20-in) stems with  
21 linear basal leaves up to 28 cm (11 in) long and spikes of small white to ivory flowers that bloom  
22 between early August and early September (Fertig, 2000). Urbanization, livestock grazing,  
23 pesticide use, competition with noxious weeds, and loss of pollinators threaten this species  
24 survival (Fertig, 2000). This species was not observed, nor is it known to occur within the  
25 project area.

- 26 • The black-footed ferret (*Mustela nigripes*) is listed as an endangered species  
27 that inhabits prairie dog colonies.

28 The black-footed ferret (*Mustela nigripes*) is Federally-listed as endangered. The species is  
29 endemic to North America and primarily inhabits the Great Plains region. It is the only species  
30 of ferret native to the Americas. The species was believed to be extinct by the late 1980s, but in  
31 1981, a small relic population was discovered near Meeteetse, Wyoming (WGFD, 2005a).  
32 From this population 18 individuals were captured to start a captive breeding program, which  
33 was initiated by the WGFD (WGFD, 2005a). Nonessential experimental populations have been  
34 reintroduced to 18 locations in 8 states and Mexico (FWS, 2008). Four of these reintroduced  
35 populations – those in Aubrey Valley, Arizona; Cheyenne River and Conata Basin, South  
36 Dakota; and Shirley Basin, Wyoming – have successfully stabilized and no longer require  
37 supplemental individuals from captive breeding (FWS, 2008). Six additional locations are  
38 considered marginal to improving (FWS, 2008).

39 The black-footed ferret is a small mammal in the weasel family with a natural to buff-colored  
40 body and black face, feet, and tail. Generally, black-footed ferret occurrence coincides with  
41 prairie dog habitat (black-tailed [*Cynomys ludovicianus*], Gunnison's [*C. gunnisoni*], and white-  
42 tailed [*C. leucurus*]) because prairie dog is the main prey of the ferret, and the ferret also uses  
43 prairie dog burrows for shelter (FWS, 2008). Black-footed ferrets are more likely to occur in  
44 black-tailed prairie dog habitat than in other prairie dog species' habitat; historically, it is  
45 estimated that 85 percent of all black-tailed ferrets occurred in black-tailed prairie dog habitat, 8  
46 percent in Gunnison's prairie dog habitat, and 7 percent in white-tailed prairie dog habitat (FWS,

1 2008a). A black-footed ferret survey was not required, since black-footed ferrets live exclusively  
2 in prairie dog colonies, which are not present within the project area.

3 In a 2004 letter (FWS, 2004a), the FWS relieved the requirement for black-footed ferret surveys  
4 to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose  
5 of identifying previously unknown ferret populations. Incidental takes of individual ferrets in  
6 black-tailed prairie dog habitat, which is "block cleared," is considered by the FWS to not be an  
7 issue and would not result in an effect on any wild population. However, this block clearance  
8 does not relieve federal agencies of the need to assess a proposed action's effect on the  
9 species' survival and recovery. Further, the FWS directs federal agencies to assess whether a  
10 proposed action could have an adverse effect on the value of prairie dog habitat as a future  
11 reintroduction site for the black-footed ferret (FWS, 2004a).

- 12 • The bald eagle (*Haliaeetus leucocephalus*) was delisted from the Federal List  
13 of Endangered and Threatened Wildlife in July 2007 (72 FR 37346), but is  
14 still protected under the Bald and Golden Eagle Protection Act and the  
15 Migratory Bird Treaty Act, and at the State level as a species of concern.

16 Bald eagle nesting habitat does not exist within the study area; but they might be found in the  
17 project area during migration. According to WGFD Wildlife Observations System Data, the bald  
18 eagle has not been recorded in the study area (LCI, 2008b). The bald eagle is a large raptor  
19 species with a white head and tail, brown body feathers and is generally associated with lakes  
20 and other large, open bodies of water. Bald eagles prey on fish, small mammals, birds, and  
21 occasionally carrion.

## 22 Species of Concern

23 Twelve rare plant species are known to occur in Sweetwater County. These plant species are  
24 listed in Table 3-7. During the vegetation surveys, special consideration was given to these  
25 species of concern (vascular plant species considered to be of extremely high, high, or medium  
26 conservation concern within the state of Wyoming) and the micro-environments capable of  
27 supporting these species. However, no plant species of concern were observed within the  
28 project area.

29 The state-listed wildlife species of special concern (WGFD, 2005b) not included under other  
30 wildlife categories discussed in previous sections, and their probability of occurrence in the  
31 project area, are listed below in Table 3-8.

32 State-listed species that may occur in the project area are classified as Native Species Status  
33 (NSS) 2, 3, or 4 (WGFD, 2005b). Although there are no Status 1 species listed as potentially  
34 occurring in the project area, Status 1 species have populations that are restricted or declining  
35 with the threat of extirpation, and have significant habitat loss. Status 2 species have declining  
36 populations that are threatened with extirpation, and have restricted or vulnerable habitat.  
37 These species may also be sensitive to human disturbance or have significant habitat loss.  
38 Status 3 species have: a) populations that are restricted or declining with the threat of  
39 extirpation, b) habitat that is restricted or vulnerable, or c) a wide distribution and unknown  
40 population, with significant habitat loss. Status 4 species have: a) populations that are restricted  
41 or declining with stable habitat, b) widely distributed stable populations with restricted habitat  
42 that are sensitive to human disturbance, or c) stable or increasing populations with significant  
43 loss of habitat.

44 Listed waterfowl and shorebird species such as the American white pelican (*Pelecanus*  
45 *erythrorhynchos*), upland sandpiper (*Bartramia longicauda*), and long-billed curlew (*Numenius*  
46 *americanus*), and passerines, such as McCown's longspur (*Calcarius mccownii*), chestnut-  
47 collared longspur (*Calcarius ornatus*), and bobolink (*Dolichonyx oryzivorus*), are unlikely to be in

1 the project area because there is no suitable habitat for these species, though they may pass  
 2 through the project area during migration. The sage thrasher, Brewer's sparrow, and sage  
 3 sparrow (all Status 4 species) were observed in the project area. Suitable habitat exists for the  
 4 wouldow lark bunting (*Calamospiza melanocorys*), though this species was not observed.

5 State-listed mammal species that may occur in the project area have been classified as NSS 2,  
 6 3, or 4 (WGFD, 2005b). Several listed shrew and bat species, such as the dwarf shrew (*Sorex*  
 7 *nanus*), vagrant shrew (*Sorex vagrans*), hoary bat (*Lasiurus cinereus*), and silver-haired bat  
 8 (*Lasionycteris noctivagans*), have ranges that include the project area. There is no suitable  
 9 habitat in the study area so they are unlikely to be present. Suitable roosting habitats for the  
 10 western small-footed myotis (*Myotis ciliolabrum*), little brown myotis (*Myotis lucifugus*), long-  
 11 legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), Townsend's big-eared bat  
 12 (*Corynorhinus townsendii*), and pallid bat (*Antrozous pallidus*) might be found in rock crevices,  
 13 rock outcrops, or trees near the Stratton Rim to the north of the project area. These species  
 14 could also potentially roost in the vertical walls of eroded streambeds in the project area. None  
 15 of these species was observed in the project area. The state-listed olive-backed pocket mouse  
 16 (*Perognathus fasciatus*) and prairie vole (*Microtus ochrogaster*) were not observed in the project  
 17 area; however, suitable habitat exists in the project area and these species are known to be in  
 18 the region (WGFD, 2004).

19 Surveys were conducted for pygmy rabbits (*Brachylagus idahoensis*; Status 3 species) at the  
 20 project area during the summer of 2007. Based on these surveys, pygmy rabbits were found  
 21 sporadically in the Lowland Big Sagebrush Shrubland habitat. Scat, burrows, and individual  
 22 Pygmy rabbits were observed along all transects completed within the Lowland Big Sagebrush  
 23 Shrubland communities at the project area.

**Table 3-6. Rare Plant Species Known to Occur in Sweetwater County**

Scientific Name	Common Name	Local Distribution	Heritage <sup>1</sup> /State Rank <sup>2</sup>	Federal Status <sup>3</sup>
<i>Artemisia biennis var diffusa</i>	Mystery Wormwood	Central Sweetwater Co.	G5T1Q/S1	C2
<i>Asclepias uncialis</i>	Dwarf Milkweed	Northwestern Sweetwater Co.	G3/SH	C2, S-R2
<i>Astragalus jejunus var jejenus</i>	Starveling Milkvetch	Eastern and Western edges of Sweetwater Co.	G3T1/S1	C2
<i>Astragalus proimanthus</i>	Precocious Milkvetch	Extreme southwestern Sweetwater Co.	G1/S1	C2
<i>Cirsium ownbeyi</i>	Ownbey's Thistle	South-central Sweetwater Co.	G3/S1	C2
<i>Descurainia torulosa</i>	Wyoming Tansy Mustard	South-central Sweetwater Co.	G1/S1	C2, S-R2, S-R4
<i>Lesquerella macrocarpa</i>	Large-fruited Bladderpod	North-central Sweetwater Co.	G2/S2	C2
<i>Oryzopsis contracta</i>	Contracted Indian Ricegrass	Northeast, northwest, and southwest Sweetwater Co.	G3/S3	C2
<i>Penstemon acaulis</i>	Stemless	Extreme southwestern	G3/S1	C2, S-R4

**Table 3-6. Rare Plant Species Known to Occur in Sweetwater County**

Scientific Name	Common Name	Local Distribution	Heritage <sup>1</sup> /State Rank <sup>2</sup>	Federal Status <sup>3</sup>
<i>var acaulis</i>	Beardtongue	Sweetwater Co.		
<i>Penstemon gibbensii</i>	Gibben's Beardtongue	Extreme southeastern Sweetwater Co.	G1/S1	C2
<i>Phlox opalensis</i>	Opal Phlox	Central part of western Sweetwater Co.	G1/S1	C2
<i>Thelesperma caespitosum</i>	Green River Greenthread	Southwestern Sweetwater Co.	G1/S1	C2, S-R4

Reference: LCI, 2008b

**<sup>1</sup> Heritage Rank Codes:**

- G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction (Critically endangered throughout its range).
- G2: Imperiled globally because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout its range).
- G3: Very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). (Threatened throughout its range).
- G4: Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.
- G5: Demonstrably secure globally, though it may be quite rare in parts of its range especially at the periphery.
- T1: The variety is critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction (Critically endangered throughout its range).
- Q: Indicates uncertainty about taxonomic status.

**<sup>2</sup> State Rank Codes:**

- S1: Critically imperiled in state because of extreme rarity (5 or fewer occurrences, or very few individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state (Critically endangered in state).
- S2: Imperiled in state because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extirpation from the state (Endangered or threatened in state).
- S3: Rare in state (21 to 100 occurrences).
- SH: Of historical occurrence, not documented in Wyoming since 1920.

**<sup>3</sup> Federal Status Codes:**

- C2: Notice of Review, Category 2: taxa for which current information indicates that proposing to list as endangered or threatened is possible, but appropriate or substantial biological information is not on file to support an immediate rulemaking.
- S: Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by :
  - a. Significant current or predicted downward trends in population numbers or density.
  - b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
- R: Forest Region

1

Table 3-7. Wildlife Species of Special Concern				
Species	Status <sup>1</sup>	Preferred Habitat	Potential Occurrence	Identified on the Project Site
<b>Birds</b>				
American White Pelican	NSS3	Big rivers, lakes, reservoirs, estuaries, islands, peninsulas	Unlikely	
Great Blue Heron	NSS4	Wetlands, water banks, rivers, lakes, fields, meadows	Present	
Snowy Egret	NSS3	Marshes, water banks, and shallow rivers, lakes, ponds	Possible	
Northern Pintail	NSS3	Riparian/wetlands, rivers, lakes, ponds in grasslands, fields, boreal forest	Likely	
Canvasback	NSS3	Riparian/wetlands, big rivers, lakes	Present	
Redhead	NSS3	Wetlands, lakes, rivers	Likely	
Sandhill Crane	NSS3	Wetlands, grasslands, banks of rivers, lakes, ponds	Possible	
Upland Sandpiper	NSS4	Fen, cropland, grassland, fields	Unlikely	
Long-billed Curlew	NSS3	Wetland/riparian, grassland, meadows	Unlikely	
Western Burrowing Owl	NSS4	Grasslands, deserts, and savannas in burrows	Likely	
Short-eared Owl	NSS4	Wetland, fen, grassland, cropland	Possible	
Wardlaw Flycatcher	NSS3	Riparian, shrubland, woodland	Possible	
Sage Thrasher	NSS4	Desert, shrubland, sagebrush plains	Present	X
Brewer's Sparrow	NSS4	Desert, shrubland, sagebrush plains	Present	X
Sage Sparrow	NSS4	Desert, shrubland, sagebrush	Present	X
Lark Bunting	NSS4	Cropland, desert, grassland	Likely	
Grasshopper Sparrow	NSS4	Grasslands, fields, savanna	Present	X
McCown's Longspur	NSS4	Cropland, grassland	Unlikely	
Chestnut-collared Longspur	NSS4	Cropland, desert, grassland	Unlikely	
Bobolink	NSS4	Wetland, cropland, grassland	Unlikely	

**Table 3-7. Wildlife Species of Special Concern**

Species	Status <sup>1</sup>	Preferred Habitat	Potential Occurrence	Identified on the Project Site
<b>Mammals</b>				
Dwarf Shrew	NSS3	Wetlands in alpine, scree, conifer forest, grassland, shrubland, woodland	Possible	
Vagrant Shrew	NSS3	Wetland/riparian, fen, conifer forest, woodland, grassland, field, shrubland	Possible	
Western Small-footed Myotis	NSS3	Roost in rock-crevices, caves, tunnels, under boulder, loose bark, buildings, mines in desert, badland, semiarid habitat	Possible	
Little Brown Myotis	NSS3	Roost in buildings, caves, hollow trees in fens, wetland/riparian, forest, shrublands, woodlands	Possible	
Long-legged Myotis	NSS2	Roosts in caves, mines, buildings, rock crevices, under bark, hollow trees in riparian, desert, forest, woodland	Possible	
Hoary Bat	NSS4	Roosts in tree foliage, rock crevices, tree trunks and cavities in riparian, conifer forest, woodland	Unlikely	
Silver-haired Bat	NSS4	Tree cavities of conifer forest adjacent to lakes, ponds, streams	Unlikely	
Big Brown Bat	NSS3	Roost in buildings, trees, rock crevices, tunnels, caves in woodlands and conifer forests	Possible	
Townsend's Big-eared Bat	NSS2	Roost in caves, mines, buildings, tree cavities in conifer forest, woodland sagebrush, riparian	Possible	
Pallid Bat	NSS2	Roost in rock crevices in desert and grasslands	Possible	
Pygmy Rabbit	NSS3	Burrows in dense big sage brush	Present	X
Olive-backed Pocket Mouse	NSS3	Burrows in cropland, grassland, shrubland	Likely	
Prairie Vole	NSS3	Burrows in grasslands, fields	Likely	

Reference: LCI, 2008b

**<sup>1</sup> State - Native Species Status**

**NSS1** - Native Species Status 1 - Populations are greatly restricted or declining, extirpation appears possible

Table 3-7. Wildlife Species of Special Concern				
Species	Status <sup>1</sup>	Preferred Habitat	Potential Occurrence	Identified on the Project Site

and on-going significant loss of habitat.

**NSS2** - Native Species Status 2 - Populations are declining, extirpation appears possible, habitat is restricted or vulnerable but no recent on-going significant loss; species may be sensitive to human disturbance.

**NSS3** - Native Species Status 3 - Populations are greatly restricted or declining, extirpation appears possible, habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

**NSS4** - Native Species Status 4 - Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted.

1

## 2 3.7 Meteorology, Climatology, and Air Quality

### 3 3.7.1 Meteorology and Climatology

4 The majority of Wyoming is dominated by mountain ranges and rangelands of the Rocky  
 5 Mountains and high plains. The mountain ranges are perpendicular to the prevailing westerly  
 6 winds and provide effective barriers to the significant pacific-generated weather systems. Much  
 7 of the moisture produced from these systems is dropped along the western slopes, thereby  
 8 leaving the State east of the mountains, in a semiarid condition.

9 The Continental Divide traverses the State from the northwest corner to the center of the  
 10 southern border with Colorado. This high altitude uplift separates the major drainages that flow  
 11 to the Pacific Ocean from those that flow to the Atlantic Ocean. Along the way, the divide splits  
 12 and creates an oblong basin. This approximately 8960 sq km (3,500 sq mi) basin was created  
 13 during the uplift in south-central Wyoming. Precipitation, averaging only 18 to 25 cm (7 to 10 in)  
 14 a year, that falls within this basin is trapped and doesn't drain to either ocean, but rather  
 15 evaporates or percolates into the ground.

16 The Lost Creek Project area is located within the Great Divide Basin, at an elevation of  
 17 approximately 2,133 m (7,000 ft). This region of the state experiences diverse weather patterns  
 18 that fluctuate throughout the year, due in large part to its proximity to the Rocky Mountain  
 19 system and its relatively high elevation. The area is characterized by long winters, generally  
 20 from December to April, which can bring frequent snow storms. Summer can be hot in the Great  
 21 Divide Basin due to the lack of moisture; however the summer season tends to be short, with  
 22 occasional hail, thunder, or snow storms. While the climate has remained relatively stable in  
 23 this region, a discussion of global climate change is presented in Chapter 5. Meteorological  
 24 stations operated by the National Oceanographic and Atmospheric Administration (NOAA)  
 25 within a 80-km (50-mi) radius of Lost Creek are shown in Figure 3-14.

#### 26 3.7.1.1 Temperature

27 Temperatures fluctuate greatly throughout the year in the Great Divide Basin. Located in a  
 28 semi-arid climate, summer temperatures at the project site can be quite warm, while winters are  
 29 commonly quite cold. The average minimum daily temperature in the region is approximately -2  
 30 °C (10 °F), with January yielding the coldest temperatures. The average maximum daily

1 temperature is approximately 30 °C (85 °F), with July being the hottest month on average  
2 (NCDC, 2009).

3 Summer nights are normally cool although daytime temperatures may be quite high. The fall,  
4 winter, and spring can experience rapid changes with frequent variations from cold to mild  
5 periods. Freezes in early fall and late spring are typical and result in long winters and a short  
6 growing season. In the mountains and high valleys, freezes can occur any time in the summer.  
7 During winter warm spells, night time temperatures can remain above freezing. Valleys  
8 protected from the wind by mountain ranges can provide ideal pockets for cold air to settle and  
9 temperatures in the valley can be considerably lower than on nearby mountainsides (NRC,  
10 2009).

#### 11 3.7.1.2 *Wind*

12 Wyoming is quite windy, and frequently during winter winds reach 48 to 64 km/h (30 to 40 mph)  
13 with gusts to 80 to 97 km/h (50 or 60 mph). Prevailing wind directions vary from west-southwest  
14 through west to northwest. In many localities winds are so strong and constant that trees (when  
15 present) show a definite lean towards the east or southeast. Many wind farms have been  
16 established over southern Wyoming in places such as Arlington, Medicine Bow, Rock River and  
17 just south of Cheyenne to take advantage of this renewable energy source. Figure 3-15 shows  
18 a wind rose that reflects annual wind patterns for the Lost Soldier site, 12 notheast of the Lost  
19 Creek project area (NOAA, 2009).

20 The high plains area near the project site experiences moderate westerly winds throughout the  
21 year. These prevailing winds are generated by high pressure systems that originate in the north  
22 Pacific and Canadian Rocky Mountains. These systems move east across the mountainous  
23 western U.S. and Canada, where most of the precipitation is released, leaving fairly dry, steady  
24 winds that empty into the eastern foot hills and plain regions such as the Great Divide Basin.

25 The following wind data was collected at two climate stations in proximity to the Lost Creek  
26 project area. The first station, installed in 2006 is near the Town of Bairoil, approximately 19 km  
27 (12 mi) northeast of the project area, and the second station was constructed on the Lost Creek  
28 project area in 2007. The annual average wind speed was 7 meters per second (m/s), or 16  
29 miles per hour (mph) during May, 2006 to April, 2007. The wind speed was highest in February  
30 and November and was 9 m/s (20mph). The lowest wind speed occurred in July and August  
31 and was 5 m/s (11 mph) (LCI, 2008a).

32

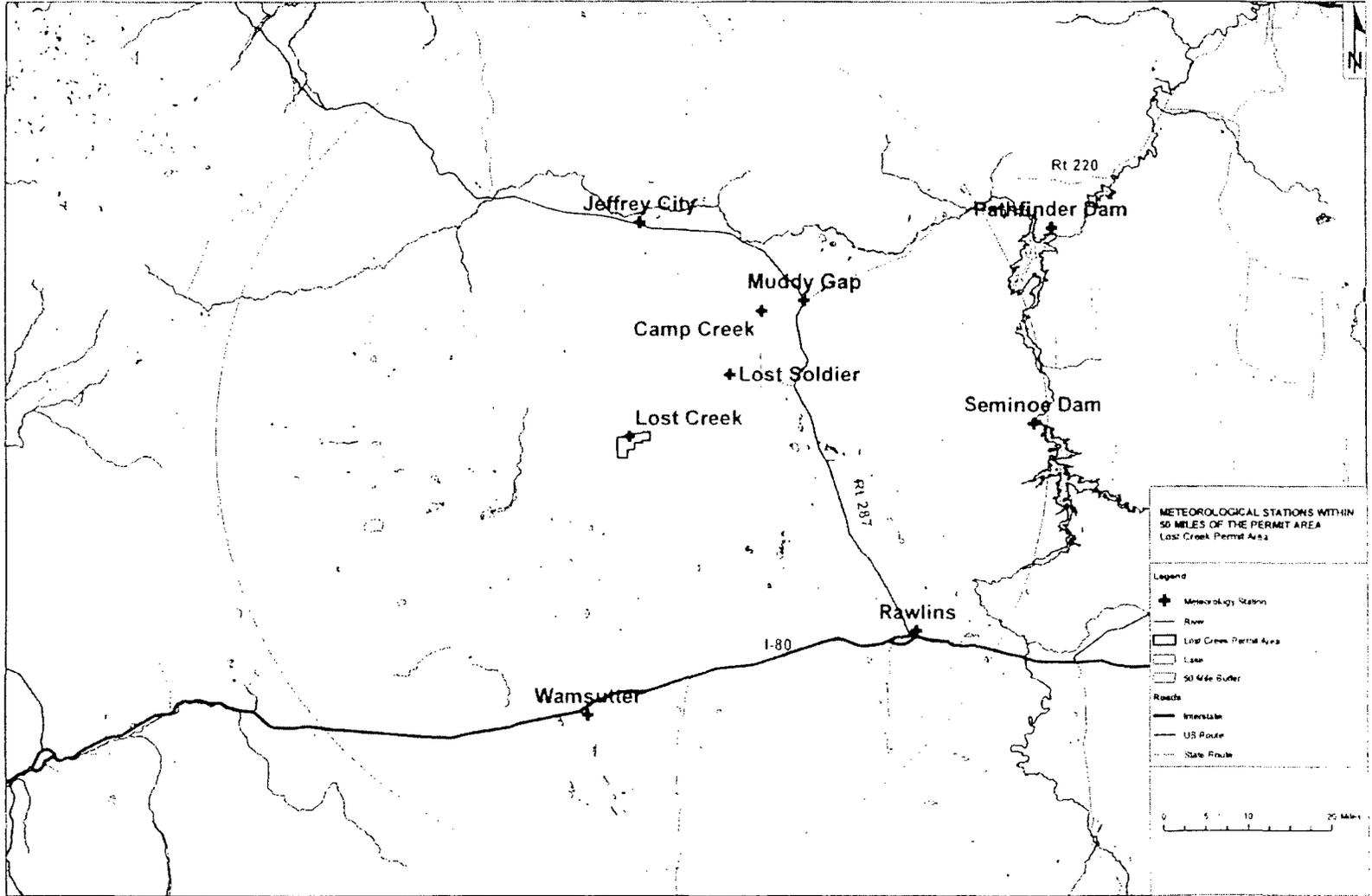
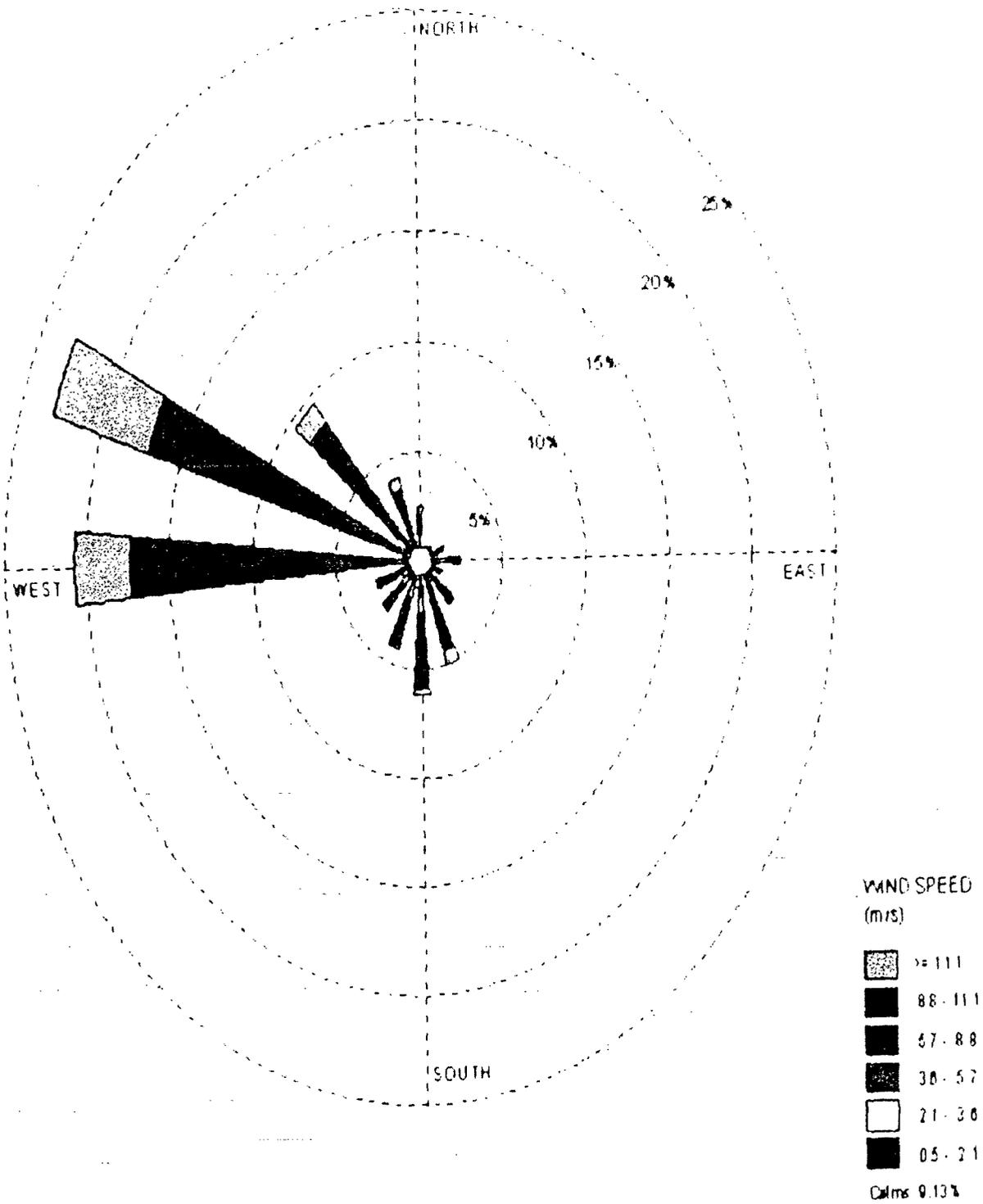


Figure 3-14. Regional NOAA Weather Stations



1  
2

Figure 3-15. Wind Rose (Lost Solider Station)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18

3.7.1.3 *Precipitation*

The Lost Creek project area receives relatively little rainfall, lending itself to semi-arid conditions. Generally, the Rocky Mountain range that surrounds the Great Divide Basin absorbs the majority of the rain and snow that falls. The mean annual precipitation within the area is approximately 25 cm (10 in; LCI, 2008a). While precipitation occurs throughout the year; the mean monthly precipitation exceeds one inch only in April, May, and June. May is the wettest month, with 5 cm (2 in) of mean precipitation. Due to the extreme windy conditions in the winter, gages may actually underestimate the annual snowfall moisture. Storms generated from severe weather conditions could bring wind, rain, snow or hail from any given direction. However severe storms are rare in this area due to the surrounding mountains that effectively block or weaken storms (LCI, 2008a).

Table 3-9 highlights the low and high monthly mean, and the annual mean temperature, precipitation, and snowfall within the Lost Creek project area climatic zone. Climate data was received from a weather station in Jeffery City, approximately 38 km (24 mi) north of the project area. The climate data covers the period 1971-2000 (NOAA, 2004).

**Table 3-8. Climate Data for Jeffery City, Wyoming Climate Station, 2005**

Temperature (°C/ °F)	Mean-Annual	5.3/ 41.5
	Low-Monthly Mean	-7.0/ 19.4
	High-Monthly Mean	19.0/ 66.2
Precipitation (cm/ inches)	Mean-Annual	27.1/ 10.6
	Low-Monthly Mean	0.89/ .35
	High-Monthly Mean	5.71/ 2.2
Snowfall (cm/ inches)	Mean-Annual	143/ 56.2
	Low-Monthly Mean	0/ 0
	High-Monthly Mean	26.9/ 10.5

Source: NOAA, 2004

19  
20  
21

3.7.1.4 *Evaporation*

The majority of the US west of the 105<sup>th</sup> meridian has evaporation rates that exceed precipitation. The exceptions are the coastal Pacific Northwest and high mountain areas of the Rockies, Sierras, and in the Basin and Range. In the area of the Great Divide Basin, the average annual evaporation is about 3.5 times the annual precipitation. Stations at Rock Springs (west of the Lost Creek project area) and the Pathfinder Reservoir (east of the Lost Creek project area) average 95.6 and 84.6 cm (37.7 and 33.3 in) of evaporation, annually (Pochop 1985). The highest rates are during the months of June, July and August, when 12.7 to 17.8 cm (5 to 7 in) per month evaporate. The lowest months are December and January, when less than one inch evaporates. Pochop, et al. (1985) also studied evaporation rates of a variety of wastewaters. He found that uranium wastes water evaporated at a rate 3 percent lower than tap water.

32

1 **3.7.2 Air Quality**

2 The EPA has established air quality standards to promote and sustain healthy living conditions.  
3 These standards, known as the National Ambient Air Quality Standards (NAAQS), have been  
4 adopted by the WDEQ, and are presented in Table 3.2-8 of the GEIS (NRC, 2009). Every state  
5 is required by EPA to evaluate baseline conditions by conducting an air quality monitoring  
6 program. Based upon the results of the monitoring, counties were placed into one of two  
7 categories: attainment and non-attainment. Attainment means that the pollutant levels  
8 measured do not exceed the NAAQS. The entire area within the Wyoming West Uranium  
9 Milling Region is classified as attainment for all primary pollutants (NRC, 2009). The Lost Creek  
10 project area is located in this region in Sweetwater County. Currently, there is little activity on  
11 the proposed project site that generates any air emissions. Although there are several energy  
12 facilities located in the vicinity, the rural project area is classified as an attainment (clean air)  
13 area for all the primary pollutants. The air quality conditions for four locations in south-central  
14 Wyoming are presented in Table 3-11 (WDEQ, 2009). The hilly terrain with sparse sagebrush  
15 vegetation and windy conditions lends itself to good conditions for dispersion of air pollutants.  
16 There are no occupied residential units in the project area. The nearest residential receptors are  
17 located in the community of Bairoil, which is approximately 24 km (15 mi) northeast of the Lost  
18 Creek site (LCI, 2008a).

1

<u>Monitoring Stations</u>	<u>Wamsutter</u>	<u>Casper</u>	<u>Lander</u>	<u>Murphy Ridge</u>	
<b>Distance to Site</b>	40 km (25 mi)	161 km (100 mi)	80 km (50 mi)	241 km 150 mi	
<b>Pollutant</b>	<b>Standards</b>				<b>Averaging Time</b>
Carbon Monoxide	N/A	N/A	N/A	0.7 ppm	8-hour
	N/A	N/A	N/A	0.9 ppm	1-hour
Lead	1.5 ug/m <sup>3</sup>	N/A	N/A	N/A	Quarterly Average
Nitrogen Dioxide	0.007 ug/m <sup>3</sup>	N/A	N/A	0.003 ug/m <sup>3</sup>	Annual (Arithmetic Mean)
Particulate Matter (PM <sub>10</sub> )	227.0 ug/m <sup>3</sup> (Note: 2006 was 73.0 ug/m <sup>3</sup> )	30 ug/m <sup>3</sup>	40 ug/m <sup>3</sup>	64 ug/m <sup>3</sup>	24-hour
Particulate Matter (PM <sub>2.5</sub> )	N/A	N/A	26.0 ug/m <sup>3</sup>	N/A	Annual (Arithmetic Mean)
	N/A	N/A	7.6 ug/m <sup>3</sup>	N/A	24-hour
Ozone	0.064 ppm	N/A	N/A	0.068 ppm	8-hour
Sulfur Dioxide	0.001 ppm	N/A	N/A	0.001 ppm	Annual
	0.010 ppm	N/A	N/A	0.002 ppm	24-hour

2 Source: WDEQ, 2009

3 **3.8 Noise**

4 Existing ambient noise levels are used to establish baseline conditions and determine potential  
 5 site-specific disturbances associated with ISL milling activities. As described in the GEIS, the  
 6 Wyoming West Uranium Milling Region is predominantly rural and undeveloped. Rural areas  
 7 tend to be quiet, open sagebrush-grass and forested areas where natural phenomena such as  
 8 wind, rain, insects, birds, and other wildlife account for most natural background sounds.  
 9 Baseline noise levels for typical undeveloped desert or arid environments range from day-night  
 10 sound levels of 22 dB on calm days to 38 dB on windy days (NRC, 2009).

11 Considering this setting, land uses within the project area, and those beyond, generate very little  
 12 noise for offsite receptors. The relatively isolated setting currently experiences typical rural

1 sound levels. The hilly terrain, sparse sagebrush vegetation, and windy conditions contribute to  
2 attenuating sound levels as they travel over distances.

3 Sound level measurements were attempted on June 13, 2007, but yielded no results, as all  
4 sound pressure levels fell below the instrument range of 40 dB (LCI, 2008a). As a result, it was  
5 assumed that the existing (ambient) sound levels were less than 40 dBA, and is consistent with  
6 the statement in the GEIS stating that existing ambient noise levels in this region would be 22 to  
7 38 dBA (NRC, 2009).

8 Noise is only a concern to the areas surrounding the project site because it can interfere with  
9 wildlife activities. There are no occupied residential units, or other sensitive receptors, in, or  
10 near, the project area. The nearest residential receptors are located in the community of Bairoil,  
11 which is approximately 24 km (15 mi) northeast of the Lost Creek site (LCI, 2008a). With  
12 regards to onsite wildlife receptors, observations suggest that noise from oil and gas operations  
13 may affect lek activity for the greater sage-grouse (Braun et al., 2002). However, as of 2007, no  
14 active leks are located within the project area (LCI, 2008a). The closest known lek just outside  
15 the northeast project boundary (called the Crooked Well Lek) was deemed to be inactive. Six  
16 active leks were observed in the study area.

### 17 **3.9 Historical, Cultural, and Paleontological Resources**

18 The historical and cultural resources investigations for the Lost Creek project included  
19 archaeological surveys, a paleontological survey, ethnographic review, and tribal consultation.  
20 A single man-made structure is located within the project area. The structure is the Crooked  
21 Well Reservoir, located in the northeastern quadrant of the project. The reservoir is a stock  
22 pond covering about 0.1 ha (0.25 ac). The structure is a common landscape feature in the  
23 region and it was not evaluated for cultural resources significance

#### 24 **3.9.1 Cultural History**

25 The project lies on the desiccated High Plains within the Great Divide Basin which is most  
26 commonly regarded as a high elevation, closed basin with semi-arid characteristics. The basin  
27 is marked by the presence of shallow drainages and rolling topography characterized by breaks  
28 and occasional buttes. In the project proper there are no permanent or intermittent water  
29 sources. Three ephemeral drainages are located in the project and study areas. The largest of  
30 these is Battle Spring Draw northeast of the project well field. There is no mention of springs in  
31 the project vicinity except for one that may be associated with Crooked Well Reservoir which is  
32 on a side draw of Battle Spring Draw. The ephemeral drainages and any springs would have  
33 supplied seasonal potable water to both humans and wildlife.

34 Floral and faunal resources that could have been exploited in the prehistoric periods are present  
35 in the project. Except for Indian rice grass, most of the floral resources represent species used  
36 ethnographically for basketry, dyes, or medicines rather than foodstuffs. This is not the case  
37 with the faunal resources. In the historic eras, large mammals including pronghorn antelope,  
38 bison, mule deer, and elk were present and supported Shoshone and Ute populations and  
39 westward-bound emigrants using the Cherokee, Mormon, Oregon, and Overland trails that cut  
40 through the basin though not through the project.

41 The archeological cultural sequence for the project is divided between the prehistoric periods  
42 (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The former  
43 encompasses about 11,000 years between 12,000 B.P. (before present; A.D. 1950) and 250  
44 B.P. (about A.D. 1700). The latter extends from about A.D. 1700 to A.D. 1959, which is the 50-  
45 year cutoff date for possible inclusion on to the *National Register of Historic Places* (NRHP).

1 3.9.1.1 *Prehistoric Era*

2 The Paleoindian period (12,000 to 8500 B.P.) is not formally broken in phases however named  
3 complexes have been developed based on changes in projectile point styles such as Clovis,  
4 Folsom, Agate Basin, Hell Gap, Eden, Scottsbluff, and Cody. Few Paleoindian sites have been  
5 identified in Wyoming, but those that have represent some of the most important in the nation.

6 According to Kinneer et al. (2007:10), the closest possible Paleoindian site to the project is the  
7 Union Pacific Mammoth site, located in Rawlins. The site, which contained bison (*Bison bison*),  
8 Columbian mammoth (*Mammuthus columbi*), and Woodland muskox (*Bootherium bombifions*)  
9 remains, did not yield Paleoindian artifacts but the bone appeared to show signs of butchering.  
10 The site dates to approximately 11,280±350 B.P. based on associated charcoal which is  
11 roughly contemporaneous with Clovis-age sites in the region (Pitblado, 2009). Confirmed  
12 Paleoindian sites in the region, yielding both Pleistocene megafauna and Paleoindian artifacts,  
13 include the James Allen site in southwestern Wyoming; Hell Gap and Agate Basin in eastern  
14 Wyoming; and Medicine Lodge Creek in central Wyoming.

15 The Paleoindian period comes to a close in the terminal Pleistocene/early Holocene era. The  
16 Pleistocene megafauna (mammoth, muskox for example) are replaced by modern bison, elk,  
17 deer, and antelope. These smaller grazers were better adapted to the change from savannah  
18 to grassland communities that resulted from the onset of warmer and drier conditions in the  
19 Holocene. The Archaic period (8500 to 1800 B.P.) in southwestern Wyoming is broken into four  
20 phases. The Early Archaic (8500 to 5000 B.P.) phases are Great Divide and Opal; the Late  
21 Archaic (5000 to 1800 B.P.) phases are Pine Spring and Deadman Wash.

22 Early Archaic sites are marked by the presence of various side- and corner-notched projectile  
23 points and side-notched knives. Basin houses are identified in both phases. The economic  
24 focus continues to be broad spectrum hunting and gathering with increasing emphasis on  
25 smaller game species in the Opal phase. The emphasis shifts, however, in the subsequent Late  
26 Archaic phases. Modern bison was the preferred game of Late Archaic hunters. Diagnostics  
27 recovered from these sites show that large corner-notched projectile points was the preferred  
28 weapon. Late Archaic faunal assemblages are also marked by the presence of smaller game  
29 animals and mid-size ungulates such as deer and antelope.

30 The acceptance of new technologies heralds the subsequent Late Prehistoric period (1800 to  
31 250 B.P.). Smaller projectile points adapted to use with arrows are accepted by the Native  
32 American hunters. Prior to the Late Prehistoric, the points were hafted on spears. Earthenware  
33 technology also is introduced to the region from the south and east and this technology allows  
34 for additions to food preparation techniques. Techniques such as stewing, braising, and boiling  
35 were now possible and this significantly broadened the number of species, both floral and  
36 faunal, that could be utilized.

37 3.9.1.2 *Protohistoric/Historic Era*

38 The Protohistoric Period dates between about A.D. 1700 and 1840. It represents the period  
39 when European goods and the domesticated horse are introduced into the region but Late  
40 Prehistoric lifeways were still predominate. There is no appreciable European presence in the  
41 region though French fur traders are moving up and down the Missouri River. Across the  
42 northern High Plains, there was active trading in European material goods including metal  
43 knives, pots, and glass beads (Brooks, 2009; Johnson, 2009). However, Native American  
44 goods in similar styles also continued to be produced.

45 The Historic era is subdivided into seven periods: Early Historic (A.D. 1801-1842), Pre-territorial  
46 (A.D. 1843-1867), Territorial (A.D. 1868-1889), Expansion (A.D. 1890-1919), Depression (A.D.  
47 1920-1939), World War II (A.D. 1940-1946), and Post-World War II (A.D. 1947-1959). Various

1 themes have been identified which crosscut the periods. The themes that are called out in  
 2 Kinneer et al. (2007) include Early Transportation and Oil and Mineral Exploration.

3 The project area was historically used for cattle ranching with limited oil and gas exploration in  
 4 the nearby vicinity. There is no indication from the sites identified to date in the project area that  
 5 there were earlier historic occupations of the area. This suggests that historic occupations are  
 6 limited to the Expansion and post-expansion periods

7 **3.9.2 Historic and Cultural Resources Identified and Places of Cultural Significance**

8 *3.9.2.1 Previous Cultural Resources Investigations*

9 Three Class III surveys were conducted in the project area. Two surveys were completed for  
 10 earlier projects not related to the Lost Creek project. These two included Wyoming State  
 11 Historic Preservation Office Cultural Resources Office (WYCRO) project Numbers 80-278 and  
 12 88-875. Project 80-278 was completed by Western Wyoming College for a proposed uranium  
 13 drill site. Project 88-875 was conducted by BLM for a proposed fence line.

14 The current project and associated study areas were subjected to systematic cultural resources  
 15 investigations in 2007 (Kinneer et al., 2007). The work was conducted under BLM Cultural  
 16 Resource Use Permit (CRUP) No. 033-WY-SR06. The archaeological work was completed in  
 17 two phases: July to October 2006 and May 2007.

18 The Class I site file search was conducted prior to fieldwork. The site file research identified the  
 19 two previous surveys and also found that Project 88-875 located archaeological site 48SW7633,  
 20 a possible sheepherder's camp. The camp was recommended not eligible by the original  
 21 investigators (BLM; Kinneer et al. 2007). Kinneer et al. (2007) relocated the site and also  
 22 recommended the site not eligible to the NRHP.

23 Systematic survey of the project area covered 1,523 ha (3,764 ac) of BLM-managed land and  
 24 270 ha (666 ac) of State of Wyoming land. The 2007 fieldwork was conducted using a BLM-  
 25 mandated survey approach consisting of the use of standard interval survey transects, not  
 26 exceeding 30 m (100 ft) in separation. All sites and isolated resources were documented when  
 27 initially found. No part of the project area was excluded from survey (Kinneer et al., 2007).

28 The survey resulted in the relocation of Site 48SW7633 and the identification of 17 new sites  
 29 and 75 isolated resources. The isolated resources are summarized in the Table below (Table 3-  
 30 12). Under the State Protocol between BLM and the Wyoming SHPO, the isolated finds are  
 31 ineligible to the NRHP and no further archaeological consideration of them is recommended.

32

**Table 3-10. Archaeological Sites Located within the Area of Potential Effect**

Site Number	Site Type	Recommendation
48SW16593 CA-2475	Historic: trash scatter	Not eligible
48SW16594 CA-2478	Historic, Prehistoric: Lithic and trash scatters with windmill base	Not eligible
48SW16595 CA-2483	Historic:, trash scatter	Not eligible

**Table 3-10. Archaeological Sites Located within the Area of Potential Effect**

Site Number	Site Type	Recommendation
48SW16601 CA-2529	Historic:, trash scatter	Not eligible
48SW16602 CA-3151	Historic, Prehistoric: Lithic and trash scatters	Not eligible
48SW16603 CA-3158	Historic: trash scatter	Not eligible
48SW16764 CA-2608	Historic, Prehistoric: Lithic and trash scatters	Not eligible
48SW16596 CA-2488	Historic, Prehistoric: Lithic and trash scatters	Not eligible; all items were surface finds.
48SW16597 CA-2489	Historic, Prehistoric: lithic and trash scatters	Not eligible; no significant subsurface deposits.
48SW16604 CA-3163	Prehistoric: lithic scatter with hearth	Eligible; avoidance recommended. If not possible, then data recovery.
48SW16605 CA-3167	Prehistoric: lithic scatter	Not eligible; all cultural items were surface finds.
48SW16606 CA-3175	Prehistoric: lithic scatter with hearth	Not eligible; subsurface finds were evaluated as rodent redeposited. There has been deflation also.
48SW16607 CA-3180	Prehistoric: lithic scatter	Not eligible; no significant subsurface deposits.
48SW16608 CA-3182	Prehistoric: lithic scatter with Paleoindian paleosol	Eligible; avoidance recommended. If not possible, then data recovery.
48SW16763 CA-2604	Historic, Prehistoric: Lithic and trash scatters	Not eligible; no significant subsurface deposits.
48SW16765 CA-2610	Historic, Prehistoric: Lithic and trash scatters	Eligible; avoidance recommended. If not possible, then data recovery.
48SW16766 CA-2613	Prehistoric: lithic scatter	Not eligible; no significant subsurface deposits.

1 Source: Kineer et. al 2007

2

3 Seven of the newly identified archaeological sites were recommended ineligible to the NRHP as  
 4 well. The sites are dominated by historic debris with minor Native American components. The  
 5 latter are of indeterminate age and could date to either the prehistoric or historic periods.

1 Of the new sites identified, 10 sites were tested and evaluated for listing. Based on the  
2 identification and testing results, three prehistoric sites (48SW16604, 48SW16608, and  
3 48SW16765) were recommended as eligible to the NRHP.

#### 4 3.9.2.1.2 Ethnology – Identification and Evaluation

5 The only Tribe to have shown an interest in the Lost Creek site was the Eastern Shoshone. The  
6 THPO visited the site in 2008 but found it to be of no interest to the Tribe.

### 7 **3.9.3 Historic Properties Listed in the National and State Registers**

8 No cultural resources in the project area are currently listed on the State or National Registers  
9 of Historic Places. Kinneer et al. (2007) recommended three archaeological sites eligible to the  
10 NRHP and the BLM and Wyoming SHPO concurred. If the Proposed Action is selected, two of  
11 the sites, 48SW16608 and 48SW16765, would not be impacted by the project and no further  
12 investigation would be conducted. The third site, 48SW16604, lies within the project well field  
13 and it would be subjected to data recovery following the development of a MOA between the  
14 NRC, BLM, and Wyoming SHPO. Additional consulting parties may include the Eastern  
15 Shoshone who indicated that the proposed data recovery treatment plan was acceptable.

16 The sites recommended as eligible to the NRHP are prehistoric lithic scatters with and without  
17 features. Site 48SW16604 encompasses about 14,973 m<sup>2</sup> (161,708 ft<sup>2</sup>) but the artifact  
18 densities are lighter in the western part of the site than in the east along an ephemeral drainage  
19 (Kinneer et al., 2007). Testing at the site found a basin-shaped hearth. Diagnostic artifacts and  
20 radiocarbon dating suggested that intermittent occupation of the site occurred between the  
21 Paleoindian and Late Prehistoric eras. Kinneer et al. (2007:48) noted that the site has the  
22 potential to address research issues concerning chronology, lithic technology,  
23 paleoenvironments, and subsistence strategies. Subsequently, Kinneer (2008) developed a  
24 treatment plan for this site and the plan was submitted to the BLM. BLM accepted the plan and  
25 has issued Wyoming BLM CRUP No. 568-WY-AR09 which authorizes data recovery at the site.  
26 The plan was submitted by BLM to Wyoming SHPO; by letter dated 24 July 2008, Wyoming  
27 SHPO concurred with BLM's determination of eligibility and acceptance of the treatment plan.  
28 Subsequently, NRC has also reviewed and accepted the treatment plan on June 30, 2009.

29 Site 48SW16608 encompasses about 4,613 m<sup>2</sup> (49,820 ft<sup>2</sup>) with the highest artifact densities in  
30 the deflated eastern half of the site (Kinneer et al., 2007). Diagnostic artifacts and the  
31 radiocarbon dating suggested that the site had been occupied during Paleoindian times. Site  
32 48SW16608 has the potential to address research issues concerning chronology, lithic  
33 technology, paleoenvironments, and subsistence strategies (Kinneer et al 2007).

34 Site 48SW16765 encompasses about 1,079 m<sup>2</sup> (11,653 ft<sup>2</sup>) and the area is marked by a thin but  
35 persistent scatter of chipped stone tools and debitage. There is also a small amount of historic  
36 trash (Kinneer et al., 2007:70). Testing at the site found an ill-defined pit feature in association  
37 with a well-defined, stratified midden. A single fragmentary Archaic point was recovered.  
38 Kinneer et al. (2007) noted that the site has the potential to address research issues regarding  
39 Archaic subsistence strategies. If the site cannot be avoided, then a treatment plan would be  
40 needed to address the affects of the proposed action on the resource.

### 41 **3.9.4 Tribal Consultation**

42 No Indian reservation land is located within or near the project area (LCI, 2008a). The only  
43 Tribal reservation in Wyoming is the Wind River Indian Reservation which is about 168 km (105  
44 mi) northwest of the project area. Additionally, no properties having religious and/or cultural  
45 significance to contemporary Native Americans are known to exist within or near the project

1 area” (LCI, 2008a). NRC has initiated consultation with the Native American tribes who have  
2 aboriginal ties to the project area to determine if properties are present. To date, only the  
3 Eastern Shoshone and Northern Arapaho have responded to the NRC requests for information  
4 through a series of telephone conversations.

### 5 **3.9.5 Paleontological Resources**

6 BLM Instruction Memorandum No. 2008-009 (October 15, 2007; Memo 2008-009) was used to  
7 evaluate the potential for geologic units to occur within the Lost Creek project area. As defined  
8 in memorandum, “geologic units are classified based on the relative abundance of vertebrate  
9 fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse  
10 impacts, with a higher class number indicating a higher potential.” The BLM’s system rates the  
11 likelihood that specific geological units would contain fossils. It is not a substitute for on-ground  
12 survey as site-specific conditions must be evaluated as well.

13  
14 According to the Geologic Map of Wyoming (Love and Christianson, 1985), the project area is  
15 marked by the presence of Quaternary age, near surface deposits and Tertiary age formations.  
16 Under the BLM’s Potential Fossil Yield Classification (PYFC) system the Quaternary age  
17 deposits are assigned a Class 2 ranking. Class 2 rankings are assigned to recent, sedimentary  
18 units considered unlikely to have vertebrate fossils or significant nonvertebrate fossils. The near  
19 surface deposits are usually younger than 10,000 years old, may include aeolian materials, and  
20 deposits that have undergone significant diagenetic alteration. While important localities might  
21 exist in such deposits, their level of occurrence is considered low.

22  
23 The project area Tertiary age deposits are capped by Battle Spring Formation sandstone and  
24 shale. The unit is thick in the project area and the underlying Wasatch Formation, of the same  
25 age, is considered unlikely to be exposed. Under the PFYC system, the Battle Spring  
26 Formation is assigned a ranking of Class 3A to 3B. These rankings range from moderate (3A)  
27 to unknown (3B) sensitivity for the occurrence of significant vertebrate or invertebrate fossils.  
28 Because the sensitivity is moderate to unknown, survey by a BLM permitted paleontologist is  
29 recommended.

### 30 **3.10 Visual and Scenic Resources**

31 The Lost Creek project area is characterized by low-relief, sagebrush-dominated land, dissected  
32 by a small network of ephemeral drainages. The scenery is characteristic of surrounding areas  
33 in the Great Divide Basin, though less visually appealing than many other locations. Few  
34 intermittent meandering streams, creeks and associated riparian vegetation cross the open  
35 steppe, providing localized visual diversity to the otherwise homogeneous landscapes. More  
36 rugged mountainous landscapes can be seen in the background to the north and to the south.  
37 Previous modifications to the natural environment of the project area include fencing, power  
38 lines, and four-wheel drive (two-track) roads. Drilling rigs can currently be seen in the project  
39 area.

40 The BLM administers 85 percent of the land (1,449 ha [3,580 ac]) in the project area and  
41 evaluates the scenic quality of the land it administers through a “Visual Resource Inventory.” the  
42 objective of which is “to manage public lands in a manner which will protect the quality of the  
43 scenic (visual) values of these lands” (BLM, 1984). The BLM Visual Resource Inventory  
44 process consists of a scenic quality evaluation, a sensitivity level analysis, and a delineation of  
45 distance zones. Together, these evaluations are used to group areas into Visual Resource  
46 Management (VRM) classes, which provide guidance for management decisions. Areas are  
47 classified on a four-level scale, with Class I being the most protective of visual and scenic

1 resources (and restrictive on allowable land uses), and Class IV being the least restrictive on  
2 uses due to the lack of visual landscape concerns (BLM, 1984).

3 Visual resources consist of landforms, vegetation, rock and water features and cultural  
4 modifications that create the visual character and sensitivity of landscapes. Examples in the  
5 Lost Creek project area would include the ephemeral drainages crossing the landscape, as well  
6 as the views of the mountains in the distance. Important visual resources are areas that have  
7 landscape qualities of unusual or intrinsic scenic value and areas of human and cultural use that  
8 are valued for their visual settings. Factors considered in evaluating the importance of visual  
9 resources include the visual quality and visual sensitivity, as discussed in further detail below  
10 (BLM, 1984).

11 Distance zones also influence the potential impact of scenery changes on receptors. Potentially  
12 sensitive view areas are discussed with respect to three distance zones:

- 13 • Fore ground (within 0.8 km, [0.5 mi]),
- 14 • middleground (0.8 to 3.2 km, [0.5 to 2 mi]), and
- 15 • background (beyond 3.2 km, [2 mi]).

16 The BLM has established VRM classifications and has resources management plans for all of  
17 the Wyoming West Uranium Milling Region, which includes the Lost Creek site (NRC, 2009).  
18 The VRM classifications for the region are shown in Figure 3.2-20 of the GEIS (NRC, 2009).  
19 The landscape has been modified in some of the more urban areas, and in a number of rural  
20 areas by mineral extraction activities. The bulk of the Wyoming West Uranium Milling Region is  
21 categorized as VRM Class III (along highways) and Class IV (open grassland, oil and gas,  
22 urban areas). The BLM resource management plans for this region do not identify any VRM  
23 Class I resource areas.

24 The area considered for visual resources, includes the project area, access roads, and a 3.2 km  
25 (2 mi) buffer area outside of the project area. Beyond this distance, any changes to the  
26 landscape would be in the background distance zone, and either unobtrusive or imperceptible to  
27 viewers.

28 "Visual quality", defined by the overall visual impression or attractiveness of an area, considers  
29 the variety, vividness, coherence, harmony or pattern of landscape features and is  
30 characterized according to three levels: 1) distinctive resources that are unique or exemplary in  
31 quality; 2) representative resources that are typical of the physiographic region and commonly  
32 encountered; and 3) indistinctive resources that are landscape or cultural areas that either lack  
33 visual resource amenities or have been degraded.

34 The scenic quality inventory was based on methods provided in BLM Manual 8410 – Visual  
35 Resource Inventory as well as a review of the factors that contribute to the existing VRM Class  
36 IV inventory for the project area. The key factors of landform, vegetation, water, color, influence  
37 of adjacent scenery, scarcity and cultural modifications were evaluated and scored according to  
38 the rating criteria. According to *Standard Review Plan for In-situ Leach Uranium Extraction*  
39 *License Applications* (NUREG-1569), if the visual resource evaluation rating is 19 or less, no  
40 further evaluation is required (NRC, 2003). The scenic quality field inventory score calculated  
41 for the Lost Creek Site according to BLM methodology was 7 out of a possible 32 (LCI, 2008a).

42 "Visual sensitivity", defined as a measure of an area's potential sensitivity to visual change,  
43 considers types of viewers and viewer exposure. Visual sensitivity considers viewer types and  
44 numbers, as well as viewing distance zones. Areas and associated viewer types considered to  
45 be potentially sensitive to visual changes include: park, recreation and wilderness study areas,  
46 major travel routes, and residential areas.

1 Visually sensitive areas include parks, recreation and natural areas, major travel routes, and  
2 residential areas within 3.2 km (2 mi) of the project area. Potentially sensitive areas located 3.2  
3 km (2 mi) or more from the project area are not considered in this study since beyond this  
4 distance changes from the project would be indistinct compared to the existing conditions. The  
5 viewer groups and use areas described below are considered to be moderately or highly  
6 sensitive to visual impacts when in the foreground or middle-ground distance.

7 No developed parks or recreation areas are located within the visual resources study area.  
8 Travel routes in the visual resources study area include CR 63, CR 23, and Sooner Road. The  
9 project area is not visible from any of these transportation corridors from viewpoints within the  
10 visual resources study area. Additionally, there are no residences within the visual resources  
11 study area.

12 The project area is approximately 48 km (30 mi) southwest from the Ferris Mountain Wilderness  
13 Study Area, but no Wilderness Areas or Areas of Critical Environmental Concern are located  
14 within the visual resources study area. The project area is in near recreation areas, activities,  
15 such as hiking, sight-seeing, antler collecting, OHV use, hunting, and wild horse viewing are  
16 dispersed. There are no designated wildlife viewing locations in the study area (LCI, 2008a),  
17 though the project area does include Wyoming Game and Fishing Department hunting areas for  
18 antelope, deer, elk, and mountain lion.

19 The project area is not visually pristine or of special visual interest due to existing infrastructure  
20 and other industrial facilities in the area. The sole visually sensitive receptors within the visual  
21 resources study area are a small number of dispersed recreationists. The project area has  
22 been designated VRM Class III by the BLM (LCI, 2008a).

### 23 **3.11 Socioeconomics**

24 The proposed Lost Creek ISR project site is located in the rural northeast section of Sweetwater  
25 County, Wyoming. The site is located approximately 61 km (38 miles) northwest of Rawlins  
26 (population of approximately 8,500) and is approximately 24 km (15 miles) southwest of the  
27 town of Bairoil (population of approximately 100). There were approximately 40,000 residents in  
28 Sweetwater County in 2008, which includes approximately 27,000 square km (10,425 square  
29 miles). The primary population centers in Sweetwater County are located in the cities of Rock  
30 Springs (population of approximately 19,500) and Green River (population of approximately  
31 12,300), which are located approximately 130 km (80 miles), and 150 km (94 miles)  
32 respectively, to the southwest of the project area. It is likely that ISR employment could be  
33 drawn from the larger population centers such as Rawlins, Green River, Rock Springs, Casper  
34 (population of approximately 53,000) and Lander (population; approximately 7,000), which are  
35 within commuting distance to the proposed project area. Small towns in the area such as  
36 Bairoil, Wamsutter (population of approximately 270), and Jeffery City (population;  
37 approximately 100) could also contribute to the ISR work force (US Census Bureau, 2009).

38 Rock Springs, the largest population center in Sweetwater County, and the center for mining  
39 and energy activity in this portion of Wyoming, became a symbol for boomtowns following the oil  
40 boycott in 1973 and experienced all the problems associated with rapid population growth:  
41 inadequate public services, social disruption and inadequate funding for public services. Social  
42 disruption, associated with the earlier Rock Springs boomtown period, became the subject of  
43 national television coverage. Over the last thirty years, the State of Wyoming, Sweetwater  
44 County, and the City of Rock Springs have developed the institutional capacity to manage boom  
45 and bust cycles and are therefore much better prepared to manage change associated with new  
46 projects. The minerals industry accounts for a substantial source of revenue to the state and  
47 local governments. Produced minerals are classified as personal property, and mineral

1 producers pay two types of taxes (1) a county property tax (ad valorem-gross products) on  
 2 production and (2) a state severance tax (LCI 2008). Severance taxes are distributed according  
 3 to Wyoming Statute (WS) 39-14-801. The Permanent Wyoming Mineral Trust Fund is a fund  
 4 that holds in reserve 25 percent of all severance taxes paid to the State. This fund acts like a  
 5 savings account where monies are distributed state funds (LCI 2008). In addition, local  
 6 government bodies have developed a variety of tax programs which help fund public services  
 7 and infrastructure needs.

8 The principal industries in Sweetwater County are mining, construction, and retail trade. Mining  
 9 and natural resources account for the largest job market in Sweetwater County. The workforce  
 10 is young (median age of 35.6 years relative to the state as a whole, which is 37 years).  
 11 Wyoming has a history of “boom and bust” trends that have occurred within the mining industry.  
 12 Isolated areas similar to the proposed project area whose economies have become overly  
 13 dependent on mining activities can quickly become depressed once the natural resources are  
 14 exhausted or once the markets for the resources become depressed. In order to avoid these  
 15 unfavorable economic trends, much of the work force typically comes from larger, more  
 16 economically diversified population centers, such as those mentioned above (Wyoming  
 17 Business Council, 2009).

18 **3.11.1 Demographics**

19 Sweetwater County is the fourth most populated county in the state, but because of physical  
 20 size, has a relatively low population density at 8.5 people per square km (approximately 4  
 21 people per square mile). The population of Sweetwater County is primarily concentrated near  
 22 the cities of Rock Springs and Green River, in the western portion of the County, while the  
 23 northeastern section of the county, where the proposed project site is located has a relatively  
 24 low population. The population of Sweetwater County is mostly comprised of White non-  
 25 Hispanics, with Hispanic, American Indian, Black, and other races each comprising less than 10  
 26 percent of the population. The breakdown is detailed in Table 3-13 (US Census Bureau, 2009).  
 27 Population projections by the Census Bureau show the State of Wyoming is projected to grow  
 28 through 2010 then stabilize around 2020 with a slight decline in population into 2030. Counties  
 29 with resource based economies would likely continue in bust and boom cycles dependent on  
 30 the demand for resource and energy.

Table 3-11. Demographics of Sweetwater County	
Race	Percent of the Population
White Non-Hispanic	86.9
Hispanic	9.4
Two or More Races	2.4
American Indian	1.8
Black	0.7

31 Source: US Census Bureau, 2009

32 **3.11.2 Income**

33 The mining industry is the biggest employer in Sweetwater County, accounting for  
 34 approximately 20 percent of the work force, followed by U.S. Government jobs, which employ  
 35 approximately 14 percent of the county population, while retail trade and construction also

1 collectively provide approximately 20 percent of the job market. When compared to the state as  
2 a whole, Sweetwater County is more dependent on the mining industry, and is less dependent  
3 on the education, healthcare, and social services industries. The estimated median household  
4 income in Sweetwater is \$63,533, which is higher than the estimated median household income  
5 in the entire State of Wyoming, which is \$50,000 (US Census Bureau, 2009).

6 Unemployment in Sweetwater County is low as is typical of counties with extractive industries,  
7 ranging from 2-3 percent throughout 2008 (Wyoming Department of Employment, 2009).  
8 However, the rate doubled by the first quarter of 2009, a result of the global recession reducing  
9 demand/prices for energy.

### 10 **3.11.3 Housing**

11 The average household size in Sweetwater County is 2.6 persons. The median single family  
12 home value is \$171,931, and the median monthly contract for rent is \$514. There is an overall  
13 shortage of available housing in Sweetwater and in neighboring counties due to the demand  
14 fueled by transient workers that strain the housing inventory. Bairoil is the closest town to the  
15 project area, and while it is difficult to determine the current housing vacancy rate in Bairoil, and  
16 other towns and cities in the area, due to changes in the housing and real estate market, the  
17 housing supply is limited and could be easily exhausted by the addition of new residents. When  
18 compared to the rest of Wyoming, Sweetwater County has a larger average household size,  
19 and the median single family home value is also higher than the state average of \$52,433 (US  
20 Census Bureau, 2009).

### 21 **3.11.4 Employment Structure**

22 The mining industry is the largest employer Sweetwater County. The local, state, and federal  
23 government is the next biggest employer, followed by the retail trade and construction  
24 industries. The employment data is broken down into state and county data in the following  
25 sections (U.S. Census Bureau, 2009).

#### 26 **3.11.4.1 State Data**

27 As mentioned earlier, the State of Wyoming has been experiencing an economic boom over the  
28 last several years due to the increased demand for energy and minerals. This has led to an  
29 increase in employment in the mining industry and a decrease in diversification of the state  
30 economy. With the global recession affecting the demand for energy, the associated decline in  
31 price for natural gas, oil and coal, exploration/extractive activities have decreased. This has led  
32 to an increase in unemployment from 2.9 percent in May 2008 to 5.0 percent in 2009 (Wyoming  
33 Department of Employment, Research and Planning, 2009).

34 The federal government is the largest employer in the State of Wyoming, accounting for 23.2  
35 percent of Wyoming's jobs. Leisure and hospitality businesses are the second largest  
36 employers, holding 11.6 percent of the job market. The retail trade industry is close behind,  
37 employing approximately 11 percent of the state population, and the mining industry accounts  
38 for 9.5 percent of the state work force.

#### 39 **3.11.4.2 County Data**

40 Mining and natural resources account for the largest job market in Sweetwater County. The  
41 predominant natural resources sought out in the county include coal, oil, trona, and uranium.  
42 Mining operations are responsible for 20 percent of the county work force at this time, and with  
43 diversified and abundant natural resources, mining operations are likely to continue in the  
44 foreseeable future in Sweetwater County. Government and government enterprises also

1 employ a large proportion of the county's work force (14 percent). The retail trade industry  
2 follows as the third largest employer in the county, accounting for 10 percent of the job market  
3 (US Census Bureau, 2009). The unemployment rate, however, has risen from 2.4 percent in  
4 May of 2008 to 5.0 in May of 2009 (Wyoming Department of Employment, Research and  
5 Planning, 2009).

### 6 **3.11.5 Local Finance**

7 There are no corporate or personal state income or inventory taxes in Sweetwater County. The  
8 state allows, and the County does, tax commercial personal property. All tangible personal  
9 property used in business is taxable and must be listed once a year with the County tax  
10 assessor (Wyoming Statute 39-13-103). The County determines assessed valuation of  
11 commercial property at 11.5 percent of the market value and applies a mill levy of 63.088 (set  
12 by the County Commissioners) (Sweetwater County, 2009a). In addition, industrial enterprises,  
13 contractors, and subcontractors operating in the state must pay a use tax to the Department of  
14 Revenue on all purchases of materials, fixtures, or other supplies purchased in other states, if  
15 those purchases were made tax free or at a lesser tax rate than the applicable Wyoming sales  
16 tax rate for the county where the materials are stored, used, or consumed (Wyoming  
17 Department of Revenue, 2001).

18 Sweetwater County has a 6 percent sales and use tax (statewide base of 4 percent, plus 1  
19 percent optional county tax, plus one percent capital facilities). The average property tax rate in  
20 Sweetwater County is 7.06 percent. Wyoming also imposes "ad valorem taxes" on mineral  
21 extraction properties. Taxes levied for uranium production were 4 percent in 2007 and totaled  
22 \$17 million. Sweetwater County generated \$7,159 in 2007 via ad valorem tax collection (NRC,  
23 2009). Additionally, under Wyoming statute, cities, towns, and counties, by voter approval, may  
24 impose an excise tax of up to 4 percent on all sleeping accommodations for guests staying less  
25 than thirty days. This tax also extends to mobile accommodations such as tents, trailers, and  
26 campers. In addition there is a lodging tax which provides additional income from workers and  
27 visitors living in local motels. In addition, Sweetwater County imposes a 2 percent lodging tax  
28 (Liu, 2008).

### 29 **3.11.6 Education**

30 The annual Sweetwater County School District enrollment is 6,964 students, which is divided  
31 into two separate districts. The average student teacher ratio is 14.9 to 1, while the state  
32 student to teacher ratio for school year 2007 was 12.4 to 1 (Wyoming Department of Education,  
33 2007).

34 The Carbon County School District 1 is the closest public school district to the project area, and  
35 includes Bairoil School, and Bairoil Elementary School, as well as several elementary, middle,  
36 and high schools located in Rawlins. Rawlins is located approximately 58 km (38 miles)  
37 southeast of the project area in Carbon County. The annual enrollment for Carbon County  
38 School District 1 is 1,787 students with an average student teacher ration of 9.26 to 1 (based on  
39 2006 data) (Wyoming Department of Education 2009).

### 40 **3.11.7 Health and Social Services**

41 The closest health care facility with emergency care to the project area is the Carbon County  
42 Memorial Hospital, which is a 35 bed acute care facility which includes an Emergency Room,  
43 Intensive Care Unit, Medical, Surgical, Obstetric, Ambulatory Surgery, and a 10-bed Long Term  
44 Care Unit. It is located approximately 62 km (38 miles) to the southeast of the project area in  
45 Rawlins. The shortest route from the project area is to the east via Sooner Road, CR 22 and SR

1 73 to U.S. 287, then south to Rawlins. The main health care facility in Sweetwater County is  
2 the Memorial Hospital of Sweetwater, located approximately 130 km (80 miles) to the southwest  
3 of the project area in Rock Springs. It is a non-profit, 99-bed, rural acute-care facility. Among  
4 the health services offered are intensive care, cardiopulmonary/respiratory, and emergency  
5 care. There are also a number of private and state-operated social services facilities in  
6 Sweetwater County. Among them are the Family Services Department, the United Way, and  
7 the Child Support Services of Wyoming.

8 The closest waste collection and transfer station is the Sweetwater County Solid Waste District  
9 #2, located approximately 32 km (20 mi) from the project area in Bairoil. Waste from the  
10 transfer station is taken to the Sweetwater County landfill in Rock Springs, approximately 110  
11 (road) miles south-southwest of Bairoil.

12 The Town of Bairoil is served by a wastewater treatment system which consists of two separate  
13 lagoons. Discharge point 001 is the outfall from a single cell non-aerated lagoon which  
14 discharges to Able Creek and serves the south side of town. Discharge point 002 is the outfall  
15 from a two cell non-aerated lagoon which serves the north side of town and discharges to Reed  
16 Creek. Drinking water in the area comes from Bairoil via groundwater extraction (Battle Springs  
17 Formation). The municipal water supply system capacity is 946,250 Lpd (250,000 gpd) with a  
18 peak day demand of 946,250 Lpd (250,000 gpd) (WSEO, 2009). Electric service in the area  
19 comes from Merit Energy Company, a Texas-based oil and gas company that has an office  
20 located at 101 Primrose Avenue in Bairoil.

### 21 **3.12 Public and Occupational Health and Safety**

22 The purpose of this section is to summarize the natural background radiation levels in and  
23 around the Lost Creek project area. Descriptions of these levels are known as “pre-operational”  
24 or “baseline” radiological conditions, and they would be used for evaluating potential radiological  
25 impacts associated with ISR operations. Also included in this chapter of the document are  
26 descriptions of applicable safety criteria and radiation dose limits that have been established for  
27 protection of public and occupational health and safety.

28 Radiation dose is a measure of the amount of ionizing energy that is deposited in the body.  
29 Ionizing radiation is a natural component of the environment and ecosystem and members of  
30 the public are exposed to natural radiation continuously. Radiation doses to the general public  
31 occur from radioactive materials found in the earth’s soils, rocks, and minerals. Radon-222 is a  
32 radioactive gas that escapes into ambient air from the decay of uranium (and its progeny  
33 radium-226) found in most soils and rocks. Naturally-occurring low levels of uranium and  
34 radium are also found in drinking water and foods. Cosmic radiation from outer space is  
35 another natural source of radiation. In addition to natural sources of radiation, there are also  
36 artificial or manmade sources that contribute to the dose received by the general public.  
37 Medical diagnostic procedures using radioisotopes and x-rays are a primary manmade radiation  
38 source. The National Council for Radiation Protection (NCRP) in its Report No. 160, estimates  
39 the annual average dose to the public from all natural background radiation sources (terrestrial  
40 and cosmic) is 3.1 millisieverts [mSv; 310 millirem (mrem)]. The annual average dose to the  
41 public from all sources (natural and manmade) is 6.2 mSv (620 mrem) (NCRP, 2009).

#### 42 **3.12.1 Background Radiological Conditions**

43 In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, a  
44 pre-operational monitoring program was developed and implemented to establish baseline  
45 conditions at the proposed Lost Creek ISR site. Results of the baseline radiological  
46 environmental monitoring provide data on background levels that can be used for evaluating

1 future impacts from routine facility operations or from accidental or unplanned releases. The  
2 scope of the baseline program conducted for the proposed Lost Creek ISR site meets the intent  
3 of the NRC's guidelines in Regulatory Guide 4.14, Radiological Effluent and Environmental  
4 Monitoring at Uranium Mills, Revision 1.

5 In the ER Section 3.12, Background Radiological Characteristics, the applicant describes  
6 methods and results of the baseline radiological survey initiated in November of 2006 and  
7 completed in 2008. The goal of the survey was to describe surface areas that exhibit  
8 anomalously high radioactive concentrations and/or external radiation levels. These data would  
9 establish a background radiological condition in water resources, provide source data for  
10 MILDOS dispersion and dose modeling, and would be used in comparing operational impacts  
11 considered during decommissioning, (LCI, 2008a).

12 Using the guidance of Regulatory Guide 4.14 (NRC, 1980), some of the specific sampling  
13 methods included:

- 14 • An integrated overland gamma scan survey using gamma sensitive NaI (TI) detectors  
15 with GPS positioning for mapping the ambient gamma radiation levels across the site;
- 16 • Sampling of ten 100 m<sup>2</sup> (1076 ft<sup>2</sup>) sampling grids with ten sub-surface soil samples to a  
17 depth of 15.4 cm (6 in). Each group of ten samples per grid was combined into one  
18 composite sample and analyzed for radium-226, uranium, thorium-230, and lead-210.
- 19 • Groundwater and storm water samples were collected on a quarterly basis and analyzed  
20 for radium-226, uranium, thorium-230, and lead-210;
- 21 • Vegetation samples were collected at three downwind locations at three different times  
22 during the summer of 2008; and
- 23 • Passive air samples were collected to measure gamma and radon-222 at locations  
24 within and outside the proposed operational project area.

25 The intent of the overland gamma survey was to characterize and quantify natural background  
26 or pre-operational radiation levels and radionuclide concentrations in soils throughout the Lost  
27 Creek project area. As discussed in ER Section 3.12.1.3, results of the overland gamma survey  
28 and soil sampling show higher than expected variability of radioactive concentrations in surface  
29 soils. However, averaged results for measured gamma radiation and soil concentrations are  
30 within the range of concentrations typically measured in this region of Wyoming. Elevated areas  
31 were identified by the applicant as likely attributable to different types of soil and rocks with  
32 elevated levels of natural background radioactivity. Similar variability in surface or near-surface  
33 measurements taken at other Wyoming sites have been attributed to natural radioactivity  
34 potentially influenced by weathering factors such as erosion and/or deposition (Whicker et al.,  
35 2008).

36 Soil samples were analyzed for radium-226, uranium, thorium-230, and lead-210. As presented  
37 in ER Section 3.12, measured concentrations for the majority of the sampled radionuclides were  
38 higher than typical background ranges for the U.S. though consistent with typical background  
39 ranges for this region of Wyoming. For comparison, background radium levels in soil in the U.S.  
40 typically average 1 picocurie (pCi) per gram (NCRP, 2009). The typical range of background  
41 concentrations is 0.5 to 2 pCi/g for the sampled radionuclides. The average radium-226  
42 concentration for surface samples taken at the Lost Creek site was 6.0 pCi/g with a maximum  
43 concentration of 8.8 pCi/g. The uranium average was 4.4 pCi/g with a maximum concentration  
44 of 12.9 pCi/g. The thorium-230 average was 0.9 pCi/g with a maximum concentration of 2.1  
45 pCi/g. The lead-210 average was 0.9 pCi/g with a maximum concentration of 4.9 pCi/g.

1 The concentrations of radionuclides in groundwater can be strongly correlated with the location  
2 of the uranium mineralization. The average concentration of uranium in all the samples collected  
3 during baseline monitoring was 0.306 milligrams per liter (mg/L) while the EPA drinking water  
4 Maximum Contaminant Level (MCL) is 0.03 mg/L. Radium concentrations were also high, e.g.,  
5 the radium-226 (Ra-226) concentration in HJ monitor well LC19M is 420.5 picoCuries per liter  
6 (pCi/L). The MCL for Ra-226 is 5 pCi/L.

7 Baseline surface water samples were collected and analyzed for natural uranium, radium-226,  
8 radium-228, gross alpha, gross beta, lead-210, and thorium-230. Results are presented in ER  
9 Table 2.7-4 and are all below detection limits except for uranium and gross alpha. Uranium  
10 values were all less than 0.001 mg/L and gross alpha samples were less than 5 pCi/L. These  
11 values are within levels measured at other background locations across the region (LCI, 2008a).

12 Vegetation samples were collected at three downwind locations at three different times during  
13 the summer of 2008. The samples were analyzed for natural uranium, radium-226, lead-210,  
14 polonium-210, and thorium-230. The reported average uranium concentration values were 0.18  
15 mg/kg and 0.00012  $\mu\text{Ci/kg}$ . Reported average values for remaining radionuclides are Ra-226  
16 ( $1.2 \times 10^{-4} \mu\text{Ci/kg}$ ); Th-230 ( $2.5 \times 10^{-5} \mu\text{Ci/kg}$ ); and Po-210 ( $6.2 \times 10^{-5} \mu\text{Ci/kg}$ ), and Pb-210 ( $9.2 \times$   
17  $10^{-4} \mu\text{Ci/kg}$ ). These values are within levels measured at other background locations across the  
18 region (LCI 2008a).

19 Six radon samplers placed in downwind and upwind locations were used for baseline  
20 measurements. Sampling results for four quarters are presented in Table 3.7-11 of the  
21 applicant's ER (LCI, 2008a). Reported outdoor radon-222 results range between 22.5 and  
22 370.6 pCi/L/day, which approximately equals an average daily concentration range for the  
23 quarterly sampling periods of 0.27 to 3.8 pCi/L in air. These values are within levels measured  
24 at other background locations across the region (NCRP, 2009). The applicant also conducted  
25 radon dose and radon flux modeling for six emission sources using the computer code  
26 MILDOS-AREA and the Uranium Mill Tailings Radon Flux Calculator. Modeling results  
27 performed by LCI show that the maximum dose at the project boundary is roughly 3 percent of  
28 the annual public limit of 1 mSv (100 mrem) total effective dose equivalent (TEDE).

29 Air particulate samples were collected at five locations during four quarters starting in November  
30 2007. Consistent with guidance in Regulatory Guide 4.14, air samplers were placed at the  
31 location of the nearest resident, upwind (background) location, and selected downwind locations  
32 within the project area. Quarterly composite samples for each location were analyzed for  
33 natural uranium, radium-226, thorium-230, and lead-210. Reported results are summarized  
34 below:

- 35 • Uranium: Sixteen of twenty samples for uranium were below the detection limit  
36 of  $1.0 \times 10^{-16} \mu\text{Ci/mL}$ , and the maximum was  $5.61 \times 10^{-16} \mu\text{Ci/mL}$ , which is less  
37 than 1 percent of the 10 CFR Part 20, Appendix B effluent release limit of  $9.0 \times$   
38  $10^{-14} \mu\text{Ci/mL}$ .
- 39 • Th-230: Sixteen of twenty samples for Th-230 were below the detection limit of  
40  $1.0 \times 10^{-16} \mu\text{Ci/mL}$ , and the maximum was  $2.59 \times 10^{-16} \mu\text{Ci/mL}$ , which is less than  
41 1 percent of the 10 CFR Part 20, Appendix B effluent release limit of  $3.0 \times 10^{-14}$   
42  $\mu\text{Ci/mL}$ .
- 43 • Ra-226: Sixteen of twenty samples for Ra-226 were below the detection limit of  
44  $1.0 \times 10^{-16} \mu\text{Ci/mL}$ , and the maximum was  $2.23 \times 10^{-15} \mu\text{Ci/mL}$ , which is less than  
45 1% of the 10 CFR Part 20, Appendix B effluent release limit of  $9.0 \times 10^{-13}$   
46  $\mu\text{Ci/mL}$ .

- **Pb-210:** All twenty samples for Pb-210 were measured above the detection limit, with concentrations ranging from  $3.02 \times 10^{-15}$  to  $2.38 \times 10^{-14}$   $\mu\text{Ci/mL}$ . The maximum value was 4% of the 10 CFR Part 20, Appendix B effluent release limit of  $6.0 \times 10^{-13}$   $\mu\text{Ci/mL}$ .

These radionuclide air particulate concentrations are within levels measured at other background locations across the region and the U.S. (NCRP, 2009).

No livestock were sacrificed to obtain samples. Cattle are not expected to be exposed to a significant amount of contamination from the site. Although cattle would be able to graze up to the fenced site boundary, cattle are only in the region during 6 months of the year. Also, the scarcity of food in the area would keep cattle from remaining near the site for extended periods of time. It is expected that the doses associated with the potential beef tissue-to-human exposure pathway would be indistinguishable from the doses due to natural background radiation levels. The information provided for the Lost Creek project area does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS.

Results provided to date indicate that a reasonable baseline for radiological conditions can be established for the Lost Creek project area.

### 3.12.2 Public Health and Safety

The NRC has the statutory responsibility, under the AEA to protect the public health and safety. NRC's regulations in 10 CFR Part 20 specify annual dose limits to members of the public of 1 mSv (100 mrem) TEDE and 0.02 mSv (2 mrem) per hour from any external radiation sources. This public dose limit from NRC licensed activities is a fraction of the background radiation dose as discussed above in Section 3.12.1.

The Kennecott uranium mine is located approximately 3 km (2 mi) south of the Lost Creek project area. An ISR application has been received for the Antelope & Jab site, located approximately 5 km (3 mi) to the north, and there are several inactive and decommissioned conventional uranium mills within the 80 km (50 mi) radius. However, because of their relative distances, none of these projects are considered to represent a significant source of radiation exposure in and around the Lost Creek project area. Therefore, the natural background represents the only radiation exposure to individuals in the area surrounding the Lost Creek project area.

Other than slightly elevated background readings in a limited number of boundary locations at the proposed site, the information provided for the Lost Creek project area does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS. The limited number of locations with elevated readings is most likely due to natural conditions and variability in the background conditions, or past exploration activities. The baseline gamma surveys presented in the ER and TR provide adequate documentation of pre-operational conditions for the Lost Creek project area and would be used as part of the overall baseline data package during operational and decommissioning activities.

### 3.12.3 Occupational Health and Safety

Occupational health and safety risks to workers from exposure to radiation are regulated by the NRC, mainly through the Radiation Protection Standards contained in 10 CFR Part 20. In addition to annual radiation dose limits, these regulations incorporate the principal of maintaining doses "as low as reasonably achievable" (ALARA) such as through the use of proper worker safety training, engineering, and administrative controls to prevent or minimize

1 radiation exposures and effluents, and monitoring of radiation doses and effluents. The ALARA  
2 principle takes into consideration the purpose of the licensed activity and its benefits, weighs the  
3 associated costs and benefits to reduce radiation doses as appropriate (including selecting the  
4 most cost-effective and efficient technology for reducing doses), and quantifies the net benefits  
5 for each considered option to reduce radiation doses or exposures to other hazardous materials  
6 (e.g., chemicals) used at an ISR facility. Radiation safety measures are required for protecting  
7 and minimizing worker doses at uranium ISR facilities, ensuring that radiation doses are less  
8 than the occupational limits and are maintained ALARA.

9 Also of concern with respect to occupational health and safety are industrial hazards and  
10 exposure to non-radioactive pollutants, which for an ISR operation can include normal industrial  
11 airborne pollutants associated with service equipment (e.g., vehicles), fugitive dust from access  
12 roads and wellfield activities, and various chemicals used in the in-situ extraction process.  
13 Industrial safety aspects associated with the use of hazardous chemicals at the Lost Creek  
14 project area would be regulated by the Wyoming Division of Mine Inspection and Safety  
15 (Wyoming, Title 30- Mines and Minerals, Chapter 2-Mining Operations, Article 2- Inspector of  
16 Mines). The type of chemicals and permitted levels are discussed in Section 4.13.

### 17 **3.13 Waste Management**

18 Wastes in Wyoming are regulated by the State and managed by both the counties and the  
19 State. Solid wastes generally go to county-run facilities, while liquid wastes are managed by the  
20 larger cities. Hazardous wastes, if small in quantity (less than 6.8 kg/yr [15 lb/yr]), may be  
21 handled at county-run facilities; otherwise, larger quantities are shipped out-of-state, to either  
22 Colorado or Utah.

#### 23 **3.13.1 Solid Waste**

24 Solid wastes generated in Sweetwater County are managed by the Sweetwater County Solid  
25 Waste Disposal District (SWCSWD) #1, located in Rock Springs. The SWCSWD #1 operates  
26 the largest landfill in the County. Under its current program, the SWCSWD #1 handles  
27 municipal solid wastes (MSW), construction and demolition (C&D) wastes, ISR well fields  
28 wastes, auto engines, electronic wastes, landscape wastes, and small amounts of household  
29 hazardous wastes. In addition, the landfill in Rock Springs has: 1) a composting facility; 2) a  
30 used materials warehouse (e.g., building materials); 3) bulk disposal drop off; 4) used oil and  
31 batteries disposal; and 5) commercial tire disposal.

32 The Rock Springs Landfill has a capacity of 2.7 million cubic meters (3.1 million cubic yards),  
33 and accepts, on an average day, about 250 tons of waste (approximately 607 cu m/day [667 cu  
34 yd/day], at a compaction rate of about 260 kg/cu m [750 lb/cu yd], without daily cover included).  
35 The majority of the waste accepted is MSW (about 65 percent). The remaining waste (35  
36 percent) is made up mostly of C&D wastes, with minor amounts of other wastes described  
37 earlier (Sweetwater County, 2009b).

38 SWCSWD #2 is located in Wamsutter, but only accepts residential solid waste at its landfill.  
39 There is a small transfer station in Bairoil, however, it only accepts residential solid waste, as  
40 well.

41 Lander County, to the north, operates several small landfills, as well as a transfer station, but  
42 much smaller in size than the SWCSWD #1 facilities. In the City of Rawlins, in Carbon County,  
43 the landfill no longer accepts solid wastes, but transfers them to a larger landfill in Casper.  
44 There are no large commercially operated landfills in, or near, the Great Divide Basin.

1 **3.13.2 Liquid Waste**

2 Sanitary wastes are regulated by the WY DEQ Water Quality Division (WQD). For rates less  
3 than 2000 gallons per day (gpd), a septic system or small package plant may be used. For  
4 larger rates, a large municipal system is required. The nearest large municipal systems to the  
5 Lost Creek site are in Rock Springs and Casper.

6 Production 'bleed' wastes would be disposed of in deep wells permitted under the Underground  
7 Injection Control (UIC) program administered by the WDEQ, Water Quality Division.

8 **3.13.3 Radioactive Wastes**

9 The only existing facility that is licensed by NRC to accept 1e.(2) byproduct material wastes for  
10 disposal in Wyoming is the Pathfinder-Shirley Basin uranium mill tailings impoundment in Mills,  
11 Wyoming. Additionally, two sites are licensed to accept 11e.(2) byproduct material for disposal  
12 are the EnergySolutions site in Clive, Utah, and the White Mesa uranium mill site in Blanding,  
13 Utah. The EnergySolutions facility, the largest licensed commercial low-level radioactive waste  
14 disposal facility, is in a remote area, located approximately 80 miles west of Salt Lake City,  
15 Utah. The facility is permitted to receive 11e.(2) byproduct Material and mixed waste (combined  
16 radioactive and hazardous wastes). It is also permitted to receive soil, sludges, resins, dry  
17 active waste, and other radioactively contaminated debris. The facility is accessible by both rail  
18 and highway (EnergySolutions, 2009).

19 **3.14 References**

20 33 CFR Part 328. *Code of Federal Regulations*, Title 33, Navigation and Navigable Waters, Part  
21 323, "Definition of Waters of the United States."

22 40 CFR Part 142. *Code of Federal Regulations*, Title 40, Protection of the Environment, Part  
23 142, "National Primary Drinking Water Regulations Implementation."

24 40 CFR Part 143. *Code of Federal Regulations*, Title 40, Protection of the Environment, Part  
25 143, "National Secondary Drinking Water Regulations."

26 BLM, 1984. Manual 8400 - Visual Resource Management. <[http://www.blm.gov/nstc/VRM/  
27 8400.html](http://www.blm.gov/nstc/VRM/8400.html)>

28 BLM, 2004. Wild Horse Herd Management Areas, 2004 Herd Management Area Map, U.S.  
29 Department of Interior Bureau of Land Management, Wyoming.

30 BLM, 2008. Proposed Resource Management Plan and Final Environmental Impact Statement  
31 for Lands Administered by the Bureau of Land Management. Rawlins Field Office. Rawlins,  
32 Wyoming. January 2008.

33 Chapman, S.S., Bryce, S.A., Omernik, J.M., Despain, D.G., ZumBerge, J., and Conrad, M,  
34 2004. Ecoregions of Wyoming (color poster with map, descriptive text, summary tables, and  
35 photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

36 COE, 2009. Personal Communication between A. Bjornsen, NRC, and M. Bilodeau, USACE,  
37 Regarding: Drainage Canals in the Great Divide Basin." October 5, 2005. ADAMS Accession  
38 No. ML092790369.

39 Collentine et al., 1981. Occurrence and characteristics of ground water in the Great Divide and  
40 Washakie Basins, Wyoming. Wyoming Water Research Institute. Technical Report Vol. VI-A.

- 1 EnergySolutions, 2009. Clive Operations and Waste Disposal.  
2 <<http://www.energysolutions.com>>
- 3 EPA, 2007. National Ambient Air Quality Standards <<http://www.epa.gov/air/criteria>>
- 4 Federal Highway Administration (FHWA), 2004. Traffic Noise Model 2.5 (TNM): User's Manual.  
5 February 2004
- 6 Fertig, W. 2000. "Status Review of the Ute ladies tresses (*Spiranthes diluvialis*) in Wyoming."  
7 Wyoming Natural Diversity Database, University of Wyoming. Prepared for the Wyoming  
8 Cooperative Fish and Wildlife Research Unit, U.S. Fish and Wildlife Service, and Wyoming  
9 Game and Fish Department.
- 10 Hydro-Engineering, 2007. Lost Creek aquifer test analyses. Hydro-Engineering, LLC. March  
11 2007.
- 12 Hyrdo-Search, 1982. 1982 Hydrogeology program for the Conoco/Lost Creek uranium project.
- 13 Kinneer, Christopher, Andrew Mueller, Christian Zier, and Danny Walker. (Kinneer et al.). 2007.  
14 A Cultural Resource Inventory of the Lost Creek ISR, LLC Project in Sweetwater County,  
15 Wyoming.
- 16 Kinneer, Christopher. 2008. Treatment Plan for Mitigative Excavation of Prehistoric Site  
17 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming.  
18 January 2008.
- 19 LCI, 2007. Lost Creek ISR, LLC. Lost Creek petrography and uranium mineralogy. Ur Energy
- 20 LCI, 2008a. Lost Creek ISR, LLC. Lost Creek Project Environmental Report, Volumes 1 through  
21 3 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License  
22 (Docket No. 40-9068). March 2008.
- 23 LCI, 2008b. Lost Creek ISR, LLC. Lost Creek Project Technical Report, Volumes 1 through 3  
24 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket  
25 No. 40-9068). March 2008.
- 26 LCI, 2008c. Lost Creek ISR, LLC. Lost Creek Project Response to Request for Additional  
27 Information, South-Central Wyoming. Application for US NRC Source Material License (Docket  
28 No. 40-9068).
- 29 LCI, 2009. Lost Creek ISR, LLC. Lost Creek Project Exemption Request (Docket N. 40-9068)  
30 July 2009
- 31 Liu, Wenlin, 2008, Wyoming Sales, Use, and Lodging Tax Revenue Report, Department of  
32 Administration and Information, Economic Analysis Division, State of Wyoming.  
33 <[http://eadiv.state.wy.us/s&utax/Report\\_FY08.pdf](http://eadiv.state.wy.us/s&utax/Report_FY08.pdf)>
- 34 Love, J.D. and Ann Coe Christiansen. 1985. *Geologic Map of Wyoming*. U.S. Geological  
35 Survey. Denver, Colorado.
- 36 Miller, 2003. Peak flow characteristics of Wyoming streams. Geological Survey (US). Water  
37 Resources Rpt No. 03-4107
- 38 Munn and Arneson, 1998. Soils of Wyoming: A digital statewide map at 1:500,000-scale. Agr.  
39 Expt. Sta. Rpt. B-1069. University of Wyoming, College of Agriculture, Laramie (WY).
- 40 NCDC, 2009. Record of Climatological Observances (for 3 NOAA/NWS Stations – Muddy Gap,  
41 Jeffrey City, and Wamsutter, WY) National Climatic Data Center.

- 1 NOAA, 2004. National Climatic Data Center. <<http://www.noaa.gov/pub/orders>  
2 /3691251997260dat.html. Accessed October 2009.
- 3 NOAA, 2009. NOAA National Environmental Satellite Data and Information Service 2009.  
4 <http://www.nesdis.noaa.gov/>
- 5 NCRP, 2009. National Council on Radiation Protection and Measurements (NCRP). Ionizing  
6 Radiation Exposure of the Population of the United States, Report No.160. March 3, 2009.  
7 Bethesda, Maryland.
- 8 NRC, 1980. U.S. Nuclear Regulatory Commission. Regulatory Guide 4.14, Revision 1.  
9 Radiological Effluent and Environmental Monitoring at Uranium Mills. April 25, 1980.
- 10 NRC, 2003. U.S. Nuclear Regulatory Commission. In-situ Leach Uranium Extraction License  
11 Applications– Final Report. NUREG-1569. June 2003. Washington, DC.
- 12 NRC, 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling  
13 Facilities. NUREG-1910, Vol. 1 and 2. June 2009.
- 14 Petrotek Engineering Corporation, 2007. Analysis of the LC19M aquifer test, Lost Creek project,  
15 Wyoming. 2007 August.
- 16 Pochop, Larry, John Borrelli and Victor Hasfurther. 1984 (revised 1985). *Design Characteristics*  
17 *for Evaporation Ponds in Wyoming*. Report to the Wyoming Water Research Center. August  
18 1985.
- 19 State of Wyoming, 2009. Groundwater Quality Standards.  
20 <[http://deq.state.wy.us/wqd/WQDrules/Chapter\\_08.pdf](http://deq.state.wy.us/wqd/WQDrules/Chapter_08.pdf)>
- 21 Sweetwater County Conservation District, Land and Resource Use Plan and Policy, January  
22 2005.
- 23 Sweetwater County School District 1. <[www.sweetwater1.org](http://www.sweetwater1.org)>
- 24 Sweetwater County School District 2. < [www.sw2.k12.wy.us](http://www.sw2.k12.wy.us)>
- 25 Sweetwater County, 2009a. Property Tax Guide.  
26 <[www.co.sweet.wy.us/treas/propertytaxes/page2.html](http://www.co.sweet.wy.us/treas/propertytaxes/page2.html)>. October 2009.
- 27 Sweetwater County, 2009b. Sweetwater County Solid Waste Disposal District #1. Personal  
28 telephone contact by Alan Bjornsen with Kevin Herman, General Manager, September 2009.
- 29 University of Wyoming, 2009. <http://www.uwyo.edu>
- 30 University of Wyoming, 2008. Big Game Crucial Ranges in Wyoming at 1:100,000. GIS data  
31 obtained from Wyoming Geolibrary, updated July 29, 2008.
- 32 U.S. Census Bureau Data, 2009. <[www.census.gov](http://www.census.gov)>
- 33 FWS (U.S. Fish and Wildlife Service). 2002. Migratory Birds of High Federal Interest in  
34 Wyoming, Coal Mine List. Wyoming Field Office of the U.S. Fish and Wildlife Service,  
35 Cheyenne.
- 36 FWS (U.S. Fish and Wildlife Service). 2004a. Letter to Interested Party from B.T. Kelly, Field  
37 Supervisor, Wyoming Field Office, U.S. Fish and Wildlife Service. Subject: Block Clearance for  
38 Black-Footed Ferret Surveys. February 2, 2004. ADAMS No. ML092780370.
- 39 FWS (U.S. Fish and Wildlife Service). 2008. Letter from FWS Ecological Services to Gregory F.  
40 Suber, U.S. Nuclear Regulatory Commission. November 12, 2008. ADAMS No.  
41 ML083290451.

- 1 Wyoming Department of Environmental Quality (WDEQ). 2008. Air Quality Standards and  
2 Regulations. <<http://deq.state.wy.us/aqd/standards.asp>>.
- 3 WGFD, 2004. Atlas of birds, mammals, amphibians, and reptiles in Wyoming.
- 4 WGFD (Wyoming Game and Fish Department). 2005a. "Black-footed Ferret (*Mustela*  
5 *nigripes*)" in *Final Comprehensive Wildlife Conservation Strategy*. July 12, 2005. <[http://gf.  
6 state.wy.us/wildlife/CompConvStrategy/Species/Mammals/PDFS/Black-footed%20Ferrett.pdf](http://gf.state.wy.us/wildlife/CompConvStrategy/Species/Mammals/PDFS/Black-footed%20Ferrett.pdf)>  
7 (30 September 2009).
- 8 WGFD (Wyoming Game and Fish Department), 2005b. Final Comprehensive Wildlife  
9 Conservation Strategy for Wyoming. Wyoming Game and Fish Department. Buffalo, WY. July,  
10 2005.
- 11 WGFD, 2007. Annual Big Game Job Completion Reports. Wyoming Game and Fish  
12 Department. Buffalo, WY.
- 13 Whicker R., P. Cartier, J. Cain, K. Milmine, M. Griffin 2008. Radiological Site Characterizations:  
14 Gamma Surveys, Gamma/<sup>226</sup>Ra Correlations, and Related Spatial Analysis Techniques. Health  
15 Phys 95(Suppl 5):S180-S189; 2008.
- 16 Williams, 2009, Personal communication with Pat Drinkle, Tax Assessors Office Sweetwater  
17 County, June 25, 2009
- 18 WYDOT Noise, 1996. Noise Analysis and Abatement Guidelines, Wyoming Department of  
19 Transportation dated June 1996.
- 20 Wyoming Business Council, 2009. <<http://www.wyomingbusiness.org>>
- 21 Wyoming Department of Education, 2007. <[http://www.k12.wy.us/statistics/stat2/2007\\_teacher\\_  
22 pupil\\_school\\_counts.pdf](http://www.k12.wy.us/statistics/stat2/2007_teacher_pupil_school_counts.pdf)>
- 23 Wyoming Department of Employment, Research and Planning, 2009. Wyoming Unemployment  
24 Rate Increases to 5.0percent in May <<http://wydoe.state.wy.us/LMI/news.htm>>
- 25 Wyoming Department of Employment, 2009. Wyoming Labor Market Information, Local Area  
26 Unemployment Statistics. <<http://doe.state.wy.us/lmi/laus.htm>>
- 27 Wyoming Department of Revenue, 2001. State of Wyoming Property Tax System June, 8.  
28 <<http://revenue.state.wy.us/PortalVBVS/uploads/propertytaxsystem.pdf>>
- 29 Wyoming Department of Revenue and Excise Tax, 2001. Memorandum To all owners and  
30 lessees of industrial plants and mines in Wyoming <[http://revenue.state.wy.us/Portal  
31 VBVS/uploads/Memorandum\\_3WyomingResidentgeneral\\_primercontractors.pdf](http://revenue.state.wy.us/PortalVBVS/uploads/Memorandum_3WyomingResidentgeneral_primercontractors.pdf)>
- 32 Wyoming Economic Analysis Division, 2009. Economic Summary: 1Q09  
33 <[http://eadiv.state.wy.us/wef/Economic\\_Summary1Q09.pdf](http://eadiv.state.wy.us/wef/Economic_Summary1Q09.pdf)> <[http://doe.state.wy.us/lmi  
34 /laus.htm](http://doe.state.wy.us/lmi/laus.htm)>
- 35 Wyoming Economic Analysis Division, 2009. Wyoming Cost of Living for the Fourth Quarter  
36 2008. <<http://eadiv.state.wy.us/wcli/NewsRelease-4Q08.pdf>>
- 37 Wyoming State Code. Title 30, Mines and Minerals. Chapter 2, "Mining Operations."
- 38 WSEO, 2006. (Wyoming State Engineer's Office). Water Rights Database.  
39 <<http://seo.state.wy.us/wrdb/index.aspx>>.
- 40 WSEO, 2009. (Wyoming State Engineer's Office). Wyoming State Engineer's Office Technical  
41 Memorandum for the Green River Basin – Water Use Profile. <[http://waterplan.state.wy.us/plan  
42 /green/2009/techmemos/Industrial\\_Use.pdf](http://waterplan.state.wy.us/plan/green/2009/techmemos/Industrial_Use.pdf)> May 28, 2009.

## 4 ENVIRONMENTAL IMPACTS AND MITIGATIVE ACTIONS

### 4.1 Introduction

This chapter describes the potential environmental consequences associated with the alternatives presented in “Chapter 2: In-situ Recovery and Alternatives.” It is organized by resource area and by each stage of the proposed action (*i.e.* construction, operation, aquifer restoration, and decommissioning), which distills the issues and concerns into distinct subjects for discussion analysis.

NRC’s regulations at 10 CFR Part 51 that implement NEPA require consideration of the potential environmental impacts of the proposed action and reasonable alternatives. NRC’s NUREG-1748 (NRC, 2003) categorizes the significance of potential environmental impacts as follows:

**SMALL:** The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

**MODERATE:** The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

**LARGE:** The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

### 4.2 Land Use Impacts

As described in the GEIS, much of the land in the Wyoming West Milling Region having milling interests is unpopulated rangeland, federally owned and administered by the U.S. Bureau of Land Management. Most of the remainder of the land are also publicly owned (by the State of Wyoming), with some land privately held. Land is used primarily for recreation, wildlife management, and mineral extraction (NRC, 2009)

Potential environmental impacts to land use at the Lost Creek site may occur during all phases of the ISR facility’s lifecycle. Impacts could include land disturbance as part of construction and decommissioning, grazing and access restrictions, and competing access for mineral rights. Potential impacts to ecological, historic, and cultural resources may be impacted as well (they are described in later sections of this chapter).

Detailed discussion of the potential environmental impacts to land use from construction, operation, aquifer restoration, and decommissioning are provided in the following sections for the alternatives considered.

#### 4.2.1 Proposed Action (Alternative 1)

LCI is applying for a source and byproduct material license in order to facilitate the production of a wet yellowcake slurry from the ore body contained within project area. The applicant is proposing the construction, operation, and reclamation of facilities for ISR operations within the project area. The entire project footprint would affect an estimated 115 ha (285 ac) within the 1,709 ha (4,220 ac) project area. There could be adverse impacts from the proposed action on current land uses, such as recreation, wildlife management, natural resource exploration and extraction, cultural and historical resources, and grazing. These impacts would be short-term

1 (less than 20 years), and would not have large impacts on current land uses. Additional  
2 mitigation measures beyond the proposed decommissioning and reclamation by the applicant  
3 would not be needed. The impacts for each stage of the ISR processed are analyzed below.

4 *4.2.1.1 Construction Impacts*

5 In the GEIS (Section 4.2.1.1), land use impacts during construction may occur from land  
6 disturbances (including alterations of ecological cultural or historic resources) and access  
7 restrictions (including limitations on other mineral extraction activities, grazing activities, or  
8 recreational activities). It was expected that land disturbances during construction would be  
9 temporary and limited to small areas within permitted boundaries, and that well sites, staging  
10 areas, and trenches would be reseeded and restored. Changes to land use access including  
11 grazing restrictions and impacts on recreational activities would be limited due to the small size  
12 of restricted areas, temporary nature of restrictions, and availability of other land for these  
13 activities. Ecological, historical, and cultural resources could be affected, but would be  
14 protected by careful planning and surveying to help identify resources and avoid or mitigate  
15 impacts. For all land use aspects except ecological, historical, and cultural resources, the GEIS  
16 determined that potential impacts would be SMALL. The potential impacts to these resources  
17 are described in later sections of this chapter. In situations involving grazing restrictions and  
18 competing access to mineral rights on the site, it was expected that agreements between the  
19 parties would serve to mitigate impacts.

20 The construction phase would have the largest impact on current land uses in the area due to  
21 the high level of concentrated disturbance to the natural environment. Of the disturbed region,  
22 an estimated 23 ha (57 ac) would be stripped of vegetation and topsoil. A 3.3 km (2.1 mi) long,  
23 9 m (30 ft) wide gravel access road would be constructed, linking the project area to the  
24 Wamsutter-Crooks Gap Road to the west of the project area. Shoulders and culverts for  
25 drainage would be constructed on the edges of the road. Facility construction activities would  
26 include the construction of the central processing plant (CPP), storage ponds, maintenance  
27 buildings, and ancillary production units that would include injection wells, monitoring wells, and  
28 production wells, as well as header houses. The construction of the planned six production  
29 (mine) units would be completed in phases after the construction of the CPP and storage ponds,  
30 and would commence sequentially over a period of seven years (see Figure 2-1, Project  
31 Schedule) as each production unit would move into production.

32 Ranching activities associated with grazing has been, and continues to be, an important social  
33 and cultural use (a way of life) in rural Wyoming. Recreational activities, such as hunting and off  
34 road vehicle exploration would be restricted in the CPP construction area. Construction  
35 activities for the CPP would have a potentially SMALL impact on the existing grazing leases and  
36 recreational activities due to the necessary relocation of all grazing livestock and relocation of  
37 recreational activities that would normally use the area of CPP. This is because the amount of  
38 disturbed land is small compared to the total ranchland that is available. However, the noise  
39 and dust disturbance generated from the concentrated construction activities could affect land  
40 outside the restricted areas.

41 The construction of the six planned production (mine) units within the project area would be  
42 phased as the respective injection, production, and monitoring wells, together with the pipeline  
43 systems are constructed. While there would be subsurface disturbance as the production units  
44 are constructed, there would be smaller impacts to existing land uses than those seen in the  
45 construction of the CPP. There would be fewer contractors needed to develop the production  
46 units when compared to the higher volume of workers needed during the construction of the  
47 CPP and appurtenant facilities. Therefore, the noise, traffic, and overall disturbance would be  
48 less than that expected during the construction of the CPP. When each production unit is

1 fenced, grazing livestock would be affected to the extent that they would be prevented from  
2 entering the fenced areas. Once again, the amount of land that would be affected is small in  
3 comparison with the large amount of grazing land available. There would also be a potential  
4 impact to the rural ranching use in the area during the construction of the production units since  
5 there would be less land available. Wild horses, prevalent in the Lost Creek area, would also be  
6 potentially affected, but would instinctively avoid those areas undergoing construction due to the  
7 heavy human activity.

8 The visual presence of wells and header houses could also impact the natural setting and  
9 overall cultural landscape. However, since much of the production unit construction activities  
10 would occur in the subsurface, as the pipelines would be below the frost line, there would be  
11 less impact to the overall visual aspect of the place than those seen in the construction of the  
12 CPP. Recreational activities would also be prohibited in the production units while construction  
13 occurs, and therefore, potentially affected.

14 Overall, the low intensity of all the impacts mentioned above implies that the impact of  
15 construction of the Proposed Action on land use would be SMALL. Based on the foregoing  
16 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
17 Therefore, impacts from construction are expected to be SMALL.

18 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
19 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
20 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
21 along with the actions proposed, are comparable to those described in the GEIS for Land Use  
22 and incorporates by reference the GEIS' conclusions that the impacts to Land Use during  
23 construction are expected to be SMALL. Furthermore, while the NRC Staff has identified  
24 additional new information during its independent review; it nevertheless, does not change the  
25 expected environmental impact beyond what was described in the GEIS.

#### 26 4.2.1.2 *Operations Impacts*

27 As described in the GEIS (Section 4.2.1.2), the types of land use impacts from operational  
28 activities would be expected to be similar to construction impacts regarding access restrictions  
29 because the infrastructure would be in place. Additional land disturbances would not be  
30 expected to occur from conducting operational activities. Because access restriction and land  
31 disturbance related impacts would be similar to, or less than, those for construction, the GEIS  
32 determined that overall potential impacts to land use from operational activities would  
33 be SMALL.

34 The primary difference between operation and construction impacts would be the timing and  
35 magnitude of each phase. Operations at the proposed LCI facility are estimated to occur for  
36 approximately 8 to 9 years, versus the relatively short construction period of 12 to 18 months.  
37 During operations, the current land uses would be curtailed within the affected portions of the  
38 project area. Livestock would be prevented from entering the fenced areas surrounding the  
39 CPP, storage ponds and the production units. This would create an adverse impact (albeit  
40 SMALL) on livestock grazing allotments, in the area in that livestock ranching patterns would be  
41 altered, and livestock might be moved to other grazing lands away from the project area. Wild  
42 horses would also tend to avoid those areas of human disturbance. The reason the operational  
43 impacts would be small is though lasting for a longer period, its activities are less intensive than  
44 construction. Construction is the principal land disturbing activity, with excavation and land  
45 clearing, and has a greater impact on land use. By the operations phase, the buildings would  
46 have all been constructed, and the storage areas would all be in use. There would be additional  
47 well drilling and new two-track roads made, but their disturbance is much less intensive than the  
48 construction phase.

1 Recreational activities, such as off-road exploration and hunting, would also be adversely  
2 impacted during the operation of the ISR facilities since public access would be restricted within  
3 the project area. Other mining activities, such as oil and gas, coal, and other uranium  
4 operations could also be affected by the operation of the ISR facility. Once the production units  
5 and CPP are in place, other mining activities would be restricted within the project area to  
6 activities that would be physically compatible with ISR projects.

7 By contributing to a change in the natural environment, the operational phase would impact the  
8 long history of ranching and livestock grazing that has occurred in the area. Also, there has  
9 been extensive exploratory drilling for various other natural resources that has been going on in  
10 the area since the 1970's. The operation of the ISR facility would have an overall impact on  
11 mining in the area by contributing to additional natural resource extraction operations in the  
12 area. Operations would also deplete the uranium within the underling ore body, which would  
13 impact the availability of this resource. The total concentration of the impacts anticipated during  
14 operation, however, would be smaller than the overall anticipated construction impacts.  
15 Nevertheless, operation impacts would last longer than the construction impacts. A site-specific  
16 analysis confirms, and is consistent with, the assessment made in the GEIS, that the overall  
17 impacts to land use during the operations phase would be SMALL (NRC, 2009a; LCI, 2008a).

18 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
19 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
20 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
21 along with the actions proposed, are comparable to those described in the GEIS for Land Use  
22 and incorporates by reference the GEIS' conclusions that the impacts to Land Use during  
23 operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
24 significant information during its independent review that would change the expected  
25 environmental impact beyond what was described in the GEIS.

#### 26 4.2.1.3 *Aquifer Restoration Impacts*

27 In Section 4.2.1.3 of the GEIS, aquifer restoration impacts to land use are discussed. Due to  
28 the use of the same infrastructure as during operations, land use impacts from aquifer  
29 restoration would be similar to, or less than, those from operations. It is expected that as  
30 aquifer restoration proceeds and well fields are closed, some operational activities would  
31 diminish. Therefore, aquifer restoration impacts to land use are expected to be SMALL.

32 LCI expects that restoration would take at least one year for each production unit. Since the  
33 potential impacts would be temporary, and since the restoration work force would be relatively  
34 small, the overall impacts from aquifer restoration are consistent with the assumptions stated in  
35 the GEIS. Therefore the potential impacts from aquifer restoration would be SMALL (NRC,  
36 2009a).

37 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
38 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
39 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
40 along with the actions proposed, are comparable to those described in the GEIS for Land Use  
41 and incorporates by reference the GEIS' conclusions that the impacts to Land Use during  
42 aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified  
43 new and significant information during its independent review that would change the expected  
44 environmental impact beyond what was described in the GEIS.

#### 45 4.2.1.4 *Decommissioning Impacts*

46 Decommissioning impacts to land use are discussed in Section 4.2.1.4 of the GEIS. It was  
47 expected that land use impacts from decommissioning would be similar to those described for

1 construction, with a temporary increase in land-disturbing activities for dismantling, removing,  
2 and disposing of facilities, equipment, and excavated contaminated soils. Access restrictions  
3 may remain until decommissioning and reclamation are completed; although it is possible that a  
4 licensee could decommission and reclaim the site in stages. Reclamation of land to preexisting  
5 conditions and uses would help mitigate long-term potential impacts. The GEIS determined that  
6 impacts to land use during decommissioning would be SMALL.

7 The decommissioning phase of the Lost Creek project would include the decontamination and  
8 dismantling of the project facilities and roads, contouring the land to its natural state, and  
9 reseeding and placement of soils. Land use impacts would be similar in scale to those seen in  
10 the construction phase. Current land uses would be affected to a similar extent as construction  
11 as the land is returned to its natural state. Since these impacts would be temporary, the natural  
12 environment would be returned to its pre-ISR operations state. Based on the foregoing analysis,  
13 site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore,  
14 impacts decommissioning are expected to be SMALL. (NRC, 2009a; LCI, 2008a).

15 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
16 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
17 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
18 along with the actions proposed, are comparable to those described in the GEIS for Land Use  
19 and incorporates by reference the GEIS' conclusions that the impacts to Land Use during  
20 decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified  
21 new and significant information during its independent review that would change the expected  
22 environmental impact beyond what was described in the GEIS.

#### 23 **4.2.2 No-Action (Alternative 2)**

24 Under the No-Action alternative there would be no impacts from ISR development at Lost Creek  
25 to any of the current land uses through added traffic, noise, or land disturbances. The current  
26 land uses, including grazing lands, natural resource extraction, and recreational activities would  
27 continue. There could still be impacts to land uses from other activities occurring in the area.  
28 For example, the two herd management areas, Lost Creek and Stewart Creek, currently have  
29 45 and 28 active mining claims, respectively, according to the BLM (2009). However, when  
30 compared to the potential impacts from the other alternatives, the No-Action Alternative would  
31 have no impacts to land use from any of the phases of ISR development, and therefore, would  
32 have no need for mitigation.

#### 33 **4.2.3 Dry Yellowcake (Alternative 3)**

34 Under Alternative 3, the NRC would issue LCI a license for the construction, operation, aquifer  
35 restoration, and decommissioning of facilities for ISR uranium milling and processing of dry  
36 yellowcake as the final product. This alternative differs from the Proposed Action only by the  
37 addition of the equipment for the processing of dry yellowcake from a wet slurry. The dryer  
38 equipment would be installed in the CPP (which would be constructed with a space allocated for  
39 drying equipment) at the Lost Creek site. The dry yellowcake would, then, be transported from  
40 the Lost Creek site directly to Metropolis, Illinois for ultimate processing into fuel for nuclear  
41 reactors. Addition of the drying process would eliminate the step of transporting the yellowcake  
42 slurry from the Lost Creek site to an intermediate facility before being shipped to Metropolis,  
43 Illinois for further processing. The potential impacts to land use for this alternative resulting from  
44 each of the four phases of ISR project development would not differ from that of the proposed  
45 action, and are expected to be SMALL.

1 **4.3 Transportation Impacts**

2 The GEIS states, while the volume of traffic on the roads of the Wyoming West Milling Region is  
3 low, the estimated low additional volume of traffic associated with all phases of ISR  
4 development is not expected to change the overall amount of traffic or number of accidents. A  
5 possible exception, however, may be from commuting workers during construction of an ISR.  
6 At such a time, the peak workforce would be driving to and from the construction site on a daily  
7 basis, using roads with normally low traffic volumes. The low-trafficked roads may be more  
8 susceptible to wear and tear from increased traffic, and experience localized, intermittent  
9 (temporary) SMALL to MODERATE impacts associated with dust, noise and incidental wildlife  
10 kills. The magnitude of these potential impacts would be influenced by site-specific conditions,  
11 including the proximity to local residences, wildlife habitats, and grazing areas (NRC, 2009)

12 As stated in the GEIS (NRC, 2009) potential environmental impacts to transportation at the Lost  
13 Creek site may occur during all phases of the ISR facility's lifecycle. Impacts would be due to  
14 the movement of workers to and from the site, and to the shipment of materials and chemicals  
15 on and off the site. Impacts may be experienced in the form of dust, noise, and incidental  
16 wildlife or livestock kills, increased traffic on local roads, and from the consequences of  
17 accidents.

18 **4.3.1 Proposed Action (Alternative 1)**

19 **4.3.1.1 Construction Impacts**

20 In the GEIS (Section 4.2.2.1), it was anticipated that low levels of traffic generated by ISR  
21 construction activities (relative to local traffic counts) would not significantly increase traffic or  
22 accidents on many of the roads in the region. Roads that currently experience low traffic counts  
23 could potentially be impacted to a moderate degree by the additional worker commuting traffic  
24 during periods of peak employment, such as during construction. Additionally, moderate dust,  
25 noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access  
26 roads (dust in particular for unpaved access roads). For these reasons, the GEIS determined  
27 that construction impacts to transportation would be SMALL to MODERATE

28 Most construction workers are expected to travel to the project area from Casper and Rawlins.  
29 They would travel US287 to Lamont, then west to Bairoil approximately 10 km (6 mi) on WY 73,  
30 then about 20 km (12 mi) west on CR 22 to Sooner Road (BLM #3215) to the project area  
31 access road. The speed limit through the Town of Bairoil is 48 kmph (30 mph), and the nearest  
32 residence to CR 22 is 275 meters (300 yards). The Sooner Road (eastern) point of access  
33 would be used almost exclusively for commuting construction workers (with light-duty trucks)  
34 arriving from points east such as Casper and Rawlins. This eastern access road has been  
35 upgraded to BLM standards.

36 Most of the heavier transports of materials and equipment into and from the site, however,  
37 would use the unpaved Wamsutter-Crooks Gap Road to the west of the project area that  
38 connects Wamsutter and Jeffrey City. This western access road has been upgraded to BLM  
39 standards. Virtually no traffic, however, is expected to come south from Jeffrey City, rather,  
40 trucks would travel north from I-80 at Wamsutter. The section of the Wamsutter-Crooks Gap  
41 Road near Wamsutter is used heavily by the oil and gas industries, therefore, the additional  
42 truck traffic anticipated during construction of the Lost Creek project is not likely to be noticed.  
43 In addition, there are no residences along this route that would be affected by noise, dust and  
44 odor from the vehicles. Sweetwater County has plans to re-surface the southernmost 16  
45 kilometers (10 miles) of the Wamsutter-Crooks Gap Road with crushed asphalt during 2009,  
46 which would substantially reduce the amount of dust generated.

1 During construction, an estimated 30 to 35 light-duty trucks and 2 to 5 heavy-duty trucks would  
2 travel to and from the site each day. Light-duty traffic would likely approach the site from either  
3 the west or east, whereas heavy-duty traffic would be required to use Wamsutter–Crooks Gap  
4 Road from the west. Because of the remote location of the site, annual average daily traffic  
5 counts (AADT) are not available for those unpaved roads in proximity to the project area. The  
6 nearest road with available data is S.R. 73, which enters Bairoil from U.S. 287 at Lamont. This  
7 highway averages 230 vehicles per day. Assuming a maximum number of 40 vehicles per day  
8 carrying out two way trips, the potential increase in traffic along Bairoil Road, while noticeable,  
9 would still be well below the threshold at which traffic volume would be a concern. Project  
10 related increases in traffic along larger roadways such as U.S. 287 and I-80 (maximum AADT of  
11 1,870 and 13,840, respectively) would also be considered negligible.

12 Tractor trailer trucks would deliver the materials and equipment necessary to construct the  
13 facilities and well fields at the Lost Creek ISR Project. Because ISR facilities are relatively  
14 small-scale construction projects (compared to oil and gas extraction), the magnitude of trucking  
15 activities required to support this stage of the project would be minor. Though a variety of  
16 construction vehicles would likely be required, many would be transported to the sites on  
17 standard flatbed trailers. Exceptions may include graders, cranes, drill rigs, water trucks and  
18 perhaps oversized loads carrying ion exchange vessels or other non-standard loads related to  
19 the construction of the processing plant. Beyond outgoing commuter traffic, trucks would  
20 transfer unrestricted solid waste (e.g., rags, trash, packing materials, broken parts or  
21 equipment) to local permitted landfills.

22 Crash data for the project area roadways was analyzed in the ER (LCI, 2008a). According to  
23 documented crashes that occurred between 2002 and 2006, truck crashes rarely occur. For SR  
24 73 (from Lamont to Bairoil), no truck crashes occurred during the study period. Based on the  
25 current crash rates and the estimated minimal increase in volumes due to site development,  
26 there would likely be no measurable increase in crashes on the area roadways.

27 Six mine units are proposed for ISR uranium extraction at the Lost Creek project. The  
28 construction of the associated well fields would be staggered over time as opposed to carried  
29 out as a single endeavor. This means that some form of construction related traffic would  
30 persist at the site for about seven years, or roughly half of the project lifespan. Road  
31 construction represents a long-term impact on land use in the project area, with approximately  
32 7.8 ha (19.3 ac) being converted from rangeland to road surface. However, most of these  
33 impacts are temporary, as ISR operations are sequential and because of ongoing reclamation.  
34 All roads except for those roads specifically requested by the BLM to remain would be  
35 reclaimed (see section 4.3.2.4).

36 Even with the increase of daily trucks traveling to and from the project site, due to the limited  
37 duration of construction activities (12-18 months) the impact of construction traffic to the  
38 roadway network is expected to be short-term. Based on the foregoing analysis, site-specific  
39 conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from  
40 construction are expected to be SMALL.

41 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
42 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
43 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
44 along with the actions proposed, are comparable to those described in the GEIS for  
45 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
46 Transportation during construction are expected to be SMALL. Furthermore, while the NRC  
47 Staff has identified additional new information during its independent review; it nevertheless,  
48 does not change the expected environmental impact beyond what was described in the GEIS.

1 4.3.1.2 *Operation Impacts*

2 As described in the GEIS (Section 4.2.2.2), during operations, the low levels of facility-related  
3 traffic would not noticeably increase traffic or accidents on most roads, although local, less-  
4 traveled roads could be moderately impacted during periods of peak employment. Dust, noise,  
5 and possible incidental wildlife or livestock kill impacts on or near site access roads would  
6 continue to be experienced.

7 The GEIS also assesses the potential for and consequence from accidents involving the  
8 transportation of hazardous chemicals and radioactive materials. While the GEIS recognizes  
9 the potential for high consequences from a severe accident involving transportation of  
10 hazardous chemicals in a populated area, the probability of such accidents occurring is  
11 determined to be low owing to the small number of shipments, comprehensive regulatory  
12 controls, and use of best management practices. For radioactive material shipments  
13 (yellowcake product, ion-exchange resins, waste materials), compliance with transportation  
14 regulations is expected to limit radiological risk for normal operations. Additionally, the GEIS  
15 estimates that there is a low radiological risk for accident conditions. Emergency response  
16 protocols would also help mitigate long-term consequences of severe accidents involving  
17 release of uranium. The GEIS determined that potential impacts to transportation from  
18 operations would be SMALL to MODERATE.

19 LCI estimates that light truck traffic associated with the operation phase would decrease from 30  
20 to 35 light during construction to 20 trucks traveling to and from the site each day. The number  
21 of heavy trucks would remain constant between 2 and 5 to and from the site daily. Shipments of  
22 yellowcake slurry to an offsite drying facility would be required approximately every 5.5 days  
23 with the project running at capacity.

24 Transportation related risks during the operation phase can be broken down into four categories  
25 of vehicle contents: 1) supplies to the processing facility; 2) outgoing yellowcake slurry to a  
26 drying facility; 3) offsite disposal of unrestricted solid waste and process-contaminated  
27 radioactive solid waste, or 11e(2) by-product material; and 4) ISR workers. These risks are  
28 summarized below in the following paragraphs. LCI has described these risks in detail in their  
29 Environmental Report (LCI, 2008a).

30 Because the development of the six mine units of the Lost Creek ISR project would follow a  
31 phased (sequential) schedule, construction and operations phases would overlap for all but the  
32 final unit (Mine Unit 6, see Figure 2-6). Weekly to monthly shipments of various supplies would  
33 be required. For construction, these include steel, PVC, HDPE pipe, wire, valves, fittings,  
34 structural steel, and so on. Operations would require process chemicals including carbon  
35 dioxide, oxygen, salt, soda ash, and peroxide, along with gasoline and diesel. Both phases  
36 would require potable water, office supplies, grease, and oils. These chemicals and supplies  
37 are commonly used in other industrial applications and their transport is regulated by the  
38 USDOT. The potential for a shipping accident depends on the frequency of deliveries, the  
39 distance traveled, and the accident rates described in Table 3.3-2 of the ER (LCI, 2008a). In  
40 general, truck accidents occur at a rate of  $4.0 \times 10^{-7}$  accidents per km ( $6.4 \times 10^{-7}$  accidents per  
41 mi) on interstates in rural areas and  $1.4 \times 10^{-6}$  accidents per km ( $2.2 \times 10^{-6}$  accidents per mi) for  
42 interstates in urban areas and for two-lane roads similar to those in the project vicinity. The  
43 environmental impacts would depend in the severity of the accident, the magnitude of the  
44 release, and the unique properties of the chemicals involved.

45 The operation phase includes transporting yellowcake slurry from the processing facility to an  
46 offsite dryer (at this time, its location is unknown). With the project operating at full capacity,  
47 approximately 70 shipments of slurry would be required per year. The roads from the project  
48 area to the nearest major highways are shown in Figure 4-1. The risk of an accident involving

1 the shipping of yellowcake slurry was investigated by assuming transport to two representative  
2 facilities: the closest is Smith Ranch in the Powder River Basin, Wyoming (Figure 4-2), and the  
3 most distant is Alta Mesa near Falfurrias, Texas (Figure 4-3). Using published truck accident  
4 rates for two-lane and interstate highways in Table 4-1. The probability of an accident involving  
5 yellowcake slurry en route to Smith Ranch was calculated at 0.00039 and to Falfurrias at  
6 0.0024. Based upon WDOT traffic data (2002-2005), the probability in any given year of an  
7 injury-causing or fatal accident involving a loaded (outgoing) or unloaded (returning) Lost Creek  
8 ISR tanker truck is estimated to lie between 14 and 89 in 1,000, or a 1.4 to 8.9 percent  
9 probability of an accident (WDOT, 2007a, 2007b).

10 The risk of an accident involving a yellowcake slurry spill would be minimized by the exclusive  
11 use of USDOT-approved vehicles, drivers holding appropriate licenses, and adherence to  
12 existing NRC transportation regulations in 10 CFR Part 71. Should a spill occur, yellowcake  
13 slurry would pour onto the ground surface and infiltrate into soil, but would not become airborne  
14 until the slurry dried. The viscosity of yellowcake slurry would also reduce the chance that a  
15 spill would travel a sufficient distance, and thereby reduces the likelihood of slurry entering a  
16 waterway before being contained. The drying time of the slurry should provide adequate to for  
17 responding personnel to contain and salvage the affected soil. The disturbed surfaces would  
18 then be restored and re-vegetated in accordance with all applicable state and NRC regulations.

19 LCI's Radiation Safety Training Program would instruct employees on contamination and spill  
20 control, as well as security and emergency procedures. An emergency response manual would  
21 be developed, including actions to minimize and monitor the exposure to employees and  
22 members of the public in the event of an unplanned release (External Radiation Exposure  
23 Monitoring Program, LCI 2008b). All drivers transporting bulk quantities of licensed material  
24 would be familiar with the shipment and how to properly respond to accidents involving the  
25 material. In addition to these precautions, the risks of the accidental release of and exposure to  
26 radioactive materials would be further minimized by LCI engaging in regular road maintenance.  
27 Employees would also be trained how to respond to emergency scenarios. LCI staff would be  
28 the primary responders to accidents within the project site (LCI, 2008b). The actual  
29 consequences of a yellowcake slurry spill are small due to the appropriate use of such safety  
30 controls and emergency response protocols (NRC, 2009a).

31 Any solid waste generated by the Lost Creek ISR project would be sorted into unrestricted solid  
32 waste and by-product material. Unrestricted waste is that refuse that is determined to be  
33 uncontaminated or has been sufficiently decontaminated to be disposed of in the Sweetwater  
34 County District No. 1 Landfill. Process-contaminated radioactive waste would be transported to  
35 a licensed 11e.(2) disposal facility. The estimated annual number of loads of 11e(2) waste is  
36 four to five, based on 61 to 77 m<sup>3</sup> (80 to 100 yd<sup>3</sup>) of such waste being generated per year and  
37 truck capacity at 15 m<sup>3</sup> (20 yd<sup>3</sup>). The probability of an accident occurring for any given trip is the  
38 same as discussed above with regards to shipments of process chemicals. However, the  
39 potential risks for radiation exposure are lower than for a spill involving yellowcake slurry as the  
40 waste material is generally less radioactive and consists largely of solid materials that are easy  
41 to contain and less likely to aerosolize. The potential impacts of a radioactive waste or  
42 yellowcake slurry release on public and occupational health and safety is beyond the scope of  
43 this Section and is discussed in Section 4.12.2.

44 The frequency of heavy-duty truck transport is estimated to remain the same from the  
45 construction to the operation phase. Shipments of process chemicals to the site and the  
46 shipment of product from the site would contribute to minimal transportation risks on the roads  
47 in the region of the proposed project. As was the case with the construction phase, increases in  
48 traffic and the potential for road wear would be most noticeable onsite, on the local, unpaved  
49 county roads, and on BLM roads. Impacts to road surfaces would be minimized by restricting

1 and minimizing site access to non-project vehicles during operations, and by posting speed  
2 limits. However, if improvements to offsite roads are deemed necessary, permits would be  
3 obtained from the BLM and Sweetwater County, and their relevant guidelines would be  
4 followed. Beyond these local roads to paved surfaces, the overall volume of traffic and impacts  
5 to regional transportation networks is anticipated to be low.

6 As most of this traffic would be related to commuting, there would be some risk to employees,  
7 including fatigue, collisions with animals, and adverse weather. Crash rates for the local  
8 highways are low (Table 3.3-2 of the ER) and the volume of expected traffic relative to  
9 published traffic counts suggests commuting would not significantly change traffic conditions or  
10 accident rates. The width of the existing county roads is sufficient to allow two tractor trailer  
11 trucks to pass one another, and have been constructed for year round travel. As no divided  
12 lanes are provided on Sweetwater County roads in the vicinity of the proposed site, traffic must  
13 stop when students are boarding onto or disembarking from school buses.

14 Even with the decrease of daily trucks traveling to and from the project site, the impact of  
15 operations traffic to the roadway network is expected to be long-term, and risks are low, given  
16 the expected frequency of accidents and emergency procedures employed. Based on the  
17 foregoing analysis, site-specific conditions are consistent with the assumptions stated in the  
18 GEIS, that "yellowcake can be shipped with a low potential of affecting the environment,"  
19 assuming that safety controls and compliance with existing transportation regulations are met.  
20 Therefore, impacts from operation are expected to be SMALL.

21 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
22 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
23 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
24 along with the actions proposed, are comparable to those described in the GEIS for  
25 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
26 Transportation during operation are expected to be SMALL. Furthermore, while the NRC Staff  
27 has identified additional new information during its independent review; it nevertheless, does not  
28 change the expected environmental impact beyond what was described in the GEIS.

#### 29 4.3.1.3 *Aquifer Restoration Impacts*

30 The GEIS (Section 4.2.2.3) estimates the magnitude of transportation activities during aquifer  
31 restoration to be lower than for construction and operations. Aquifer restoration-related  
32 transportation activities are expected to be primarily limited to supplies (including chemicals fro  
33 reverse osmosis), chemical waste shipments, onsite transportation and employee commuting.  
34 The GEIS considers transportation impacts from aquifer restoration to be SMALL to  
35 MODERATE, for the same reasons discussed under the Operations Phase.

36 Transportation impacts during the aquifer restoration phase would be similar to those of the  
37 operations phase. However, as the rate of uranium recovery gradually decreases through the  
38 course of aquifer restoration, the number of shipments of yellowcake slurry to offsite drying  
39 facilities would also decrease. However, because aquifer restoration would proceed  
40 concurrently with the construction and operation of other mine units, impacts during this phase  
41 are expected to be long-term. Based on the foregoing analysis, site-specific conditions are  
42 consistent with the assumptions stated in the GEIS. Therefore, impacts from aquifer restoration  
43 are expected to be SMALL.

44 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
45 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
46 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
47 along with the actions proposed, are comparable to those described in the GEIS for

1 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
2 Transportation during aquifer restoration are expected to be SMALL. Furthermore, the NRC  
3 Staff has not identified new and significant information during its independent review that would  
4 change the expected environmental impact beyond what was described in the GEIS.

#### 5 4.3.1.4 Decommissioning Impacts

6 As discussed in the GEIS (Section 4.2.2.4), the types of transportation activities during  
7 decommissioning, and therefore the types of potential impacts, would be similar to those  
8 discussed for construction and operations, except that the magnitude of transportation activities  
9 (e.g., number and types of waste and supply shipments, no yellowcake shipments) from  
10 decommissioning could be lower than for operations. Accident risks from transportation during  
11 decommissioning would be bounded by the estimates of yellowcake transportation risk during  
12 operations. The GEIS determines that potential impacts during decommissioning would be  
13 SMALL, due to the lower levels of transportation activities expected.

14 Though no estimates for vehicular trips are currently available, onsite traffic may increase  
15 slightly after the aquifer restoration phase is complete for the following: 1) radiological surveys,  
16 infrastructure inspection and decontamination; 2) extraction of buried pipelines and in-situ well  
17 abandonment; 3) re-grading and reclaiming disturbed areas; 4) removal of contaminated  
18 materials and 5) follow-up monitoring of the restored site. Waste materials generated during  
19 decommissioning would be segregated by type and transported to approved disposal facilities.  
20 These range from ordinary municipal solid waste streams to those NRC-approved facilities  
21 capable of receiving 11e.(2) waste materials. Approximately 90 percent of the waste materials  
22 is expected to be suitable for disposal in a local, unrestricted landfill (NRC, 2009). The  
23 remaining 11e.(2) materials would be transported to a licensed facility, such as the one in Clive,  
24 Utah. The probability of an accident en route would be the same as that discussed under the  
25 operation phase and is dependent on the route taken, facility location and required number of  
26 trips.

27 The eventual fate of the access roads built to connect Sooner Road and Wamsutter – Crooks  
28 Gap Road with plant facility and the well fields would rest with the BLM, though it is anticipated  
29 that these roads would remain in use for some period after decommissioning in order to  
30 facilitate site monitoring. Should the BLM so request, these access roads would be reclaimed at  
31 the applicant's expense. This includes removal of culverts, removal of road surfacing materials,  
32 re-contouring as necessary, preparation of the seedbed, and reseeded. Unimproved roads  
33 may require scarification, ripping, or disking to reduce compaction before seed application.

34 Because of the relatively low traffic counts associated with decommissioning and the reduced  
35 risk of transportation accidents in comparison to the operations phase, regional transportation  
36 impacts are expected to be short-term. Based on the foregoing analysis, site-specific conditions  
37 are consistent with the assumptions stated in the GEIS. Therefore, impacts from  
38 decommissioning are expected to be SMALL.

39 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
40 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
41 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
42 along with the actions proposed, are comparable to those described in the GEIS for  
43 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
44 Transportation during decommissioning are expected to be SMALL. Furthermore, the NRC  
45 Staff has not identified new and significant information during its independent review that would  
46 change the expected environmental impact beyond what was described in the GEIS.

1 **4.3.2 No-Action (Alternative 2)**

2 Under the No-Action Alternative, there would be no change in traffic flows and routings, service  
3 levels, or the integrity of the road surfaces and profiles associated with the Lost Creek project.  
4 This alternative would have no impact to transportation resources.

5

6

7

8

9

10

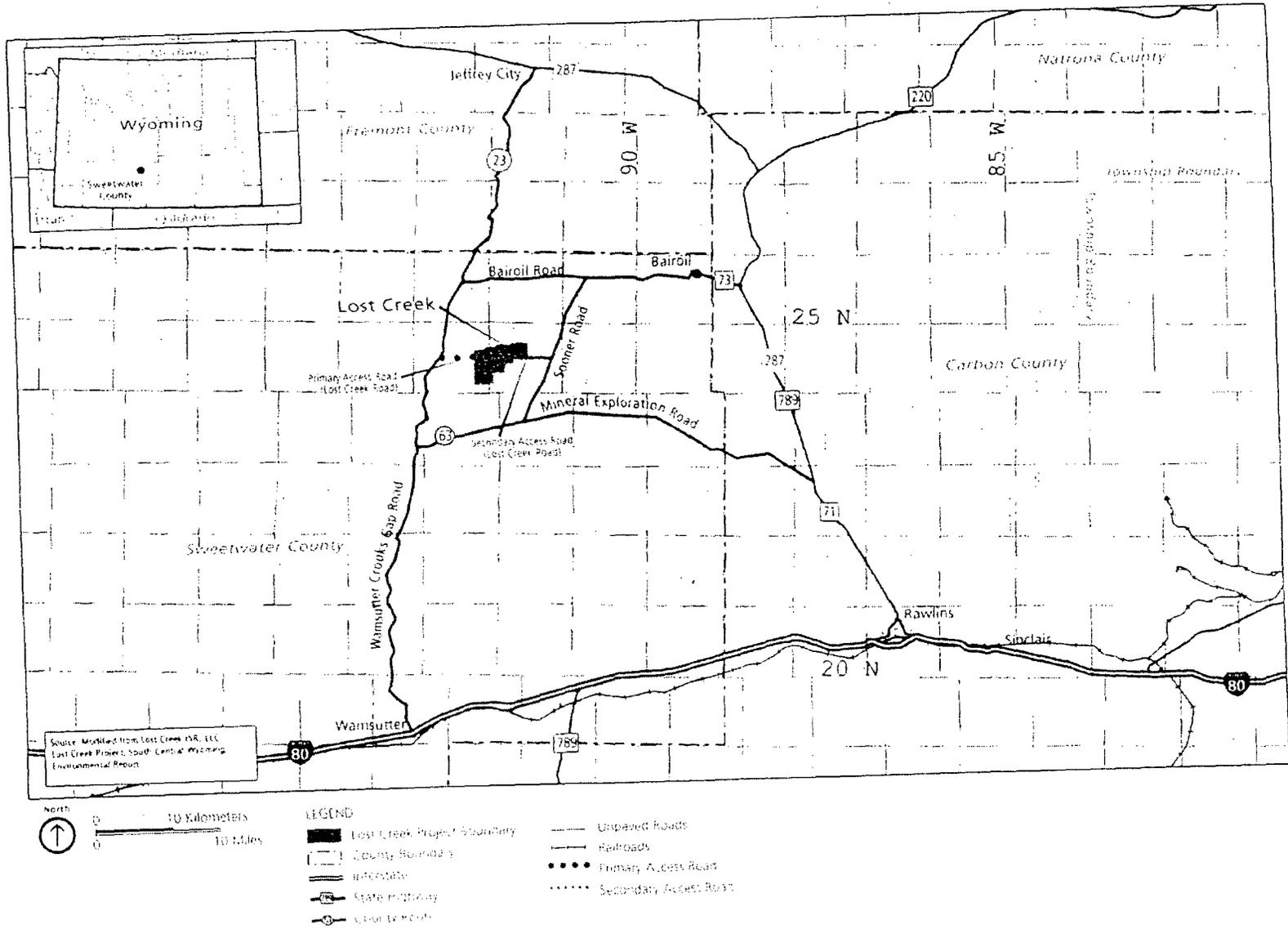


Figure 4-1. Area Roads

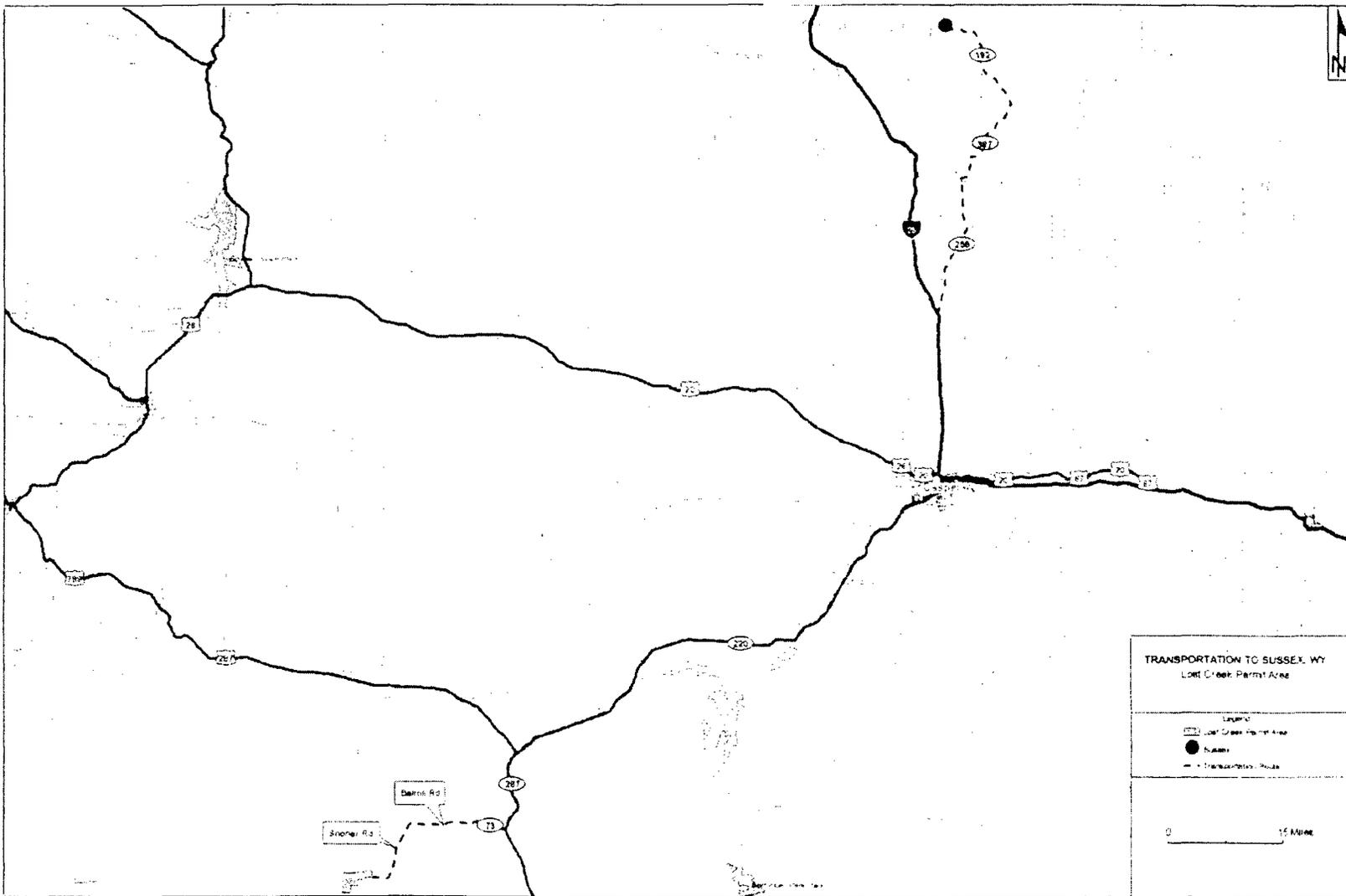


Figure 4-2. Regional Roads to Sussex, WY

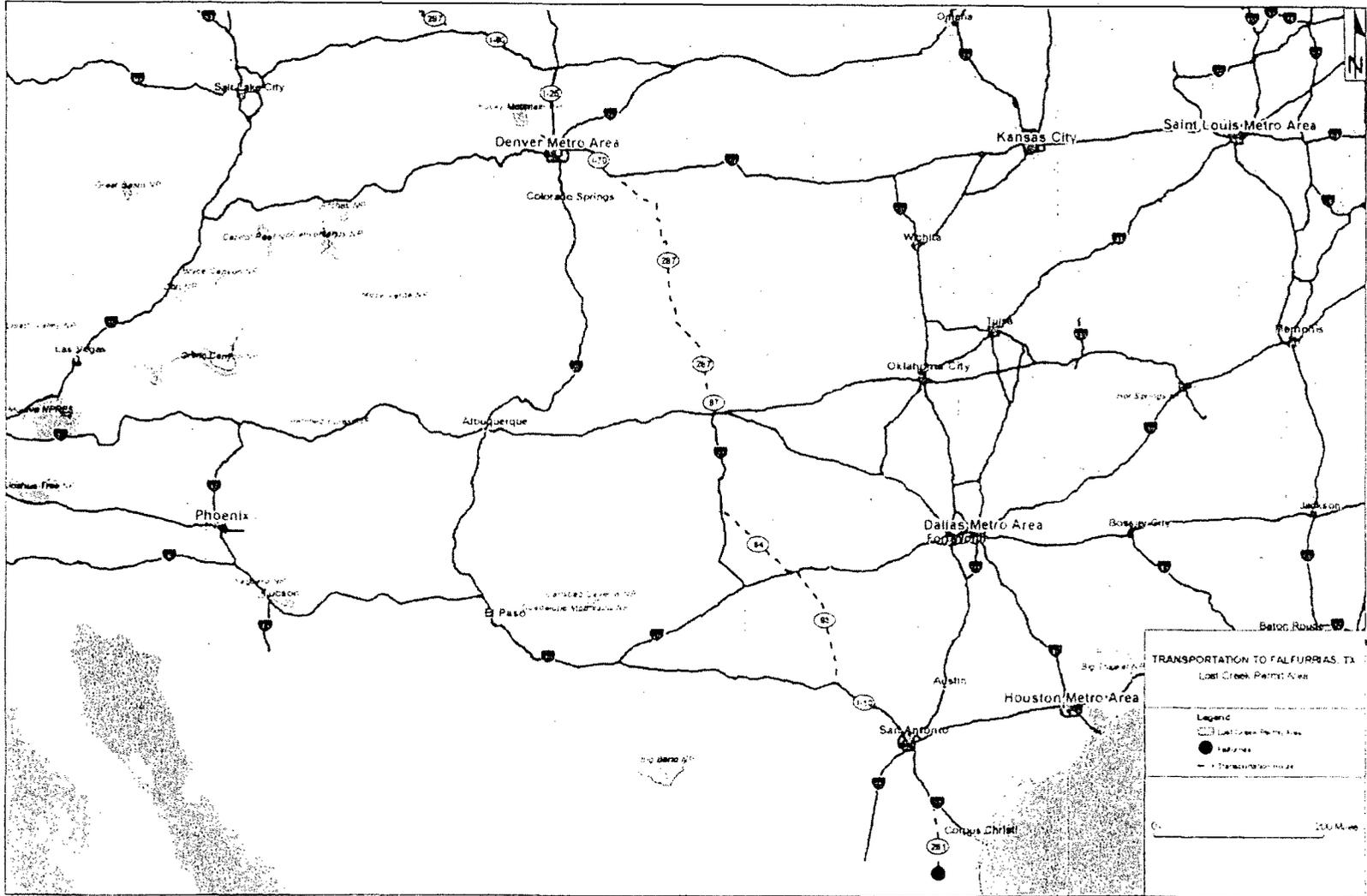


Figure 4-3. Interstate Roads to Falfurrias, TX

4-15

1 **4.3.3 Dry Yellowcake (Alternative 3)**

2 *4.3.3.1 Construction Impacts*

3 The physical components of the ISR facility would be the same as described in the Proposed  
4 Action, with the exception of the addition of a yellowcake dryer in the CPP. Since the CPP  
5 would be designed to house a yellowcake dryer, the addition of the dryer equipment would not  
6 change the footprint of the ISR facility. Additional tractor trailer traffic, however, would be  
7 required to supply parts for the yellowcake dryer, but traffic counts for heavy trucks would be  
8 expected to remain within the range of 2 to 5 per week. Proposed local and regional routes for  
9 incoming and outgoing traffic, traffic counts, and vehicle types would all remain the same as  
10 Proposed Action. Therefore, impacts to transportation under this alternative would be short-  
11 term. Based on the foregoing analysis, site-specific conditions are consistent with the  
12 assumptions stated in the GEIS. Therefore, impacts from construction are expected to be  
13 SMALL.

14 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
15 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
16 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
17 along with the actions proposed, are comparable to those described in the GEIS for  
18 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
19 Transportation during construction are expected to be SMALL. Furthermore, while the NRC  
20 Staff has identified additional new information during its independent review; it nevertheless,  
21 does not change the expected environmental impact beyond what was described in the GEIS.

22 *4.3.3.2 Operation Impacts*

23 LCI estimates that light truck traffic associated with the operation phase would decrease from 30  
24 to 35 light during construction to 20 trucks traveling to and from the site each day. The number  
25 of heavy trucks would remain constant between 2 and 5 to and from the site daily. These  
26 numbers are the same as for the Proposed Action (Alternative 1). However, as dry yellowcake,  
27 rather than yellowcake slurry, would be produced for Alternative 3, departing truckloads of  
28 uranium would be notably less frequent. It is anticipated that outgoing shipments would occur  
29 approximately once a week or once every two weeks, or about half as often as for slurry  
30 shipments.

31 Transportation related risks during the operation phase can be broken down into four  
32 categories: 1) shipments of supplies to the processing facility; 2) outgoing shipments of  
33 drummed yellowcake to Metropolis, Illinois; and 3) offsite disposal of unrestricted solid waste  
34 and low-level radioactive solid waste, or 11e.(2) waste; and 4) ISR workers. The risk associated  
35 with each category, and the implications of an accident, is discussed in section 4.2 of the ER  
36 (LCI, 2008a). Risks for incoming shipments of supplies and of solid waste would be identical to  
37 those discussed in the preceding section 4.3.1.2 for the Proposed Action. However,  
38 transportation risks associated with the shipment of dried yellowcake would be slightly different  
39 from that of yellowcake slurry, and are described in the GEIS (NRC, 2009).

40 The potential for a shipping accident depends on the frequency of deliveries, the distance  
41 traveled, and the accident rates described in Table 3.3-2 of the ER (LCI 2008a). In general,  
42 truck accidents occur at a rate of  $4.0 \times 10^{-7}$  accidents per km ( $6.4 \times 10^{-7}$  accidents per mi) on  
43 interstates in rural areas and  $1.4 \times 10^{-6}$  accidents per km ( $2.2 \times 10^{-6}$  accidents per mi) for  
44 interstates in urban areas for two-lane roads similar to those in the project vicinity. The risk of  
45 an accident involving the shipping of dried yellowcake slurry can be calculated by applying the  
46 latter, more conservative accident rate of over the 2,012 km (1,250 mi) distance to the  
47 Honeywell Uranium Conversion Facility in Metropolis, Illinois. The probability of an accident

1 involving a shipment of dried yellowcake would be 0.0028. This is approximately the same as  
2 the risk of shipping yellowcake slurry to the most distant drying facility (Alta Mesa) in Falfurrias,  
3 Texas. With the project operating at full capacity, approximately 35 outgoing shipments of  
4 drummed yellowcake would be required per year, or roughly half the number (70) of shipments  
5 of yellowcake slurry for the proposed action. Assuming 35 one-way trips per year, the risk of  
6 any kind of transportation accident is 88 in 1,000 (based on the calculations in Section 2.3.8 of  
7 the TR, which uses 50 percent solid slurry as basis for calculations; LCI, 2007b).

8 Between 2002 and 2005, 0.9 percent of Wyoming traffic accidents caused a fatality and 25.4  
9 percent of accidents resulted in an injury (LCI, 2008a). Therefore, the probability in any given  
10 year of an injury-causing or fatal accident involving a loaded (outgoing) or unloaded (returning)  
11 Lost Creek ISR tanker truck is at 45 in 1,000.

12 The safety precautions and security measures described for the Proposed Action in Section  
13 4.3.1.2 also apply to transportation of dried yellowcake drums under Alternative 3. These  
14 include using exclusive use shipments and properly licensed and briefed drivers, compliance  
15 with existing NRC transportation regulations, strict adherence to LCI's Security Plan, employee  
16 training regarding contamination and spill control and security and emergency procedures,  
17 implementation of an emergency response plan (ERP [as required]), and routine road  
18 maintenance. The potential impacts of a radioactive waste or yellowcake release on public and  
19 occupational health and safety is beyond the scope of this Section and is discussed in Section  
20 4.12.3.

21 With regards to transportation risks to the commuting workforce and potential impacts to road  
22 surfaces, these issues also remain the same as for the Proposed Action, as described in  
23 Section 4.3.1.2. Considering that transportation risks and impacts are similar and that  
24 unplanned releases of uranium from transportation accidents could be minimized through  
25 established safety protocols and remediation in accordance with ERPs, the impact of operation  
26 phase traffic to the roadway network is expected to be long-term. Based on the foregoing  
27 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
28 Therefore, impacts from operation are expected to be SMALL.

29 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
30 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
31 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
32 along with the actions proposed, are comparable to those described in the GEIS for  
33 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
34 Transportation during operation are expected to be SMALL. Furthermore, while the NRC Staff  
35 has identified additional new information during its independent review; it nevertheless, does not  
36 change the expected environmental impact beyond what was described in the GEIS.

#### 37 4.3.3.3 *Aquifer Restoration Impacts*

38 Potential impacts to transportation during aquifer restoration would be the same as stated for  
39 the Proposed Action (Section 4.3.1.3), and would thus be long-term. Based on the foregoing  
40 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
41 Therefore, impacts from aquifer restoration are expected to be SMALL.

42 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
43 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
44 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
45 along with the actions proposed, are comparable to those described in the GEIS for  
46 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
47 Transportation during aquifer restoration are expected to be SMALL. Furthermore, the NRC

1 Staff has not identified new and significant information during its independent review that would  
2 change the expected environmental impact beyond what was described in the GEIS.

#### 3 4.3.3.4 *Decommissioning Impacts*

4 Potential impacts to transportation during decommissioning would be the same as stated for the  
5 Proposed Action (Section 4.3.1.4), and would thus be long-term. Based on the foregoing  
6 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
7 Therefore, impacts from decommissioning are expected to be SMALL.

8 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
9 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
10 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
11 along with the actions proposed, are comparable to those described in the GEIS for  
12 Transportation and incorporates by reference the GEIS' conclusions that the impacts to  
13 Transportation during decommissioning are expected to be SMALL. Furthermore, the NRC  
14 Staff has not identified new and significant information during its independent review that would  
15 change the expected environmental impact beyond what was described in the GEIS.

### 16 **4.4 Geology and Soils Impacts**

17 Potential environmental impacts to geology and soils can occur during all phases of the Lost  
18 Creek ISR Facility lifecycle, much as they would in any other area of the Wyoming West  
19 Uranium Milling Region. However, these impacts would occur largely during the construction  
20 phase of the project when most of the earth moving and well drilling takes place.

#### 21 **4.4.1 Proposed Action (Alternative 1)**

##### 22 4.4.1.1 *Construction Impacts*

23 As indicated in the GEIS (Section 4.2.3) during construction of ISR facilities, the principal  
24 impacts on geology and soils would result from earth-moving activities associated with  
25 constructing surface facilities, access roads, well fields, and pipelines. Earth-moving activities  
26 that might impact soils include the clearing of ground or top soil and preparing surfaces for the  
27 processing plant, satellite facilities, pumping and distribution houses, access roads, drilling sites,  
28 and associated structures. Similarly, excavating and backfilling trenches for pipelines and  
29 cables may impact soils in the project area.

30 The GEIS indicates that the impact of construction activities on geology and soils will depend on  
31 local topography, surface bedrock geology, and soil characteristics. The earth moving activities  
32 are normally limited to only a small portion of the project. Consequently, earth-moving activities  
33 would result in only SMALL and temporary (months) disturbance of soils-impacts that are  
34 commonly mitigated using accepted best management practices (BMPs). Construction  
35 activities at the Lost Creek ISR Project would also increase the potential for erosion from both  
36 wind and water due to the removal of vegetation and the physical disturbance from vehicle and  
37 heavy equipment traffic. However, these activities would result in SMALL impacts if equipment  
38 operators adopt construction BMPs that prevent or substantially reduce erosion (NRC, 2009).

39 The GEIS further indicates that ISR mining activities would not result in the removal of any rock  
40 matrix or structure. No subsidence would result at the site from the collapse of overlying rock  
41 strata in the mining zone, which could happen in underground mining operations. No other  
42 geologic impacts are anticipated to occur with the ISR mining method.

43 The potential environmental impacts to geology and soils at the Lost Creek project area are  
44 described in Section 4.3 of the ER. The disturbance to soils would be limited to approximately

1 23.5 ha (58 ac) of the total 1,709 ha (4,220 ac) of the project area and include the area of the  
2 plant facilities, well fields, and any access roads that would be constructed. Potential impacts to  
3 soils include soil loss, sedimentation, compaction, salinity, loss of soil productivity and soil  
4 contamination. Effect to soils in the project area will result from the clearing of vegetation,  
5 excavating, leveling, stockpiling, compacting, and redistributing of soils during construction and,  
6 later, during reclamation. While some of these disturbances are short-term in weeks or months  
7 (e.g., mud pits, pipelines, field construction, lay down areas, etc.), other disturbances last the  
8 duration of the project (e.g., main access roads and the Plant site). However, these longer-term  
9 disturbances would also be temporary as any disturbance affected by the project would be  
10 restored and reclaimed after the project has reached the end of its life. The activities planned  
11 by the applicant for surface reclamation are detailed Section 6.0 of the TR.

12 Wind erosion is a concern in the project area. Most of the soils in the project area have a  
13 significant percentage of silt, which is directly related to dust emissions from unpaved roads.  
14 Vehicular traffic on these unpaved roads and construction presents the greatest threat to soils  
15 with a potential for wind erosion. Wind erosion would be controlled by removing vegetation only  
16 where it is necessary and by techniques that may include surface roads with gravel, limiting  
17 traffic speeds, watering unpaved roads, spreading soil binding agents, and timely reclamation  
18 (LCI, 2008b).

19 Water erosion is not a large concern in the project area due to very low (flat) surface slopes,  
20 limited amount of precipitation, and the lack of perennial and intermittent streams. However  
21 removal of vegetation for any activity exposes soils to increased erosion. Soil loss would be  
22 reduced by timely reclamation, installing drainage controls and reseeding and installing water  
23 bars across reclaimed areas.

24 Both construction and operation activities have the potential to compact soils due to heavy  
25 trucks driving over bare soils. While soils sensitive to compaction, such as clay loams, do not  
26 exist in the project area, the amount of surface-disturbing activity could damage soil properties  
27 and cause compaction. Compaction of soils could decrease infiltration, promoting and increase  
28 in runoff. The applicant plans to address this concern by disking and reseeding soils compacter  
29 during construction and operation activities as soon as possible following use.

30 Based on the limited construction area and the implementation of the BMPs discussed above,  
31 the potential environmental impacts of construction activities on geology and soils at the Lost  
32 Creek ISR Project would be temporary. The foregoing analysis for site-specific conditions is  
33 consistent with the assumptions stated in the GEIS. Therefore, impacts from construction are  
34 expected to be SMALL.

35 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
36 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
37 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
38 along with the actions proposed, are comparable to those described in the GEIS for Geology  
39 and Soils and incorporates by reference the GEIS' conclusions that the impacts to Geology and  
40 Soils during construction are expected to be SMALL. Furthermore, while the NRC Staff has  
41 identified additional new information during its independent review; it nevertheless, does not  
42 change the expected environmental impact beyond what was described in the GEIS.

#### 43 4.4.1.2 *Operation Impacts*

44 As described in the GEIS (Section 4.2.3.2) during ISR operations, a non-uranium-bearing  
45 (barren) solution, or lixiviant, is injected through wells into the mineralized zone. The lixiviant  
46 moves through the pores in the host rock, dissolving uranium and other metals. Production  
47 wells withdraw the resulting "pregnant" lixiviant, which now contains uranium and other

1 dissolved metals, and pump it to a CPP or to a satellite processing facility for further uranium  
2 recovery and purification.

3 The removal of uranium from the target sandstones during ISR operations would result in a  
4 permanent change to the composition of uranium-bearing rock formations. However, the  
5 uranium mobilization and recovery process in the target sandstones, deep below the ground  
6 surface, does not result in the removal of rock matrix or structure and, therefore, no significant  
7 matrix compression or ground subsidence is expected. Therefore, impacts on geology from  
8 ground subsidence at ISR projects are expected to be SMALL (GEIS, Section 4.2.3.2)

9 The GEIS (Section 4.2.3.2) further indicates that a potential impact to soils from ISR operations  
10 arises from the necessity to move barren and pregnant uranium-bearing lixiviant to and from  
11 the processing facility in aboveground and underground pipelines. If a pipe ruptures or fails,  
12 lixiviant can be released and (1) pond on the surface, (2) run off into surface water bodies, (3)  
13 infiltrate and adsorb in overlying-soil and rock, or (4) infiltrate and percolate to groundwater. In  
14 the case of spills from pipeline leaks and ruptures, licensees are expected to establish  
15 immediate spill responses through onsite standard operation procedures. As part of the  
16 monitoring requirements at ISR facilities, licensees must report certain spills to the NRC within  
17 24 hours. Licensees in the State of Wyoming must also comply with applicable WDEQ  
18 requirements for spill response and reporting.

19 Additionally, depending on the method of disposal for process-related liquid effluents (i.e.,  
20 through the use of evaporation ponds and/or by land application), failure of the pond liner or  
21 embankment system and buildup of certain constituents in land-applied water may negatively  
22 impact soils. Licensees would be expected to construct and monitor evaporation pond liners  
23 and embankments in accordance with NRC-approved plans, and licensees would be expected  
24 to obtain the appropriate permits from state regulatory agencies for land application and to  
25 conduct regular soil monitoring. Such actions would tend to mitigate impacts to soils from these  
26 waste disposal methods.

27 Based on these considerations, the GEIS (Section 4.2.3.2) concludes that impacts to soils from  
28 spills during operation could range from SMALL to LARGE depending on the chemical  
29 composition of the liquid spilled and the volume of soil affected by the spill. Because of the  
30 required immediate responses at ISR facilities, spill recovery actions, and routine monitoring  
31 programs, impacts from spills are temporary, and the overall long-term impact to soils would be  
32 SMALL.

33 Potential tank, pipeline, and pond failures are described in Sections 7.4.1, 7.4.2, and 7.4.3 of  
34 the applicant's TR. Containment of tanks within the CPP is designed to prevent releases to soil  
35 from tank failure. The design and monitoring of ponds and pipelines should similarly limit any  
36 release to soil that may occur from these structures. During operations, the applicant would  
37 have in place a program to monitor well field and pipeline flow and pressure. This program is  
38 discussed in the Section 6.3.2 and is designed to ensure the timely detection of any releases  
39 from leaks from pipeline breaks or ruptures and minimize the volume of such releases.

40 However, should a release from a pipeline occur that represents an environmental concern, the  
41 applicant indicates that the area would be surveyed and the contaminated soils would be  
42 removed and disposed of according to NRC and/or state regulations. Pipelines would be buried  
43 1.5 to 1.8 m (5 to 6 ft) below ground surface (bgs), below the frost line, and constructed of a  
44 corrosion-free HDPE material. Consequently, the probability of such a failure, after the  
45 pipelines have been tested and placed in service, is considered small. The storage ponds would  
46 be constructed with a liner and leak detection systems, and these systems would be monitored  
47 daily. In the event a leak is detected, the fluid in the compromised unit would be transferred to

1 the second pond and the liner would be repaired as need. The pond area would be surveyed  
2 and reclaimed as part of the final reclamation, eliminating any long-term impact.

3 Based on these considerations, the potential environmental impacts to soils from spills during  
4 operation at the Lost Creek ISR Project could range from SMALL to LARGE depending on the  
5 chemical composition of the liquid spilled and the volume of soil affected by the spill. However,  
6 because of the required immediate responses at ISR facilities, spill recovery actions, and  
7 routine monitoring programs, impacts from spills are temporary, and the overall long-term  
8 potential impact to soils would be SMALL.

9 There would be no significant matrix compression or ground subsidence expected, and it is  
10 unlikely that the proposed ISR activities operations would reactivate the fault. Documented  
11 cases where fluid withdrawal, or injection has impacted fault transmissivity, so that small  
12 earthquakes have occurred when the change of reservoir pressure was on the order of 450  
13 to 2275 kg (1,000 to 5,000 lb) per square inch (psi) or higher. Operations at Lost Creek,  
14 however, are expected to induce only small pressure changes (e.g., approximately 23 to 68 ksi  
15 [50 to 150 psi]). Based on the foregoing analysis, site-specific conditions are consistent with  
16 the assumptions stated in the GEIS. Therefore, impacts from operation are expected to be  
17 SMALL.

18 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
19 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
20 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
21 along with the actions proposed, are comparable to those described in the GEIS for Geology  
22 and Soils and incorporates, in part, by reference the GEIS' conclusions that the impacts to  
23 Geology and Soils during operation are expected to be MODERATE, but may be reduced to  
24 SMALL, providing monitoring and spill recovery programs are carried out. Furthermore, the  
25 NRC Staff has not identified new and significant information during its independent review that  
26 would change the expected environmental impact beyond what was described in the GEIS.

#### 27 4.4.1.3 *Aquifer Restoration Impacts*

28 As indicated in the GEIS (Section 4.2.3.3), aquifer restoration programs typically use a  
29 combination of (1) groundwater transfer, (2) groundwater sweep, (3) reverse osmosis, permeate  
30 injection, and recirculation, (4) stabilization, and (5) water treatment and surface conveyance.  
31 The groundwater sweep and recirculation process does not result in the removal of rock matrix  
32 or structure and, therefore, no significant matrix compression or ground subsidence is expected.  
33 The water pressure in the aquifer is decreased during restoration because a negative water  
34 balance is maintained in the well field being restored to ensure water flows into the well field  
35 from its edges, reducing the spread of contamination. However, the change in pressure is  
36 limited by recirculation of treated groundwater and, therefore, it is very unlikely that ISR  
37 operations will reactivate any local faults and extremely unlikely that any earthquakes would be  
38 generated. Therefore, in the Wyoming West Uranium Milling Region, where the Lost Creek site  
39 is located, the potential environmental impacts to geology from aquifer restoration are expected  
40 to be SMALL.

41 Based on the same considerations as used when evaluating the potential impact to soils from  
42 spills and leak, the GEIS (Section 4.2.3.3) has concluded that impacts to soils from spills during  
43 operation could range from SMALL to LARGE depending on the chemical composition of the  
44 liquid spilled and the volume of soil affected by the spill. Because of the required immediate  
45 responses at ISR facilities, spill recovery actions, and routine monitoring programs, impacts  
46 from spills are temporary, and the overall long-term impact to soils would be expected to be  
47 SMALL.

1 The same spill and leak detection program would be used during restoration as during  
2 operations. Similarly, the applicant would be required to conduct the same spill response and  
3 cleanup program during restoration as required during operations (GEIS Section 4.2.2.2).  
4 Consequently, the impact to soils from spills and pipeline leaks during aquifer restoration should  
5 be similar to that identified for the operation phase to the project. Thus, the potential  
6 environmental impacts to soils from spills during aquifer restoration at Lost Creek project are  
7 expected to be SMALL. The required immediate response, the spill recovery actions, and the  
8 routine monitoring programs, impacts from spills would be temporary, and the overall long-term  
9 potential impact to soils at the Lost Creek ISR Project would be expected to be SMALL.

10 In addition, ISR mining activities during aquifer restoration at Lost Creek would not result in the  
11 removal of any rock matrix or structure. No significant matrix compression or ground  
12 subsidence is expected, as the net withdrawal of lixiviant (bleed) would be typically one percent  
13 or less. No subsidence would result at the site from the collapse of overlying rock strata in the  
14 mining zone during the restoration phase, as the target aquifer lies far below the ground  
15 surface. Similarly, no impacts on the fault are expected during aquifer restoration. Based on  
16 the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the  
17 GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL.

18 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
19 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
20 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
21 along with the actions proposed, are comparable to those described in the GEIS for Geology  
22 and Soils and incorporates by reference the GEIS' conclusions that the impacts to Geology and  
23 Soils during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not  
24 identified new and significant information during its independent review that would change the  
25 expected environmental impact beyond what was described in the GEIS.

#### 26 4.4.1.4 Decommissioning Impacts

27 As indicated by the GEIS (Section 4.2.3.4), decommissioning of ISR facilities includes: (1)  
28 dismantling process facilities and associated structures, (2) removing buried piping, and (3)  
29 plugging and abandoning wells using accepted practices. The main impacts to geology and  
30 soils at the project site during decommissioning would be from activities associated with land  
31 reclamation and cleanup of contaminated soils.

32 As further indicated in the GEIS, before decommissioning and reclamation activities begin, the  
33 licensee is required to submit a decommissioning plan to NRC for review and approval. Any  
34 areas potentially impacted by operations would be included in surveys to ensure all areas of  
35 elevated soil concentrations are identified and properly cleaned up to comply with NRC  
36 regulations at 10 CER Part 40, Appendix A, Criterion 6(6). Additionally, a goal of reclamation is  
37 to return the site to pre-production conditions through return of topsoil and re-establishment of  
38 vegetative communities.

39 The GEIS concluded that most of the impacts to geology and soils associated with  
40 decommissioning would be detectable but SMALL. Disruption and/or displacement of existing  
41 soils would be relatively slight. Changes in amounts and locations of impervious surfaces would  
42 be measurable but would not be large enough to noticeably alter existing natural conditions.  
43 Mitigation may be needed to offset adverse impacts but would be relatively simple to implement,  
44 and likely be successful.

45 The surface reclamation and decommissioning activities planned for the Lost Creek project area  
46 indicates that all lands disturbed by the mining project would be restored to their pre-mining land  
47 use of livestock grazing and wildlife habitat. Any buildings or structures would be

1 decontaminated to regulatory standards, and either demolished and trucked to a disposal facility  
2 or turned over to the landowner, if desired. Baseline soils, vegetation, and radiological data  
3 would be used as a guide in evaluating final reclamation. The final decommissioning plan would  
4 be sent to the NRC for review and approval.

5 While there may be some short-term impacts as reclamation is in progress, the outcome of  
6 these activities should be to return the project area to pre-mining land use. As a result, the  
7 potential environmental impacts to geology and soils associated with decommissioning at the  
8 Lost Creek project area would be noticeable. Based on the foregoing analysis, site-specific  
9 conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from  
10 decommissioning are expected to be SMALL.

11 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
12 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
13 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
14 along with the actions proposed, are comparable to those described in the GEIS for Geology  
15 and Soils and incorporates by reference the GEIS' conclusions that the impacts to Geology and  
16 Soils during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not  
17 identified new and significant information during its independent review that would change the  
18 expected environmental impact beyond what was described in the GEIS.

#### 19 **4.4.2 No-Action (Alternative 2)**

20 The No-Action Alternative would result in no change to existing soil and/or topographic and  
21 geologic conditions at the proposed project area or in the region. Land and disturbance would  
22 be avoided and the area would retain its soil and/or topographic and geologic characteristics for  
23 the region. The existing soils and/or topography and geology present within the project area  
24 would not be affected. Therefore, there would be no impacts. There still would be other land  
25 use activities (mineral exploration, recreation and hunting) that would have impacts particularly  
26 on the soils of the area.

#### 27 **4.4.3 Dry Yellowcake (Alternative 3)**

28 Alternative 3 would include issuing LCI a license for the construction, operation, aquifer  
29 restoration, and decommissioning of facilities for ISR uranium milling, but processing the  
30 recovered uranium into a dry powder instead of yellowcake slurry. The potential environmental  
31 impacts to geology and soils for this alternative would not differ from those identified for  
32 Alternative 1. Consequently, the potential environmental impacts to geology and soils for  
33 Alternative 3 are identical to those identified for the proposed action, SMALL.

### 34 **4.5 Water Resources Impacts**

#### 35 **4.5.1 Surface Waters and Wetlands Impacts**

36 Potential environmental impacts to surface water at the Lost Creek site may occur during all  
37 phases of the ISR facility's lifecycle. Impacts can result from road construction and crossings,  
38 erosion runoff, spills or leaks of fuel and lubricants, discharges of storm water and process-  
39 related fluids, and discharge of well field fluids as a result of pipeline or well head leaks.

40 This section will focus on the potential impacts to surface waters. No wetlands occur on the  
41 Lost Creek project area that would be impacted by the proposed action or any of its alternatives.  
42 Detailed discussion of the potential environmental impacts to surface water from construction,  
43 operation, aquifer restoration, and decommissioning are provided in the following sections.

1 4.5.1.1 *Proposed Action (Alternative 1)*

2 4.5.1.1.1 Construction Impacts to Surface Waters and Wetlands

3 As described in the GEIS (Section 4.2.4.1.1), potential impacts to surface waters from  
4 construction involve road crossings, filling, erosion, runoff, and spills or leaks of fuels and  
5 lubricants for construction equipment. These impacts, should they occur, would be mitigated  
6 through proper planning, design, construction methods, and best management practices. U.S.  
7 Army Corps of Engineers (USACE) permits may be required when filling and crossing wetlands  
8 or working in the bed or banks of a stream. The GEIS considered that temporary changes to  
9 spring and stream flow from grading and changes in topography and natural drainage patterns  
10 could be mitigated or restored after the construction phase is complete. Additionally, while  
11 impacts from incidental spills of drilling fluids into local streams could occur. They would also be  
12 expected to be temporary due to the implementation of monitoring equipment. The GEIS  
13 estimates that impacts from roads, parking areas, and buildings on recharge to shallow aquifers  
14 would be SMALL, owing to the limited area of impervious surfaces proposed by license  
15 applicants. Overall, the GEIS determined that construction impacts to surface water would be  
16 SMALL because the ephemeral channels within the Great Divide Basin are not considered  
17 Waters of the U.S.; they do not drain to a Water of the U.S. (A. Bjornsen personal  
18 communication with Matthew Bilodeau of the Corps of Engineers, 2009).

19 The primary disturbances to the ground surface occurring during the construction phase include  
20 well field drilling, road and facility construction, and pipeline installations. Construction related  
21 disturbances would occur within small areas relative to the overall project area, and over a  
22 relatively short duration. All construction work would occur during the summer and fall months  
23 when the ephemeral channels are dry.

24 **Roads:** An existing and relatively well-traveled two-track road traverses the project area from  
25 Wamsutter-Crooks Gap Road to Sooner Road. This road (Lost Creek Road) would be  
26 improved for heavy truck usage and would likely remain as a permanent feature beyond site  
27 decommissioning. Additional details regarding Lost Creek Road are provided in Section 2.2.2.2.  
28 Other, temporary access roads would also need to be constructed, branching out from Lost  
29 Creek Road and providing access to the well fields for the drill rigs required to install the  
30 injection and production wells. The proposed road network would involve a minimum of seven  
31 crossings of ephemeral channels. Two of the crossings already exist, but would require  
32 improvements. Five new crossings would also need to be constructed. Crossings would be  
33 designed to be the minimum width necessary (using BLM standards) for safe vehicular traffic.  
34 Where crossings (without using culverts) are feasible, they would occur at the natural  
35 streambed elevation and perpendicular to flow. No fill material would be needed for these  
36 crossings. Steeply incised channel banks may be graded to create gently sloping approaches  
37 to these channel crossings. Proper sedimentation and erosion control, such as silt fences and  
38 hay bales, would be installed to minimize sedimentation into the channels, and disturbed soil  
39 would be re-seeded.

40 Temporary disturbances to the soil from vehicular passes may cause some sediment transport  
41 during periods of surface flow (storm water runoff). However, the amount of sediment transport  
42 would be expected to have a negligible effect on the stability of the channel and water quality.  
43 Accidental spills of petrochemicals such as oil and gas would be mitigated by routine vehicle  
44 maintenance and inspection. In addition to applying for a general Wyoming Pollutant Discharge  
45 Elimination System (WYPDES) permit, LCI would prepare a Storm Water Pollution Prevention  
46 Plan (SWPPP).

47 Impacts associated with road construction and vehicular traffic would thus be considered to be  
48 long-term and adverse, but SMALL. The scope of the impact would range from typically site-

1 specific to potentially regional, but only in the rare instance when a sediment plume or  
2 accidental petrochemical discharge is conveyed outside the study area by flowing water.

3 **Electric Lines:** Electricity would enter the project area from the west, and is expected to cross  
4 overhead above six ephemeral channels. Lines would be elevated above ground using utility  
5 poles placed outside of the ephemeral channels, resulting in no impacts to surface waters.

6 **Wells:** The uranium ore body at Lost Creek has a narrow, elongated configuration  
7 approximately 60.7 ha (150 ac) in size that would be perpendicular to surface drainage features  
8 (see Figure 2-6). Complete avoidance of ephemeral channels would not be possible-it may be  
9 necessary to install wells in an ephemeral channel. This work would be done during the dry  
10 season, and impacts would be minimized through the installation of erosion and sedimentation  
11 control features described earlier (LCI, 2008a).

12 Drilling fluid associated with well installation would be contained in proximity to the drill rig within  
13 a temporary pit. At locations in ephemeral channels or washes, the drilling fluid and residual  
14 cuttings in the pit would be emptied and cleaned upon the completion of the installation, with the  
15 waste materials being trucked offsite for proper disposal (NRC, 2009). Pits for wells installed in  
16 uplands may be removed in the same manner, or may be backfilled and graded flush with the  
17 surrounding terrain.

18 Wellheads installed within stream channels would be designed to withstand storm water flows  
19 using exterior protection measures such as diversion swales and/or riprap. Temporary pumps  
20 would be attached to the newly created well casing to pump out impurities and turbid water until  
21 such time that the well becomes clean of debris. For wells located in ephemeral channels,  
22 pumped water would be released directly into ephemeral channels where the water is expected  
23 to quickly be absorbed into the soil. Once the installation of each well is completed, measures  
24 would be taken to stabilize loose soil such as re-seeding and mulching using standard erosion  
25 control techniques.

26 Surface water impacts associated with well field installation are expected to be temporary, as  
27 the wells would eventually be removed and the area reclaimed. However, because they would  
28 persist for the life of the mine unit, they would thus be classified as long-term. The scope,  
29 nature and extent of surface water impacts associated with well installation would be SMALL.

30 **Pipelines:** The injection and production wells would be interconnected and tied to the CPP via  
31 flexible, PVC pipes buried at a depth below the soil surface to prevent freezing. This would  
32 require that pipes bisect ephemeral channels at numerous locations. Work would be performed  
33 when the channels are dry using small-scale excavation equipment capable of creating a  
34 narrow, shallow trench. Excavated soil would be returned to the trench at the pre-existing grade  
35 after the pipes have been installed. Bare soil would be re-seeded and mulched for stability (LCI,  
36 2008a). Impacts to the channels and water quality are expected to be the same as discussed  
37 above for well installation: SMALL.

38 **CPP:** The CPP would be constructed north of the uranium ore body in an upland area. The  
39 CPP would have no direct impacts to surface waters channels or to the Crooked Well Reservoir,  
40 to the northeast. In the event of a heavy rainfall event during construction, concentrated runoff  
41 would be diverted to ditches and/or energy dissipaters. These measures would insure that  
42 overall impacts to surface waters and downstream wetlands from the construction of the CPP  
43 would be short-term (*i.e.*, episodic and rare). Based on the foregoing analysis, site-specific  
44 conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from  
45 construction are expected to be SMALL.

46 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
47 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,

1 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
2 along with the actions proposed, are comparable to those described in the GEIS for Surface  
3 Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to  
4 Surface Water and Wetlands during construction are expected to be SMALL. Furthermore,  
5 while the NRC Staff has identified additional new information during its independent review; it  
6 nevertheless, does not change the expected environmental impact beyond what was described  
7 in the GEIS.

8 4.5.1.1.2 Operation Impacts to Surface Waters

9 The GEIS (Section 4.2.4.1.2) states that through permitting processes, federal and state  
10 agencies regulate both the discharge of storm water runoff and process-related water. Impacts  
11 from these discharges would be controlled, as licensees would be expected to operate within  
12 the conditions of their permits. The potential impact of spills to surface waters would depend on  
13 the size of the spill, the chemical composition of the liquid spilled, the success of remediation,  
14 the use of the surface water, and the proximity of the spill to surface water. For these reasons,  
15 overall, the GEIS determines the potential impacts to surface waters during operations to be  
16 SMALL to MODERATE.

17 Upon completion of the necessary infrastructure and initiation of the uranium recovery process  
18 at Lost Creek, the CPP would be constructed on a concrete slab with a protective berm erected  
19 around the perimeter to prohibit any spills from escaping the area. A storm water management  
20 plan would be implemented in accordance with WDEQ requirements to detain or treat runoff  
21 from the CPP. Runoff would be diverted away from the facility, where it is expected to become  
22 absorbed into the soil. Wastewater would not be discharged to surface water channels (LCI,  
23 2008a).

24 Crews would be required to check and maintain the injection, production and monitoring wells  
25 during the uranium recovery process, primarily to identify leaks or spills, and to remediate them  
26 quickly. During these activities, vehicles would need to cross ephemeral channels to access all  
27 portions of the well fields. Temporary disturbances to soil from such vehicular passes may  
28 occur, liberating limited amounts of sediment to downstream areas. Based on the foregoing  
29 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for a  
30 SMALL impact. Therefore, impacts from operation (potential spills and contaminated runoff) are  
31 expected to be SMALL.

32 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
33 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
34 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
35 along with the actions proposed, are comparable to those described in the GEIS for Surface  
36 Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to  
37 Surface Water and Wetlands during operation are expected to be SMALL. Furthermore, the  
38 NRC Staff has not identified new and significant information during its independent review that  
39 would change the expected environmental impact beyond what was described in the GEIS.

40 4.5.1.1.3 Aquifer Restoration Impacts to Surface Waters

41 The GEIS (Section 4.2.4.1.3) states that through permitting processes, federal and state  
42 agencies regulate the discharge of storm water runoff and process-related water. Impacts from  
43 these discharges would be controlled, as licensees would be expected to operate within the  
44 conditions of their permits. The potential impact of spills to surface waters would depend on the  
45 size of the spill, the success of remediation, the use of the surface water, and the proximity of  
46 the spill to surface water. For these reasons, the GEIS determines that impacts to surface  
47 waters during operations would be SMALL.

1 The Lost Creek project requires the restoration of groundwater aquifers once the uranium  
2 recovery process is completed. The process of aquifer restoration is more fully described in  
3 Section 2.5 of the GEIS (NRC, 2009a), in Section 2.1.1.6 of this SEIS, and in Section 6.2.3 of  
4 the Lost Creek TR (LCI, 2008b).

5 The restoration of groundwater aquifers results in the production of wastewater. However, no  
6 wastewater would be released into surface waters, and therefore, no impacts to surface waters  
7 are expected.

8 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
9 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
10 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
11 along with the actions proposed, are comparable to those described in the GEIS for Surface  
12 Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to  
13 Surface Water and Wetlands during aquifer restoration are expected to be SMALL.  
14 Furthermore, the NRC Staff has not identified new and significant information during its  
15 independent review that would change the expected environmental impact beyond what was  
16 described in the GEIS.

#### 17 4.5.1.1.4 Decommissioning Impacts to Surface Waters

18 As described in the GEIS (Section 4.2.4.1.4), impacts from decommissioning would be expected  
19 to similar to, but less than, impacts from construction. Activities to clean up, and re-contour and  
20 reclaim the land surface during decommissioning would be expected to mitigate potentially long-  
21 term impacts to surface waters. Nevertheless, potential impacts to surface water from  
22 decommissioning would be expected to be SMALL.

23 Section 2.1.1.5 of this SEIS and Section 6.4 of the Lost Creek ISR, LLC TR (LCI, 2008b)  
24 provides details on the decommissioning process for the project. In summary, all buildings and  
25 pipelines would be removed, and wells would be plugged and abandoned. The removal of  
26 property improvements would be similar to construction impacts in the context of potential  
27 surface water impacts (see Section 4.5.1.1.1).

28 As buildings and associated structures are decontaminated and removed, temporary soil  
29 disturbances would occur. Sedimentation from loosened soil would be prevented from entering  
30 surface waters and downstream wetlands during the decommissioning of buildings, minimizing  
31 impacts. Based on the foregoing analysis, site-specific conditions are consistent with the  
32 assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be  
33 SMALL.

34 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
35 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
36 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
37 along with the actions proposed, are comparable to those described in the GEIS for Surface  
38 Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to  
39 Surface Water and Wetlands during aquifer restoration are expected to be SMALL.  
40 Furthermore, the NRC Staff has not identified new and significant information during its  
41 independent review that would change the expected environmental impact beyond what was  
42 described in the GEIS.

#### 43 4.5.1.2 *No-Action (Alternative 2)*

44 Under the No-Action Alternative, there would continue to be minimal anthropogenic impacts to  
45 surface water features. The prevailing land uses in the project area are livestock ranching,

1 recreational activities, and natural resource exploration. There are no coal bed methane (CBM)  
2 or oil and gas activities that occur on, or in the vicinity of, Lost Creek the project area.

3 The project area currently maintains a network of two-track ranch roads for vehicular access.  
4 The roads consist of unimproved and unmaintained dirt paths that bisect natural drainage  
5 channels and washes at various locations. These 'trail' roads would continue to be utilized in  
6 their existing conditions, with the result having the potential for airborne particulates to reach  
7 surface water channels, and potentially increase the risk for petroleum products from vehicular  
8 activity leaking or running off into channels during ranching, recreation, or geophysical  
9 explorations. Under the No-Action alternative, no additional impacts to surface water would  
10 occur. Local long-term impacts would persist due to the continued use of existing roads

11 Under the No-Action Alternative, livestock would continue to have access to channels/washes  
12 and Crooked Well Reservoir resulting in the grazing of wetland vegetation, defecation in  
13 channels, soil disturbances, and soil compaction. Cattle entering stream channels tend to  
14 create instabilities along banks, resulting in higher than normal soil erosion during periods of  
15 storm water runoff. In combination, these actions may cause long-term but SMALL impacts to  
16 surface water quality.

#### 17 4.5.1.3 *Dry Yellowcake (Alternative 3)*

18 Alternative 3 consists of the same construction, operation, aquifer restoration, and  
19 decommissioning phases as the Proposed Action, but with only a slight modification to  
20 processing the production of a dry yellowcake product. The yellowcake slurry (as would be  
21 produced as a final product in the Proposed Action) would be dried on-site within the CPP. No  
22 changes to the development footprint, wells, road network, electric lines, pipelines, or ponds  
23 would be proposed under this alternative compared to the Proposed Action. As such, the  
24 potential impacts to surface waters under this alternative would be the same as described for  
25 the Proposed Action, SMALL.

26 There are no wetlands located on the Lost Creek site, and therefore, there would be no impacts.

### 27 **4.5.2 Groundwater Impacts**

28 Potential environmental impacts to groundwater resources in the Lost Creek ISR Project can  
29 occur during each phase of the ISR facility's lifecycle. ISR activities could potentially impact  
30 aquifers above and below the uranium-bearing production zone, as well as the uranium-bearing  
31 aquifer itself outside of the license area. Surface or near surface activities that can introduce  
32 contaminants into soils are more likely to impact shallow (near-surface) aquifers while ISR  
33 operations and aquifer restoration will likely impact the deeper uranium-bearing aquifer, and  
34 potentially impact any aquifers above and below, and adjacent surrounding aquifers.

35 ISR facility impacts to groundwater resources can occur from surface spills and leaks, releases  
36 from shallow Surface piping, consumptive water use, horizontal and vertical excursions of  
37 leaching solutions from production aquifers, degradation of water quality from changes in the  
38 production aquifer's chemistry, and waste management practices involving land application,  
39 evaporation ponds, or deep well injection. Detailed discussion of the potential impacts to  
40 groundwater resources from construction, operations, aquifer restoration, and decommissioning  
41 are provided in the following sections.

#### 42 4.5.2.1 *Proposed Action (Alternative 1)*

##### 43 4.5.2.1.1 Construction Impacts to Groundwater

44 As indicated in the GEIS (Section 4.2.4.2.1), potential impacts to groundwater during  
45 construction is primarily from consumptive use of groundwater, injection of drilling fluids and

1 muds during well drilling, and spills of fuels and lubricants from construction equipment. During  
2 the construction of the well fields and facility at Lost Creek, potential impacts to groundwater  
3 could occur from the consumptive use of groundwater, introduction of drilling fluids and muds  
4 into the environment during well installation, discharge of pumped water to the surface during  
5 hydrologic testing and surface spills of fuels and lubricants.

6 The consumptive water use during construction at the Lost Creek site would be generally limited  
7 to dust control, drilling support, and cement mixing. Most water used for construction at the Lost  
8 Creek project would be extracted from a well completed in the FG horizon. The sands in this  
9 horizon constitute an aquifer unit located at depths from 55 to 107 m (180 to 350 ft) below  
10 surface, which are hydrologically separated from the HJ production sand and DE surficial  
11 aquifer. The consumptive water use during construction is expected to be small and temporary  
12 relative to the water supply available in the FG Sands.

13 The volume of drilling fluids and muds used during well installation is expected to be limited and  
14 best management practices would be applied to prevent, identify and correct impacts to soils  
15 and the surficial DE aquifer at Lost Creek. Drilling fluids and muds would be placed into mud  
16 pits to control the spread of the fluids, to minimize the area of soil contamination and to enhance  
17 evaporation. According to the site potentiometric data, the depth to the water table in the  
18 surficial DE aquifer at Lost Creek ranges from 24 to 46 m (80 to 150 ft) below ground surface  
19 and a low permeability BC horizon overlies the DE horizon. Therefore any small amount of  
20 leakage from the pits or spills from drilling activities should result in only a small amount of  
21 infiltration and not cause noticeable changes in the DE surficial aquifer water quality. The  
22 introduction of drilling fluids to the DE, FG, and HJ aquifers may occur during drilling of  
23 production wells and monitoring wells, but is expected to be minimal, as drilling muds are  
24 designed to seal the hole so that casing may be set.

25 As wells are installed, some water may be pumped from aquifers for hydrologic tests for  
26 pumping tests. This water would be discharged to the surface in accordance with approved  
27 permits from the State of Wyoming that the applicant would obtain prior to any release. The  
28 surface discharge permits protect near surface aquifers by limiting the discharge volume and  
29 prescribing concentration limits to waters that can be discharged.

30 During all construction operations at Lost Creek, the groundwater quality of near surface  
31 aquifers would further be protected if best management practices are employed during facility  
32 construction and well field installation. The volume of fuels and lubricants to be kept in the  
33 license area during construction is usually small and minor leaks or spills would not be expected  
34 to contaminate the groundwater. Such spills would principally be surficial in nature and would  
35 have a SMALL impact on surface soils and vegetation.

36 Based on this analysis, consumptive groundwater use during the construction phase is limited  
37 and is expected to have a SMALL and temporary impact. The impacts to soil and groundwater  
38 resources during well field and facility construction would be SMALL based on the limited nature  
39 of construction activities and implementation of best management practices to protect soils and  
40 shallow groundwater. Based on the foregoing analysis, site-specific conditions are consistent  
41 with the assumptions stated in the GEIS.

42 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
43 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
44 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
45 along with the actions proposed, are comparable to those described in the GEIS for  
46 Groundwater and incorporates by reference the GEIS' conclusions that the impacts to  
47 Groundwater during construction are expected to be SMALL. Furthermore, while the NRC Staff

1 has identified additional new information during its independent review; it nevertheless, does not  
2 change the expected environmental impact beyond what was described in the GEIS.

3 4.5.2.1.2 Operation Impacts to Groundwater

4 As indicated in Section 4.2.4.2.2 of the GEIS, during ISR operations, potential environmental  
5 impacts to shallow (near-surface) aquifers are related to leaks of lixiviant from pipelines, wells,  
6 or header houses and to waste management practices such as the use of evaporation ponds  
7 and disposal of treated wastewater by land application. Potential environmental impacts to  
8 groundwater resources in the production and surrounding aquifers also include consumptive  
9 water use and changes to water quality. Water quality changes would result from normal  
10 operations in the production aquifer and from possible horizontal and vertical lixiviant excursions  
11 beyond the production zone. Disposal of processing wastes by deep well injection during ISR  
12 operations also can potentially impact groundwater resources (NRC, 2009).

13 4.5.2.1.2.1 *Operation Impacts to Shallow (Near-Surface) Aquifers*

14 The GEIS (Section 4.2.4.2.2.1) discusses the potential impacts to shallow aquifers during ISR  
15 operations. A network of buried pipelines is used during ISR operations for transporting lixiviant  
16 between the pump house and the satellite or main processing facility and also to connect  
17 injection and extraction wells to manifolds inside the pumping header houses. The failure of  
18 pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers could result  
19 in leaks and spills of pregnant and barren lixiviant, which could impact water quality in shallow  
20 aquifers. The potential environmental impact of such pipeline, valve, well integrity failure, or  
21 pond leakage depends on a number of factors, including the depth to shallow groundwater, the  
22 use of shallow groundwater, and the degree of hydraulic connection of shallow aquifers to  
23 regionally important aquifers. As indicated in the GEIS, potential environment impacts could be  
24 MODERATE to LARGE if 1) the groundwater in the shallow aquifers is close to the ground  
25 surface, 2) the shallow aquifers are important sources for local domestic or agricultural water  
26 supplies, or 3) the shallow aquifers are hydraulically connected to other locally or regionally  
27 important aquifers.

28 As previously discussed in Sections 3.4 and 3.5.3 of this EIS, the top 213 m (700 ft) of the Battle  
29 Spring Formation in the study area has been divided into at least five horizons marked from top  
30 to bottom as BC, DE, FG, HJ, and KM. These horizons are sandstone layers separated from  
31 one another by various thicknesses of shale, mudstone and siltstone. The first saturated  
32 horizon is the DE Horizon. The overlying BC Horizon is unsaturated and separated from the  
33 underlying DE Horizon by a shale sequence. The DE Horizon is described as comprised of  
34 alternating very fine to coarse-grained sandstone, mudstone and siltstone. The top of the DE  
35 Horizon ranges from 30 to 61 m (100 to 200 ft) bgs. Water level data indicate that a water table  
36 generally exists within DE Horizon, although it may be locally confined. The shallow water table  
37 in this area is typically 24 to 46 m (80 to 150 ft) bgs. Directly underlying the DE Horizon is the  
38 FG Horizon, which hosts the aquifer directly overlying the production zone (HJ Horizon).

39 A survey of groundwater wells in the area (see Section 3.5.3 of this EIS) indicates that shallow  
40 groundwater is an important source of water and is used within 3.2-km (2-mi) radius of the  
41 project area. However, the depth to the water table and its separation from the land surface by  
42 the relatively impermeable BC horizon and the intervening impermeable shale overlying the DE  
43 Horizon indicates that the potential for infiltrating fluids released at the surface to reach the  
44 shallowest aquifer would be minimal. Any releases would likely be slowed or attenuated by the  
45 low permeability beds within the BC Horizon or the underlying shale unit separating the BC and  
46 DE Horizons. Thus the potential impacts during operations to the shallow aquifer from releases  
47 from the surface would be localized and SMALL. Based on the foregoing analysis, site-specific  
48 conditions are consistent with the assumptions stated in the GEIS for a SMALL impact.

1 As indicated by the GEIS, any potential impact of releases at or near the ground surface on  
2 shallow groundwater can be greatly reduced by leak detection programs required by the NRC.  
3 The applicant plans a leak detection and spill cleanup program as outlined in section 5.7.8.3  
4 (Storage Pond Leak Detection) and section 4.0 (Effluent Control Systems) of the TR (LCI,  
5 2008). In addition, preventative measures such as well mechanical integrity testing would limit  
6 the likelihood of well integrity failure during operations.

7 Moreover, the potential leakage from the planned storage ponds can be minimized by the  
8 design and operation of these ponds. The applicant has indicated that these ponds would be  
9 built with impermeable liners with leak detection systems underlying the liner. Any detection of  
10 leaks beneath the liner would lead to the closure of that pond and the necessary repairs to the  
11 liner. During operations, the leak detection standpipes would be checked for evidence of  
12 leakage. Visual inspection of the pond embankments, fences and liners and the measurement  
13 of pond freeboard would also be performed during normal operations. A Pond Inspection  
14 Program would be developed for the project and would meet the guidance contained in NRC  
15 Regulatory Guide 3.11 and commitments made by the applicant in section 5.3.2 of the TR (LCI,  
16 2008).

17 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
18 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
19 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
20 along with the actions proposed, are comparable to those described in the GEIS for Near  
21 Surface Aquifers and incorporates by reference the GEIS' conclusions that the impacts to Near  
22 Surface Aquifers during operation are expected to be MODERATE, but may be reduced to  
23 SMALL, providing monitoring and detection systems function properly, and responses are made  
24 quickly. Furthermore, while the NRC Staff has identified additional new information during its  
25 independent review; it nevertheless, does not change the expected environmental impact  
26 beyond what was described in the GEIS.

#### 27 4.5.2.1.2.2 *Operation Impacts to Production and Surrounding Aquifers*

28 The potential environmental impacts to groundwater supplies in the production and other  
29 surrounding aquifers are related to consumptive water use and groundwater quality.

30 **Water Consumptive Use:** As discussed in the GEIS (Section 4.2.4.2.2.2), groundwater is  
31 withdrawn and re-injected into the production zone during ISR operations. Most of the water  
32 withdrawn from the aquifer is returned to the aquifer. The portion that is not returned to the  
33 aquifer is referred to as consumptive use. The consumptive use is due primarily to production  
34 bleed (about 1 to 1.5% of groundwater withdrawal) and also includes other smaller losses. The  
35 production bleed is the net withdrawal maintained to ensure groundwater gradients toward the  
36 center of the production network. This net withdrawal ensures there is an inflow of groundwater  
37 into the well field to minimize excursions of lixiviant and its associated contaminants out of the  
38 well field.

39 Consumptive water use during ISR operations could potentially impact local water users who  
40 use water from the production aquifer outside the exempted zone. This potential impact would  
41 result from lowering the water levels in nearby wells thereby reducing the yield of these wells.  
42 In addition, if the production zone is hydraulically connected to other aquifers above and/or  
43 below the water zone, consumptive use may potentially impact the water levels in these  
44 overlying and underlying aquifers and reduce the yield in any nearby wells withdrawing water  
45 from these aquifers.

46 Assuming an average withdrawal rate over the life of the Lost Creek project of 656 Lpm (175  
47 gpm), the applicant has provided predictions of the drawdown (reduction in hydraulic head) at

1 the end of production/restoration operations (LCI, 2008b). The average withdrawal used in  
2 making these predictions is based on withdrawals during both production and restoration phase  
3 of the project. These predictions assume that all withdrawals are from the HJ Horizon and that  
4 the HJ Horizon is extensive and confined from above and below. The predictions also assume  
5 that the Fault acts as barrier to flow and, consequently, all flow comes from one side of the  
6 Fault. The drawdown at the end of production/restoration operations is predicted to be 53 m  
7 (177 ft) at 3.2 km (2 mi) from the centroid of production, 50 m (164 ft) at 4.8 km (3 mi) and 45 m  
8 (148 ft) at 8 km (5 mi). Actual drawdown during operations will be dependent on the behavior of  
9 the Fault barrier under production conditions and vertical flow from overlying and underlying FG  
10 and UKM aquifers. Leakage through these barriers would have the effect of reducing the  
11 drawdown relative to those predicted above. Excessive drawdown could also be mitigated by  
12 providing pumps to flowing wells that stop flow in response to mine unit groundwater  
13 withdrawals. Similarly, greater pumping capacity and/or drilling wells to a deeper level mitigate  
14 these impacts. The applicant has committed to a program of monitoring water levels in nearby  
15 wells and to provide additional pumping capacity, as necessary (LCI, 2008a).

16 As discussed in Section 3.5.3.1 of this EIS, fifteen wells have been identified within 8 km (5 mi)  
17 of the project area that could be impacted by drawdown. Water levels in any of these wells  
18 open to the HJ horizon could be significantly impacted. Although many of these wells are not  
19 installed at the same depth as the production wells, the estimated 3-degree dip (west) of the  
20 Battle Spring formation may allow potential drawdown to affect several shallower wells to the  
21 east and northeast. Because the assumption used in making the predictions that the HJ  
22 Horizon is extensive and confined may not be accurate, some groundwater may be drawn from  
23 overlying and underlying aquifer units during production as well. This would result in an  
24 accompanying reduction in water levels in wells penetrating these sands and could result in  
25 drawdowns in the nearby stock wells. Based on the information supplied by the applicant, three  
26 of the wells within an 8-km (5-mi) radius, particularly to the east and northeast of the facility,  
27 could be significantly impacted by consumptive use of groundwater during operation and  
28 restoration at the proposed facility. After production and restoration are complete and  
29 groundwater withdrawals are terminated at the Lost Creek ISR Project, water levels would tend  
30 to recover. However, the recharge in this area is limited and recovery may be slow. Rebound  
31 to pre-operation water levels may take many years to occur.

32 A reduction in water levels in nearby wells could increase the pumping requirements for these  
33 wells, with complete dewatering possible in two wells; P5112W/4775 and P8444P. It appears  
34 that one of the nearby BLM wells, P10696P, taps a confined aquifer that has sufficient hydraulic  
35 head for groundwater to flow to the surface by artesian pressure, negating the need for a pump.  
36 Reduction in hydraulic head at this well may stop it from naturally flowing to the surface and  
37 require a pump to raise water to the ground surface. Under the conservative drawdown  
38 scenario presented by the applicant, only a few (3) of the 15 stock wells would be adversely  
39 affected by ISR operations, hence the short-term impact of consumptive groundwater use  
40 during mine operation and restoration would expected to be MODERATE. Mitigation of  
41 excessive drawdown by the applicant during operation and restoration, using the methods  
42 mentioned earlier in this section would change this impact to SMALL. Although there would be  
43 potentially slow recovery of water levels to preoperational depths after restoration is complete,  
44 the available hydraulic head in the existing wells is great enough that the long-term  
45 environmental impact from consumptive use during the operational phase at Lost Creek is  
46 expected to be SMALL. Based on the foregoing analysis, site-specific conditions are consistent  
47 with the assumptions stated in the GEIS for a MODERATE impact assessment, as local water  
48 users near a well field could be affected in the short-term in the same aquifer.

1 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
2 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
3 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
4 along with the actions proposed, are comparable to those described in the GEIS for  
5 Consumptive Use to Production and Surrounding Aquifers and incorporates by reference the  
6 GEIS' conclusions that the impacts to Consumptive Use to Production and Surrounding Aquifers  
7 during operation are expected to be MODERATE, but may be reduced to SMALL, providing  
8 monitoring and detection systems function properly, and responses are made quickly.  
9 Furthermore, while the NRC Staff has identified additional new information during its  
10 independent review; it nevertheless, does not change the expected environmental impact  
11 beyond what was described in the GEIS.

12 **Excursions and Groundwater Quality:** As discussed in the GEIS, groundwater quality in the  
13 production zone is degraded as part of ISR operations. In Wyoming, the portion of the  
14 production aquifer used for the ISR process must be exempted as an underground source of  
15 drinking water by the U.S. Environmental Protection Agency. After production is completed, the  
16 licensee is required to initiate aquifer restoration activities to restore the production zone water  
17 quality to preoperational baseline levels, MCLs or ACLs. If the aquifer cannot be returned to  
18 preoperational baseline conditions, NRC requires that the production aquifer be returned to the  
19 MCLs provided in Table 5C of 10 CFR Part 40 Appendix A or to Alternate Concentration Limits  
20 (ACLs) approved by NRC. For proposed ACLs to be approved, they must be shown to be  
21 protective of public health at the site. For these reasons, potential impacts to the water quality  
22 of the uranium-bearing production zone aquifer as a result of ISR operations would generally be  
23 expected to be SMALL and temporary. Based on the foregoing analysis, site-specific conditions  
24 are consistent with the assumptions stated in the GEIS for a SMALL impact determination.

25 To prevent horizontal excursions, inward hydraulic gradients are expected to be maintained in  
26 the production aquifer during ISR operations. These inward hydraulic gradients are created by  
27 the net groundwater withdrawals (production bleeds of 1 to 1.5%) maintained through continued  
28 pumping during ISR operations. Groundwater flows in response to these inward hydraulic  
29 gradients, thus ensuring that groundwater flow is toward the production zone. This inward  
30 groundwater flow toward the extraction wells prevents horizontal excursions of lixiviant solutions  
31 away from the production zone.

32 The NRC also requires the licensee to take preventive measures to reduce the likelihood and  
33 consequences of potential excursions. A ring of monitoring wells within and encircling the  
34 production zone is required for early detection of horizontal excursions. If excursions are  
35 detected, corrective actions are required outside of the exempted portion of the production  
36 aquifer in order to control the excursions.

37 Vertical excursions may also potentially occur into aquifers overlying or underlying the  
38 production zone aquifer. As analysis presented in the GEIS indicates, the potential for migration  
39 of lixiviant solution into an overlying or underlying aquifer is small if the thickness of the aquitard  
40 separating the production zone from the overlying and underlying is sufficient and the  
41 permeability of the aquitard is low. Hydraulic gradient between the production zone and  
42 overlying or underlying aquifers also help to determine the potential for vertical excursions.  
43 Vertical excursions can also occur due to improperly sealed boreholes, to poorly completed  
44 wells, or to a loss of mechanical integrity of ISL injection and extraction wells. To ensure the  
45 detection of vertical excursions, NRC also requires monitoring in the overlying and underlying  
46 aquifers. A program of mechanical integrity testing of all ISL well is also required. Corrective  
47 action is required if any vertical excursions are detected.

1 In Section 2.11.4 of the GEIS, the NRC staff documented, that based on historical information,  
2 excursions have occurred at operating ISR facilities. Separately, the NRC staff analyzed the  
3 environmental impacts from both horizontal and vertical excursions at three NRC-licensed ISR  
4 facilities. In that analysis, which involved 60 events at the three facilities, the NRC staff found  
5 that, for most of the events, the licensees were able to control and reverse the excursions  
6 through pumping and extraction at nearby wells. Most excursions were short-lived, although a  
7 few continued for several years. In all cases, however, none resulted in environmental impacts  
8 (NRC, 2009b).

9 Many of the hydrogeologic conditions at the proposed Lost Creek ISL facility are similar to those  
10 found at other ISL facilities. Groundwater in the HJ production aquifer may be confined locally  
11 and the aquifer displays sufficient hydraulic conductivity to minimize excursions during ISL  
12 mining. The drawdown created by pumping in the production zone should facilitate containment  
13 of the lixiviant in the mining zone and allow the recovery of any horizontal or vertical excursions,  
14 should they occur. The site-specific hydrogeology, however, has several unique features that  
15 present challenges for the Lost Creek site. Foremost among these features is the Fault that runs  
16 through the project area (see Section 3.4 of this EIS). Displacement along the fault results in  
17 geologic beds that are offset across the Fault. Thus, the production zone, overlying, and  
18 underlying aquifers do not appear to be laterally continuous across the Fault. The Fault has  
19 also been shown to be a barrier to groundwater flow but does not appear to be impermeable.  
20 These factors present a number of complications when trying to ensure hydraulic control and  
21 monitoring of the production zone and overlying and underlying aquifers, particularly for those  
22 areas adjacent to the Fault. The fault may similarly complicate efforts to restore the aquifer.

23 In addition to the Fault, the extent of confinement provided by the overlying Lost Creek Shale  
24 and the underlying Sage Brush Shale is uncertain (See Sections 3.4 and 3.5.2.1 of this EIS).  
25 While these shales are areally extensive, large sections of the Sage Brush Shale are less than  
26 3.4 m (10 ft) thick in the proposed project area, and several areas of the Lost Creek Shale are  
27 less than 3.4 m (10 ft) thick in the proposed project area. Data presented by the applicant  
28 indicate that in some locations within the mining units these confining units are only 1.5 m (5 ft)  
29 thick. These areas of thinning in the overlying and underlying confining layers suggest that  
30 there may be some hydraulic connection between the production aquifer and the overlying and  
31 underlying aquifers. These concerns are supported by the results of the 2007 pumping tests.  
32 Minor responses in the overlying and underlying aquifer were observed during these tests. A  
33 number of potential causes for these responses have been suggested in addition to leakage  
34 across the confining layers, including potential impacts from off-site pumping, leakage through  
35 abandoned boreholes, or communication across the Fault. However, the cause of these  
36 responses observed in the overlying and underlying aquifers during the 2007 pumping tests  
37 have not been clearly identified.

38 The applicant indicates that each mine unit would be subject to further extensive testing during  
39 the Mine Unit Test required before initiating solution mine in each mine unit. This addition  
40 testing would employ a greater density of monitoring well within the production zone aquifer and  
41 overlying aquifer on both sides of the fault. This additional hydrologic testing would provide  
42 better information regarding the cause of the drawdown response in overlying and underlying  
43 wells. These results would be provided in the Mine Unit Data Packages, which require review  
44 and approval by the NRC. The applicant indicates that engineering practices are available to  
45 isolate the lixiviant from overlying and underlying aquifers, but has not provided supporting  
46 information. The applicant, however, must be able to design and install monitoring network that  
47 is capable of detecting both horizontal and excursions from the production zone, and must  
48 demonstrate that restoration is feasible.

1 This all being said, the aquifers bounding the proposed HJ production zone, as well as the HJ  
2 horizon itself, contain naturally high levels of radionuclides and exceed the WDEQ Class I, II  
3 and III and EPA primary drinking water standards for gross alpha, uranium, and combined Ra  
4 226 and 228. Consequently, any impacts to water quality due to excursions, either horizontally  
5 in the production zone or vertically into the bounding aquifer units, during operations are  
6 expected to be SMALL. Based on the foregoing analysis, site-specific conditions are consistent  
7 with the assumptions stated in the GEIS for a potentially SMALL environmental impact, so long  
8 as the applicant (LCI) installs and maintains the monitoring well network properly.

9 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
10 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
11 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
12 along with the actions proposed, are comparable to those described in the GEIS for Excursions  
13 and Groundwater Quality and incorporates by reference the GEIS' conclusions that the impacts  
14 to Excursions to Groundwater Quality during operation are expected to be MODERATE, but  
15 may be reduced to SMALL, providing monitoring and detection systems function properly, and  
16 responses are made quickly. Furthermore, while the NRC Staff has identified additional new  
17 information during its independent review; it nevertheless, does not change the expected  
18 environmental impact beyond what was described in the GEIS.

#### 19 4.5.2.1.2.3 *Operation Impacts to Deep Aquifers Below the Production Aquifers*

20 Potential environmental impacts to confined deep aquifers below the production aquifers could  
21 be due to deep well injection of processing wastes into deep aquifers. Under different  
22 environmental laws such as the Clean Water Act, the SDWA, and the Clean Air Act, the EPA  
23 has statutory authority to regulate activities that may affect the environment. Underground  
24 injection of fluid requires a permit from the EPA or from an authorized state UIC program. The  
25 WDEQ has been authorized to administer the UIC program in Wyoming and is responsible for  
26 issuing any permits for deep well disposal at the Lost Creek site.

27 The GEIS indicates that the potential environmental impact of disposal of leaching solution into  
28 deep aquifers below ore-bearing aquifers would be expected to be SMALL, if water production  
29 from deep aquifers is not economically feasible or the groundwater quality from these aquifers is  
30 not suitable for domestic or agricultural uses (e.g., high salinity), and they are confined above by  
31 sufficiently thick and continuous low permeability layers.

32 The GEIS (Section 4.2.4.2.2.3) indicates that in the Wyoming West Uranium Milling Region,  
33 where the Lost Creek ISR Project is located, the Cretaceous Mesa Verde aquifer included in the  
34 Upper Colorado River Basin aquifer system is typically deeply buried, contain saline water and  
35 are not commonly tapped for water supply (Whitehead, 1996). The Mesa Verde aquifer is  
36 separated from the overlying aquifers (including the ore-bearing aquifer) by the regionally  
37 extensive Lewis Shale. Hence, the Mesa Verde aquifer could be suitable for disposal of brine  
38 solutions and other liquid wastes.

39 Lost Creek plans to dispose of waste fluids using deep well injection and is seeking a permit for  
40 a Class I injection well from the WDEQ. The WDEQ would evaluate the suitability of the  
41 proposed deep injection wells. The WDEQ would only grant such a permit if the waste fluids  
42 can be suitably isolated in a deep aquifer and not affect any overlying potable aquifers.  
43 Consequently, it is assumed that the potential environmental impact to deep aquifers below the  
44 production aquifers of deep well injection of waste would be SMALL. Based on the foregoing  
45 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
46 Therefore, impacts from operation are expected to be SMALL.

1 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
2 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
3 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
4 along with the actions proposed, are comparable to those described in the GEIS for Deep  
5 Aquifers Below the Production Aquifer and incorporates by reference the GEIS' conclusions that  
6 the impacts to Deep Aquifers Below the Production Aquifer during operation are expected to be  
7 SMALL. Furthermore, while the NRC Staff has identified additional new information during its  
8 independent review; it nevertheless, does not change the expected environmental impact  
9 beyond what was described in the GEIS.

#### 10 4.5.2.1.3 Aquifer Restoration Impacts to Groundwater

11 As indicated in GEIS (Section 4.2.4.2.3), the potential environmental impacts to groundwater  
12 resources during aquifer restoration are related to groundwater consumptive use and waste  
13 management practices, including discharge to waste storage ponds, and potential deep  
14 disposal of brine slurries resulting from reverse osmosis. In addition, aquifer restoration directly  
15 affects groundwater quality in the vicinity of the well field being restored.

16 Lost Creek is planning three phases of restoration: groundwater sweep, groundwater treatment,  
17 and recirculation. A reductant may be added anytime to the fluids circulated during restoration  
18 to lower the oxidation potential of the production zone, in order to render uranium less mobile.  
19 During groundwater sweep, water is pumped from the mine unit, without re-injection, resulting in  
20 an influx of baseline quality water from the perimeter of the mine unit. This baseline quality  
21 water effectively sweeps the affected portion of the aquifer. Following the sweep phase, water  
22 would be pumped from the mine unit to treatment equipment and then re-injected into the mine  
23 unit. Ion exchange and reverse osmosis circuits are used during this phase to treat the  
24 groundwater. At completion of the groundwater treatment phase in a mine unit, recirculation  
25 would be initiated. Recirculation consists of pumping from the mine unit and re-injecting the  
26 recovered solution to recirculate solutions and homogenize the groundwater conditions.

27 Regardless of the process, hydraulic control of the former production zone must be maintained  
28 during restoration. This is accomplished by maintaining an inward hydraulic gradient through a  
29 production bleed (see Section 4.5.2.1.4). As discussed in the GEIS, the impacts of consumptive  
30 use during aquifer restoration are generally greater than during ISR operations. This is  
31 particularly true during the sweep phase when a greater amount of groundwater is generally  
32 withdrawn from the production aquifer. During the sweep phase, groundwater is not re-injected  
33 into the production aquifer and all withdrawals are considered consumptive.

34 As discussed in Section 4.5.2.1.4 of this SEIS, the applicant has provided predictions of  
35 drawdown based on an average consumptive use of 656 Lpm (175 gpm) during the project  
36 period. The applicant plans to concurrently restore individual well fields while moving on to ISR  
37 operations at other areas. Thus, it is anticipated that only a limited portion of the proposed  
38 wellfields would be in restoration phase at any particular time. This mix of well fields in  
39 production and restoration was considered when developing the above estimate of average  
40 consumptive use. As discussed in Section 4.5.2.1.4, significant drawdown in hydraulic head  
41 have been calculated. The drawdown at the end of production/restoration operations is  
42 predicted to be 53 m (177 ft) at 3.2 km (2 mi) from the centroid of production 50 m (164 ft) at 4.8  
43 km (3 mi), and 45 m (148 ft) at 8 km (5 mi). Although the prediction is for drawdown in the HJ  
44 Horizon based on the assumption that the HJ Horizon is fully confined above and below, there  
45 may be potential cause drawdown in units overlying and underlying the HJ Horizon which can  
46 impact water levels and groundwater usage in a number of nearby stock wells. Consequently,  
47 the temporary impact of consumptive groundwater use during aquifer restoration is likely to be  
48 MODERATE. These temporary effects could span many years; however, the final impact would

1 likely be SMALL since water levels should eventually recover after aquifer restoration is  
2 complete.

3 A network of buried pipelines is used during ISR restoration for transporting restoration fluids  
4 between the pump house and the satellite or main processing facility and also to connect  
5 injection and extraction wells to manifolds inside the pumping header houses. Although the  
6 liquids carried in these pipes during restoration are less potent, the failure of pipeline fittings or  
7 valves, or failures of well mechanical integrity in shallow aquifers could result in leaks and spills  
8 of these fluids, which could impact water quality in shallow aquifers. Similarly, the waste  
9 storage ponds would operate and could result in leakage to shallow groundwater. These  
10 potential impacts to shallow groundwater have previously been evaluated in Section 4.5.2.1.4.  
11 As this evaluation indicated, the potential environmental impact to shallow aquifer during the  
12 restoration phase from releases from the surface would be SMALL.

13 The disposal of waste fluids via deep well injection of waste is planned during aquifer restoration  
14 in much the same manner as during ISR operation. As previously indicated in Section 4.5.2.1.4,  
15 it is assumed that the potential environmental impact to deep aquifers below the production  
16 aquifers of deep well injection of waste would be SMALL. Based on the foregoing analysis, site-  
17 specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts  
18 from aquifer restoration are expected to be SMALL.

19 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
20 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
21 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
22 along with the actions proposed, are comparable to those described in the GEIS for  
23 Groundwater and incorporates by reference the GEIS' conclusions that the impacts to  
24 Groundwater during aquifer restoration are expected to be MODERATE, but may be reduced to  
25 SMALL, providing monitoring and detection systems function properly, and responses are made  
26 quickly. Furthermore, while the NRC Staff has identified additional new information during its  
27 independent review; it nevertheless, does not change the expected environmental impact  
28 beyond what was described in the GEIS.

#### 29 4.5.2.1.4 Decommissioning Impacts to Groundwater

30 The environmental impacts to groundwater during dismantling and decommissioning ISR  
31 facilities are primarily associated with consumptive use of groundwater, potential spills of fuels  
32 and lubricants, and well abandonment. The consumptive groundwater use could include water  
33 use for dust suppression, re-vegetation, and reclaiming disturbed areas. The potential  
34 environmental impacts during the decommissioning phase are expected to be similar to  
35 potential impacts during the construction phase. Groundwater consumptive use during the  
36 decommissioning activities would be less than groundwater consumptive use during ISR  
37 operation and groundwater restoration activities. Spills of fuels and lubricants during  
38 decommissioning activities could impact shallow aquifers. Implementation of BMPs during  
39 decommissioning can help to reduce the likelihood and magnitude of such spills and facilitate  
40 cleanup. Based on consideration of BMPs to minimize water use and spills, potential  
41 environmental impacts to the groundwater resources in shallow aquifers from decommissioning  
42 would be expected to be SMALL.

43 After ISR operations are completed, improperly abandoned wells could impact aquifers above  
44 the production aquifer by providing hydrologic connections between aquifers. As part of the  
45 restoration and reclamation activities, all monitoring, injection, and production wells would be  
46 plugged and abandoned in accordance with the Wyoming UIC program requirements. The  
47 wells would be filled with cement and clay and then cut off below plough depth to ensure that  
48 groundwater does not flow through the abandoned wells (Stout and Stover, 1997). If this

1 process is properly implemented and the abandoned wells are properly isolated from the flow  
2 domain, the potential environmental impacts would be expected to be SMALL. Based on the  
3 foregoing analysis, site-specific conditions are consistent with the assumptions stated in the  
4 GEIS (NRC, 2009).

5 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
6 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
7 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
8 along with the actions proposed, are comparable to those described in the GEIS for  
9 Groundwater and incorporates by reference the GEIS' conclusions that the impacts to  
10 Groundwater during decommissioning are expected to be SMALL. Furthermore, the NRC Staff  
11 has not identified new and significant information during its independent review that would  
12 change the expected environmental impact beyond what was described in the GEIS.

#### 13 4.5.2.2 *No-Action (Alternative 2)*

14 The No-Action Alternative would result in no construction or operational activities on site that  
15 might impact shallow groundwater. This alternative also would not require the injection of  
16 lixiviant into the production aquifer or the consumptive use of groundwater. The disposal of  
17 waste liquids and solids would no longer be necessary and therefore would pose no threat to  
18 groundwater quality or affect the functioning of existing BLM stock wells in the affected  
19 environment. Consequently, the No-Action alternative would result in no impacts to  
20 groundwater.

#### 21 4.5.2.3 *Dry Yellowcake (Alternative 3)*

22 Alternative 3 would include issuing LCI a license for the construction, operation, aquifer  
23 restoration, and decommissioning of facilities for ISR uranium milling, but processing the  
24 recovered uranium into a dry powder instead of a yellowcake slurry. The potential  
25 environmental impacts to groundwater for this alternative would not differ from those identified  
26 for the proposed action. Consequently, the potential environmental impacts to groundwater for  
27 Alternative 3 are identical to those identified for the proposed action.

### 28 **4.6 Ecological Resources Impacts**

29 Potential environmental impacts to ecological resources at the Lost Creek site, to both flora and  
30 fauna, may occur during all phases of the ISR facility's lifecycle. Impacts may include the  
31 removal of vegetation from the site (with the associated reduction in wildlife habitat and forage  
32 productivity and an increased risk of soil erosion and weed invasion); the modification of existing  
33 vegetative communities as a result of site activities; the loss of sensitive plants and habitats;  
34 and the potential spread of invasive species and noxious weed populations. Concerning  
35 wildlife, impacts may involve loss, alteration, and/or incremental fragmentation of habitat;  
36 displacement of and stresses on wildlife; and direct and/or indirect mortalities.

37 Detailed discussion of the potential environmental impacts to ecological resources from  
38 construction, operation, aquifer restoration, and decommissioning are provided in the following  
39 sections.

#### 40 **4.6.1 Proposed Action (Alternative 1)**

##### 41 4.6.1.1 *Construction Impacts*

42 As discussed in the GEIS (Section 4.2.5.1), during construction, terrestrial vegetation may be  
43 affected through (1) the removal of vegetation from the milling site (and associated reduction in  
44 wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion);

1 (2) the modification of existing vegetative communities; (3) the loss of sensitive plants and  
2 habitats as a result of clearing and grading; and (4) the potential spread of invasive species and  
3 noxious weed populations.

4 Ecological resources could be affected from the land disturbance of ISR facility construction.  
5 Construction would involve vegetation removal during clearing for facilities (e.g., individual well  
6 sites, header houses, the plant, roads, parking, lay down areas, and storage ponds), which  
7 would result in destruction of habitats and relocation of mobile wildlife. Facility construction  
8 would be completed in phases, with restoration following each stage to minimize impacts to  
9 vegetation and wildlife.

10 The off-site impacts of construction would be minimal. Construction activities would produce a  
11 minor increase in vehicle traffic and, hence, could increase the potential number of animals  
12 killed on the roadways. Construction would also produce a temporary increase in dust, some of  
13 which could be deposited on vegetation both on- and off-site. However, vegetation in this  
14 naturally dusty, arid region is expected to be adapted to moderate, temporary increases of dust  
15 coverage.

#### 16 4.6.1.1.1 Construction Impacts to Terrestrial Ecology

##### 17 4.6.1.1.1.1 *Construction Impacts to Vegetation*

18 As further indicated in the GEIS, the percent of vegetation removed and land disturbed by  
19 construction activities (from less than 1 percent up to 20 percent of the permit area) would be a  
20 SMALL impact in comparison to the total permit area and surrounding plant communities.  
21 Additionally, the clearing of herbaceous vegetation in an open grassland or shrub steppe  
22 community is expected to have a short-term, SMALL impact given the rapid colonization by  
23 annual and perennial species in the disturbed areas and restoration of the vegetative cover.  
24 The clearing of wooded areas may have a long-term impact given the pace of natural  
25 succession, and such impacts would be SMALL to MODERATE, depending on the amount of  
26 the surrounding wooded area. Noxious weeds are expected to be controlled with appropriate  
27 spraying techniques and therefore, impacts would be SMALL (NRC, 2009).

28 ISR uranium recovery facility construction primarily affects terrestrial vegetation through: (1) the  
29 removal of vegetation from the facility site during construction; (2) the modification of existing  
30 vegetative communities as a result of maintenance; (3) the loss of sensitive plants and habitats  
31 as a result of construction clearing and grading; and (4) the potential spread of invasive species  
32 and noxious weed populations as a result of construction (NRC, 2009).

33 During the life of the proposed Lost Creek project, the land area that would be disturbed would  
34 be about 115 ha (285 ac, or 7 percent) of the approximate total project area of 1,709 ha (4,220  
35 ac). Of these 115 disturbed hectares (285 ac), 23.5 ha (58 ac) would be stripped of vegetation.  
36 The remaining 91.9 ha (227 ac) would be part of the mine units, consisting of the production  
37 well fields and monitoring rings, and would be disturbed during periods of access to these  
38 areas. However, Lost Creek operations would be conducted in a series of six mine units that  
39 are installed, produced, and reclaimed sequentially; therefore, only small portions of the project  
40 area would be disturbed at a given time. The approximate land areas of various habitat types  
41 that would be stripped and disturbed are presented below in Table 4-1. Unless otherwise  
42 arranged and approved by the relevant agencies, all disturbed areas would be reclaimed to  
43 support the pre-operational land uses, livestock grazing and wildlife habitat.

44 The construction of the CPP, main access roads, surface impoundments, and mine units would  
45 involve removal of vegetation and soil to create level ground for building construction. This  
46 would occur within the big sagebrush community type. Topsoil would be removed and  
47 temporarily stockpiled on the site for future decommissioning and habitat restoration efforts.

1 The processing plant, roads, and impoundments would have long-term disturbance (the life of  
 2 the project), while the mine unit areas would have a shorter period of disturbance  
 3 (approximately two years). To stabilize soils and support the ecosystem, vegetation would be  
 4 established at disturbed areas with the approved BLM and WDEQ native seed mixture as soon  
 5 as conditions allow. Only a relatively small portion of vegetation would be affected compared to  
 6 the overall project area. Impacts from mud pit and pipeline constructions would be short-term,  
 7 with re-grading and seeding beginning immediately upon completion of construction.

8 Surface disturbance increases the susceptibility of the project area to invasive and noxious  
 9 weeds, including Canada Thistle (*Cirsium arvense*), Russian Knapweed (*Centaurea maculosa*),  
 10 Perennial Pepperweed (*Lepidium latifolium*), and Quackgrass (*Elytrigia repens*). These species  
 11 are perennial and may quickly invade large areas depending on the season of the year. As  
 12 such, surface disturbance would be minimized and vehicular access would be restricted to  
 13 specific roads (LCI, 2008a). Disturbed areas would be temporarily reseeded with WDEQ and  
 14 BLM approved seed mixture, as soon as conditions allow, preventing the establishment of  
 15 competitive weeds. Invasive and noxious weeds would be monitored and if they become an  
 16 issue, other alternatives, such as spot-spray herbicide application, would be considered. The  
 17 revegetation methods are detailed in the applicant's Plan of Operations submitted to the BLM  
 18 (LCI, 2008c).

19 There are no known federally-listed endangered plant species within the project area.  
 20 Therefore, no impacts to listed species are expected, and no mitigation is needed.

21 Therefore, from the foregoing analysis, site-specific conditions are consistent with the  
 22 assumptions stated in the GEIS. Therefore, impacts to vegetation from construction are  
 23 expected to be SMALL. Based on the disturbed land area compared to the total project area,  
 24 some individual plants would be affected, but impacts would not generally affect a sizeable  
 25 segment of the plant species' population over a relatively large area.

26 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
 27 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
 28 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
 29 along with the actions proposed, are comparable to those described in the GEIS for Vegetation  
 30 and incorporates by reference the GEIS' conclusions that the impacts to Vegetation during  
 31 construction are expected to be SMALL. Furthermore, while the NRC Staff has identified  
 32 additional new information during its independent review; it nevertheless, does not change the  
 33 expected environmental impact beyond what was described in the GEIS.

**Table 4-1. Stripped and Disturbed Land by Vegetation Type**

Disturbance Location	Term of Disturbance <sup>1</sup>	Disturbed Vegetation - hectares (acres)				Total Stripped Area hectares (acres)	Total Disturbed Area hectares (acres)
		Upland Big Sagebrush Shrubland		Lowland Big Sagebrush Shrubland			
		Stripped	Disturbed	Stripped	Disturbed		
<b>ROADS</b>							
Permanent main access road	LT	4.0 (9.8)	4.0 (9.8)	0.6 (1.6)	0.6 (1.6)	4.6 (11.4)	4.6 (11.4)
Permanent main roads	LT	1.2 (2.9)	1.2 (2.9)	0.2 0.2(0.5)	0.2 (0.5)	1.4 (3.4)	1.4 (3.4)

Secondary roads	LT	1.6 (3.9)	IPA <sup>3</sup>	0.2 (0.6)	IPA	1.8 (4.5)	IPA
Two-track roads (OPA) <sup>2</sup>	LT	0	1.0 (2.5)	0	0.2 (0.4)	0	1.2 (2.9)
<b>PIPELINES AND HEADER HOUSES</b>							
Header Houses	LT	0.1 (0.3)	IPA	<0.1 (0.1)	IPA	>0.1 (0.4)	IPA
Main Pipeline Ditch	ST	0.4 (0.9)	0.4 (0.9)	<0.1 (0.1)	<0.1 (0.1)	0.4 (1.0)	0.4 (1.0)
Secondary lines (OPA)	ST	0.5 (1.3)	0.5 (1.3)	0.1 (0.2)	0.1 (0.2)	0.6 (1.5)	0.6 (1.5)
Tertiary lines	ST	1.9 (4.6)	IPA	0.3 (0.8)	IPA	2.2 (5.4)	IPA
<b>MUD PITS</b>							
Mud Pits (I/P wells)	ST	3.6 (9.0)	IPA	0.6 (1.4)	IPA	4.2 (10.4)	IPA
Mud Pits (Monitoring wells)	ST	0.4 (1.1)	0.4 (1.1)	<0.1 (0.1)	<0.1 (0.1)	0.5 (1.2)	0.5 (1.2)
Mud Pits (Delineation Holes)	ST	2.6 (6.4)	IPA	0.4 (1.0)	IPA	3.0 (7.4)	IPA
<b>FIELD CONSTRUCTION LAYDOWN AREAS</b>	ST	0.5 (1.2)	IPA	0.1 (0.2)	IPA	0.6 (1.4)	IPA
<b>PATTERN AREAS</b>	MT	--	88.7 (219)	--	14.2 (35)	--	102.9 (254)
<b>PLANT COMPOUND</b>	LT	2.1 (5.1)	3.5 (8.6)	2.0 (4.9)	0.6 (1.4)	4.0 (10.00)	4.0 (10.00)
<b>Totals</b>		18.8 (46.5)	99.6 (246.1)	4.7 (11.5)	15.9 (39.3)	23.5 (58.0)	115.5 (285.4)

Reference: LCI, 2008a

<sup>1</sup> LT = long term (greater than or equal to the Project life)

MT = mid-term (mine unit life- 3years)

ST = short term (two weeks to six months)

<sup>2</sup> OPA=the portion that is Outside Pattern Areas

<sup>3</sup> IPA = Inside Pattern Areas (production field + monitoring ring = mine unit)

1                   4.6.1.1.1.2 *Construction Impacts to Wildlife*

2   The GEIS also states that, in general, wildlife species are expected to disperse from the project  
3   area as construction activities approach, although smaller, less mobile species may die during  
4   clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect  
5   mortalities are possible, and thus construction impacts would be SMALL to MODERATE (NRC,  
6   2009). These impacts could be mitigated if standard management practices issued by the  
7   Wyoming Game and Fish Department (WGFD) are followed. Impacts to sage grouse and big  
8   game species could also be mitigated if BLM and WGFD guidelines are followed. Impacts to  
9   raptor species from power distribution lines could be mitigated by following the Avian Power  
10  Line Interaction Committee (APLIC) guidance, and avoid disturbing areas near active nests and  
11  prior to the fledgling of young (APLIC 2006).

12 Direct wildlife habitat loss from construction is estimated to be approximately 7 percent of the  
13 project area (LCI, 2008). The two major vegetation/habitat types disturbed by project  
14 construction include Lowland and Upland Big Sagebrush Shrub land. Project construction  
15 would result in the long-term loss of about 1.6 ha (4 ac) of Lowland Big Sagebrush Shrub land  
16 and 9.7 ha (24 ac) of Upland Big Sagebrush Shrub land (Table 4-1). In addition, approximately  
17 14.2 ha (35 ac) of Lowland Big Sagebrush Shrub land and 89.8 ha (222 ac) of Upland Big  
18 Sagebrush Shrub land would be temporarily disturbed, e.g., without total removal of vegetation  
19 (Table 4-1).

20 The Lowland Big Sagebrush Shrub land habitat had the highest diversity and density of nesting  
21 birds at the project area (LCI, 2008b). Long-term loss of 1.6 ha (4 ac) of Lowland Big  
22 Sagebrush Shrub land habitat would occur with project construction. Depending on the timing  
23 of construction, direct mortality of individuals or loss of nests could occur.

24 During the construction phase of the project, impacts to small mammals, reptiles, and  
25 amphibians would include habitat loss and possibly direct mortality due to contact with  
26 equipment. Because only a small percent of the total project area would be disturbed, most  
27 species are likely to disperse to neighboring areas with minimal habitat loss. Construction  
28 activities are not expected to measurably affect any wildlife species' populations; therefore,  
29 impacts from construction to wildlife would be SMALL.

30 Direct impacts to passerine birds, small mammals, reptiles, and amphibians could include  
31 mortality from motor vehicle collisions with the addition of traffic due to construction; however,  
32 these impacts would be SMALL because they would affect only a few individuals and would not  
33 be expected to have any long-term impacts on the general population of the individual species.

34 Indirect impacts to passerine birds would include the displacement of shrub-dependent species  
35 while construction activities are on going. Birds are mobile and would likely disperse into  
36 adjacent habitat areas where there is an abundance of similar habitat. Impacts to passerine  
37 birds would not be expected to be outside the natural range of variability and would not be  
38 expected to have any long-term impacts on the general population. Based on the foregoing  
39 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
40 Therefore, impacts to wildlife from construction are expected to be SMALL.

41 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
42 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
43 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
44 along with the actions proposed, are comparable to those described in the GEIS for Wildlife and  
45 incorporates by reference the GEIS' conclusions that the impacts to Wildlife during construction  
46 are expected to be MODERATE, but may be reduced to SMALL, by following exclusionary  
47 periods for specified species. Furthermore, while the NRC Staff has identified additional new

1 information during its independent review; it nevertheless, does not change the expected  
2 environmental impact beyond what was described in the GEIS.

### 3 Big Game

4 All wildlife management practices are established in conjunction with the BLM, WGFD and  
5 USFWS guidelines. The applicant would implement measures and BMPs in order to minimize  
6 and mitigate impacts to wildlife. These measures are designed to be consistent with regional  
7 recommendation by land and wildlife management agencies (BLM, 2008a; WGFD 2008; and  
8 WGFD 2009). These measures would also help minimize impacts to plant communities.  
9 Standard construction, erosion control, and other BMPs described in other sections would also  
10 help to minimize ecological impacts.

#### 11 *Road and Right of Way Measures*

- 12 • Main access roads would be upgraded and access roads within the project  
13 area would use existing two-track roads to the extent possible to help  
14 minimize new disturbance of sagebrush habitat. The roads would be  
15 upgraded or constructed following BLM and WGFD recommendations to  
16 minimize the road width, re-vegetate road shoulders, and limit vehicular  
17 speeds.
- 18 • All utilities would be located in the same ROW. The proposed pipeline and  
19 transmission line would be placed in or adjacent to the access road ROW to  
20 help minimize habitat impacts where possible.
- 21 • All Project access by employees and visitors would be restricted to the main  
22 access road.
- 23 • Existing two-track roads that are adjacent to the main access road and  
24 project facilities would be gated and or signed to help prevent additional  
25 traffic disturbances in the area. This measure would help prevent  
26 disturbance of nesting raptors and sage-grouse leks.

#### 27 *Fencing and Screening Measures*

- 28 • Well fields would be fenced to keep out cattle and wild horses and would be  
29 designed to minimize mortality rates. Fences would be temporary and would  
30 be removed after ISR operations at the well field are complete. Fences  
31 would be constructed to BLM specifications.
- 32 • All mud pits outside of fenced areas would be fenced during the drilling  
33 phase, while the pits are open and contain drilling liquid.
- 34 • If the fluid in the storage ponds is determined to be harmful to birds, netting or  
35 other appropriate deterrents would be placed to eliminate any hazard to  
36 migratory birds, sage-grouse or other wildlife. The deterrent would be  
37 consistent with agency recommendations.
- 38 • Vent pipes would be covered by netting or other methods to prevent bats,  
39 birds, or small mammals from being trapped.

#### 40 *Transmission Lines*

- 41 • To prevent the electrocution of raptors in the project area, the primary  
42 transmission line and power poles would be built to the latest approved  
43 methods (APLIC, 2006). This would include cross-arm design, transformer  
44 design, and perch guards.

- 1 • To help minimize raptor roosting on power poles and to minimize predation  
2 on sage grouse, appropriate roost guards would be attached to power poles  
3 and cross arms. The design would follow BLM guidelines (Oles, 2007) or  
4 other appropriate guidelines.
- 5 • Secondary and tertiary transmission lines would be buried in order to  
6 minimize risks to raptors and large birds.

7 *Restoration/Reclamation*

- 8 • Reclamation would be phased during all stages of the construction and  
9 operation of the operations plan. Areas that are temporarily disturbed would  
10 be restored and reseeded after disturbance at the next available seeding  
11 opportunity. Temporary access roads would be restored and reseeded when  
12 no longer needed. Non-maintained road shoulders would be seeded and left  
13 undisturbed.
- 14 • All seed mixes used for restoration would be approved by the BLM. Only  
15 native species would be used in seed mixes. All seed mixes designed for  
16 permanent restoration would include sagebrush.
- 17 • Weed control is an important issue for restoration and protection of existing  
18 habitats for sage grouse and other species, and plant communities. Weed  
19 prevention measures following BLM guidelines and recommendations would  
20 be implemented (BLM, 1996 and 2008).

21 *Reduce Human Disturbance and Incidental Loss of Wildlife*

- 22 • It is important that all employees be informed of applicable wildlife laws and  
23 penalties associated with unlawful taking and harassment of wildlife.
- 24 • It is also required that employees undergo training that describes: 1) the  
25 types of wildlife in the area susceptible to collisions with motor vehicles; 2)  
26 the circumstances when collisions are most likely to occur; and 3) measures  
27 that should be taken to avoid wildlife/vehicle collisions.
- 28 • All new and improved roads related to the project are required to be signed  
29 and or gated to minimize public traffic.
- 30 • All two-track roads that connect to project access road(s) would be signed or  
31 gated as needed to minimize disturbance of nesting ferruginous hawks or  
32 sage-grouse leks. This would be coordinated with appropriate staff from the  
33 BLM and/or WGFD.
- 34 • Prior to any ground disturbance activities in potential sage-grouse nesting  
35 habitat, a survey would be completed for sage grouse and sage grouse nests  
36 following BLM guidelines.

37 *Wildlife Closures and Timing Windows*

- 38 • The wildlife species in the following table have been selected by the BLM and  
39 WGFD as needing stipulations during development activities to protect their  
40 populations and habitats. Although not all of these species are present in the  
41 project area, the standard wildlife exclusion periods recommended by the  
42 BLM and WGFD are presented in Table 4-2. The applicant would follow  
43 exclusion periods, as applicable, by species during construction and  
44 operation to protect key wildlife resources in the project area (LCI, 2008).

1

Table 4-2. Seasonal Wildlife Stipulations		
Affected Areas/Species	Restriction	Restricted Area
Big game crucial winter ranges	November 15–April 30	Antelope, elk, moose, bighorn sheep, and mule deer crucial winter ranges
Parturition areas	May 1–June 30	Identified parturition areas
Sage-grouse non-core area	(1) Prohibit surface disturbance/occupancy year round; March 1–May 20 avoid human activity 6:00 p.m.–9:00 a.m. (2) Avoid surface disturbing activities March 15–July 15	(1) Within ¼ mile of occupied sage-grouse leks (2) Within 2-mile radius for sage-grouse identified nesting/early brood rearing habitat
Sage-grouse core area	See Stipulations for Development in Core Sage-grouse Population Areas (WGFD, 2009; Appendix C)	See Stipulations for Development in Core Sage-grouse Population Areas (WGFD, 2009; Appendix C)
Sage-grouse winter concentration areas	November 15–March 14	Within identified winter habitat
Mountain plover	April 10–July 10	Potential and occupied habitat
Burrowing owl	April 15–September 15	Within ¾-mile radius
Ferruginous hawk nest	March 1–July 31	Within 1-mile radius
Golden eagle nest	February 1–July 15	Within 1-mile radius
Goshawk nest	April 1–August 31	Within ¾-mile radius
Great horned owl nest	February 1–July 15	Within ¾-mile radius
Kestrel nest	April 1–July 31	Within ¾-mile radius
Merlin nest	April 1–July 31	Within ¾-mile radius
Northern harrier nest	April 1–July 31	Within ¾-mile radius
Peregrine falcon nest	March 1–July 31	Within ¾-mile radius
Prairie falcon nest	April 1–July 31	Within ¾-mile radius
Red-tailed hawk nest	February 1–July 15	Within ¾-mile radius
Short-eared owl nest	March 1–July 31	Within ¾-mile radius
Swainson's hawk nest	April 1–July 31	Within ¾-mile radius
Other raptor nests	February 1–July 15	Within ¾-mile radius
Active raptor nests	Year round	Within 825 feet (ferruginous hawks, 1,200 feet)
Big game crucial winter ranges	November 15–April 30	Antelope, elk, moose, bighorn sheep, and mule deer crucial winter ranges

Table 4-2. Seasonal Wildlife Stipulations		
Affected Areas/Species	Restriction	Restricted Area
Parturition areas	May 1–June 30	Identified parturition areas
Sage-grouse non-core area	(1) Prohibit surface disturbance/occupancy year round; March 1–May 20 avoid human activity 6:00 p.m.–9:00 a.m.  (2) Avoid surface disturbing activities March 15–July 15	(1) Within ¼ mile of occupied sage-grouse leks  (2) Within 2-mile radius for sage-grouse identified nesting/early brood rearing habitat
Sage-grouse core area	See Stipulations for Development in Core Sage-grouse Population Areas (Appendix C of WGFD, 2009)	See Stipulations for Development in Core Sage-grouse Population Areas (Appendix C of WGFD, 2009)
Sage-grouse winter concentration areas	November 15–March 14	Within identified winter habitat
Mountain plover	April 10–July 10	Potential and occupied habitat
Burrowing owl	April 15–September 15	Within ¼-mile radius

1 Source: BLM, 2008b; WGFD, 2009.

2 4.6.1.1.1.3 *Wildlife Enhancements*

3 LCI would work with the BLM and WGFD to complete wildlife enhancements in the project area  
 4 or nearby areas that are not proposed for operations or disturbance. These enhancements  
 5 could include placement of new raptor nest platforms, creation of new water sources, or habitat  
 6 modifications/improvements to improve specific habitat conditions for sage-grouse or other high  
 7 interest species. All seeding would be completed with native species; sagebrush would be  
 8 included in all seed mixes.

9 4.6.1.1.2 Construction Impacts to Big Game

10 The project area provides winter/year-long range to pronghorn antelope and is not considered  
 11 mule deer range, but is considered transitional range for elk. The project site also provides  
 12 range to the Stewart Creek and Lost Creek wild horse herds (BLM, 2004). Because the site  
 13 provides only marginal habitat to mule deer and elk, no impacts on these species are  
 14 anticipated. There would be no impact to big-game critical or key winter or summer ranges or  
 15 migration corridors (University of Wyoming, 2008).

16 About 115 ha (285 ac) of pronghorn antelope and wild horse habitat (Lowland and Upland Big  
 17 Sagebrush Shrub land) would be disturbed by project construction. Direct impacts to pronghorn  
 18 antelope and wild horses may include direct loss and modification of habitat, increased mortality  
 19 from increased traffic on local and regional roads, and increased disturbances due to human  
 20 presence. Direct impacts to pronghorn antelope and wild horses would be SMALL because  
 21 they would affect only a few individuals and are not expected to threaten the continued  
 22 existence of the species' population in the project area.

23 Indirect impacts to pronghorn antelope and wild horses may include displacement from  
 24 increased human activity and increased poaching and/or harvest from improved access on new  
 25 roads. In addition, increased human presence due to construction and operation would affect  
 26 pronghorn antelope and wild horse use of areas adjacent to the project. Pronghorn antelope

1 have been shown to become habituated to increased traffic volumes and heavy equipment if the  
2 traffic and equipment move in a predictable way (Reeve, 1984). However, initial well drilling  
3 activities and unpredictable traffic flows may cause pronghorn to disperse from the area. Some  
4 long-term disturbance (during the life of the milling operation) of pronghorn antelope habitat  
5 would occur with project construction. Pronghorn antelope displacement of up to 1.0 km (0.6  
6 mi) has been observed from construction activities (Easterly et al., 1991). There is adequate  
7 pronghorn antelope habitat in the surrounding area and antelope would possibly return to the  
8 project area once initial construction activities have concluded. Wild horses are more transitory  
9 and would likely move away from areas of human disturbance. Vegetative forage losses due to  
10 construction would be mitigated via staged reclamation of disturbed areas providing grass and  
11 forb forage within a few years of habitat disturbance. Indirect impacts to pronghorn antelope  
12 and wild horses would be SMALL because these species are highly mobile and long-term  
13 impacts on the total population of these species are not anticipated.

14 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
15 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
16 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
17 along with the actions proposed, are comparable to those described in the GEIS for Big Game  
18 and incorporates by reference the GEIS' conclusions that the impacts to Big Game during  
19 construction are expected to be SMALL. Furthermore, while the NRC Staff has identified  
20 additional new information during its independent review; it nevertheless, does not change the  
21 expected environmental impact beyond what was described in the GEIS.

#### 22 Sage-Grouse

23 No active sage-grouse leks are located in the project area; however, six active leks are located  
24 within the 3.2-km (2.0 mi) buffer zone (LCI, 2008b). The potential impacts to sage-grouse that  
25 may be associated with construction activities include loss of nesting/brood-rearing habitat, loss  
26 of wintering habitat, decreased population productivity due to loss of nesting/brood-rearing  
27 habitat, increased predation due to increased roosting sites for raptors on power poles and  
28 other structures, mortality due to exposure from toxic chemicals, loss of nests due to  
29 construction activities, and displacement of birds into adjacent areas. Seasonal guidelines with  
30 respect to noise, vehicular traffic, and human proximity have been established by the WGFD  
31 (WGFD, 2009) and BLM (BLM, 2008b).

32 The project area is located within a sage grouse Core Population Area as delineated by the  
33 Wyoming governor's Sage-Grouse Implementation Team (WGFD, 2008). The Wyoming  
34 governor issued an Executive Order (E.O.) in August 2008 regarding management and  
35 development in Core Population Areas. Therefore, activities associated with ISR uranium  
36 recovery facility construction would conform to the Governor's policy on the Stipulations for  
37 Development in Core Sage Grouse Population Areas (WGFD, 2008).

38 Project construction could result in the short- and long-term loss of 115 ha (285 ac) of potential  
39 habitat for sage grouse within the project area. Construction of project facilities, pipelines,  
40 transmission lines and roads creates a long-term loss of sage-grouse habitat and increases  
41 fragmentation of existing habitat. Transmission line poles, power lines and other facilities  
42 provide roosting sites to raptors and corvids, which can result in increased predation during the  
43 life of the milling operation. Other sources of direct impacts may occur from disruptive human  
44 activities near leks or other key habitat areas. Human activities can also disrupt normal sage  
45 grouse behavior related to breeding, brood rearing, or foraging. Increased human-caused noise  
46 may reduce lek attendance and reduce wintering habitat suitability. Increased dust from project  
47 roads may reduce the palatability of sagebrush plants (LCI, 2008b). The increased traffic

1 adjacent to the Sooner Lek (located approximately 91.4 m [300 ft] from Sooner Road) could  
2 result in lower lek attendance.

3 Seasonal guidelines for greater sage grouse with respect to noise, vehicular traffic, and human  
4 disturbance have been established by the WGFD (WGFD 2009) and BLM (BLM 2008b). If  
5 BMPs are implemented that minimize noise, vehicular traffic, and human proximity in the vicinity  
6 of leks (within the 2-mile radius of an active lek), direct and indirect impacts to sage-grouse  
7 would be reduced from MODERATE to SMALL.

8 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
9 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
10 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
11 along with the actions proposed, are comparable to those described in the GEIS for Sage  
12 Grouse and incorporates by reference the GEIS' conclusions that the impacts to Sage Grouse  
13 during construction are expected to be MODERATE, but may be reduced to SMALL, by  
14 following exclusionary periods for specified species. Furthermore, while the NRC Staff has  
15 identified additional new information during its independent review; it nevertheless, does not  
16 change the expected environmental impact beyond what was described in the GEIS.

#### 17 Raptors

18 No active raptor nests occur within the project area (LCI, 2008b). Twelve historic ferruginous  
19 hawk nests were documented by the BLM within a 1.6-km (1.0 mi) buffer zone, but were not  
20 located during the 2006 and 2007 surveys (LCI, 2008b). Several other raptor species were  
21 recorded within the study area; but nesting was not documented.

22 Raptors are particularly sensitive to noise and the presence of human activity. Potential impacts  
23 to raptors include loss of nesting and foraging habitat, collisions with structures and vehicles,  
24 nest abandonment and reproductive failure due to increased human activities, reduction in prey  
25 populations, and displacement of birds into adjacent areas. Seasonal guidelines with respect to  
26 noise, vehicular traffic, and human proximity have been established by the WGFD (WGFD,  
27 2009) and BLM (BLM, 2008b).

28 Ferruginous hawks have shown to be sensitive to human disturbance, especially during periods  
29 of courtship, nest building, incubation, and brood rearing (Collins and Reynolds, 2005). Nest  
30 abandonment and loss of eggs or fledglings could occur with human disturbance during the  
31 early nesting period.

32 Mortality from power lines would be minimized by the use of raptor deterrent products and the  
33 burial of transmission lines from the transformer to the header houses, and the header houses  
34 to the wells. To minimize avian mortality, power lines should be constructed to the most current  
35 standards using publications such as those from the Avian Power Line Interaction Committee  
36 (APLIC; 2006).

37 If WGFD guidelines and APLIC (2006) power line construction standards are implemented in  
38 the vicinity of known raptor nests, impacts to raptors would be reduced from MODERATE to  
39 SMALL. Impacts may affect a few individuals, but are not expected to threaten the continued  
40 existence of the species in the project area.

41 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
42 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
43 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
44 along with the actions proposed, are comparable to those described in the GEIS for Sage  
45 Grouse and incorporates by reference the GEIS' conclusions that the impacts to Raptors during  
46 construction are expected to be MODERATE, but may be reduced to SMALL, by following

1 exclusionary periods for specified species. Furthermore, while the NRC Staff has identified  
2 additional new information during its independent review; it nevertheless, does not change the  
3 expected environmental impact beyond what was described in the GEIS.

#### 4 4.6.1.1.3 Construction Impacts to Aquatic Ecology

5 Baseline surveys indicate that aquatic life and wetlands do not exist within the boundaries of the  
6 project area. Surface water may be present for a short period of time mainly during snow  
7 melting season, but does not substantially sustain aquatic wildlife or wetland species.  
8 Therefore, no impacts to aquatic wildlife or wetlands are anticipated.

#### 9 4.6.1.1.4 Construction Impacts to Threatened and Endangered Species

10 If threatened or endangered species are identified in the project site during surveys, impacts  
11 may be SMALL to LARGE, depending on site conditions (NRC, 2009). Mitigation plans to avoid  
12 and reduce impacts to potentially affected species would be developed.

13 No federally- or state-listed sensitive plant species, endangered or threatened plant species, or  
14 designated critical habitats occur within the project area; therefore, no adverse impacts are  
15 anticipated. The bald eagle (formerly listed as threatened, currently delisted) and black-footed  
16 ferret (endangered) are the only federally-listed, previously listed, or candidate wildlife species  
17 that may potentially occur in the local vicinity (USFWS, 2008). The bald eagle may occur as a  
18 sporadic migrant, and may forage on the site occasionally. The nearest known bald eagle nest  
19 to the site is greater than 8 km (5 mi) away. The black-footed ferret is found in active prairie dog  
20 colonies. There are no active black or white-tailed prairie dog colonies in the project area and  
21 the nearest active prairie dog colonies are 1.6 to 3.2 km (1.0 to 2.0 mi) south and southwest of  
22 the project area. No impacts are anticipated from project construction and operation to the bald  
23 eagle or black-footed ferret.

24 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
25 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
26 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
27 along with the actions proposed, are comparable to those described in the GEIS for Threatened  
28 and Endangered Species and incorporates by reference the GEIS' conclusions that the impacts  
29 to Threatened and Endangered Species during construction are expected to be SMALL.  
30 Furthermore, the NRC Staff has not identified new and significant information during its  
31 independent review that would change the expected environmental impact beyond what was  
32 described in the GEIS.

#### 33 4.6.1.1.5 Construction Impacts to Species of Concern

34 The project area supports habitat for several species of concern, including passerine and  
35 breeding birds, pygmy rabbits, olive-backed pocket mouse, and prairie vole. These species  
36 would all potentially be affected by construction activities.

37 The sage thrasher, Brewer's sparrow, and sage sparrow (all Status 4 species) were observed in  
38 the project area. Suitable habitat exists for the wouldow lark bunting, though this species was  
39 not observed. Lowland Big Sagebrush Shrub land habitat provided the highest densities of  
40 breeding birds; however, birds were also located in the Upland Big Sagebrush Shrub land  
41 Habitat. Project construction and operation may result in the short-term and long-term loss of  
42 115 ha (285 ac) of nesting habitat for these bird species within the proposed permit area.  
43 Construction and operation activities may displace birds to lower quality habitat areas and could  
44 result in localized lower reproduction and increased predation. Another potential direct impact  
45 to sagebrush obligate birds is mortality from motor vehicle collisions. Impacts would be SMALL  
46 because only small areas of land would be disturbed at any given time during the lifespan of the

1 project. This would enable birds to relocate to neighboring areas. In addition, the applicant  
2 (LCI) would follow seasonal guidelines for wildlife exclusion periods (Table 4-2), which would  
3 further reduce any disruption to nesting activities.

4 Pygmy rabbits were found sporadically in the Lowland Big Sagebrush Shrub land habitat during  
5 surveys conducted by the applicant during the summer of 2007 (LCI, 2008b). Figure 3-7 shows  
6 pygmy rabbit habitat (Lowland Big Sagebrush Shrub land) at the project area. Project  
7 construction and operation would result in the short-term and long-term loss of 16 ha (39 ac) of  
8 pygmy rabbit habitat (Lowland Big Sagebrush Shrub land) within the project area. Pygmy  
9 rabbits stay within limited habitat areas. Mortality of individual pygmy rabbits may occur as a  
10 result of construction activities in Lowland Big Sagebrush Shrub land habitat. Project facilities,  
11 mine units, mud pits, storage ponds, and access roads may result in exposure to pygmy rabbits  
12 from harmful substances or materials. These impacts would be SMALL because they would  
13 affect only a few individuals and are not expected to threaten the continued existence of the  
14 species in the project area. The size of the impacted pygmy rabbit habitat (16 ha [39 ac]) is  
15 small in relation to the overall area of habitat available in the project area.

16 The state-listed olive-backed pocket mouse and prairie vole were not observed at the project  
17 area; however, suitable habitat exists and these species are known to be in the region (WGFD,  
18 2004). Loss of potential habitat would occur with project construction and operation and direct  
19 mortality could occur during the construction and clearing phase of the project; however, local  
20 populations should recover rapidly. These impacts would be SMALL because only a few  
21 individuals would be affected. These species would likely travel to suitable habitat adjacent to  
22 the construction areas.

23 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
24 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
25 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
26 along with the actions proposed, are comparable to those described in the GEIS for Species of  
27 Concern and incorporates by reference the GEIS' conclusions that the impacts to Species of  
28 Concern during construction are expected to be SMALL. Furthermore, the NRC Staff has not  
29 identified new and significant information during its independent review that would change the  
30 expected environmental impact beyond what was described in the GEIS.

### 31 4.6.1.2 Operation Impacts

32 As discussed in the GEIS (Section 4.2.5.2), wildlife habitats could be altered by operations  
33 (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat  
34 and operations. Access to crucial wintering habitat and water could be limited by fencing.  
35 However, the WGFD specifies fencing construction techniques to minimize impediments to big  
36 game movement. Migratory birds could be affected by exposure to constituents in evaporation  
37 ponds, but perimeter fencing and netting would limit impacts.

38 As further indicated in the GEIS, temporary contamination or alteration of soils would likely  
39 occur from operational leaks and spills possibly from transportation or land application of treated  
40 wastewater. However, detection and response to leaks and spills (e.g., soil cleanup) and  
41 eventual survey and decommissioning of all potentially impacted soils would limit the magnitude  
42 of overall impacts to terrestrial ecology. Spill detection and response plans would also reduce  
43 impacts to aquatic species from spills around wellheads and leaks from pipelines. Mitigation  
44 measures such as perimeter fencing, netting, leak detection and spill response plans, and  
45 periodic wildlife surveys would likely reduce the significance of overall impacts to SMALL.

#### 1        4.6.1.2.1 Operational Impacts to Vegetation

2        During operation activities, well fields and supporting facilities would be accessed frequently  
3        using the defined road network. Surface disturbance increases the susceptibility of the project  
4        area to invasive and noxious weeds. As such, surface disturbance would be minimized and  
5        vehicular access would be restricted to specific roads. Disturbed areas would be reseeded with  
6        WDEQ and BLM approved seed mixture, as soon as conditions allow, preventing the  
7        establishment of competitive weeds. Invasive and noxious weeds would be monitored and if  
8        they become an issue, other alternatives, such as herbicide application, could be considered.

9        Impacts to vegetation from facility operations resulting from spills around well heads and leaks  
10       from pipelines would be SMALL and would be handled using BMPs. Based on the foregoing  
11       analysis, activities at the Lost Creek site are consistent with the assumptions stated in the GEIS  
12       (NRC, 2009a). Leak detection systems and spill response plans to quickly remove affected  
13       soils and capture release fluids would be expected to reduce impacts.

14       After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
15       with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
16       and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
17       along with the actions proposed, are comparable to those described in the GEIS for Vegetation  
18       and incorporates by reference the GEIS' conclusions that the impacts to Vegetation during  
19       operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
20       significant information during its independent review that would change the expected  
21       environmental impact beyond what was described in the GEIS.

#### 22       4.6.1.2.2 Operational Impacts to Wildlife

23       The primary impacts of ISR facility operation on terrestrial wildlife are described in the GEIS: (1)  
24       habitat alteration and incremental habitat fragmentation; (2) displacement/stress to wildlife from  
25       human activity; and (3) direct and/or indirect mortalities from project construction and operation  
26       (NRC, 2009a).

27       Movement of big game through the project area is not expected to be impacted by most ISR  
28       operations. The limited use of fencing that impedes ingress and egress to the project area  
29       would further mitigate impacts to wildlife's use of the area. Fencing recommended by the  
30       WGFD (WGFD, 2004b) would be used.

31       Wildlife use of areas adjacent to ISR operations is anticipated to increase as animals become  
32       habituated to the activity. Because wildlife may be in proximity to facility buildings, roads, and  
33       mine units, some impacts to wildlife would be expected to occur from direct conflict with  
34       vehicular traffic and the presence of on-site personnel. Generally these impacts would be  
35       SMALL because they would affect only a few individuals and would not threaten the continued  
36       existence of any particular species in the project area. However, proximity to active sage-  
37       grouse leks or raptor nests has the potential to adversely affect their reproduction, and thus,  
38       would have a SMALL to MODERATE impact. The applicant would adhere to seasonal  
39       guidelines established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b) with respect to  
40       noise, vehicular traffic, and human proximity would reduce the impact to these species to be  
41       SMALL.

42       Potential impacts to migratory birds and other wildlife from exposure to toxic chemicals in the  
43       storage ponds may occur. Netting or other appropriate deterrents would be installed to  
44       eliminate any hazard to migratory birds, sage grouse or other wildlife. The deterrent would be  
45       consistent with agency recommendations. With the use of mitigation measures including  
46       perimeter fencing and surface netting, impacts to wildlife from the storage ponds would be  
47       SMALL.

1 During facility operations, spills around wellheads and leaks from pipelines could expose wildlife  
2 to toxic chemicals. The applicant's leak detection systems and spill response plans to remove  
3 affected soils and capture release fluids would be expected to reduce impacts. If spills or leaks  
4 are handled using BMPs, impacts to wildlife would be SMALL.

5 No impacts to federal T&E species are anticipated during facility operation. Impacts to species  
6 of concern during facility operation would be similar to those discussed for construction, but at a  
7 significantly lesser degree, because facilities would remain in place during the life of the milling  
8 operation. Potential direct impacts would include loss of habitat and displacement of affected  
9 species, mortality from motor vehicle collisions for mobile species, exposure to toxic chemicals,  
10 and avoidance due to human activity. If BMPs discussed above are followed, impacts to  
11 species of concern during facility operation would be SMALL because they would affect only a  
12 few individuals and would not threaten the continued existence of any particular species in the  
13 project area.

14 Based on the analyses above, site-specific conditions are consistent with the assumptions in the  
15 GEIS. Therefore, the overall impacts to wildlife from operation of the Lost Creek ISR are  
16 expected to be SMALL.

17 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
18 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
19 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
20 along with the actions proposed, are comparable to those described in the GEIS for Wildlife and  
21 incorporates by reference the GEIS' conclusions that the impacts to Wildlife during operation  
22 are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant  
23 information during its independent review that would change the expected environmental impact  
24 beyond what was described in the GEIS.

### 25 4.6.1.3 Aquifer Restoration Impacts

26 GEIS Section 4.2.5.3 discusses the potential impacts to ecological resources during the aquifer  
27 restoration phase. Impacts could include habitat disruption, but existing (in-place) infrastructure  
28 would be used during aquifer restoration, with little additional ground disturbance. Migratory  
29 birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing  
30 and netting would reduce impacts.

31 Contamination of soils and surface waters could result from leaks and spills and land application  
32 of treated wastewater (NRC, 2009). However, detection and response techniques, and  
33 eventual survey and decommissioning of all potentially impacted soils and sediments, would  
34 limit the magnitude of overall impacts to terrestrial and aquatic ecology. Mitigation measures  
35 such as perimeter fencing, netting, and leak detection and spill response plans would reduce  
36 the significance of overall impacts to SMALL.

37 Impacts to threatened and endangered species would be similar to those from operations (i.e.,  
38 SMALL), because existing infrastructure would continue to be used.

39 Since the existing infrastructure is already to be in place, aquifer restoration activities would  
40 produce potential ecological impacts similar to facility operation and, therefore, potential impacts  
41 would be SMALL (NRC, 2009a). Adherence to seasonal guidelines established by the WGFD  
42 (WGFD, 2009) and BLM (BLM, 2008b) with respect to noise, vehicular traffic, and human  
43 proximity would mitigate potential impacts to affected species. Only a small number of  
44 individuals would be affected, therefore, the impact would be SMALL.

1 Based on the foregoing analyses, activities at the Lost Creek site are consistent with the  
2 assumptions in the GEIS. Therefore, impacts to ecological resources from aquifer restoration  
3 are expected to be SMALL.

4 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
5 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
6 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
7 along with the actions proposed, are comparable to those described in the GEIS for Ecology  
8 and incorporates by reference the GEIS' conclusions that the impacts to Ecology during aquifer  
9 restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
10 significant information during its independent review that would change the expected  
11 environmental impact beyond what was described in the GEIS.

#### 12 4.6.1.4 Decommissioning Impacts

13 As discussed in GEIS Section 4.2.5.4, decommissioning and reclamation activities, would result  
14 in temporary land disturbance as soils are excavated, buried piping is recovered and removed,  
15 and structures are demolished and removed. Re-vegetation and re-contouring would restore  
16 habitat previously altered during construction and operations. Wildlife would be temporarily  
17 displaced, but are expected to return after decommissioning and reclamation are completed and  
18 vegetation and habitat are reestablished. Decommissioning and reclamation activities could  
19 also result in temporary increases in sediment load in local streams, but aquatic species would  
20 recover quickly as sediment load decreases. Based on the foregoing analysis, site-specific  
21 conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from  
22 decommissioning are expected to be SMALL.

23 As stated in the GEIS, with respect to threatened and endangered species, potential impacts  
24 resulting from individual takes would occur due to conflicts with decommissioning activities  
25 (equipment, traffic). Temporary land disturbance would occur as structures are demolished and  
26 removed and the ground surface is re-contoured. An inventory of threatened or endangered  
27 species developed during the site-specific environmental review of the detailed  
28 decommissioning plan would identify unique or special habitats, and Endangered Species Act  
29 consultations with the U.S. Fish and Wildlife Service would further assist in reducing impacts.  
30 Upon completion of decommissioning, re-vegetation, and re-contouring, habitat would be  
31 reestablished and impacts would, therefore, be limited. Impacts to threatened and endangered  
32 species may be SMALL to LARGE, depending on site conditions.

33 Impacts from decommissioning would, in part, be similar to those discussed for construction of  
34 the facility in terms of increased noise and traffic. The main difference between the  
35 decommissioning phase and the construction phase includes the actual loss of vegetation and  
36 habitat during construction, whereas decommissioning would restore these systems. These  
37 impacts would be temporary (12 to 18 months) and reduced with time as decommissioning and  
38 reclamation proceed (NRC, 2009a).

39 Decommissioning would involve abandonment of the mine units and removal of the supporting  
40 facilities and roads. Stockpiled topsoil would be used to re-grade the processing plant and  
41 storage ponds to pre-construction contours and seeded with native vegetation once the  
42 buildings are removed. No loss of additional vegetative communities is expected beyond those  
43 previously lost disturbed during construction. The removal of piping would impact vegetation  
44 that has reestablished itself, although this, too, would be temporary once the disturbed soil is re-  
45 seeded. The decommissioning process is expected to create added noise and traffic as  
46 buildings are taken down and hauled away. During this time, wildlife could come in conflict with  
47 heavy equipment, or may move elsewhere on the property due to higher-than-normal noise.

1 Much of the disturbances to vegetation described in previous sections would occur within the  
2 sagebrush vegetative community type. This community type is gaining increasing importance  
3 within its range as areas are being lost and converted to grass due to wildfire and human  
4 disturbances. Compounding the issue is the difficulty in successfully re-establishing sagebrush,  
5 resulting in long-term impacts to vegetation, wildlife habitat, and visual and scenic resources.  
6 Refined techniques in seeding sagebrush have shown significant improvements in successful  
7 establishment of the species (Lambert, 2005). Such improved methods may include the use of  
8 cased-hole punched seeding with polypropylene casings as described by Seefeldt and Booth  
9 (2005). For those areas previously dominated by sagebrush, the applicant would re-establish  
10 sagebrush using such techniques.

11 As required, the applicant would submit an updated reclamation plan to the BLM for approval,  
12 which would be reviewed and approved by the appropriate state and federal agencies. It is  
13 expected that temporarily displaced wildlife would return to the area once decommissioning and  
14 reclamation are completed.

15 Decommissioning impacts would be temporary, and implementation of BMPs would reduce any  
16 of the impacts associated with the decommissioning process. The activities proposed at the  
17 Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts  
18 from decommissioning are expected to be SMALL.

19 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
20 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
21 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
22 along with the actions proposed, are comparable to those described in the GEIS for Ecology  
23 and incorporates by reference the GEIS' conclusions that the impacts to Ecology during  
24 decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified  
25 new and significant information during its independent review that would change the expected  
26 environmental impact beyond what was described in the GEIS.

### 27 **4.6.2 No-Action (Alternative 2)**

28 Under the No-Action Alternative, there would be no ISR facility construction associated with this  
29 project, and therefore no land disturbance or vegetation removal associated with construction,  
30 operation, aquifer restoration, or decommissioning. The area would continue to provide  
31 vegetation communities and wildlife habitat typical of the region. Land would continue to be  
32 used for pastureland and grazing leases would continue. When compared to the action  
33 alternatives, there would be no impacts to ecological resources under this alternative.

### 34 **4.6.3 Dry Yellowcake (Alternative 3)**

35 Under Alternative 3, the NRC would issue LCI a license for the construction, operation, aquifer  
36 restoration, and decommissioning of facilities for ISR uranium milling and processing of dry  
37 yellowcake as the final product. By doing so, the project would consist of adding equipment for  
38 the processing of dry yellowcake. The additional equipment would be installed in the CPP  
39 building with the same footprint size located on the Lost Creek site as Alternative 1. The dry  
40 yellowcake would be transported from the Lost Creek site directly to Metropolis, Illinois for  
41 ultimate processing into the fuel for nuclear reactors. This additional process would eliminate  
42 the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry  
43 processing facility before being shipped to Illinois.

44 The potential impacts to ecological resources from the four phases of the proposed ISR facility  
45 development under Alternative 3 would be the same as those described under Alternative 1

1 (proposed action). There would be no increased land disturbance, as the only change would be  
2 the installation of a yellowcake dryer, which would be installed in the CPP already fitted to  
3 house the unit. There would be no other construction of roads, buildings, storage areas required  
4 for this alternative. In addition, the potential impacts to ecological resources would be the same  
5 for the operation, aquifer restoration and decommissioning phases as the proposed action.

## 6 **4.7 Air Quality Impacts**

7 As stated in the GEIS (Section 4.2.6) ISR facilities "are not major non-radiological air emission  
8 sources." As a result, an ISR impacts on air quality would be SMALL, if the following conditions  
9 were met:

- 10 • Gaseous emissions are within regulatory limits and requirements;
- 11 • Air quality in the region of influence is in compliance with NAAQS; and
- 12 • The facility is not classified as a major source under New Source Review or  
13 operating (Title V) permit programs.

14 Potential environmental impacts to air quality at the Lost Creek site may occur during all phases  
15 of the ISR facility's lifecycle. Impacts primarily involve fugitive dust and combustion emissions  
16 from vehicles and diesel equipment associated with construction, operation, and  
17 decommissioning activities. Other dust-type emissions may be associated with the suspension  
18 of dried spill areas and radon releases from well system relief valves, resin transfer, or elution.  
19 A factor of concern would be the presence of Prevention of Significant Deterioration (PSD)  
20 Class I areas. However, there are no PSD Class I areas in, or near, the Wyoming West Uranium  
21 Milling Region where the Lost Creek facility is located.

22 Detailed discussion of the potential environmental impacts to air quality from construction,  
23 operation, aquifer restoration, and decommissioning are presented in the following sections.

### 24 **4.7.1 Proposed Action (Alternative 1)**

#### 25 *4.7.1.1 Construction Impacts*

26 The GEIS, in Section 4.2.6.1, describes fugitive dust and combustion (vehicle and diesel  
27 equipment) emissions during land-disturbing activities associated with construction as expected  
28 to be short-term, and being reduced through best management practices (e.g., wetting of roads  
29 and cleared land areas to reduce dust emissions). Estimated fugitive dust emissions during ISL  
30 construction are expected to be well below the NAAQS for PM<sub>2.5</sub> and for PM<sub>10</sub>. Additionally,  
31 particulate, sulfur dioxide, and nitrogen dioxide emissions from ISR facilities are expected to a  
32 small percentage (1 to 9 percent) of the PSD Class II allowable increments.

33 Air emissions during the construction phase of the Lost Creek ISR project would consist  
34 primarily of fugitive dust and emissions from equipment running diesel and gasoline-fueled  
35 combustion engines such as drill rigs, water trucks, bulldozers, and light-duty passenger trucks.  
36 Construction activities would create air pollution resulting from incoming, outgoing and onsite  
37 motor vehicle traffic, heavy equipment use, and mine unit drilling. During construction, truck  
38 transport of materials would be the primary source of air pollution that would affect offsite  
39 receptors, but this impact would be minor. Most of the combustion emissions would be confined  
40 to the project area. Fugitive dust would be generated by travel on unpaved roads and disturbed  
41 lands both on and off the site.

42 During construction, it is estimated that 35 light trucks and 5 heavy trucks would travel to and  
43 from the site each day. The majority of the construction workforce would be commuting from the

1 Rawlins, Casper, Wamsutter, and/or Lander areas (LCI, 2008a). This traffic is not expected to  
2 impact other off site communities because of the temporary nature of construction and the low  
3 volumes of vehicles in comparison to the average traffic volume of nearby public roads (see  
4 Section 4.3.2.1 of this SEIS).

5 The air quality within the proposed Lost Creek study area would not be substantially affected by  
6 project construction because of: 1) the temporary nature of the activity; 2) the limited footprint of  
7 the construction area relative to the project area; 3) the relatively low volume of traffic and heavy  
8 equipment compared with conventional uranium mining activities and 4) the low background  
9 concentrations of pollutants. Both CO and PM impacts caused by the emissions from the  
10 operation of construction machinery and by fugitive dust would be short-term and SMALL. The  
11 foregoing analysis of site-specific conditions are consistent with the assumptions in the GEIS.

12 Best management practices (BMPs), following BLM and WDEQ guidelines, would ensure that  
13 the construction equipment would minimize fugitive dust emissions. These practices include  
14 wetting and stabilization of unpaved roads and disturbed land to suppress dust generation,  
15 cleaning paved roadways, and scheduling (phasing) construction activities to minimize the  
16 amount and duration of exposed earth. Based on the foregoing analysis, site-specific conditions  
17 are consistent with the assumptions stated in the GEIS. Therefore, for NAAQS attainment  
18 areas, like the area around the Lost Creek site, non-radiological air quality impacts would be  
19 SMALL.

20 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
21 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
22 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
23 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
24 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
25 construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
26 significant information during its independent review that would change the expected  
27 environmental impact beyond what was described in the GEIS.

### 28 4.7.1.2 Operation Impacts

29 GEIS Section 4.2.6.2 states that operating ISR facilities are not major point source emitters and  
30 are not expected to be classified as major sources during the operation phase. Additionally,  
31 although excess vapor pressure in the uranium recovery pipelines could be vented throughout  
32 the system, such emissions would be rapidly dispersed in the atmosphere and so potential  
33 impacts are expected to be SMALL.

34 Other potential non-radiological emissions during operations include fugitive dust and fuel from  
35 equipment, maintenance, transport trucks, and other vehicles (NRC, 2009). For NAAQS  
36 attainment areas, non-radiological air quality impacts would be SMALL.

37 The GEIS notes that radiological impacts can result from: 1) dust releases from drying of  
38 lixiviant pipeline spills; 2) radon releases from well system relief valves; 3) resin transfer or  
39 elution; 4) and gaseous/particulate emissions from yellowcake dryers. Only small amounts of  
40 low dose materials are expected to be released based on operational controls and rapid  
41 response to spills. Required spill prevention, control, and response procedures would be used  
42 to minimize impacts from spills. Compliance with the NRC-required radiation monitoring  
43 programs would ensure releases are well within regulatory limits. The impacts from radiological  
44 emissions are addressed under Section 4.2.12, Public and Occupational Health Impacts.

45 Sources for air emissions generated during operations include: 1) building production processes  
46 (e.g., operation of pumps, use of generators), 2) onsite motor vehicle activity, 3) vehicles used  
47 by the commuting workforce, and 4) heavy truck traffic. Trucking activities would include

1 maintenance and inspection visits and the transportation of incoming supplies and outgoing  
2 yellowcake slurry and waste materials. It is estimated that about 20 light trucks and 5 heavy  
3 trucks would travel to and from the site each day (LCI, 2008a). CO impacts from engine  
4 combustion and heating, ventilation, and air conditioning (HVAC) equipment at the CPP would  
5 be short-term. The activities proposed at the Lost Creek site are consistent with the  
6 assumptions stated in the GEIS. Therefore, impacts to air quality from operation are expected  
7 to be SMALL.

8 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
9 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
10 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
11 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
12 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
13 operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
14 significant information during its independent review that would change the expected  
15 environmental impact beyond what was described in the GEIS.

#### 16 4.7.1.3 *Aquifer Restoration Impacts*

17 GEIS Section 4.2.6.3, states that air quality impacts from aquifer restoration are expected to be  
18 similar to, but less than, those during operations because the same infrastructure is used for  
19 aquifer restoration as during operations. Additionally, fugitive dust and fuel emissions from  
20 vehicles and equipment during aquifer restoration is expected to be similar to, but less than, the  
21 dust and fuel emissions during operations. For NAAQS attainment areas, non-radiological air  
22 quality impacts would be SMALL.

23 Potential air impacts during the aquifer restoration phase would result from fugitive dust and  
24 combustion emissions from many of the same types of emission sources identified earlier in the  
25 operations phase. Vehicular traffic would be limited to delivery of supplies and the commuting  
26 staff, with a decreasing frequency of offsite shipments of yellowcake slurry as restoration  
27 proceeds. Therefore, there would be fewer trips than during the operation phase. This phase of  
28 the Lost Creek ISR Project would use existing infrastructure and equipment similar to that  
29 employed during the operation phase. Accordingly, impacts would be similar to the operation  
30 phase.

31 Air quality would not be substantially affected by the aquifer restoration activities because of the  
32 low number of vehicles used. PM impacts caused by the emissions from restoration equipment  
33 and by fugitive dust would be local, short-term, and adverse, but SMALL. CO impacts from  
34 engine combustion would be short-term. The activities at the proposed Lost Creek site are  
35 consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from  
36 aquifer restoration are expected to be SMALL.

37 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
38 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
39 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
40 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
41 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
42 aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified  
43 new and significant information during its independent review that would change the expected  
44 environmental impact beyond what was described in the GEIS.

#### 45 4.7.1.4 *Decommissioning Impacts*

46 Decommissioning activities would be similar to those of construction (NRC, 2009). In the short  
47 term, emission levels are expected to increase given the activity (demolishing of process and

1 administrative buildings, excavating and removing contaminated soils, grading of disturbed  
2 areas). However, such emissions would be expected to decrease as decommissioning  
3 proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with  
4 construction, would be short-term, and would be reduced through best management practices  
5 (e.g., dust suppression). For NAAQS attainment areas, non-radiological air quality impacts  
6 would be SMALL (NRC, 2009).

7 Potential air impacts during the decommissioning phase would include fugitive dust, vehicle  
8 emissions. Diesel emissions from many of the same sources identified earlier in the construction  
9 phase would have similar results. In the short term, emission levels could increase, especially  
10 for particulate matter from activities such as dismantling buildings and milling equipment,  
11 removing any contaminated soil, and grading the surface as part of reclamation activities. The  
12 plugging and abandonment of production and injection wells would use equipment that  
13 generates gaseous emissions, as would the heavy trucks required to ship non-contaminated  
14 waste to local landfills and 11e.(2) waste to a licensed facility. These emissions would also be  
15 expected to be limited in duration, similar to the operation and aquifer restoration phases.

16 PM impacts caused by the emissions from decommissioning equipment and by fugitive dust  
17 would be local, short-term, and adverse, but SMALL. CO impacts from engine combustion  
18 would be short-term. The activities at the proposed Lost Creek site are consistent with the  
19 assumptions stated in the GEIS. Therefore, impacts to air quality from decommissioning are  
20 expected to be SMALL.

21 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
22 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
23 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
24 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
25 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
26 decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified  
27 new and significant information during its independent review that would change the expected  
28 environmental impact beyond what was described in the GEIS.

#### 29 **4.7.2 No-Action (Alternative 2)**

30 Under the No-Action Alternative, there would be no change in the air quality at this site or at any  
31 surrounding receptors. While natural resource exploration activities would continue and perhaps  
32 expand in the future, these activities would typically be of short duration and would involve few  
33 vehicles and no permanent, pollutant-emitting infrastructure. The generation of fugitive dust is  
34 currently minimized by the fact that there is an existing two-track road traverses the site from  
35 east to west, allowing both prospective miners, grazing managers, and recreational traffic to  
36 gain access to the site without additional land disturbance.

37 The Lost Creek project area currently meets the NAAQS for attainment status and because  
38 there are no significant air pollution sources at the proposed site, and it is expected that this  
39 area would continue to meet the NAAQS. This alternative would result in neither beneficial nor  
40 negative impacts to air quality.

#### 41 **4.7.3 Dry Yellowcake (Alternative 3)**

42 Alternative 3 would be the same as Alternative 1 (the Proposed Action), except that the uranium  
43 processing of yellowcake slurry would be changed to processing dry yellowcake. This additional  
44 process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site  
45 to an intermediate dry processing facility. This change, however, would have no substantial

1 effect on air quality impacts. A discussion of the potential radiological impacts of air quality is  
2 presented in Section 4.12 of this SEIS.

#### 3 4.7.3.1 Construction Impacts

4 Under Alternative 3, the emission of PM and CO during construction would only be slightly  
5 elevated at the project site relative to the Proposed Action. This is because the construction of  
6 the CPP would accommodate a yellowcake dryer, involving potentially different heavy  
7 equipment utilization from the proposed action. Traffic counts may also increase slightly as  
8 associated supplies are delivered to the site. These additional trips would result in the  
9 generation of additional fugitive dust from traffic along gravel ranch roads, as well as particulate  
10 and CO from diesel fuel combustion.

11 While the construction activities associated with Alternative 3 may result in a slightly greater  
12 intensive use of heavy equipment, there would, nevertheless, be no incremental change in the  
13 air emission levels in the project area or at any surrounding receptors, when compared to  
14 Alternative 1. The nearest residential receptors, which are located approximately 24 km (15 mi)  
15 northeast of the project area, would not experience any increases in air pollution levels from  
16 construction activities at the proposed project site for the following reasons: 1) they do not lie in  
17 the path (direction) of the prevailing winds; and 2) the pollutants would have dispersed over the  
18 24 km (15 mi) distance before reaching the receptor. PM impacts caused by the emissions from  
19 the operation of construction machinery and from fugitive dust would be short-term and SMALL.  
20 CO impacts from engine combustion would be short-term. The activities proposed at the Lost  
21 Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts to air  
22 quality from construction are expected to be SMALL.

23 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
24 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
25 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
26 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
27 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality and  
28 incorporates by reference the GEIS' conclusions that the impacts to Land Use during  
29 construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
30 significant information during its independent review that would change the expected  
31 environmental impact beyond what was described in the GEIS.

#### 32 4.7.3.2 Operation Impacts

33 The impacts of operation of Alternative 3 would be the same as those stated for Alternative 1. In  
34 fact, because the end product would be dried yellowcake as opposed to yellowcake slurry,  
35 outgoing shipments would be relatively less frequent (see Section 4.3.3.2 of this SEIS). Fewer  
36 trips would result in potentially less fugitive dust being generated by rolling traffic of tractor  
37 trailers, and less PM and CO from diesel truck exhaust. Nevertheless, because PM and CO  
38 disperses rapidly, impacts would be localized at the area of disturbance, or at the point source  
39 of emission. HEPA filters and vacuum dryer designs would reduce particulate emissions from  
40 operations, and ventilation reduces radon buildup during operations.

41 The nearest residential receptor location, which is located approximately 24 km (15 mi)  
42 northeast of the project area, would not experience any incremental change in air pollution  
43 levels due to the activities during operations at the proposed site. PM impacts caused by the  
44 emissions from operations equipment and from fugitive dust and. CO impacts from engine  
45 combustion would be short-term. Based on the foregoing analysis, site-specific conditions are  
46 consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from  
47 facility operation are expected to be SMALL.

1 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
2 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
3 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
4 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
5 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
6 operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
7 significant information during its independent review that would change the expected  
8 environmental impact beyond what was described in the GEIS.

#### 9 4.7.3.3 *Aquifer Restoration Impacts*

10 The impacts of aquifer restoration for Alternative 3 would be the same as those stated in the  
11 preceding Section 4.7.3.2, though perhaps limited even further by the fact that fewer shipments  
12 of process chemicals would be required. The nearest residential receptor location, which is  
13 located approximately 24 km (15 mi) northeast of the project area, would not experience any  
14 incremental change in air pollution levels due to aquifer restoration activities at the proposed  
15 project area. PM impacts caused by the emissions from restoration equipment and by fugitive  
16 dust and CO impacts from engine combustion would be short-term. Based on the foregoing  
17 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
18 Therefore, impacts to air quality from aquifer restoration are expected to be SMALL.

19 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
20 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
21 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
22 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
23 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
24 aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified  
25 new and significant information during its independent review that would change the expected  
26 environmental impact beyond what was described in the GEIS.

#### 27 4.7.3.4 *Decommissioning Impacts*

28 The impacts of the decommissioning of Alternative 3 would be the same as those stated for  
29 Alternative 2, though perhaps increased slightly to account for the additional CPP components.  
30 The nearest receptor, which is located approximately 24 km (15 mi) northeast of the project  
31 area, would not experience any incremental change in air pollution levels due to the  
32 decommissioning activities. Though offsite haulage may increase to account for the disposal of  
33 additional infrastructure, the low level of traffic and the resulting emissions would not contribute  
34 noticeably to the traffic volumes on the routes between the project area and the disposal  
35 facilities.

36 PM impacts caused by the emissions from decommissioning equipment and from fugitive dust  
37 and CO impacts from engine combustion would also be short-term. Based on the foregoing  
38 analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.  
39 Therefore, impacts to air quality from decommissioning are expected to be SMALL. These  
40 impacts would be SMALL because of: 1) the relative small size of the project; 2) the short  
41 duration of the activity; and 3) excellent atmospheric dispersion characteristics of the region.

42 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
43 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
44 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
45 along with the actions proposed, are comparable to those described in the GEIS for Air Quality  
46 and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during  
47 decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified

1 new and significant information during its independent review that would change the expected  
2 environmental impact beyond what was described in the GEIS.

### 3 **4.8 Noise Impacts**

4 Potential environmental impacts from noise at the Lost Creek site may occur during all phases  
5 of the ISR facility's lifecycle. These impacts would be associated with the operation of  
6 equipment such as trucks, bulldozers, and compressors; from traffic due to commuting workers  
7 or material/waste shipments; and well field and central processing plant activities and  
8 equipment. These impacts may affect both humans and wildlife in the vicinity of the site.

9 Detailed discussion of the potential environmental impacts from noise due to construction,  
10 operation, aquifer restoration, and decommissioning are provided in the analysis of the  
11 Proposed Action (Alternative 1).

#### 12 **4.8.1 Proposed Action (Alternative 1)**

##### 13 *4.8.1.1 Construction Impacts*

14 As discussed in the GEIS (Section 4.2.7.1), potential noise impacts are expected to be greatest  
15 during construction of the ISR facility, due to the heavy equipment involved and given the  
16 likelihood that these facilities would be built in rural, previously undeveloped area where  
17 background noise levels are lower. The use of drill rigs, heavy trucks, bulldozers, and other  
18 equipment used to construct and operate the well fields, drill the wells, develop the necessary  
19 access roads, and build the production facilities would generate noise that would be audible  
20 above the undisturbed background levels. Noise levels are expected to be higher during  
21 daylight hours when construction is more likely to occur, and more noticeable in proximity to the  
22 operating equipment. Administrative and engineering controls would be expected to maintain  
23 noise levels in work areas below Occupational Health and Safety Administration (OSHA)  
24 regulatory limits and mitigated by use of personal hearing protection. For individuals living in  
25 the vicinity of the site, ambient noise levels would be expected to return to ambient  
26 (background) conditions at distance more than 300m (1,000 ft) from the construction activities  
27 (based upon free-field attenuation rates [a decrease of 6 dB for every doubling of distance from  
28 the source]). Wildlife is expected to avoid areas where noise-generating activities were  
29 ongoing; although for certain wildlife (e.g., sage grouse) continuous elevated noise levels may  
30 reduce their breeding success. Overall, these types of noise impacts would be SMALL, given  
31 the use of hearing controls for workers and the expected distance of nearest residents from the  
32 site:

33 Additionally, as stated in the GEIS, traffic noise during construction (commuting workers, truck  
34 shipments to and from the facility, and construction equipment such as trucks, bulldozers, and  
35 compressors) is expected to be localized and limited to highways in the vicinity of the site,  
36 access roads within the site, and roads in the well fields. Relative short-term increases in noise  
37 levels associated with passing traffic would be SMALL for the larger roads, but may be  
38 MODERATE for lightly traveled rural roads through smaller communities such as Bairoil,  
39 Lamont and Jeffrey City.

40 The construction phase of the Lost Creek ISR Project would involve the use of heavy equipment  
41 to create and improve road surfaces, furnish supplies, excavate footings, erect buildings, and  
42 install the wells and pipelines at the mine units. Equipment such as bulldozers, graders, tractor  
43 trailers, excavators, cranes, and drill rigs would create noise that would be audible onsite above  
44 the 40 dBA of the background noise levels. Table 4.2-1 in the GEIS presents the typical

1 equipment and their sound levels that would be anticipated to be used in the construction of the  
2 Lost Creek ISR Project.

3 The total sound levels generated by the Lost Creek ISR Project include construction equipment,  
4 motor vehicles, and drill rigs. The construction phase sound levels were based upon the  
5 reference sound levels, which were projected to receptor locations by established relationships  
6 of sound propagation over distance. Specifically, for a stationary source of sound and  
7 beginning at a distance of 15 m (50 ft), noise levels diminish by 6 dB (decibels) for each  
8 doubling of the distance from the source (FHWA, 1980). This is known as free-field attenuation,  
9 and does not consider factors such as frequency, terrain or atmospheric conditions.

10 In general, construction activity would be restricted to daylight hours, which would result in a 24-  
11 hour average sound level on-site that is below the criteria of 70 dBA (A-scale) for hearing  
12 protection (EPA, 1978).

13 Stationary onsite sources of noise at the proposed Lost Creek site are expected to have no  
14 impact on offsite receptors, based on the 6dB reduction factor for each doubling of distance.  
15 However, truck transport of construction materials would be the primary noise source that would  
16 affect offsite receptors. However, because of the limited traffic volume associated with the  
17 project as a whole (see Section 4.3), this impact would be regional, adverse and SMALL. The  
18 incremental increase in project-related traffic on the relatively well-traveled public roadways in  
19 the area (e.g., I-80, US 287) would not be expected to be noticeable. Because uranium would  
20 be recovered from a total of six mine units and no more than two are operational at one time,  
21 well field construction would take place in a sequential manner over approximately seven years.  
22 As such, noise impacts would be considered a short-term impact, regardless of receptor  
23 location. Based on the foregoing analysis, site-specific conditions are consistent with the  
24 assumptions stated in the GEIS. Therefore, noise impacts from construction are expected to be  
25 SMALL.

26 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
27 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
28 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
29 along with the actions proposed, are comparable to those described in the GEIS for Noise and  
30 incorporates by reference the GEIS' conclusions that the impacts to Noise during construction  
31 are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant  
32 information during its independent review that would change the expected environmental impact  
33 beyond what was described in the GEIS.

#### 34 4.8.1.2 Operation Impacts

35 As described in Section 4.2.7.2 of the GEIS, noise-generating activities associated with the CPP  
36 would be indoors, thus reducing potential offsite sound levels. Well field equipment (e.g.,  
37 pumps, compressors) would be contained within structures (e.g., header houses, satellite  
38 facilities), also reducing potential offsite sound levels. As for construction, traffic noise from  
39 commuting workers, truck shipments to and from the facility, and facility equipment would be  
40 expected to be localized, limited to highways in the vicinity of the site, access roads within the  
41 site, and roads in well fields. Relative short-term increases in noise levels associated with this  
42 traffic would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural  
43 roads through smaller communities. Thus, the overall impact to noise levels from operations is  
44 expected to be SMALL to MODERATE.

45 Because of the sequential manner of mine unit development proposed for the Lost Creek ISR  
46 project, operation phases overlap with construction phases for all but the sixth and final mine  
47 unit. As such, impacts during the operation phases would be the same as described in Section

1 4.8.1.1 above for approximately the first five years of the total seven years of operation. The  
2 final two years of operation would coincide with aquifer restoration and decommissioning  
3 activities in the preceding mine units. This means that overall noise impacts within the project  
4 area during the operation phase would be compounded. However, since there are no receptors  
5 close to the site, the potential impacts would be SMALL. Based on the foregoing analysis, site-  
6 specific conditions are consistent with the assumptions stated in the GEIS.

7 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
8 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
9 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
10 along with the actions proposed, are comparable to those described in the GEIS for Noise and  
11 incorporates by reference the GEIS' conclusions that the impacts to Noise during operation are  
12 expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant  
13 information during its independent review that would change the expected environmental impact  
14 beyond what was described in the GEIS.

#### 15 4.8.1.3 *Aquifer Restoration Impacts*

16 The GEIS (Section 4.2.7.3) states that general noise levels during aquifer restoration would be  
17 expected to be similar, or less than, those levels experienced during operations. Additionally,  
18 workplace noise exposure would be managed using the same administrative and engineering  
19 controls as during operations. Pumps and other well field equipment contained in buildings  
20 would reduce sound levels to offsite receptors. Existing operational infrastructure would be  
21 used, and traffic levels would be expected to be less than that seen during construction and  
22 operations. Impacts, therefore, would be expected to be SMALL to MODERATE.

23 Sound levels generated during the restoration phase include cement mixers, compressors, and  
24 pumps used for the plugging and abandonment of production and injection wells. Noise impacts  
25 from aquifer restoration activities would be expected to be similar to, or lower than, the  
26 operation phase activities at the site. Vehicular traffic is expected to be limited to delivery of  
27 supplies and staff accessing the site, therefore resulting in fewer trips than during the operation  
28 phase. Sound levels from the aquifer restoration activities would be localized and would be  
29 reduced with distance, similar to the sound levels of the other phases of activities. Since  
30 equipment and traffic were assumed to be similar to those of the operation phase, the degree of  
31 noise impact is the same as the operation phase. Therefore, noise impacts attributable to  
32 restoration activities at the project area would be expected to be long-term. The activities  
33 proposed at the Lost Creek site are consistent with the assumptions stated in the GEIS.  
34 Therefore, noise impacts from aquifer restoration are expected to be SMALL.

35 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
36 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
37 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
38 along with the actions proposed, are comparable to those described in the GEIS for Noise and  
39 incorporates by reference the GEIS' conclusions that the impacts to Noise during aquifer  
40 restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and  
41 significant information during its independent review that would change the expected  
42 environmental impact beyond what was described in the GEIS.

#### 43 4.8.1.4 *Decommissioning Impacts*

44 The GEIS (Section 4.2.7.4) discusses the potential noise impacts during decommissioning.  
45 General noise levels during decommissioning and reclamation would be expected to be similar,  
46 or less than, those levels experienced during construction. Equipment used to dismantle  
47 buildings and milling equipment, remove any contaminated soils; or grade the surface as part of

1 reclamation activities would generate noise levels that would be expected to exceed the  
2 background. These noise levels would be temporary; once decommissioning and reclamation  
3 activities were complete, noise levels would return to ambient, with occasional vehicle traffic for  
4 any longer term monitoring activities. As with construction, noise levels are expected to be  
5 higher during daylight hours when decommissioning and reclamation is more likely to occur, and  
6 more noticeable in proximity to the operating equipment. Noise generated during  
7 decommissioning would be noticeable only in proximity to equipment and temporary (typically  
8 daytime only). Workplace noise exposure would be managed using the same administrative  
9 and engineering controls as during construction and operations, and given the likely distance of  
10 nearby residents from the activity (i.e., greater than 300 m [1,000 ft]), it is not expected that the  
11 noise would be discernable to offsite residents or communities. Therefore, the GEIS considered  
12 noise impacts from decommissioning to be SMALL.

13 Sound levels generated at the proposed site during decommissioning would be similar to the  
14 construction activities and would include earth moving, excavation, and building demolition.  
15 Noise impacts from decommissioning activities would be expected to be similar to, or lower  
16 than, the construction activities at the site. Decommissioning activities would result in a  
17 substantial, but temporary, noise impact to the areas surrounding the proposed area.

18 It is expected that the nearest receptor, which is located approximately 24 km (15 mi) northeast  
19 of the project area, would not experience any change in sound levels due to decommissioning  
20 activities, resulting in no impact. There would be no noise impacts at the nearest residential  
21 receptor locations, which are more than 24 km (15 mi) from the project site. Site-specific  
22 conditions are consistent with the assumptions stated in the GEIS in Section 4.2.7.4. Therefore,  
23 noise impacts from decommissioning are expected to be SMALL.

24 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
25 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
26 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
27 along with the actions proposed, are comparable to those described in the GEIS for Noise and  
28 incorporates by reference the GEIS' conclusions that the impacts to Noise during  
29 decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified  
30 new and significant information during its independent review that would change the expected  
31 environmental impact beyond what was described in the GEIS.

#### 32 **4.8.2 No-Action (Alternative 2)**

33 Under the No-Action Alternative, there would be no change in the sound levels in the project  
34 area or at any surrounding receptors. While natural resource exploration activities would  
35 continue and perhaps expand in the future, these activities would typically be of short duration  
36 and would involve few vehicles and no permanent, noise-emitting infrastructure. These  
37 activities, coupled with the remote and rural setting of the project area, would result in sound  
38 levels remaining at or below 40 dBA. This alternative would result in neither beneficial nor  
39 adverse impacts to noise.

#### 40 **4.8.3 Dry Yellowcake (Alternative 3)**

41 Alternative 3 would be the same as the proposed action except that the uranium processing of  
42 dry yellowcake would be changed. The project would add equipment for the processing of dry  
43 yellowcake. However, since the equipment would be installed inside the CPP, the noise  
44 increase impact at the project boundary would be SMALL. In addition, this additional process  
45 would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an  
46 intermediate dry processing facility, but is expected to have no substantial effect on

1 transportation noise impacts. Alternative 3 is expected to have the same potential impacts in  
2 each of the four project phases as the proposed action.

### 3 **4.9 Historical, Cultural, and Paleontological Resources Impacts**

4 Three resource types are considered in this section: historical, cultural and paleontological. The  
5 first two resource types are linked under a series of common federal laws. Paleontological  
6 resources, however, are not subject to the same federal regulations. Under State of Wyoming  
7 regulations, archaeological and paleontological resources are subject to the same statute (see  
8 Section 1.7.6.5).

9 Detailed discussion of the potential environmental impacts to historic and cultural resources  
10 from construction, operation, aquifer restoration, and decommissioning are provided in the  
11 following sections.

#### 12 **4.9.1 Proposed Action (Alternative 1)**

13 Under Alternative 1 (Proposed Action), the NRC would issue LCI a license for ISR uranium  
14 milling and processing at the Lost Creek site. The facilities would be contained within about 115  
15 ha (285 ac); of this, about 102 ha (254 ac) are accounted for by the well fields and access road.  
16 For archaeological sites, the impacts from various actions are linked to the physical footprints of  
17 the infrastructure. In the case of Alternative 1, the following facilities would directly impact the  
18 cultural settings: the well fields, CPP, secondary access roads, powerline corridors, and  
19 storage ponds.

##### 20 *4.9.1.1 Construction Impacts*

###### 21 4.9.1.1.1 Historical and Cultural Resources

22 As discussed in the GEIS, the potential impacts during ISR facility construction could include  
23 loss of, or damage to, historic and cultural resources due excavation activities as a part of  
24 construction. Additionally, access to, historical, cultural, and archaeological resources could be  
25 temporarily restricted during construction.

26 It is expected that an applicant would conduct the appropriate historic and cultural resource  
27 surveys as part of pre-license application activities. Further, it is anticipated that the  
28 determination of eligibility for listing in the *National Register of Historic Places* (NRHP) under  
29 criteria in 36 CFR 60.4(a)–(d) and/or as Traditional Cultural Properties (TCP) would be  
30 conducted as part of the site-specific review.

31 TCPs are historic and cultural resources that are important for a group to maintain its cultural  
32 heritage. Traditional cultural properties are most often associated with Native American  
33 religious or cultural practices. Most traditional cultural properties can be identified only through  
34 consultation with Federally-recognized Native American Tribes. To determine whether  
35 significant cultural resources would be avoided or mitigated, consultations involving the NRC,  
36 the applicant, State Historic Preservation Offices (SHPO), other government agencies, and  
37 Native American Tribes (Tribal government or designated THPO) would occur. An NRC  
38 licensee would be likely be required, under conditions in its license, to stop work upon discovery  
39 of previously undocumented historic or cultural resources and to notify the appropriate federal,  
40 tribal, and state agencies with regard to mitigation measures. The GEIS determined that  
41 potential impacts to historic and cultural resources from construction could be SMALL to LARGE  
42 depending on the presence or absence of historic and cultural resources on the site.

43 The construction would have a direct impact on specific archaeological sites determined eligible  
44 to the NRHP. The effect would be short-term; therefore the impact would be MODERATE as

## Environmental Impacts

---

1 mitigation would be required (Section 106 of the NHPA). If mitigation measures were not  
2 implemented, then the impacts could range from MODERATE to LARGE.

3 Archaeological sites and isolated finds were identified within project areas that would be directly  
4 affected during construction (Kinneer et al. 2007). These locations include the well field, plant  
5 area, and any location that would be cleared or otherwise surface modified. With the exception  
6 of three of the archaeological sites, the remaining sites and isolated finds were recommended  
7 as not eligible to the NRHP (Kinneer et al. 2007).

8 Three archaeological sites (48SW16604, 48SW16608, and 48SW16765) are recommended as  
9 eligible to the NRHP (Kinneer et al. 2007). Archaeological site 48SW16604 is located within the  
10 proposed well field and could be impacted during the construction phase of the project. It is  
11 recommended that the site be avoided; if avoidance was not possible, then mitigation measures  
12 should be outlined in a formal treatment plan. The impact from the project on site 48SW16604  
13 could be MODERATE as one or more conditions of integrity could be affected.

14 In 2008, LCI's contractor developed the treatment plan for the site. In the plan, Kinneer (2008)  
15 noted that "Site 48SW16604 lies within the proposed impact area where construction related to  
16 the well field, an access road, and a pipeline would occur." Since this site is proximate to an  
17 access road, a pipeline, and well site locations, it is likely that damage to it would occur during  
18 one or more phases of the project. Thus, avoidance does not seem to be a practical option. If  
19 the project is licensed by the NRC, the site would be subjected to data recovery. The impact  
20 from the project on site 48SW16604 would be MODERATE as the consequences of the  
21 proposed action would be mitigated. In the case of Site 48SW16604, mitigation must be  
22 completed prior to the implementation of the construction phase of the project according to  
23 Section 106 of the NHPA. To mitigate this MODERATE finding, the NRC, BLM, SHPO, and LCI  
24 have developed a memorandum of agreement (MOA) to address the potential impacts to site  
25 48SW16604. The MOA is currently being reviewed by all parties and will be in place prior to  
26 construction. Prior to construction, the Unexpected Discovery Plan presented in abbreviated  
27 form in Kinneer (2008) would also be formalized to more fully outline the response steps  
28 required in the event that unexpected historical and cultural resources are encountered during  
29 the construction phase.

30 Archaeological site 48SW16608 is intersected by two existing two-track roads. Avoidance of  
31 this site is recommended, but if avoidance is not possible, then a treatment plan would be  
32 developed and submitted to the BLM and Wyoming SHPO for review (Kinneer, 2007). The  
33 treatment plan would be implemented after the license is issued but before construction  
34 proceeds. To date, no treatment plan has been developed for this site. Assuming the site can  
35 be avoided, the impact from the project on site 48SW16608 would be SMALL as there would be  
36 no impact from the proposed action.

37 Archaeological site 48SW16765 is outside of the well field. The Cultural Resource Inventory  
38 (Kinneer, 2007) recommended that the site be avoided; however, if avoidance is not possible,  
39 then mitigation would be warranted. Assuming the site can be avoided, the impact from the  
40 project on site 48SW16765 would be SMALL as there would be no impact from project actions.  
41 If this site cannot be avoided, then a treatment plan would be developed by the applicant's  
42 consultant and submitted to the NRC, BLM and Wyoming SHPO for review. The treatment plan  
43 would be implemented after the license is issued but before construction proceeds. Based on  
44 the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the  
45 GEIS. Therefore, impacts to historical and cultural resources from construction are expected to  
46 be MODERATE.

47 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
48 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,

1 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
2 along with the actions proposed, are comparable to those described in the GEIS for Historical  
3 and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to  
4 Historical and Cultural Resources during construction are expected to be MODERATE to  
5 LARGE, but may be reduced to SMALL, providing no ground disturbing occurs in non-surveyed  
6 areas, and monitoring and treatment (mitigation) plans are implemented properly. Furthermore,  
7 while the NRC Staff has identified additional new information during its independent review; it  
8 nevertheless, does not change the expected environmental impact beyond what was described  
9 in the GEIS.

#### 10 4.9.1.1.2 Paleontological Resources

11 As stated in Section 3.9.5, the project area is marked by the presence of Class 2 Quaternary  
12 age, near surface deposits and Class 3A to 3B Tertiary age formations. Class 2 deposits are  
13 not likely to yield vertebrate fossils or significant non-vertebrate fossils. Tertiary age deposits  
14 are unlikely to be exposed. Under the Potential Fossil Yield Classification system, the Battle  
15 Spring Formation is assigned a ranking of Class 3A to 3B (moderate to unknown). Since the  
16 classification of these deposits ranges from moderate to unknown, the impacts could be  
17 MODERATE. Proposed surface-disturbing activities would require sufficient assessment by a  
18 BLM-approved paleontologist to determine whether significant paleontological resources occur  
19 in the area of the proposed action. If such deposits are present, then a MOA would be  
20 developed between the BLM, NRC, and Wyoming SHPO that would outline the procedures to  
21 be followed for avoidance, mitigation, and/or monitoring.

22 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
23 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
24 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
25 along with the actions proposed, are comparable to those described in the GEIS for  
26 Paleontological Resources and incorporates by reference the GEIS' conclusions that the  
27 impacts to Paleontological Resources during construction are expected to be MODERATE, but  
28 may be reduced to SMALL, providing no ground disturbing occurs in non-surveyed areas, and  
29 monitoring and treatment (mitigation) plans are implemented properly. Furthermore, while the  
30 NRC Staff has identified additional new information during its independent review; it  
31 nevertheless, does not change the expected environmental impact beyond what was described  
32 in the GEIS.

#### 33 4.9.1.2 *Operation Impacts*

34 It is expected that potential impacts to historical, cultural, and archaeological resources from  
35 operations would be less than during construction, because less land disturbance occurs during  
36 the operations phase (NRC 2009). Additionally, conditions in the NRC license require the  
37 licensee to stop work in the event of an inadvertent discovery of historic or cultural resources  
38 and to notify the appropriate federal, tribal, and state agencies with regard to mitigation  
39 measures. For these reasons, the GEIS determined that ISR operational impacts to historic and  
40 cultural resources would be SMALL.

41 Based on the information presented in Section 2.2.4, there would be no impacts from facility  
42 operation on historical and cultural resources recommended eligible to the NRHP. Any impacts  
43 to historic and cultural resources from construction would be mitigated prior to any ground-  
44 disturbing activities. There are no cultural resources known in the project area that would be  
45 affected by facility operation or maintenance. In sum, there are direct or indirect effects on the  
46 cultural resources in the project area; however, these effects would be mitigated prior to  
47 construction. Based on the foregoing analysis, site-specific conditions are consistent with the  
48 assumptions stated in the GEIS, and the impacts to historic and cultural resources from facility

1 operation would be SMALL, as long as no ground-disturbing activities occur outside of the  
2 surveyed areas. Should ground disturbing activities occur outside of previously surveyed areas,  
3 then archaeological surveys would be conducted prior to the activity.

4 Operational impacts to paleontological resources could occur during routine maintenance  
5 actions that involve ground-disturbing activities. However, the degree to which this might be an  
6 issue cannot be determined until confirmation that significant vertebrate or invertebrate fossil  
7 resources are present in the project area. If such resources are not present, then there would  
8 be no impacts to paleontological resources from facility operations. If fossils determined  
9 significant are present, then the impacts could be SMALL to MODERATE. Proposed ground-  
10 disturbing activities would be outlined in a BLM-reviewed treatment plan for this resource class.

11 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
12 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
13 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
14 along with the actions proposed, are comparable to those described in the GEIS for Historical  
15 and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to  
16 Historical and Cultural Resources during operation are expected to be SMALL, providing no  
17 ground disturbing occurs in non-surveyed areas, and monitoring and treatment (mitigation)  
18 plans are implemented properly. Furthermore, while the NRC Staff has identified additional new  
19 information during its independent review; it nevertheless, does not change the expected  
20 environmental impact beyond what was described in the GEIS.

#### 21 4.9.1.3 Aquifer Restoration Impacts

22 Aquifer restoration impacts to historic and cultural resources are expected to be similar to, or  
23 less than, potential impacts from operations (NRC 2009). Aquifer restoration activities are  
24 generally limited to the existing infrastructure and previously disturbed areas (e.g., access  
25 roads, central processing facility). Additionally, NRC license conditions regarding inadvertent  
26 discoveries historic or cultural resources and to notification of the appropriate federal, tribal, and  
27 state agencies would remain in effect. For these reasons, the GEIS determined the potential  
28 impacts from aquifer restoration to historic and cultural resources to be SMALL.

29 Based on the information presented in Section 2.2.5, there would be no aquifer restoration  
30 impacts on historical and cultural resources recommended eligible to the NRHP, therefore, the  
31 impact to historic and cultural resources is SMALL, as long as no ground-disturbing activities  
32 occur outside of the surveyed areas. Any areas not previously surveyed should be investigated  
33 by a professional archaeologist prior to any land disturbing activities.

34 Aquifer restoration impacts to paleontological resources are unlikely to occur as operations do  
35 not involve exposure of potential fossil bearing strata beneath the Battle Spring Formation.  
36 Based on the foregoing analysis, site-specific conditions are consistent with the assumptions  
37 stated in the GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL. If  
38 fossils determined significant are present, then steps for the mitigation of the proposed action  
39 would be outlined in a BLM-reviewed treatment plan for this resource class.

40 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
41 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
42 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
43 along with the actions proposed, are comparable to those described in the GEIS for Historical  
44 and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to  
45 Historical and Cultural Resources during aquifer restoration are expected to be SMALL,  
46 providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment  
47 (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified

1 additional new information during its independent review; it nevertheless, does not change the  
2 expected environmental impact beyond what was described in the GEIS.

#### 3 4.9.1.4 *Decommissioning Impacts*

4 It is expected that decommissioning and reclamation activities would focus on previously  
5 disturbed areas, and that historic and cultural resources within the potential area of effect would  
6 already be known (NRC 2009). As a result, the GEIS considered the potential impacts to  
7 historical, cultural, and archaeological resources during decommissioning and reclamation to be  
8 SMALL.

9 Based on the information presented in Section 2.2.6 of this document, there would be no  
10 decommissioning impacts on historical, cultural and paleontological resources. Based on the  
11 foregoing analysis, site-specific conditions are consistent with the assumptions stated in the  
12 GEIS, and the impacts to historical and cultural resources from decommissioning would be  
13 SMALL, as long as no ground-disturbing activities occur outside of the surveyed areas. Any  
14 areas not previously surveyed should be investigated by a professional archaeologist prior to  
15 any land disturbing activities.

16 Impacts to paleontological resources are unlikely to occur as decommissioning does not involve  
17 exposure of potential fossil bearing strata beneath the Battle Spring Formation; therefore, the  
18 impact is SMALL. If fossils determined significant are present, then steps for the mitigation of  
19 the proposed action would be outlined in a BLM-reviewed treatment plan for this resource class.

20 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
21 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
22 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
23 along with the actions proposed, are comparable to those described in the GEIS for Historical  
24 and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to  
25 Historical and Cultural Resources during decommissioning are expected to be SMALL,  
26 providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment  
27 (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified  
28 additional new information during its independent review; it nevertheless, does not change the  
29 expected environmental impact beyond what was described in the GEIS.

#### 30 4.9.2 **No-Action (Alternative 2)**

31 Under the No-Action Alternative, there would be no impacts associated with the proposed ISR  
32 facility and therefore no impacts to subsurface or surface cultural resources related to this  
33 project. When compared to the action alternatives, there would be no effect in regards to  
34 cultural and paleontological resources (*i.e.* no archaeological sites, isolated cultural resources,  
35 or paleontological resources) would be affected by direct or indirect effects as a result of this  
36 alternative.

37 It is expected that other actions that are ongoing in the general area would continue, including  
38 oil and gas exploration and production. Cultural and ethnographic resources have to be  
39 inventoried or evaluated for oil and gas exploration and production. State and federal level  
40 permits are required and cultural and ethnographic resources are routinely identified and  
41 evaluated as part of the permitting process.

42 Although no known archaeological sites identified within the project area would be impacted by  
43 the ISR facility, it is likely that most of the surficial archaeological sites have been disturbed by  
44 routine cattle grazing. Some sites may have been disturbed by two-track roads and cattle  
45 related operations such as fences. Overall, there are impacts to cultural resources from actions  
46 not related to the current project.

1 Regarding paleontological impacts from other projects in the general area, the same types of  
2 actions may affect this resource category. Impacts from cattle grazing would be very minor and  
3 inconsequential. However, geologic units which might contain significant paleontological  
4 resources could be affected by the construction of features like reservoirs which might exceed  
5 the depth of the Quaternary surface unit. Similarly, subsurface water lines or other  
6 infrastructure might also affect geologic units of concern. It should be noted, however, that the  
7 footprint of oil, gas, and other drill types is small. Drills may extend for several hundred feet  
8 below grade. Damage from this action to geologic units at depth is minimal. Thus,  
9 consideration of the impacts to geologic units bearing potentially significant paleontological  
10 resources is not warranted unless the drill field units are exceptionally tightly spaced.

11 In sum, many prior (cumulative) actions may have impacted the cultural, historical, and  
12 paleontological resources but the extent of this impact is unknown. If the current action is not  
13 licensed, then impact to the cultural, historical and paleontological resources are likely to  
14 continue as they have in the past.

#### 15 **4.9.3 Dry Yellowcake (Alternative 3)**

16 Under Alternative 3, the wet yellowcake slurry currently proposed would be processed to a dry  
17 powder form on-site. Additional equipment to process the yellowcake would be installed in the  
18 CPP located at the Lost Creek site; however, the facility configurations outlined in Alternative 1  
19 would be the same. Because there would be no change in the physical layout of the site, the  
20 impacts to historical, cultural, and paleontological resources described under the proposed  
21 action would also apply here, to Alternative 3.

#### 22 **4.10 Visual and Scenic Resources Impacts**

23 Potential visual and scenic impacts from the proposed Lost Creek facility may occur during all  
24 phases of the ISR facility's lifecycle. These impacts primarily would be associated with the use  
25 of equipment such as drill rigs; dust and other emissions from such equipment; the construction  
26 of facility buildings, other structures, and site and well field access roads; land clearing and  
27 grading activities; and lighting for nighttime operations. Such impacts would be mitigated by  
28 rolling topography, color considerations for structures, and dust suppression techniques.

29 Also of consideration in the significance of visual impacts is the use of the BLM Visual Resource  
30 Management (VRM) classification of landscapes. Most of the landscapes in the Wyoming West  
31 Uranium Milling Region identified in the GEIS are identified as VRM Class II or Class IV, thus  
32 allowing for an activity to contrast with basic elements of the characteristic landscape to a  
33 limited extent (Class II) or to a much greater extent (Class IV).

#### 34 **4.10.1 Proposed Action (Alternative 1)**

35 Under Alternative 1 (Proposed Action), the NRC would issue LCI a license for ISR uranium  
36 milling and processing at the Lost Creek site. The facilities would be contained within about 115  
37 ha (285 ac); of this, about 102 ha (254 ac) are accounted for by the well fields and access road.  
38 Potential visual and scenic impacts would be associated with the physical presence of the well  
39 fields, buildings and infrastructure. In the case of Alternative 1, the following facilities would  
40 directly impact the visual and scenic settings: the well fields, CPP, secondary access roads,  
41 power line corridors, and storage ponds.

42 The proposed action would result in temporary, SMALL impacts to the visual and scenic  
43 resources of the area. The nature of the impacts would be in keeping with the visual resource

1 classification as a Class III area (see Section 3.10.3 of this EA) by BLM. The management  
2 objective for Visual Resource Class III areas, as defined, is to:

3 "Partially retain the existing character of the landscape. The level of change to the landscape  
4 should be moderate. Management activities may attract the attention of the casual observer but  
5 should not dominate the view of the casual observer. Changes should repeat the basic natural  
6 elements found in the predominant natural features of the characteristic landscape" (BLM,  
7 1984).

#### 8 4.10.1.1 *Construction Impacts*

9 As discussed in GEIS Section 4.2.9.1, visual impacts during construction can result from  
10 equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and  
11 hillside and roadside cuts. Depending on the location of a proposed ISL facility relative to  
12 viewpoints such as highways, process facility construction and drill rigs could be visible. For  
13 nighttime operation, the drill rigs would be lighted, and this would create a visual impact  
14 because the drill rigs would be most visible and provide the most contrast if they were located  
15 on elevated areas. Most impacts would be temporary as equipment is moved and would be  
16 mitigated by best management practices (e.g., dust suppression). Additionally, because these  
17 sites are expected to be in sparsely populated areas and there would be generally rolling  
18 topography of the region, most visual impacts during construction would not be expected to be  
19 visible from more than about 1 km [0.6 mi]. As previously discussed, Prevention of Significant  
20 Deterioration Class I areas require more stringent air quality standards that can affect visual  
21 impacts; however, there are no PSD Class I areas in the Wyoming West Uranium Milling  
22 Region. Finally, proposed ISR facilities are expected to be located more than 16 km [10 mi]  
23 from the closest VRM Class II area, and the visual impacts associated with ISL construction  
24 would be consistent with the predominant VRM Class III and IV classification, therefore, visual  
25 impacts associated with ISL construction would be expected to be SMALL.

26 During construction, visual resources would be affected to some degree by vegetative  
27 disturbance, road building, drilling, piping, and facility construction and placement. These  
28 impacts are anticipated to be SMALL.

29 The greatest potential impact to visual resources would result from well field development, when  
30 drilling rig masts contrast with the general topography. Visual impacts from facilities  
31 construction (e.g., drilling and land disturbance) would generally be temporary (short-term) and  
32 visual impacts from buildings would be SMALL. Additional impacts would include dust from  
33 clearing for parking, access roads, well sites, storage pads, retention (evaporation) ponds,  
34 monitoring wells, and piping. The potential visual and scenic impacts would be greatest for new  
35 ISR facilities developed in rural, previously undeveloped areas. The project area, however,  
36 currently has other land uses (fencing, power lines, and four-wheel-drive roads) that have  
37 disturbed the landscape, and thus impacts would be expected to be SMALL for the proposed  
38 action.

39 Due to of the number of wells that may be involved in this ISR operation, multiple drill rigs are  
40 likely to be operating during well field construction. For the project area, a maximum of  
41 approximately 67 ha (165 ac) would be disturbed at any one time. This estimate includes the  
42 CPP, all on-site roads, operating mine units, mud pits for resource and delineation and  
43 monitoring wells, and pipelines. No more than four percent of the project area would be  
44 disturbed at any time. A typical truck-mounted rotary drill rig may be about 9-12 m (30-40 ft) tall  
45 (USAGE, 2001). Once a well is completed and conditioned for use, the drill rig would be moved  
46 to a new location to drill the next hole. Because temperatures in the affected environment drop  
47 below freezing, wellheads for completed wells would be covered to prevent freezing and protect  
48 the well. These covers would be low structures (1-2 m [3-6 ft] high) and present only a slight

1 contrast with the existing landscape. Unless the topography is extremely flat and void of  
2 vegetation, it is likely that these structures would not be visible from distances on the order of 1  
3 km (0.6 mi) or more. Actual boundaries of well fields and the number of wells would not be  
4 known until final preoperational exploration was completed. Planned access roads, pipelines,  
5 and potential locations of retention ponds would also be uncertain within each well field.

6 Most visual and scenic impacts associated with earth-moving activities during construction  
7 would be temporary. Roads and structures would be more long-lasting, but would be removed  
8 and reclaimed after operations cease. As noted in Section 3.9, the project area has been  
9 classified as VRM Class III according to the BLM classification system. This classification  
10 allows for an activity to contrast with basic elements of the characteristic landscape to a  
11 moderate extent. Mine unit development would occur sequentially, with reclamation in the first  
12 mine unit concurrent with construction and operations in later mine units. No more than four  
13 percent of the project area should be disturbed at any time. Process facility construction and  
14 drill rigs could be visible, however most of these modifications would not be visible from the  
15 public road network, which is lightly traveled (LCI, 2008a). The visual presence of the pipelines  
16 and wells would also impact the natural setting and overall cultural landscape. However, since  
17 much of the well field construction activities would be underground, there would be less impact  
18 to the overall view of the place than those seen in the construction of the central plant. During  
19 construction of ISR well fields and facilities, dust suppression and coloration of well covers  
20 would further reduce overall visual and scenic impacts of project construction so that total  
21 impacts would be SMALL. Based on the foregoing analysis, site-specific conditions are  
22 consistent with the assumptions stated in the GEIS. Therefore, visual impacts from construction  
23 are expected to be SMALL.

24 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
25 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
26 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
27 along with the actions proposed, are comparable to those described in the GEIS for Visual and  
28 Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to  
29 Visual and Scenic Resources during construction are expected to be SMALL. Furthermore, the  
30 NRC Staff has not identified new and significant information during its independent review that  
31 would change the expected environmental impact beyond what was described in the GEIS.

#### 32 4.10.1.2 *Operation Impacts*

33 GEIS (Section 4.2.9.2) states that visual impacts during operations would be expected to be  
34 less than those associated with construction. Most of the well field surface infrastructure would  
35 have a low profile, and most piping and cables would be buried. The tallest structures would be  
36 expected to include the central uranium processing facility (10 m [30 ft]) and power lines (6 m  
37 [20 ft]). Because these sites are in sparsely populated areas and there is generally rolling  
38 topography of the regions, most visual impacts during operations would not be visible from more  
39 than about 1 km (0.6 mi). Irregular layout of well field surface structures such as wellhead  
40 protection and header houses would further reduce visual contrast. Best management  
41 practices, and design (e.g., painting buildings) and landscaping techniques would be used to  
42 mitigate potential visual impact. The uranium districts in the four regions are all located more  
43 than 16 km (10 mi) from the closest VRM Class II region, and the visual impacts associated with  
44 ISL construction would be consistent with the predominant VRM Class III and IV. Therefore, the  
45 GEIS considered visual and scenic impacts from operations to be SMALL.

46 Most of the pipes and cables associated with well field operation are anticipated to be buried to  
47 protect them from freezing, and they would not be visible during operations. As uranium ore is  
48 depleted in one area, operations (wells) shift from that area to the next sequential area, and

1 drilling begins in another area. As a result, there is generally not a large amount of land  
2 undergoing development at one time (NRC, 2009). Because the location of uranium deposits is  
3 typically irregular, the network of pipes, wells, and power lines (power lines would be 6 m [20 ft]  
4 tall) would not be regular in pattern or appearance (i.e., not a grid), reducing visual contrast and  
5 associated potential impacts. The wellhead covers would be typically low (1-2 m [3-6 ft])  
6 structures, and the overall visual impact of an operating well field would be SMALL.

7 The CPP, storage ponds, ancillary buildings, and pump houses would be the main operational  
8 facilities affecting the visual landscape. The project area would be located 7.2 km (4.5 mi) from  
9 the nearest county road, and the distance, coupled with the rolling topography would screen the  
10 facilities from travelers. There are no locally important or high-quality views that would be  
11 affected by the proposed action. Project facilities would not be a dominant landscape feature to  
12 observers outside the project area. Impacts would also be temporary, since buildings and roads  
13 would be decommissioned and removed at the project's end, probably within 10 to 12 years of  
14 permit approval, and vegetation would be restored to its previous condition. Operation impacts  
15 to visual and scenic resources would be SMALL.

16 Mitigation through BMPs (e.g., dust suppression) as well as limiting building height and painting  
17 buildings to blend into the natural landscape would further reduce overall visual and scenic  
18 impacts of operations. Based on the foregoing analysis, site-specific conditions are consistent  
19 with the assumptions stated in the GEIS. Therefore, visual impacts from operation are expected  
20 to be SMALL.

21 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
22 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
23 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
24 along with the actions proposed, are comparable to those described in the GEIS for Visual and  
25 Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to  
26 Visual and Scenic Resources during operation are expected to be SMALL. Furthermore, the  
27 NRC Staff has not identified new and significant information during its independent review that  
28 would change the expected environmental impact beyond what was described in the GEIS.

#### 29 4.10.1.3 *Aquifer Restoration Impacts*

30 Section 4.2.9.3 of the GEIS addresses visual and scenic impacts from aquifer restoration. The  
31 GEIS states that aquifer restoration activities are expected to take place some years after the  
32 facility had been in operation and that restoration activities would use in-place infrastructure.  
33 As a result, potential visual impacts would be similar to, or less than, those experienced during  
34 operations. Additional mitigation measures (e.g., dust suppression) could be used to further  
35 reduce visual and scenic impacts. Therefore, such impacts are expected to be SMALL.

36 Visual Resource impacts from groundwater sweep and aquifer restoration would be similar to  
37 those seen in the operations phase. It is anticipated that the aquifer restoration staff would be  
38 smaller than the operations staff since efforts would be solely focused on restoring the  
39 groundwater to its previous natural chemical levels. Production units would still be restricted  
40 from other uses during the aquifer restoration phase. LCI expects that aquifer restoration would  
41 take a least a year for each production unit. Aquifer restoration would cause no modifications to  
42 scenery or topography that would persist after restoration and reclamation. Any impacts would  
43 be temporary, since buildings and roads would be decommissioned and removed at the end of  
44 the project, probably within 10 to 12 years of permit approval, and vegetation would be restored  
45 to its previous condition. Restoration and reclamation would occur sequentially, with  
46 reclamation in the first production unit concurrent with construction and operations in later  
47 production units. In general, less than 10 percent of an ISR project area is expected to be  
48 disturbed at any given time, thus, the final decommissioning event would not involve a large

1 areal footprint. Most of the modifications would not be visible from the public road network,  
2 which is lightly traveled. Based on the foregoing analysis, site-specific conditions are consistent  
3 with the assumptions stated in the GEIS. Therefore, visual impacts from aquifer restoration are  
4 expected to be SMALL.

5 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
6 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
7 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
8 along with the actions proposed, are comparable to those described in the GEIS for Visual and  
9 Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to  
10 Visual and Scenic Resources during aquifer restoration are expected to be SMALL.

11 Furthermore, the NRC Staff has not identified new and significant information during its  
12 independent review that would change the expected environmental impact beyond what was  
13 described in the GEIS.

#### 14 4.10.1.4 Decommissioning Impacts

15 As discussed in the GEIS (Section 4.2.9.4), because similar equipment would be used and  
16 activities conducted, potential visual impacts during decommissioning would be similar to, or  
17 less than, those experienced during construction. It would be expected that most potential  
18 visual impacts during decommissioning would be temporary as equipment is moved and would  
19 be mitigated by best management practices (e.g., dust suppression). Additionally, visual  
20 impacts would be low, because these sites are expected to be in sparsely populated areas, and  
21 that impacts would diminish as decommissioning activities decrease. NRC licensees are  
22 required to conduct final site decommissioning and reclamation under an approved site  
23 reclamation plan, with the goal of returning the landscape to preconstruction conditions  
24 (expected to remain predominantly VRM Class III and IV). While some roadside cuts and hill  
25 slope modifications may persist beyond decommissioning and reclamation, the GEIS analysis  
26 expects visual and scenic impacts from decommissioning to be SMALL.

27 ISR operations would cause no modifications to scenery or topography that would persist after  
28 restoration and reclamation. Once project operations are completed (probably within 10 to 12  
29 years of permit approval), all facilities would be decommissioned and removed. Reclamation  
30 efforts are intended to return the visual landscape to baseline contours and should result in  
31 reducing the impacts from operations and minimizing permanent impacts to visual resources.  
32 Before the NRC license is terminated, the licensee must submit an acceptable site reclamation  
33 plan according to 10 CFR Part 40. Re-contouring disturbed surfaces (including access roads)  
34 and reseeded them with native vegetation that can adapt to the climate and soil conditions  
35 would help return the facility to its natural state prior to ISR construction and operations.

36 No more than about 4 percent of the project area is expected to be disturbed at any time, thus  
37 the final decommissioning event would not involve a large areal footprint (LCI, 2008a). During  
38 decommissioning and reclamation, temporary impacts to the visual landscape would be  
39 expected to be similar to or less than those during the construction period. For example,  
40 equipment used to dismantle buildings and milling equipment, remove any contaminated soils,  
41 or grade the surface as part of reclamation activities would generate temporary visual contrasts.  
42 Overall impacts to the visual landscape would be expected to be SMALL, and temporary; once  
43 decommissioning and reclamation activities were complete, the visual landscape would be  
44 returned to baseline with the potential exception of equipment related to longer term monitoring  
45 activities. Most of the modifications, including decommissioning, would not be visible from the  
46 public road network, which is lightly traveled. Based on the foregoing analysis, site-specific  
47 conditions are consistent with the assumptions stated in the GEIS. Therefore, visual impacts  
48 from decommissioning are expected to be SMALL.

1 Mitigation through BMPs (e.g., dust suppression) would further reduce overall visual and scenic  
2 impacts of aquifer restoration so that total impacts would be SMALL.

3 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
4 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
5 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
6 along with the actions proposed, are comparable to those described in the GEIS for Visual and  
7 Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to  
8 Visual and Scenic Resources during decommissioning are expected to be SMALL.

9 Furthermore, the NRC Staff has not identified new and significant information during its  
10 independent review that would change the expected environmental impact beyond what was  
11 described in the GEIS.

#### 12 **4.10.2 No-Action (Alternative 2)**

13 Under the No-Action Alternative, there would be no ISR facility construction and therefore, no  
14 change to existing visual and scenic resources at the proposed project area, or in the region.  
15 The fencing, power lines, and four-wheel-drive roads in place within the project area from  
16 current and previous activities would remain, and are considered a minimal disturbance to the  
17 landscape, and thus, the impacts would be SMALL. No additional structures or uses would be  
18 introduced that would cause the existing viewscape to be affected, and the existing scenic  
19 quality would be unchanged. The scenic quality classification used by the BLM would be a C  
20 (the lowest possible), and the visual resource classification would be Class III (LCI 2008a).

#### 21 **4.10.3 Dry Yellowcake (Alternative 3)**

22 Under Alternative 3, NRC would issue the applicant a license for the construction, operation,  
23 aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing of  
24 dry yellowcake as the final product. By doing so, the project would consist of adding equipment  
25 for the processing of dry yellowcake. The additional equipment would be installed internal to the  
26 CPP at the Lost Creek site. The dry yellowcake would be transported from the Lost Creek site  
27 directly to Metropolis, Illinois for ultimate processing into the fuel for nuclear reactors. This  
28 additional process would eliminate the step of transporting the yellowcake slurry from the Lost  
29 Creek site to an intermediate dry processing facility before being shipped to Illinois. As a result,  
30 the potential impacts would be the same as those of the proposed action for all four of the ISR  
31 phases, SMALL, and the mitigation measures would also be the same.

#### 32 **4.11 Socioeconomic Impacts**

33 Potential environmental impacts to socioeconomics from activities at the Lost Creek site may  
34 occur during all phases of the ISR facility's lifecycle. Potential impacts to socioeconomics would  
35 result predominantly from employment at an ISL facility and demands on the existing public and  
36 social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work  
37 force.

38 Detailed discussion of the potential environmental impacts to socioeconomics from construction,  
39 operation, aquifer restoration, and decommissioning are provided in the following sections.

1 **4.11.1 Proposed Action (Alternative 1)**

2 **4.11.1.1 Construction Impacts**

3 In the GEIS (Section 4.2.10.1), the potential impacts to socioeconomics from construction of an  
4 ISR facility are discussed. Impacts would result predominantly from employment at an ISL  
5 facility and demands on the existing public services, tourism/recreation, housing, infrastructure  
6 (schools, utilities), and the local work force. The GEIS estimated total peak employment to be  
7 approximately 200 people, including company employees and local contractors, depending on  
8 timing of construction with other stages of the ISR lifecycle. Additionally, an estimated 140  
9 ancillary jobs could be created associated with the ISR facility (NRC 2009). During construction  
10 of surface facilities and well fields, it is expected that a general practice would be to use local  
11 contractors (drillers, construction), as available, and that local building materials and building  
12 supplies would be used to the extent practicable.

13 The GEIS also considered that most employees would choose to live in larger communities with  
14 access to more services. However, is expected that some construction workers would commute  
15 from outside the county to the ISR facility, and that skilled employees (e.g., engineers,  
16 accountants, managers) would come from outside the local work force. The potential also  
17 exists that some employees could temporarily relocate to the project area and contribute to the  
18 local economy through purchasing goods and services and taxes. Depending on where the  
19 work force and supplies came from, the GEIS determined that potential impacts to towns and  
20 communities, in terms of housing and employment structure, could be SMALL to MODERATE.

21 Given the expected short duration of construction activities (12 to 18 months), it was not  
22 expected that families would relocate closer to the site. For this reason, potential impacts to  
23 education and use of local services was determined to be SMALL.

24 Because of the small, relative size of the ISR construction workforce, the overall potential  
25 impacts to socioeconomics from construction would be expected to be SMALL to MODERATE.

26 The construction phase (construction of the CPP, associated buildings, access roads and  
27 storage areas) at Lost Creek is estimated to last approximately six months, but would avoid the  
28 winter and spring months because of weather and ecological limitations. The estimated  
29 workforce during the life of the construction period would include an estimated 70-90 workers. It  
30 is expected that approximately 70 percent of the work force would come from outside the local  
31 area (LCI, 2008a). Rural areas in Wyoming are especially vulnerable to the boom and bust  
32 trends that have occurred in the energy sector of Wyoming. Counties and towns whose  
33 economies are centered on extractive industry, generally do not have diversified economy, and  
34 have suffered when the natural resources are exhausted, or when the market for the resource  
35 becomes depressed. Impacts in each component of the socioeconomic system are discussed  
36 below.

37 **4.11.1.1.1 Demographics**

38 Most workers are expected to commute to the project area from larger, economically diversified  
39 centers such as Rock Springs, Rawlins, and Casper, which is consistent with the assumptions  
40 stated in the GEIS for the Wyoming West Uranium Milling Region. The added construction  
41 workforce is expected to have a SMALL impact on the populations of these cities.

42 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
43 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
44 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
45 along with the actions proposed, are comparable to those described in the GEIS for  
46 Demographics and incorporates by reference the GEIS' conclusions that the impacts to

1 Demographics during construction are expected to be SMALL. Furthermore, while the NRC  
2 Staff has identified additional new information during its independent review; it nevertheless,  
3 does not change the expected environmental impact beyond what was described in the GEIS.

#### 4 4.11.1.1.2 Income

5 No changes to income to Sweetwater County, surrounding counties, or the remainder of the  
6 State of Wyoming are anticipated under the Proposed Action. It is expected that workers would  
7 be paid wage rates typical of the area. Site-specific conditions are consistent with the  
8 assumptions stated in GEIS Section 4.2.10.1. The construction phase is expected to be short  
9 term; therefore, impacts would be SMALL.

10 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
11 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
12 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
13 along with the actions proposed, are comparable to those described in the GEIS for Income and  
14 incorporates by reference the GEIS' conclusions that the impacts to Income during construction  
15 are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new  
16 information during its independent review; it nevertheless, does not change the expected  
17 environmental impact beyond what was described in the GEIS.

#### 18 4.11.1.1.3 Housing

19 Changes in population drive changes in housing demand. In the case of the Lost Creek project,  
20 there are no communities within a 32 km (20 mi) radius to house construction workers (LCI  
21 2009). The nearest city is Rawlins, which is located 64 km (40 mi) from the project area.  
22 Construction workers would likely commute to and from the project site from their residences or  
23 would stay in a hotel in Rawlins or Wamsutter (LCI 2009). Hotel rooms are affordable in  
24 Rawlins due to low natural gas prices. Additionally, a new hotel is also being built in Wamsutter,  
25 however, given the short construction schedule (6 months), workers are unlikely to relocate their  
26 families (LCI 2009). Housing demand is not anticipated to increase as construction workers  
27 would either commute or stay in hotels during this time period. Site-specific conditions are  
28 consistent with the assumptions stated in the GEIS for SMALL impacts. As a result, housing  
29 impacts would be SMALL.

30 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
31 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
32 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
33 along with the actions proposed, are comparable to those described in the GEIS for Housing  
34 and incorporates by reference the GEIS' conclusions that the impacts to Housing during  
35 construction are expected to be SMALL. Furthermore, may actually be less than the expected  
36 MODERATE environmental impact described in the GEIS.

#### 37 4.11.1.1.4 Employment Structure

38 Employment structure represents the resource based extractive industries of the area. Given  
39 the existing downturn in the economy and the associated unemployment, the Lost Creek project  
40 would bring an increase in construction and service industry jobs to the area. This type of  
41 development does not add to the economic diversity of the resource dependent area. Site-  
42 specific conditions are consistent with the assumptions stated in the GEIS for SMALL impacts.  
43 These impacts to employment would be positive, but SMALL.

44 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
45 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
46 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,

1 along with the actions proposed, are comparable to those described in the GEIS for  
2 Employment Structure and incorporates by reference the GEIS' conclusions that the impacts to  
3 Employment Structure during construction are expected to be SMALL. Furthermore, while the  
4 NRC Staff has identified additional new information during its independent review; it expected  
5 environmental impact beyond what was described in the GEIS.

6 4.11.1.1.5 Local Finance

7 The construction workforce would have an impact on the local economy through the purchasing  
8 of goods and services such as food, entertainment, gas, and retail items. Tax revenue would  
9 accrue to Sweetwater County based on the value of construction equipment on the site.

10 Typically, this equipment would be registered at the County Assessor's Office, and a discount  
11 applied to the market value (50 percent) then 11.5 percent of the adjusted value is taxed at a  
12 rate of 63.088 mills (Williams, 2009). This income would help offset the increased needs for  
13 public services. To the extent that project contractors and subcontractors register equipment as  
14 required by Wyoming statute, the greater the benefit to the counties and the more capable the  
15 counties would be to manage growth through increased services. Other tax revenue accrues as  
16 described in Section 3.11 (e.g. use tax, lodging tax).

17 Local finance represents income associated with economic activity in the area (minus the cost  
18 associated with providing services for a changing population). The economic activity is  
19 expected to increase during this period, leading to an increase in the tax base especially for the  
20 state and county. Cities and towns may not benefit at a level that keeps pace with increased  
21 demand for services. Distribution of tax revenue can be a problem in some areas. Specifically,  
22 because of the structure of the taxing system, taxes may not accrue or be distributed to the  
23 localities proportionate to the population/public service impacts experienced by those entities.  
24 Tax revenue would accrue mainly in Sweetwater County and to the state. Similarly, small towns  
25 experiencing increased population/public service demand may not receive a proportionate level  
26 of tax increase as sales tax accrues in the larger population centers. This would be the case, for  
27 instance, were workers to choose to live in other counties such as Natrona or small towns such  
28 as Jeffrey City or Lamont, nearer the project (but not in Sweetwater County). Based on the  
29 foregoing analysis, site-specific conditions are consistent with the assumptions stated in the  
30 GEIS. In general, impacts are anticipated to be SMALL during the construction phase because  
31 the activity is of short duration.

32 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
33 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
34 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
35 along with the actions proposed, are comparable to those described in the GEIS for Local  
36 Finance and incorporates by reference the GEIS' conclusions that the impacts to Local Finance  
37 during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified  
38 additional new information during its independent review; it nevertheless, does not change the  
39 expected environmental impact beyond what was described in the GEIS.

40 4.11.1.1.6 Education

41 The relatively small construction workforce would not have a noticeable impact on local schools.  
42 The construction phase is expected to be short term; it is unlikely that workers would relocate  
43 their families to the project area for such a short period. Site-specific conditions are consistent  
44 with the assumptions stated in the GEIS. As a result, the impact to education would be SMALL.

45 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
46 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
47 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,

1 along with the actions proposed, are comparable to those described in the GEIS for Education  
2 and incorporates by reference the GEIS' conclusions that the impacts to Education during  
3 construction are expected to be SMALL. Furthermore, while the NRC Staff has identified  
4 additional new information during its independent review; it nevertheless, does not change the  
5 expected environmental impact beyond what was described in the GEIS.

#### 6 4.11.1.1.7 Public Services

7 The small size of the construction workforce would not increase the demand for public services,  
8 such as water supply, health and emergency services, public safety, local government services,  
9 and transportation. While a small population increase is expected during this time period due to  
10 workers commuting to, or temporarily living in, the area, local governments have developed the  
11 ability to plan for, and manage, change. Based on the foregoing analysis, site-specific  
12 conditions are consistent with the assumptions stated in the GEIS for SMALL impacts.  
13 Therefore, it is anticipated that impacts to public services would be SMALL.

14 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
15 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
16 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
17 along with the actions proposed, are comparable to those described in the GEIS for Public  
18 Services and incorporates by reference the GEIS' conclusions that the impacts to Public  
19 Services during construction are expected to be SMALL. Furthermore, while the NRC Staff has  
20 identified additional new information during its independent review; it nevertheless, does not  
21 change the expected environmental impact beyond what was described in the GEIS.

#### 22 4.11.1.2 *Operation Impacts*

23 As discussed in Section 4.2.10.2 of the GEIS, employment levels during ISR facility operations  
24 (50 to 80 workers) would be expected to be less than those for construction. Use of local  
25 contract workers and building materials would diminish, because drilling and facility construction  
26 would diminish. Revenues would be generated from federal, state, and local taxes on the  
27 facility and the uranium produced. Types of jobs would be more technical, and it was expected  
28 that the majority of the operational work force would be staffed from outside the region,  
29 particularly during start up.

30 Effects on public services (e.g., education, health care, utilities, shopping, recreation) during  
31 operation are expected to be similar to, but longer in duration than, the effects during  
32 construction.

33 Overall, the GEIS determined that potential impacts to socioeconomics from operations would  
34 be expected to be SMALL to MODERATE.

35 The operation of the proposed Lost Creek ISR facility is expected to last approximately nine  
36 years, and would employ an estimated 80 workers (LCI, 2008). The average annual salary for  
37 all full-time employees would be approximately \$50,000, with a total annual payroll is estimated  
38 at \$2,900,000. The impacts from operations would include the creation of new jobs during the  
39 life of the project, such as project managers, plant operators, lab technicians, and drill  
40 contractors. This additional work force is expected to have an impact on the local economy as  
41 these workers would purchase local goods and services throughout the estimated nine years of  
42 operations. If members of the operations workforce choose to reside in neighboring towns in  
43 the project area, there is the potential for an increased demand for local housing; the operations  
44 work force could exhaust the limited local housing inventory and could drive up local rental and  
45 sales prices.

1           4.11.1.2.1 Demographics

2       Operations would require a number of specialized workers, such as plant managers, technical  
3       professionals, and skilled tradesmen. For this reason, operation workers would likely come  
4       from outside the local area. The added operation workforce would stay in the area for longer  
5       than the construction staff (approximately nine years). This would cause a higher number of  
6       children and other full-time residents to move into the area. In addition, this increase in  
7       population would cause additional jobs to be created to service the larger population. These  
8       new jobs could also cause other workers to move into the area (along with their families). Site-  
9       specific conditions are consistent with the assumptions stated in the GEIS for MODERATE  
10      impacts. Therefore, impacts are expected to be MODERATE.

11     After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
12     with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
13     and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
14     along with the actions proposed, are comparable to those described in the GEIS for  
15     Demographics and incorporates by reference the GEIS' conclusions that the impacts to  
16     Demographics during operation are expected to be MODERATE. Furthermore, while the NRC  
17     Staff has identified additional new information during its independent review; it nevertheless,  
18     does not change the expected environmental impact beyond what was described in the GEIS.

19           4.11.1.2.2 Income

20     The average annual salary for full-time Lost Creek ISR employees (approximately 60 of 80 total)  
21     would be approximately \$45,000, with a total annual payroll is estimated at \$2,900,000. Site-  
22     specific conditions are consistent with the assumptions stated in GEIS Section 4.2.10.2.  
23     Therefore, budgetary impacts to Sweetwater County are expected to be SMALL.

24     After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
25     with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
26     and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
27     along with the actions proposed, are comparable to those described in the GEIS for Income and  
28     incorporates by reference the GEIS' conclusions that the impacts to Income during operation  
29     are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new  
30     information during its independent review; it nevertheless, does not change the expected  
31     environmental impact beyond what was described in the GEIS.

32           4.11.1.2.3 Housing

33     Changes in population drive changes in housing demand. Housing demand is anticipated to  
34     increase in the next few years as specialized workers in the extraction mineral industry relocate  
35     to Wyoming. This would further stress a housing market that is currently over-stressed. Site-  
36     specific conditions are consistent with the assumptions in GEIS Section 4.2.10.2. Therefore,  
37     impacts could be MODERATE, particularly if employees chose to live in some of the smaller  
38     communities.

39     After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
40     with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
41     and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
42     along with the actions proposed, are comparable to those described in the GEIS for Housing  
43     and incorporates by reference the GEIS' conclusions that the impacts to Housing during  
44     operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified  
45     additional new information during its independent review; it nevertheless, does not change the  
46     expected environmental impact beyond what was described in the GEIS.

#### 4.11.1.2.4 Employment Structure

The impacts from operations would include the creation of new jobs during the life of the project, such as project managers, plant operators, lab technicians, and drill contractors. Employment structure represents the resource based extractive industries of the area. As essentially another extractive industry, no changes are expected to the employment structure during this time period, however, the overall level of employment would increase. The ISR project would contribute negatively to the area's economic diversity, however. In general the more diversified the economy, the healthier. Diversified economies can weather fluctuations in one industry without going through a "bust" cycle. As mentioned in Section 3.11, the State of Wyoming has been experiencing a boom over the last several years, which has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. This is also true for Sweetwater County (Wyoming Department of Employment, Research and Planning 2009).

Based on the analysis above, site-specific conditions are consistent with the assumptions in the GEIS for MODERATE impacts. Therefore, impacts are expected to have a MODERATE impact on the local economy while not, however, increasing the diversification of the economy from extractive industries.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Employment Structure and incorporates by reference the GEIS' conclusions that the impacts to Employment Structure during operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

#### 4.11.1.2.5 Local Finance

Tax revenue would continue to accrue to the County through all stages of operation. Regarding the direct operation of the proposed project, the personal property tax would be applied to the value of all equipment used by the project (as discussed in the previous section). In addition, a state mineral severance tax would be applied to the uranium extracted from the site. State severance tax does not come back to the county directly however. The county imposes an ad valorem tax to production also.

Indirectly, the county would benefit from increased sales tax revenue. Under Wyoming law, there is a 4 percent sales and use tax to which local governments may add up to 3 percent optional tax. Sweetwater County also has a 2 percent lodging tax. Currently, Sweetwater County has an additional tax of 1 percent (Wyoming Department of Revenue, 2009). Thus, the impact of tax revenue to Sweetwater County due to the proposed action would be regional, long-term, beneficial, but SMALL. As mentioned in the previous discussion of construction impacts, the distribution of tax dollars may place an uneven benefit/burden on some localities. Based on the analysis above, site-specific conditions are consistent with the assumptions in the GEIS. Therefore, impacts are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Local Finance and incorporates by reference the GEIS' conclusions that the impacts to Local Finance

1 during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified  
2 additional new information during its independent review; it nevertheless, does not change the  
3 expected environmental impact beyond what was described in the GEIS.

4 4.11.1.2.6 Education

5 The added workforce (approximately 80 workers) and family population (up to 200) would  
6 expect to impact local schools and their infrastructure, particularly if they are small school  
7 districts with limited resources. Site-specific conditions are consistent with the assumptions in  
8 GEIS Section 4.2.10.2. Therefore, operation impacts to the local schools could be regional,  
9 long-term, and may be MODERATE, as workers would have their families with them (LCI,  
10 2008a).

11 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
12 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
13 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
14 along with the actions proposed, are comparable to those described in the GEIS for Education  
15 and incorporates by reference the GEIS' conclusions that the impacts to Education during  
16 operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified  
17 additional new information during its independent review; it nevertheless, does not change the  
18 expected environmental impact beyond what was described in the GEIS.

19 4.11.1.2.7 Public Services

20 Changes in the size of the population and the population (potentially up to 200) characteristics  
21 cause changes in demand for health and human services. Specifically, increased demand  
22 would be expected for doctors, hospitals, police and fire in order to service the ISR project  
23 workers, worker families and others who migrate to the area to respond to the increased  
24 demand for services. Operational impacts to public services and public infrastructure, as a  
25 result of the workforce relocating with their families would be area-specific, long-term and  
26 adverse (LCI, 2008a). Site-specific conditions are consistent with the assumptions in the GEIS.  
27 Therefore, it is anticipated that impacts to health and social services would be MODERATE,  
28 particularly if the area of settlement had limited services to start.

29 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
30 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
31 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
32 along with the actions proposed, are comparable to those described in the GEIS for Public  
33 Services and incorporates by reference the GEIS' conclusions that the impacts to Public  
34 Services during operation are expected to be MODERATE. Furthermore, while the NRC Staff  
35 has identified additional new information during its independent review; it nevertheless, does not  
36 change the expected environmental impact beyond what was described in the GEIS.

37 4.11.1.3 Aquifer Restoration Impacts

38 The GEIS indicates that aquifer restoration impacts to socioeconomics would be similar to  
39 impacts experienced during operations. The level of employment and demand on services  
40 would be similar to operations. The GEIS determined potential impacts to socioeconomics to be  
41 SMALL.

42 Impacts from aquifer restoration would be similar to those experienced during operations. The  
43 same ISR facility components and workforce would be involved in aquifer restoration as during  
44 operations use. Thus, the number of personnel involved would also be the same, and the  
45 potential impacts would be similar (NRC, 2009a). The restoration staff would have an impact  
46 the local economy by purchasing goods and services in the area. Site-specific conditions are

1 consistent with the assumptions in the GEIS. Therefore, impacts to the local economy, the local  
2 housing inventory, and public services and infrastructure are expected to be SMALL. Impacts  
3 could be minimized by employing project workers from the operations stage of the project.

4 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
5 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
6 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
7 along with the actions proposed, are comparable to those described in the GEIS for  
8 Socioeconomics and incorporates by reference the GEIS' conclusions that the impacts to  
9 Socioeconomics during aquifer restoration are expected to be SMALL. Furthermore, while the  
10 NRC Staff has identified additional new information during its independent review; it  
11 nevertheless, does not change the expected environmental impact beyond what was described  
12 in the GEIS.

#### 13 4.11.1.4 *Decommissioning Impacts*

14 The GEIS describes the potential impacts of decommissioning on socioeconomics. It is  
15 expected that decommissioning and reclamation activities would draw on a skill set similar to  
16 the construction workforce. Employment levels (up to 200 personnel) and use of local  
17 contractors would be similar to those required for construction. Decommissioning activities  
18 would be short in duration (24 to 30 months), so employment would be temporary. Impacts to  
19 employment and housing were expected to be similar to those for construction. The GEIS  
20 determined that overall, potential impacts to socioeconomics from decommissioning would be  
21 SMALL to MODERATE.

22 Impacts from decommissioning activities would be similar to those seen during construction.  
23 While there may be a slight change in work force personnel due to the change in work activities  
24 during the decommissioning period, these changes would be small. Similar to the construction  
25 phase, there would be a temporary number of specialized workers that would likely commute  
26 from larger population centers, such as Rawlins, Lander, Casper, Green River, and Rock  
27 Springs. If workers and their families choose to live in the area, there could be impacts to local  
28 housing, temporary lodging, and campgrounds. However, given the short time period involved  
29 in decommissioning activities (possibly, as little as 6-8 months), not including groundwater  
30 restoration activities, most workers are not expected to relocate themselves or their families to  
31 the local area. Site-specific conditions are consistent with the assumptions in GEIS Section  
32 4.2.10.4. Therefore, impacts to the local economy, infrastructure, and the local housing  
33 inventory are expected to be short-term and SMALL, depending on the number of ISR  
34 operations employees who remain from the previous stages of the ISR project.

35 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
36 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
37 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
38 along with the actions proposed, are comparable to those described in the GEIS for  
39 Socioeconomics and incorporates by reference the GEIS' conclusions that the impacts to  
40 Socioeconomics during decommissioning are expected to be SMALL. Furthermore, while the  
41 NRC Staff has identified additional new information during its independent review; it  
42 nevertheless, does not change the expected environmental impact beyond what was described  
43 in the GEIS.

#### 44 4.11.2 **No-Action (Alternative 2)**

45 Under the No-Action Alternative, there would be no changes in the population for the area due  
46 to the No-Action Alternative (not proceeding with any of the action alternatives). Other forms of  
47 energy development such as CBM and coal mining would continue to impact the regional

1 socioeconomic climate. The changes associated with the continued development of energy  
2 resources and the associated socioeconomic impacts are discussed in Chapter 5 under  
3 Cumulative Impacts. Under the No-Action Alternative, population associated with the proposed  
4 action would not increase and no associated public service impacts would occur.

### 5 **4.11.3 Dry Yellowcake (Alternative 3)**

6 The qualitative socioeconomic methods used to identify impacts associated with the ISR project  
7 are not sensitive enough to identify impacts associated with small changes in project design,  
8 employment and location of facilities, or to help discriminate between alternatives (given the  
9 relatively small differences).

10 Therefore, socioeconomic impacts from the construction, operation, aquifer restoration, and  
11 decommissioning phases of the proposed ISR facility under Alternative 3 would be similar to the  
12 impacts from construction under the proposed action. While there would be additional  
13 machinery and infrastructure developed for the production of the dry yellowcake within the  
14 central plant and some added construction efforts, it is assumed that these changes in  
15 workforce and taxable equipment involved would not be significant. Therefore, the impacts  
16 associated with this alternative would be the same as described for the proposed action.

## 17 **4.12 Environmental Justice Impacts**

18 Under Executive Order 12898 (59 FR 7629), Federal agencies are responsible for identifying  
19 and addressing potential disproportionately high and adverse human health and environmental  
20 impacts on minority and low-income populations. In 2004, the Commission issued a Policy  
21 Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing  
22 Actions (69 FR 52040), which states "The Commission is committed to the general goals set  
23 forth in E.O. 12898, and strives to meet those goals as part of its NEPA review process."

24 Some deviation from the policy is required in the following analysis because some Census  
25 geographic units are larger in the sparsely populated areas around the proposed project (e.g.  
26 block groups) and specific populations in the radius around the site (6.4 km [4 mi] in rural  
27 areas). Block group level data is included for this analysis, but the minority and low income  
28 populations within a 6.4 km (4 mi) radius cannot be determined using 2000 Census data  
29 because the block groups in this portion of Wyoming cover large geographic areas with few  
30 people. This is analytically unimportant given the homogeneous nature of the state population  
31 (both in terms of race/ethnicity and poverty).

### 32 **4.12.1 Proposed Action (Alternative 1)**

33 Within the area potentially affected by the Project, minimal minority populations are affected  
34 (Table 3-8 in Section 3.11.1 describes the demographics of the Sweetwater County). Income  
35 levels throughout the study area are diverse. The most recent estimate of per capita personal  
36 income was \$28,438 for Carbon County and \$34,656 in Sweetwater County in 2004. The  
37 median income in 2004 was \$40,750 in Carbon County and \$54,700 in Sweetwater County.  
38 These numbers are fairly consistent with the economic base of the area, which is mineral  
39 resource and agriculturally driven. The most recent poverty status statistics are from 2003  
40 census data. These data showed a poverty status of 11.8 percent in Carbon County and 8.6  
41 percent in Sweetwater County (US Census Bureau, 2003). These rates are similar to the state-  
42 wide average of 10.3 percent, which is lower than the national average of 12.5 percent (US  
43 Census Bureau, 2003). Since the economic base of the study area is largely ranching and  
44 resource extraction, low-income areas are dispersed within the study area. People with incomes

1 below the poverty status do reside within the study area, but are statistically not shown to be  
2 disproportionately represented.

3 Census Block Group data are available from the 2000 Census. Table 4-5 below shows the  
4 percent living in poverty and the percent minority in the block group which included the  
5 proposed project, in the county, in the state and in the U.S. As can be noted the differences are  
6 negligible (within the state) and well within the 20 percent threshold established by the NRC.  
7 While the data are dated, the racial/ethnic and income distribution of the state has changed  
8 slowly and no major distributional changes in income and poverty should be expected (U.S.  
9 Census, 2009).

10

Geographic Unit	Percent Low Income	Percent Minority
U.S	13.0	30.9
Wyoming	11.4	11.2
Sweetwater County	8.4	13.4
Project Block Group	10.7	10.0

11 Source: US Census Bureau, 2009

12  
13 Based on the data above, there is no concentration of people living below the poverty level and  
14 no concentrated minority populations located near the Lost Creek Project.

15 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
16 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
17 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
18 along with the actions proposed for any of the life cycle stages, would have no impact on  
19 Environmental Justice issues. Furthermore, while the NRC Staff has identified additional new  
20 information during its independent review; it nevertheless, is consistent with the general  
21 description presented in the GEIS.

#### 22 4.12.2 No-Action (Alternative 2)

23 Under the No-Action Alternative, there would be no change to the area demographics due to the  
24 proposed Lost Creek Project. No construction workers or employees would be attracted to the  
25 area due to the proposed action and the relative proportion of minority or low-income residents  
26 would not be affected. Therefore, there would be no disproportionately high and adverse  
27 impacts to minority or low-income populations expected from the No-Action alternative.

#### 28 4.12.3 Dry Yellowcake (Alternative 3)

29 Under Alternative 3, the impacts to environmental justice during construction would be the same  
30 as stated for the proposed action. There would be no disproportionately high and adverse  
31 impacts to minority and low-income populations from this alternative.

1 **4.13 Public and Occupational Health and Safety Impacts**

2 The standards for protecting public and occupational health and safety from exposure to  
3 ionizing radiation are established by the NRC in Title 10 CFR, Part 20, Standards for Protection  
4 Against Radiation. These standards are used in establishing specific criteria for evaluating  
5 impacts resulting from the proposed action and alternatives. The standards for protecting  
6 occupational exposure to chemical hazards are established by OSHA in Title 29 CFR, Part  
7 1910, Occupational Health and Safety Standards. Public exposures are addressed in  
8 Section 4.7.

9 **4.13.1 Proposed Action (Alternative 1)**

10 4.13.1.1 *Construction Impacts*

11 As described in Chapter 2 of this SEIS, construction activities associated with the Lost Creek  
12 ISR Project would include those construction activities (drilling wells, clearing and grading  
13 associated with road construction and building foundations, trenching, and laying pipelines)  
14 described in the GEIS. Other than during well construction (discussed below) the only  
15 significant radiation exposure pathway during the construction period would be through worker's  
16 potential direct exposure to, inhalation of, or ingestion of high concentrations of radionuclides  
17 within and emanating from (in the case of radon) the disturbed soil. Inhalation of fugitive dust  
18 from vehicle traffic during construction activities could also contribute to radiation dose.

19 The GEIS concludes, in Section 4.2.11.1, that impacts from inhalation of fugitive dust would be  
20 SMALL due to the fact that radionuclide concentrations are expected to be low. However,  
21 based on baseline radiological environmental monitoring for the proposed facility, some survey  
22 locations exhibit concentrations of radioactive materials in soil that are well above natural  
23 background levels. Yet, because the average concentrations of radionuclides in the soil are  
24 low, it is not expected that the inhalation of fugitive dust would result in any significant dose.  
25 Therefore, the conclusions stated in the GEIS are valid for the proposed facility. Construction is  
26 expected to have a SMALL impact on workers and the general public. Construction equipment  
27 would likely be diesel powered and would result in diesel exhaust which includes small particles.  
28 The impacts and potential human exposures from these emissions would be expected to be  
29 SMALL because the releases are usually of short duration and are readily dispersed into the  
30 atmosphere.

31 The drilling of wells would be performed via a common technique known as mud rotary drilling.  
32 This uses drilling fluid induced through the drill stem, out the drill bit, and back to the surface  
33 between the drill stem and host rock. When the fluid has returned to the surface, it passes  
34 through a trough to a mud pit, where the cuttings settle out and the fluid is recycled down the  
35 hole. Once the drilling is complete, the mud pit is allowed to dry and is covered with native soil  
36 and revegetated. Because the cuttings are taken from very near and within the ore deposits,  
37 they have the potential to be more contaminated than soil samples at the surface. To ensure  
38 that the cuttings do not create an external occupational or public health hazard, the applicant  
39 would ensure that semi-annual gamma radiation surveys are performed on at least 12 of the  
40 completed drill mud pits.

41 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
42 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
43 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
44 along with the actions proposed, are comparable to those described in the GEIS for Public and  
45 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
46 impacts to Public and Occupational Health and Safety during construction are expected to be

SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

#### 4.13.1.2 Operation Impacts

##### 4.13.1.2.1 Radiological Impacts to Public and Occupational Health and Safety from Normal Operations

As described in the GEIS, some amounts of radioactive materials would be released to the environment during ISR operations. The potential impact for these releases were evaluated by the MILDOS-AREA computer code, which was developed by Argonne National Laboratory for calculating radiation doses to individuals and populations from releases that occur at uranium recovery facilities. MILDOS uses a multi-pathway analysis for determining external dose, inhalation dose, and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary radionuclide of interest at an ISR facility is radon-222; other key radionuclides that may be released, which are also in the uranium decay scheme, include uranium, thorium-230, radium-226, and lead-210. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

The GEIS presents historical data for ISR operations, providing a range of estimated off-site doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (human receptor) locations ranged between 0.004 mSv (0.4 mrem) per year for the Crow Butte facility and 0.32 mSv (32 mrem) per year for the Irigaray facility in Campbell County, well below the 10 CFR Part 20 annual radiation dose limit of 1 mSv (100 mrem) per year (NRC, 2009a).

Location	2009	2010	2011	2012	2013	2014	2015	2016	2017
New Well fields	5.1E-03	5.7E-03	5.7E-03	5.7E-03	5.7E-03	5.7E-03	6.1E-04	0.0E+00	0.0E+00
Production Venting	4.2E+00	1.2E+02	1.5E+02	1.4E+02	1.5E+02	1.5E+02	1.6E+02	3.4E+01	0.0E+00
IX + Prod Purge	9.5E-01	2.7E+01	3.4E+01	3.4E+01	3.4E+01	3.4E+01	3.3E+01	6.8E+00	0.0E+00
Restoration Venting	0.0E+00	0.0E+00	3.7E+01	1.1E+02	1.1E+02	1.1E+02	1.2E+02	1.3E+02	8.5E+01
Restoration Purge	0.0E+00	0.0E+00	1.9E+01	5.8E+01	5.8E+01	5.8E+01	5.8E+01	5.8E+01	3.9E+01
<b>TOTAL</b>	<b>5.1E+00</b>	<b>1.5E+02</b>	<b>2.4E+02</b>	<b>3.4E+02</b>	<b>3.5E+02</b>	<b>3.5E+02</b>	<b>3.7E+02</b>	<b>2.3E+02</b>	<b>1.2E+02</b>

Source: LCI, 2008b

The application for the Lost Creek facility addresses several normal operation activities that have the potential for exposing workers and members of the public to sources of radiation. The primary source of exposure is the release of radon-222 during various processing activities, which include well field extraction activities, processing of the pregnant lixiviant from the well field extraction for uranium removal on the ion exchange columns, the elution of the uranium from the ion exchange columns and subsequent precipitation of uranium. At this time the drying

1 of the yellowcake slurry is not planned for the Lost Creek project; the liquid would be  
2 transported to another licensed facility for further processing.

3 The potential source term (i.e., atmospheric releases) for new well installation, production, and  
4 reclamation activities were calculated using the modeling of MILDOS-AREA. The MILDOS-  
5 AREA code represents the modeling as used by the NRC for its assessments included in the  
6 GEIS. The application of this methodology for the Lost Creek facility and the resultant source  
7 terms are discussed in the applicant's TR, Attachment 7.2-1. The following table summarizes  
8 releases for each major functional activity, noting that not all activities occur concurrently, such  
9 as production and restoration.

10 Based on the ISR facility radioactive source term presented in the ER and TR, the applicant  
11 evaluated the potential radiation doses at 17 site boundary locations using the MILDOS-AREA  
12 code. The highest dose at the site boundary (a hypothetical occupant living in the southeast  
13 corner of the project area, referred to as Site 1) is 0.03 mSv (3.01 mrem) per year TEDE, which  
14 is 3 percent of the 1 mSv (100 mrem) per year dose limit for a member of the public specified in  
15 10 CFR 20.1301 and within the dose range for similar facilities as reported in the GEIS (refer to  
16 above paragraph). The estimated dose results are summarized in ER Section 4.12.1.2 and TR  
17 7.2.1.

18 The GEIS also provides a summary of doses to occupationally exposed workers at ISR  
19 facilities. As stated, doses are expected to be similar regardless of the facility's location and are  
20 well within the 10 CFR Part 20 annual occupational dose limit of 50 mSv (5,000 mrem). The  
21 largest annual dose average over a 10-year period [1994-2006] was 7 mSv (700 mrem). More  
22 recently, the maximum total dose equivalents reported for 2005 and 2006 were 6.75 and 7.133  
23 mSv (675 and 713 mrem), respectively (Section 4.2.11.2.1 of the GEIS).

24 ER Section 4.12 and TR 7.2 provide information regarding occupational exposure of workers at  
25 the facility. An estimate of worker dose was made using the MILDOS-AREA modeling for a  
26 worker located in the well field area. Doses are expected to be well within 10 CFR Part 20 limits  
27 based on operational experience at similar ISR facilities (NRC, 2009). Worker doses at Lost  
28 Creek would be determined with the use of radiation dosimeters and bioassay sampling as  
29 described in the applicant's ER and TR. Based on the analysis above, site-specific conditions  
30 are consistent with the assumptions in the GEIS. Therefore, overall, radiological impacts to  
31 public and occupational health and safety are expected to be SMALL.

32 All radioactive and potentially toxic liquid waste from the processing operations is to be  
33 disposed of by deep well injection. Therefore, there are no anticipated routine liquid releases or  
34 pathways of exposure from the facility operations. Leaks and spills in the well field are  
35 evaluated as abnormal conditions in the section 4.12.2.2. No routine releases of radioactive  
36 liquids are anticipated at the proposed facility. As discussed in ER Section 1.3, the applicant  
37 would obtain the necessary license and permits from NRC, WDEQ, and other applicable  
38 agencies for liquid waste disposal prior to operation. Radiological impacts to public and  
39 occupational health and safety associated with these disposal aspects of facility operations are  
40 expected to be SMALL.

41 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
42 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
43 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
44 along with the actions proposed, are comparable to those described in the GEIS for Public and  
45 Occupational Health and Safety during normal operation, and incorporates by reference the  
46 GEIS' conclusions that radiological impacts are expected to be SMALL. Furthermore, while the  
47 NRC Staff has identified additional new information during its independent review; it

1 nevertheless, does not change the expected environmental impact beyond what was described  
2 in the GEIS.

3 4.13.1.2.2 Radiological Impacts to Public and Occupational Health and Safety from  
4 Accidents

5 The GEIS provided an identification, discussion, and consequence assessment for the  
6 abnormal and accident conditions that may occur with an ISR operation. As discussed, a  
7 radiological hazard assessment was performed (Mackin et al., 2001) that considered the various  
8 stages of an ISR facility. Four separate accidents, which represent the sources containing the  
9 higher levels of radioactivity for all aspect of operation, were considered in the hazard  
10 assessment:

- 11 • Thickener failure and spill;
- 12 • Pregnant lixiviant and loaded resin spills (radon release);
- 13 • Yellowcake dryer accident release (not relevant to Lost Creek).

14 In addition to these accidents, leaks in the well field pose minimal radiological risk to workers,  
15 but pose a radiological concern because of the potential for undetected leaks to result in  
16 significant quantities of low level contaminated soils.

17 An overview for each of these accident scenarios as evaluated in the GEIS along with a specific  
18 application to the Lost Creek facility is presented below.

19 Thickener Failure and Spill. Thickeners are used to concentrate the yellowcake slurry before it  
20 is transferred to the dryer or packaged for off-site shipment. Radionuclides could be  
21 inadvertently released to the atmosphere through thickener failure or spill. The accident  
22 scenario as evaluated in the GEIS assumed a tank or pipe leak that releases 20 percent of the  
23 thickener inside and outside of the processing building. The analyses included a variety of wind  
24 speeds, stability classes, release durations, and receptor distances. A minimum receptor  
25 distance of 500 m (1,640 ft) was selected because it is found to be the shortest distance  
26 between a processing facility and an urban development for current operating ISR facilities. Off-  
27 site, unrestricted doses from such a spill could result in a dose of 0.25 mSv (25 mrem), or 25  
28 percent of the annual public dose limit of 1 mSv (100 mrem) per year with negligible external  
29 doses based on sufficient distance between facility and receptor.

30 As discussed in the GEIS, doses to unprotected workers inside the facility have the potential of  
31 exceeding the annual dose limit of 0.05 Sv (5 rem) if timely corrective measures are not taken  
32 for protecting workers and remediating the spill. Typical protection measures such as  
33 monitoring, respiratory protection, and radioactive material control, which would be a part of the  
34 applicant's Radiation Protection Program, would reduce the worker exposures and resulting  
35 doses to a small fraction of those evaluated.

36 Under the Proposed Action, Lost Creek would not be producing yellowcake and would not be  
37 using thickeners. However, the applicant's facility would have bulk quantities of yellowcake  
38 uranium slurry that would be stored in tanks which could accidentally be released inside the  
39 processing buildings. The applicant reports that the tank area would use berms to contain leaks  
40 or spills and reduce the likelihood that such a release would migrate to the outside environment.  
41 The applicant further asserts that emergency response and mitigation procedures would be  
42 available to direct workers to minimize or eliminate the possibility of the material leaking to  
43 outside environment. In ER Section 4.3.3, Mitigation and Monitoring of Soil Impacts, impacts to  
44 soils from spills would be mitigated through the use of a Spill Prevention, Control, and  
45 Countermeasure (SPCC) plan. The plan contains accidental discharge reporting procedures,

1 spill response, and cleanup measures. Therefore, it is expected that the potential impacts of  
2 tank releases are SMALL.

3 As stated in ER Section 1.2.2.3, Instrumentation and Control and described in more detail in the  
4 applicant's December 2008 responses to the November 2008 RAIs, impacts to soil from  
5 wellfield leaks would be minimized through a series of multi-parameter (e.g., pressure, flow rate)  
6 monitors and alarms, and an automatic emergency shutdown system. The applicant also stated  
7 that routine visual inspections of plant operations would be conducted as additional protective  
8 measures.

9 Pregnant Lixiviant and Loaded Resin Spills. Process equipment (e.g. ion exchange columns)  
10 would be located on curbed concrete pads to prevent any liquids from spills or leaks from exiting  
11 the building and contaminating the outside environment of the facility. Therefore, except for  
12 wellfield leaks, the potential for an accidental liquid release with liquid pathways of exposure are  
13 not considered realistic. The primary radiation source for liquid releases within the facility would  
14 be the resulting airborne radon-222 as released from the liquid or resin tank spill.

15 The radon accident release scenario assumes a pipe or valve of the ion exchange system,  
16 containing pregnant lixiviant, develops a leak and releases (almost instantaneous) all the radon-  
17 222 at a high activity level ( $8 \times 10^5$  pCi/L). For a 30-minute exposure, dose to a worker located  
18 inside the building performing light activities without respiratory protection was 13 mSv (1,300  
19 mrem). The estimated dose is below the 10 CFR Part 20 occupational dose limit. The GEIS did  
20 not evaluate public dose; however, considering that atmospheric transport offsite would reduce  
21 the airborne levels by several orders of magnitude, any dose to a member of the public would  
22 be less than the 1 mSv (100 mrem) public dose limit of 10 CFR Part 20. Radiation Protection  
23 Program controls and monitoring measures would be expected to minimize the magnitude of  
24 any such release and further reduce the consequences of this type of accident. In ER Section  
25 4.3.3, Mitigation and Monitoring of Soil Impacts, impacts to soils from spills would be mitigated  
26 through the use of a SPCC plan. The plan contains accidental discharge reporting procedures,  
27 spill response, and cleanup measures. As such, it is expected that the potential impacts of tank  
28 releases are SMALL.

29 As stated in ER Section 1.2.2.3, Instrumentation and Control and described in more detail in the  
30 applicant's December 2008 responses to the November 2008 RAIs, impacts to soil from  
31 wellfield leaks would be minimized through a series of multi-parameter (e.g., pressure, flow rate)  
32 monitors and alarms, and an automatic emergency shutdown system. The applicant also stated  
33 that routine visual inspections of plant operations would be conducted as additional protective  
34 measures.

35 Yellowcake Dryer Accident Release. This accident scenario does not apply to Lost Creek since  
36 the applicant has indicated that yellowcake would not be produced at the proposed facility. A  
37 further assessment of this scenario is not warranted for this SEIS. Table 4-4 presents generic  
38 accident dose analysis for Lost Creek using data adapted from the GEIS (NRC, 2009a).

Table 4-5. Generic Accident Dose Analysis for ISR Operations for Lost Creek		
Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill <sup>1</sup>	50 mSv (5,000 mrem)	0.25 mSv (25 mrem)
Pregnant lixiviant, resin spill	13 mSv (1,300 mrem)	<0.13 mSv (<13 mrem)

39 <sup>1</sup> Doses for a tank release at Lost Creek are expected to be much lower given that yellowcake slurry exists in liquid-  
40 like form and has a very low potential to be released to the atmosphere or become airborne. In the event of an  
41 accidental slurry release, the potential for radiological airborne contamination is SMALL due to a facility's use of  
42 engineering and administrative controls (e.g., spill/leak response plans).

1 Accident Analysis Conclusions. The GEIS appropriately captures the type of accidents and  
2 their potential consequences that can occur at the Lost Creek facility. The NRC Staff has not  
3 identified any new and significant information during its independent review of the Lost Creek  
4 ER, the site audit, the scoping process, or evaluation of other available information. Therefore, it  
5 has been determined that there would be no significant radiological impacts from potential  
6 accidents to the public or occupational exposed workers beyond those discussed in the GEIS.  
7 Based on this finding and the conclusions of the GEIS, the impacts from potential accidents for  
8 both occupationally exposed workers and members of the public are expected to be SMALL.

9 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
10 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
11 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
12 along with the actions proposed, are comparable to those described in the GEIS for Public and  
13 Occupational Health and Safety during an accident sequence, and incorporates by reference  
14 the GEIS' conclusions that radiological impacts are expected to be MODERATE for workers,  
15 SMALL for the general public. Furthermore, while the NRC Staff has identified additional new  
16 information during its independent review; it nevertheless, does not change the expected  
17 environmental impact beyond what was described in the GEIS.

#### 18 4.13.1.2.3 Non-radiological Impacts to Public and Occupational Health and Safety from 19 Normal Operations

20 The GEIS includes an identification of the various chemicals, hazardous and non-hazardous,  
21 along with typical quantities that are typically used at ISR facilities. The use of hazardous  
22 chemicals at ISR facilities are controlled under several regulations that are designed to provide  
23 adequate protection to workers and the public. The primary regulations applicable to the use  
24 and storage include:

- 25 • 40 CFR Part 68, Chemical Accident Prevention Provisions. This regulation  
26 includes a list of regulated toxic substances and threshold quantities for  
27 accidental release prevention.
- 28 • 29 CFR 1910.119, OSHA Standards (which includes Process Safety  
29 Management [PSM]). This regulation provides a list of highly hazardous  
30 chemicals, including toxic and reactive materials that have the potential for a  
31 catastrophic event at or above the Threshold Quantity (TQ).
- 32 • 40 CFR Part 355, Emergency Planning and Notification. This regulation  
33 contains a list of extremely hazardous substances and their threshold  
34 planning quantities for the development and implementation of ERPs. A list  
35 of Reportable Quantity (RQ) values is also provided for reporting releases.
- 36 • 40 CFR Part 302.4, Designation, Reportable Quantities, and Notification -  
37 Designation of Hazardous Substances. This regulation provides a list of  
38 Comprehensive Environmental Response, Compensation, and Liability Act  
39 (CERCLA) hazardous substances compiled from the Clean Water Act, Clean  
40 Air Act, Resource Conservation and Recovery Act (RCRA), and the Toxic  
41 Substances and Control Act.

42 As discussed in ER Section 1.3, Regulatory Requirements, Permits, and Required  
43 Consultations, Lost Creek would obtain all the necessary permits and licenses prior to the  
44 startup of operations.

1 As identified in ER Section 4.2, chemical used in bulk quantities at the Lost Creek facility would  
2 include:

- 3 • sodium carbonate (soda ash)
- 4 • sodium chloride (salt)
- 5 • drilling mud
- 6 • gasoline
- 7 • diesel fuel
- 8 • propane
- 9 • oxygen
- 10 • carbon dioxide
- 11 • sulfuric acid
- 12 • hydrogen peroxide

13 Typical on-site quantities for some of these chemicals exceed the regulated, minimum reporting  
14 quantities and trigger an increased level of regulatory oversight regarding possession (type and  
15 quantities), storage, use, and disposal practices. Compliance with applicable regulations  
16 reduces the likelihood of a release. Off-site impacts would be SMALL and do not typically pose  
17 a significant risk to the public, while workers involved in a response and cleanup can experience  
18 moderate impacts if the proper emergency and cleanup procedures and worker training are not  
19 adequate or are absent.

20 In general, the handling and storage of chemicals at the Lost Creek facility would follow  
21 standard industrial safety standards and practices. As identified in the ER, industrial safety  
22 aspects associated with the use of hazardous chemicals at Lost Creek are regulated by the  
23 Wyoming State Mine Inspector.

24 In response to questions asked by the WDEQ (LCI, 2009), the applicant stated that hydrochloric  
25 acid at 37 percent solution would be delivered to the facility via bulk shipments. It would be  
26 stored in a vessel fitted with a scrubber. The sources of acid fume emissions would be from  
27 downloading the acid into the storage vessel and during storage. An analysis of potential  
28 emissions indicated that with the assistance of pollution control mechanisms, the annual  
29 emission of hydrochloric acid would be approximately 4.5 kg (10 lb) per year.

30 The facility would store soda ash in a dry storage bin equipped with a fabric bag house. Material  
31 would be blown into the storage bin from the delivery truck. The soda ash would be conveyed  
32 with a screw auger or drag chain to a sealed tank filled with water. Using EPA methods, the  
33 applicant calculated a total of 6 kg (14 lb) per year airborne soda ash emission.

34 Salt would be delivered in bulk and offload into a water filled tank equipped with a bag house.  
35 Since the salt dissolves readily in water, the only air emissions would be during off-loading. The  
36 applicant estimated a total of 8 kg (17.5 lb) per year emission.

37 Other process-related chemicals to be stored in bulk at the Lost Creek central plant include  
38 carbon dioxide, oxygen, sodium sulfide, ammonia, and hydrogen peroxide.

39 In the State of Wyoming, industrial safety at ISR mills is regulated by the Wyoming State Mine  
40 Inspector. The applicant has proposed an overall chemical safety program that is compliant  
41 with the following regulations:

- 42 • Risk Management Planning, as required in 40 CFR Part 68;

- 1 • PSM of Highly Hazardous Chemicals standard contained in 29 CFR
- 2 §1910.119;
- 3 • Threshold Planning Quantities (TPQs) listed in 40 CFR Part 355;
- 4 • RQs for spills from CERCLA in 40 CFR § 302.4.

5 The types and quantities of chemicals (hazardous and non-hazardous) for use at Lost Creek are  
6 the same as those evaluated in the GEIS. Generally, information provided for Lost Creek does  
7 not contain any new or significant information that is contrary or varies with the information and  
8 conclusions presented in the GEIS regarding potential impacts to public or occupational health  
9 and safety. Impact from use of chemicals at the facility is expected to be SMALL.

10 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
11 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
12 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
13 along with the actions proposed, are comparable to those described in the GEIS for Public and  
14 Occupational Health and Safety during normal operation, and incorporates by reference the  
15 GEIS' conclusions that non-radiological impacts are expected to be SMALL. Furthermore, while  
16 the NRC Staff has identified additional new information during its independent review; it  
17 nevertheless, does not change the expected environmental impact beyond what was described  
18 in the GEIS.

19 4.13.1.2.4 Non-radiological Impacts to Public and Occupational Health and Safety from  
20 Accidents

21 The risks from accidents associated with the use of the typical hazardous and non-hazardous  
22 chemicals for an in-situ uranium recovery facility are not different from those for other typical  
23 industrial applications. In general, these risks are deemed acceptable as long as design and  
24 facility's safety policies and practices meet industry and regulatory standards. Past history at  
25 current and former ISR facilities has shown these facilities can be designed and operated with  
26 appropriate measures to ensure proper safety for workers and the public (Section 4.2.11.2.4 of  
27 the GEIS).

28 Appendix E, Hazardous Chemicals, of the GEIS provides an accident analysis for the more  
29 hazardous chemicals. As discussed, chemicals commonly used at ISR facilities can pose a  
30 serious safety hazard if not properly handled. The GEIS did not evaluate potential hazards to  
31 workers or the public due to specific types of high consequence low probability accidents (e.g.,  
32 a fire or large magnitude sudden release of chemicals from a major tank or piping system  
33 rupture). The application of common safety practices for handling and use of chemicals is  
34 expected to lower the likelihood of these severe release events and therefore lower the risk to

35 Spills of reportable quantities from chemical bulk storage areas are to be reported to WDEQ in  
36 accordance with WDEQ-WQD Rules and Regulations, Chapter 17, Part E and 40 CFR Part 302  
37 (CERCLA).

38 The types and quantities of chemicals (hazardous and non-hazardous) for use at Lost Creek are  
39 the same or similar as those evaluated in the GEIS. Information provided for Lost Creek does  
40 not contain any new or significant information that is contrary or varies with the information and  
41 conclusions presented in the GEIS regarding non-radiological impacts on public and  
42 occupational health and safety from chemical accidents. Impact from potential accidents related  
43 to use of chemicals could pose a significant health risk to workers at the facility; however,  
44 storage and handling facility design and chemical safety programs minimize those risks both in  
45 terms of likelihood and consequences. Site-specific conditions are consistent with the  
46 conclusions in GEIS Section 4.2.11.2.4.

1 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
2 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
3 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
4 along with the actions proposed, are comparable to those described in the GEIS for Public and  
5 Occupational Health and Safety during an accident sequence, and incorporates by reference  
6 the GEIS' conclusions that non-radiological impacts are expected to be MODERATE, but may  
7 be reduced to SMALL through proper implementation of emergency procedures and training.  
8 Furthermore, while the NRC Staff has identified additional new information during its  
9 independent review; it nevertheless, does not change the expected environmental impact  
10 beyond what was described in the GEIS.

#### 11 4.13.1.3 *Aquifer Restoration Impacts*

12 As described in the GEIS, aquifer restoration activities involve activities similar to those during  
13 operations (e.g., operation of well fields, waste water treatment and disposal) the types of  
14 impacts on public and occupational health and safety are expected to be similar to operational  
15 impacts. The reduction or elimination of some operational activities (e.g., yellowcake production  
16 and drying, remote ion exchange) further limits the relative magnitude of potential worker and  
17 public health and safety hazards. The radiation doses associated with restoration are included  
18 in the assessments of Section 4.12.2.2.1 for operations. Similarly, non-radiological hazards are  
19 covered by the discussions in Section 4.12.2.2.3. Accident consequences are expected to be  
20 smaller than those evaluated in Section 4.12.2.2.2 and 4.12.2.2.4. Therefore, aquifer  
21 restoration is expected to have a very localized, SMALL adverse impact on workers (primarily  
22 from radon gas) and the general public.

23 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
24 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
25 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
26 along with the actions proposed, are comparable to those described in the GEIS for Public and  
27 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
28 impacts to Public and Occupational Health and Safety during aquifer restoration are expected to  
29 be SMALL. Furthermore, while the NRC Staff has identified additional new information during  
30 its independent review; it nevertheless, does not change the expected environmental impact  
31 beyond what was described in the GEIS.

#### 32 4.13.1.4 *Decommissioning Impacts*

33 As addressed in the GEIS, environmental impacts during decommissioning of an ISR facility are  
34 expected to be SMALL. The degree of potential impact decreases as hazards are reduced or  
35 removed, soils and facility structures are decontaminated, and lands are restored to pre-  
36 operational conditions. Typically, the initial decommissioning steps include removal of  
37 hazardous chemicals, so that the majority of safety issues that are addressed during  
38 decommissioning involve radiological hazards at the facility.

39 To ensure the safety of the workers and the public during decommissioning, the NRC requires  
40 licensed facilities to submit a decommissioning plan for review. The plan includes details of the  
41 radiation safety program that is implemented during decommissioning activities that ensure that  
42 the workers and public are adequately protected and that their doses are compliant with 10 CFR  
43 Part 20 limits. An approved plan would also provide ALARA provisions to further ensure that  
44 best safety practices are being use to minimize radiation exposures. Adequate protection of  
45 workers and the public during decommissioning is further ensured through NRC plan approval,  
46 license conditions, and inspection and enforcement.

1 Following decommissioning, the site could be released for unrestricted use; which could result  
2 in an increase in potential exposure to individuals for future use to any residual radioactive  
3 contamination. Decommissioning, and any subsequent NRC approval for release of the site for  
4 unrestricted access, would have to be in conformance with NRC's radiation protection standards  
5 as developed for decommissioning. Therefore, any potential radiation dose to members of the  
6 public would also be in conformance with standards established for protecting public health and  
7 safety.

8 Information provided by the applicant does not contain any new or significant information that is  
9 contrary or varies with the information and conclusions presented in GEIS Section 4.2.11.4  
10 regarding potential impacts to public and occupational health and safety. Impact from and  
11 following decommissioning is expected to be SMALL.

12 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
13 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
14 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
15 along with the actions proposed, are comparable to those described in the GEIS for Public and  
16 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
17 impacts to Public and Occupational Health and Safety during decommissioning are expected to  
18 be SMALL. Furthermore, while the NRC Staff has identified additional new information during  
19 its independent review; it nevertheless, does not change the expected environmental impact  
20 beyond what was described in the GEIS.

#### 21 **4.13.2 No-Action (Alternative 2)**

22 If No-Action is taken, there would be no occupational exposure. There would be no additional  
23 radiological exposures to the general public from project related effluent releases, and there  
24 would be no impact on long term environmental radiological conditions. Radiation exposure and  
25 risk to the general public would continue to be determined by exposure from natural  
26 background, medical-related exposures, consumer products and exposures from existing  
27 residual contamination. Under the No-Action Alternative, the existing residual radioactivity  
28 would remain in these areas and would not be remediated.

#### 29 **4.13.3 Dry Yellowcake (Alternative 3)**

30 This evaluated alternative is for allowing the processing of wet yellowcake into a dry powder as  
31 the final product at the Lost Creek facility.

##### 32 *4.13.3.1 Construction Impacts*

33 Construction of a new facility and equipment to perform the drying operations would not change  
34 the impact on public and occupational health and safety. Radioactive material would not be  
35 generated or handled during the construction phase, so there would be no public or  
36 occupational exposure.

37 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
38 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
39 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
40 along with the actions proposed, are comparable to those described in the GEIS for Public and  
41 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
42 impacts to Public and Occupational Health and Safety during construction are expected to be  
43 SMALL. Furthermore, while the NRC Staff has identified additional new information during its  
44 independent review; it nevertheless, does not change the expected environmental impact  
45 beyond what was described in the GEIS.

1 4.13.3.2 *Operation Impacts*

2 Operations of a dryer facility would require additional handling of radioactive material, which  
3 could increase both operational and accidental occupational or public exposures. However, the  
4 current state of yellowcake drying technology is to use a vacuum dryer, which is designed to  
5 capture virtually all escaping particles and does not produce a radiological airborne effluent  
6 (NRC, 2009a). If a vacuum dryer were used at Lost Creek, only a negligible impact to public  
7 and occupational safety would occur to the population in the area immediately surrounding the  
8 facility. Under unmitigated dryer accident conditions, 10 CFR Part 20 Subpart C exposure limits  
9 could be exceeded for occupational workers. The dose limits in 10 CFR Part 20 Subpart D  
10 would not be exceeded for the general public, due to the facility containment of any contaminant  
11 and the distance to a member of the public. Site-specific conditions are consistent with the  
12 assumptions in GEIS Section 4.2.12.2. Therefore, in this scenario, doses to workers could have  
13 an adverse MODERATE impact, whereas doses to the general public would have an adverse  
14 SMALL impact.

15 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
16 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
17 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
18 along with the actions proposed, are comparable to those described in the GEIS for Public and  
19 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
20 impacts to Public and Occupational Health and Safety during operation are expected to be  
21 potentially MODERATE for workers, but SMALL for the general public. Furthermore, while the  
22 NRC Staff has identified additional new information during its independent review; it  
23 nevertheless, does not change the expected environmental impact beyond what was described  
24 in the GEIS.

25 4.13.3.3 *Aquifer Restoration Impacts*

26 Processing wet yellowcake into a dry powder is not expected to change the nature or magnitude  
27 of aquifer restoration activities. Impacts under this scenario would be similar to those from the  
28 proposed action. Therefore, this alternative would have short-term SMALL adverse impacts to  
29 public and occupational health and safety.

30 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
31 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
32 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
33 along with the actions proposed, are comparable to those described in the GEIS for Public and  
34 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
35 impacts to Public and Occupational Health and Safety during aquifer restoration are expected to  
36 be SMALL. Furthermore, while the NRC Staff has identified additional new information during  
37 its independent review; it nevertheless, does not change the expected environmental impact  
38 beyond what was described in the GEIS.

39 4.13.3.4 *Decommissioning Impacts*

40 The decommissioning impacts of this alternative would be related to the additional activities  
41 required to decontaminate or dispose of the drying equipment and facilities. The exact  
42 magnitude of this impact would depend on the type and quantity of additional equipment  
43 installed to perform the drying activities and could be expected to result in an appreciable but  
44 relatively small increase in the total worker radiation doses for decommissioning activities.  
45 Regardless of the magnitude of the expected decommissioning activities, the NRC requires a  
46 decommissioning plan to be submitted and reviewed. The NRC's review of this plan,  
47 application of site-specific license conditions, and NRC inspection and enforcement activities

1 would keep the magnitude of potential public and occupational health and safety impacts from  
2 all decommissioning activities, including dryer facilities, SMALL (NRC, 2009a).

3 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
4 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
5 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
6 along with the actions proposed, are comparable to those described in the GEIS for Public and  
7 Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the  
8 impacts to Public and Occupational Health and Safety during decommissioning are expected to  
9 be SMALL. Furthermore, while the NRC Staff has identified additional new information during  
10 its independent review; it nevertheless, does not change the expected environmental impact  
11 beyond what was described in the GEIS.

#### 12 **4.14 Waste Management Impacts**

13 The GEIS states that ISR facilities generate both radiological and non-radiological liquid and  
14 solid wastes that must be handled and disposed of properly (NRC, 2009). Waste streams and  
15 waste management practices for the proposed Lost Creek facility are described in Section  
16 2.1.1.6 of this SEIS. Potential environmental impacts from waste management at the Lost  
17 Creek site may occur during all phases of the ISR facility's lifecycle. The primary radiological  
18 wastes to be disposed are process-related liquid wastes, possible evaporation pond sludge, and  
19 process-contaminated structures and soils, all of which are classified as 11e.(2) byproduct  
20 material. Before operations begin, however, the NRC requires an ISR facility to have an  
21 agreement in place with a licensed disposal facility to accept 11e.(2) byproduct material.

22 This section addresses the generation and management of radiological and non-radiological  
23 waste. Gaseous waste management is addressed above (Section 4.12) via radioactive airborne  
24 releases and impacts. Non-radioactive waste disposal would be conducted in accordance with  
25 State of Wyoming (WY) Department of Environmental Quality (DEQ) requirements, and local  
26 and county programs.

27 As described in the GEIS, the majority of radioactive waste that requires, treatment and disposal  
28 occur during operation and restoration of the well field. Wastes are also generated from well  
29 development, flushing of depleted eluant, resin treatment wash, filter washing, the precipitation  
30 process and plant wash down. Typical disposal methods can include evaporation ponds, land  
31 application, deep well injection, and surface discharge. For the Lost Creek facility, radioactive  
32 liquid wastes would be disposed of through deep well injection. Radioactive solid waste,  
33 including process tanks and components, would be treated as licensed 11e.(2) by-product  
34 materials, and disposed at NRC-licensed facilities. Materials that cannot be decontaminated  
35 would be shipped to such a facility that is approved for the processing and/or disposal of  
36 radioactive waste.

37 The proposed Lost Creek ISR facility would be a "Conditionally Exempt Small Quantity  
38 Generator (CESQG) of Hazardous Waste" (generating less than 6.8 kg [15 lb] of non-  
39 radioactive hazardous waste per year) under the EPA designated classes, in accordance with  
40 40 CFR 260.10. As such, any approved hazardous wastes generated at the facility would be  
41 sent to the Sweetwater County District # 1 Landfill in Rock Springs, where they would be  
42 disposed of as non-11e.(2) byproduct material.

43 Detailed discussion of the potential environmental impacts from Lost Creek wastes from the  
44 construction, operation, aquifer restoration, and decommissioning phases are provided in the  
45 following sections.

1 **4.14.1 Proposed Action (Alternative 1)**

2 4.14.1.1 *Construction Impacts*

3 As described in the GEIS (Section 4.2.12.1), waste management impacts from construction  
4 would be SMALL. This is because construction activities at an ISR facility are relatively small-  
5 scale, and sequential well field development would generate low volumes of construction  
6 waste. Most of the wastes expected to be disposed of at Lost Creek during the construction  
7 phase would be solid (non-radioactive) wastes, such as building materials and piping.

8 The relatively small amounts of waste generated during construction would include solid  
9 municipal wastes such as paper, wood, plastic, scrap metal, municipal sludge, and general  
10 construction debris (wooden pallets, pipe pieces, broken grout, etc.). Site-specific conditions  
11 are consistent with the assumptions in GEIS Section 4.2.12.1. Therefore, the overall, the  
12 potential impact from waste generation during the construction phase is expected to be SMALL.

13 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
14 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
15 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
16 along with the actions proposed, are comparable to those described in the GEIS for Waste  
17 Management and incorporates by reference the GEIS' conclusions that the impacts to Waste  
18 Management during construction are expected to be SMALL. Furthermore, while the NRC Staff  
19 has identified additional new information during its independent review; it nevertheless, does not  
20 change the expected environmental impact beyond what was described in the GEIS.

21 4.14.1.2 *Operation Impacts*

22 As described in Section 2.7 of the GEIS, operational wastes are primarily liquid waste streams  
23 consisting of process bleed (1 to 3 percent of the process flow rate) and aquifer restoration  
24 water. In addition, liquid wastes would also be generated from well development, flushing of  
25 depleted eluent to limit impurities, resin transfer wash, filter washing, uranium precipitation  
26 process wastes (brine), and plant wash down water. The methods used for handling and  
27 processing these wastes (water treatment followed by disposal utilizing evaporation ponds, land  
28 application, deep well injection, and/or surface water discharge) would reduce waste volumes  
29 destined for off-site disposal at an approved facility, thereby reducing waste-related  
30 environmental impacts. State permitting actions, NRC license conditions, and NRC inspections  
31 ensure that proper practices would be used to comply with safety requirements to protect  
32 workers and the public, and overall impacts would be SMALL.

33 Depending on the waste disposal method(s) selected, the GEIS (Section 4.2.12.2) notes that  
34 licensees must obtain the necessary permits and approvals from federal and state agencies.  
35 These permits and approvals would serve to mitigate impacts from liquid waste management so  
36 long as the licensee operates in accord with the provisions of the permits and approvals. For  
37 example, a UIC permit from EPA or the appropriate state agency (in the case where the state  
38 has primacy), and NRC approval is needed prior to construction and injection of liquid wastes  
39 down a deep well. The licensee would conduct monitoring of the well and of the disposed  
40 wastes, and the NRC and state would inspect to ensure that permit requirements are met.  
41 Other liquid waste disposal methods (i.e., surface discharge of treated wastewaters to local  
42 waterways, including ephemeral stream channels; evaporation ponds; and land application of  
43 treated wastewaters) would require similar approvals, monitoring and oversight. Site-specific  
44 activities are consistent with the assumptions in GEIS Section 4.2.12.2. Therefore, the potential  
45 waste management impacts from the disposal of process-related liquid wastes would be  
46 SMALL.

1 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
2 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
3 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
4 along with the actions proposed, are comparable to those described in the GEIS for Waste  
5 Management and incorporates by reference the GEIS' conclusions that the impacts to Waste  
6 Management during operation are expected to be SMALL. Furthermore, while the NRC Staff  
7 has identified additional new information during its independent review; it nevertheless, does not  
8 change the expected environmental impact beyond what was described in the GEIS.

9 **Deep Well Injection Discharges of Treated Liquid Waste.** As stated in the Lost Creek ER  
10 and TR documents (LCI, 2008a, 2008b), surface water discharge is not planned during  
11 operation of the ISR facility. The facility operation and design calls for waste waters to be  
12 processed through the combination of ion exchange and reverse osmosis and to the extent  
13 possible, reused in the uranium extraction process. The highly-contaminated wastewater from  
14 this processing would be disposed of by deep well injection.

15 The use of deep well injection for disposal of both radioactive and non-radioactive liquid wastes  
16 is regulated by the NRC and WDEQ. Through the permitting and approval processes,  
17 contaminant levels are evaluated for maintaining acceptable safe levels for discharge through  
18 deep well injection, ensuring impacts from waste management to worker and the public health  
19 and safety are acceptable.

20 LCI is proposing to dispose of the both 11e.(2) by product liquid wastes and some of the  
21 hazardous liquid wastes (e.g., acids, strong bases, and solvents) through deep well injection, at  
22 a depth of greater than 2440 m (8,000 ft). Proper installation and operating procedures would  
23 be used to ensure adequate protection of public and environmental health and safety. Under  
24 the Safe Drinking Water Act (SDWA), the Underground Injection Control (UIC) Program is used  
25 and regulated by the WDEQ, which has been delegated primacy from the EPA for Class I  
26 injection activities that would be utilized at Lost Creek. By design, Class I UIC is protective of all  
27 underground sources of drinking water (no discernable pathway to drinking water) and  
28 permanently removed from the accessible environment. The Class I UIC is approved as part of  
29 the EPA and WDEQ programs.

30 By definition, the WDEQ cannot issue a permit for Class I injection if a complete exposure  
31 pathway exists that leads to public consumption. When conducted in accordance with UIC  
32 regulations and approved by NRC, this type of disposal of by-product waste is protective of  
33 human health and the environment. Based on an average flow rate of 643 L (170 gal) over a 9-  
34 year period, approximately 1,015 kg (2,235 lb) of natural uranium and 4.6 Ci of radium-226  
35 would be disposed of in the wells. Radiation doses to the public are expected to be near zero  
36 (due to isolation of the injection aquifer from any potential exposure pathway to the public) and  
37 well below the public limit of 1 mSv (100 mrem) per year.

38 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
39 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
40 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
41 along with the actions proposed, are comparable to those described in the GEIS for Deep Well  
42 Disposal and incorporates by reference the GEIS' conclusions that the impacts to Deep Well  
43 Disposal during operation are expected to be SMALL. Furthermore, while the NRC Staff has  
44 identified additional new information during its independent review; it nevertheless, does not  
45 change the expected environmental impact beyond what was described in the GEIS.

46 **Solid Waste Storage and Disposal.** As described in the GEIS, solid waste generated during  
47 operations that is classified as radioactive waste is to be sent to a waste disposal facility that  
48 has been licensed for the receipt and disposal of radioactive materials. Non-radiological

1 hazardous wastes would be segregated and disposed of at the Sweetwater County District # 1  
2 (Landfill) waste disposal facility which can accept small quantities of hazardous wastes.  
3 Common wastes (*i.e.*, non-radiological and non-hazardous) would be sent to the same  
4 Sweetwater County solid waste disposal facility in Rock Springs.

5 The types of solid radioactive waste that can be expected during operations include  
6 maintenance and housekeeping rags/trash, packing materials, replacement components, filters,  
7 protective clothing, and solids removed from process pumps and vessels. LCI estimates that  
8 approximately 61 to 77 m<sup>3</sup> (80 to 100 yd<sup>3</sup>) of solid radioactively contaminated 11e.(2) by-product  
9 waste materials would be generated each year during operations. These materials would be  
10 stored on-site inside a secure (fenced or inside a structure) area until sufficient volume is  
11 generated for shipment to a facility that is licensed for treatment and/or disposal. The 11e.(2)  
12 waste would be temporarily stored on-site in containers called "super-sacs". Sacs that are full  
13 would be sealed and stored in the plant or outdoors in a tightly-sealed container capable of  
14 preventing the spread of contamination from high winds or precipitation. The ISR facility would  
15 use covered-roll off containers approved by the USDOT for transport of Low Specific Activity  
16 (LSA) material to store material outdoors, and would be transported to, and disposed of at a  
17 licensed facility.

18 Hazardous waste, as generated at the site, would be regulated under the Hazardous Waste  
19 Management regulations of the WDEQ, Solid and Hazardous Waste Division. LCI would be  
20 classified as a CESQG, defined as a generator that generates less than 100 kg (220 lb) of  
21 hazardous waste per month and complies with applicable hazardous waste program  
22 requirements. Examples of the types of hazardous wastes that would be generated, include  
23 rechargeable batteries, fluorescent light bulbs, and used oil. All wastes would be disposed of  
24 according to State and Sweetwater County regulations.

25 Overall impact from waste generation at the Lost Creek during operation is expected to be  
26 SMALL. Based upon the permitting and NRC requirements related to the proposed off-site  
27 waste disposal methods, the proposed impact would be SMALL.

28 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
29 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
30 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
31 along with the actions proposed, are comparable to those described in the GEIS for Solid Waste  
32 (including hazardous waste) Storage and Disposal and incorporates by reference the GEIS'  
33 conclusions that the impacts to Solid Waste Storage and Disposal during operation are  
34 expected to be SMALL. Furthermore, while the NRC Staff has identified additional new  
35 information during its independent review; it nevertheless, does not change the expected  
36 environmental impact beyond what was described in the GEIS.

#### 37 4.14.1.3 *Aquifer Restoration Impacts*

38 As described in Section 4.2.12.3 of the GEIS, waste management activities during aquifer  
39 restoration utilize the same treatment and disposal options implemented during normal  
40 operations. This is expected to be the case at the Lost Creek site. Some increase in  
41 wastewater volumes may be experienced, but most often this increase is offset by the decrease  
42 in the uranium production capacity. Impacts from aquifer restoration to waste management and  
43 worker and public health and safety would be SMALL, and consistent with those impacts  
44 associated with ISR facility operations and described in the GEIS.

45 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
46 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
47 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,

1 along with the actions proposed, are comparable to those described in the GEIS for Waste  
2 Management and incorporates by reference the GEIS' conclusions that the impacts to Waste  
3 Management during aquifer restoration are expected to be SMALL. Furthermore, while the  
4 NRC Staff has identified additional new information during its independent review; it  
5 nevertheless, does not change the expected environmental impact beyond what was described  
6 in the GEIS.

#### 7 4.14.1.4 Decommissioning Impacts

8 The GEIS (Section 4.2.12.4) states that radioactive wastes from the decommissioning of ISR  
9 facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment)  
10 would be disposed of as 11e.(2) by product material at a licensed facility. A pre-operational  
11 agreement with a licensed disposal facility to accept radioactive wastes would ensure that  
12 sufficient disposal capacity would be available for by-product wastes generated by  
13 decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes  
14 would be addressed in a required decommissioning plan for NRC review prior to starting  
15 decommissioning activities. Such a plan would detail how a 10 CFR Part 20 compliant radiation  
16 safety program would be implemented during decommissioning to ensure the safety of workers  
17 and the public and compliance with applicable safety regulations. Overall, the GEIS expects  
18 that volumes of radioactive, chemical, and solid wastes generated during decommissioning  
19 would be SMALL. Overall, waste management impacts from decommissioning would be  
20 SMALL.

21 The goal of decommissioning is to reduce potential impacts by removing contaminants to  
22 allowable (regulatory) levels and restoring the property and lands to pre-operational conditions.  
23 As described in the GEIS, radioactive wastes from decommissioning include excavated soils,  
24 evaporation pond sludge, and process equipment. Radioactively-contaminated wastes would  
25 be disposed of as 11e.(2) by-product material at a licensed disposal facility in accordance with  
26 10 CFR Part 40, Appendix A, Criterion 2. Disposal plan and/or agreements with disposal facility  
27 are required to be in place prior to operations. Handling, storage and disposal of  
28 decommissioning waste would be performed in accordance with license conditions, the  
29 decommissioning plan, and would be evaluated at the time through the NRC inspection  
30 process.

31 At the time of decommissioning, much of the process equipment and materials would be  
32 reusable at other ISR sites. Materials would be surveyed for residual radioactive material  
33 contamination. Uncontaminated materials would be removed for reuse or disposal.  
34 Contaminated materials may be decontaminated, transferred to another licensed facility for use,  
35 or disposed of as radioactive waste. The cement foundations for the buildings would be  
36 removed for appropriate disposal as construction and demolition material, or crushed for reuse.

37 LCI has committed to having an agreement for disposal of 11e.(2) radioactive waste materials  
38 in-place before construction of the Lost Creek project commences (LCI, 2008). Transport of  
39 radioactive materials (waste and reusable materials) would be in accordance with USDOT (49  
40 CFR Part 173) and NRC (10 CFR Part 71) transportation requirements.

41 Because of the size of the Lost Creek project and the intent of LCI to decontaminate and reuse  
42 equipment and components, the impact from decommissioning waste would be SMALL. LCI  
43 would utilize well field monitoring instrumentation and routine well field visual inspections for  
44 timely identification and remediation of well and pipeline leaks and spills, and effectively  
45 minimize the potential impact of any well field soil contamination.

1 Based on the analysis above, site-specific conditions are consistent with the assumptions in the  
2 GEIS. Therefore, the overall impact from waste generation during decommissioning is expected  
3 to be SMALL.

4 After its independent review of the Lost Creek Environmental Report, the site visit, meetings  
5 with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders,  
6 and the evaluation of available information, the NRC Staff concludes the site-specific conditions,  
7 along with the actions proposed, are comparable to those described in the GEIS for Waste  
8 Management and incorporates by reference the GEIS' conclusions that the impacts to Waste  
9 Management during decommissioning are expected to be SMALL. Furthermore, while the NRC  
10 Staff has identified additional new information during its independent review; it nevertheless,  
11 does not change the expected environmental impact beyond what was described in the GEIS.

#### 12 **4.14.2 No-Action (Alternative 2)**

13 Under the No-Action Alternative, there would be no waste generated at the Lost Creek site.  
14 There would be no deep well injection of liquid wastes, and a decommissioning plan would not  
15 be submitted. In addition, there would be no need for agreements with a licensed radioactive  
16 waste disposal facility to dispose of radioactive wastes generated during operation and  
17 decommissioning. When compared to the action alternatives, there would be no impacts to  
18 waste management associated with this Alternative.

#### 19 **4.14.3 Dry Yellowcake (Alternative 3)**

20 Under this alternative the thickened yellowcake slurry would be further pressed to remove  
21 additional water, dried into a dry "yellowcake" powder, and packaged on site. A yellowcake  
22 vacuum dryer would be added to the system to perform these functions. The heating system  
23 would be isolated from the yellowcake so no radioactive materials are entrained in the heating  
24 system. The dried product (yellowcake) would be removed from the bottom of the dryer and  
25 packaged in drums for eventual shipping offsite. Processing wet yellowcake into a dry powder  
26 is not expected to change the nature or magnitude of aquifer restoration activities. Waste  
27 management activities would typically use the same treatment and disposal options as for  
28 operations of the Proposed Action.

#### 29 **4.15 References**

30 10 CFR Part 20. *Code of Federal Regulations*, Title 10, Energy, Part 20, "Standards for  
31 Protection Against Radiation."

32 29 CFR Part 1910. *Code of Federal Regulations*, Title 29, Labor, Part 1910, "Occupational  
33 Safety and Health Standards."

34 APLIC, 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in  
35 2006. Edison Electric Institute, Avian Power Line Interaction Committee and the California  
36 Energy Commission. Washington, D.C. and Sacramento, CA.

37 Bjornsen, Alan. 2009. Personal Communication with M. Bilodeau, U.S. Army Corps of  
38 Engineers, October 5, 2009. ADAMS Accession No. ML092790369.

39 Williams, 2009, Personal Communication with Pat Drinkle, Tax Assessors Office Sweetwater  
40 County, June 25, 2009

41 BLM, 1986. Manual H-8410-1 - Visual Resource Inventory. <[http://www.blm.gov/nstc/VRM/  
42 8410.html](http://www.blm.gov/nstc/VRM/8410.html)>

- 1 BLM, 1996. Partners Against Weeds: An Action Plan for the Bureau of Land Management.
- 2 BLM, 2004. Wild Horse Herd Management Areas, 2004 Herd Management Area Map, U.S.  
3 Department of Interior Bureau of Land Management, Wyoming.
- 4 BLM, 2008b. Proposed Resource Management Plan and Final Environmental Impact Statement  
5 for Public Lands Administered by the Bureau of Land Management, Rawlins Field Office,  
6 Rawlins, Wyoming. U.S. Department of Interior Bureau of Land Management, Rawlins Field  
7 Office. January 2008.
- 8 Collins and Reynold, 2005. Ferruginous Hawk (*Buteo regalis*): A Technical Conservation  
9 Assessment. USDA Forest Service, Rocky Mountain Region. September 2, 2005.
- 10 Environmental Protection Agency, 1978. Office of Noise Abatement and Control. Protective  
11 Noise Levels. Washington, DC. EPA-550/9-79-100.
- 12 Executive Order 12898. 1994. *Federal Actions to Address Environmental Justice in Minority*  
13 *Populations and Low-Income Populations*. 59 FR 7629. (February 16).
- 14 FHWA, (U.S. Department of Transportation, Federal Highway Administration) 1981. Highway  
15 Traffic Noise Regulations and Guidance. Abstract: Measurement of Highway-Related Noise,  
16 1996.
- 17 Federal Register Vol. 69, No. 163, Tuesday, August 24, 2004. Policy Statement on the  
18 Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions.
- 19 Fertig, W. 2000. "Status Review of the Ute ladies tresses (*Spiranthes diluvialis*) in Wyoming."  
20 Wyoming Natural Diversity Database, University of Wyoming. Prepared for the Wyoming  
21 Cooperative Fish and Wildlife Research Unit, U.S. Fish and Wildlife Service, and Wyoming  
22 Game and Fish Department.
- 23 Kinneer, Christopher, Andrew Mueller, Christian Zier, and Danny Walker. (Kinneer et al.). 2007.  
24 A Cultural Resource Inventory of the Lost Creek ISR, LLC Project in Sweetwater County,  
25 Wyoming.
- 26 Lambert, Scott M. 2005. "Seeding Considerations in Restoring Big Sagebrush Habitat." In  
27 Shaw, Nancy I.; Mike Pellant; Stephen Monsen., comps. 2005 Sage-Grouse Habitat  
28 Restoration Symposium Proceedings; 2001 June 4 – 7, Boise, Idaho, Proc. RMRS-P-38. Fort  
29 Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research  
30 Station. pp. 75 – 80.
- 31 LCI, 2008a. Lost Creek ISR, LLC. Lost Creek Project Environmental Report, Volumes 1 through  
32 3 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License  
33 (Docket No. 40-9068). March 2008.
- 34 LCI, 2008b. Lost Creek ISR, LLC. Lost Creek Project Technical Report, Volumes 1 through 3  
35 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket  
36 No. 40-9068). March 2008.
- 37 LCI, 2009. July 2, 2009 letter from John W. Cash, Manager EHS and Regulatory Affairs, Lost  
38 Creek ISR, LLC to Steven Cohen, NRC, Rockville, MD.
- 39 Oles, L. 2007. Effectiveness of Raptor Perch Deterrent Devices on Power Poles for Reducing  
40 Secondary Effects on Prey Species. Bureau of Land Management. Resource Note No. 84.
- 41 Reeve, A.F. 1984. Environmental influences on male pronghorn home range and pronghorn  
42 behavior. Ph.D. Dissertation, University of Wyoming, Laramie, WY. 172 pp.

- 1 Seefeldt, S.S. and D.T. Booth. 2005. "Measuring Plant Cover in Sagebrush Steppe  
2 Rangelands: A Comparison of Methods." *Environmental Management*, Vol. 37.
- 3 U.S. Census Bureau, 2009. Block Group Data. U.S. Department of Commerce. Washington,  
4 DC. <<http://www.census.gov>>
- 5 FWS (U.S. Fish and Wildlife Service), 2008. Letter from USFWS Ecological Services to Gregory  
6 F. Suber, U.S. Nuclear Regulatory Commission. Dated November 12, 2008.
- 7 Mackin, P.C., D. Daruwalla, J. Winterle, M. Smith, and D.A. Pickett, 2001. A Baseline Risk-  
8 Informed Performance-Based Approach for In-Situ Leach Uranium Extraction Licensees.  
9 NUREG/CR-6733. Washington, DC: NRC. September 2001.
- 10 NRC, 2003. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated  
11 With 29 NMSS Programs. Final Report." Washington, DC: NRC. August 2003.
- 12 NRC, 2009a. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling  
13 Facilities. NUREG-1910, Vol. 1 and 2. June 2009.
- 14 NRC, 2009b. Wyoming site visit, internal staff notes; NRC Site Visits Trip Report, Jan. 12-15,  
15 2009.
- 16 Stout and Stover, 1997. The Smith Ranch Uranium Project. The Uranium Institute Twenty  
17 Second Annual International Symposium.
- 18 University of Wyoming. 2008. Big Game Crucial Ranges in Wyoming at 1:100,000. GIS data  
19 obtained from Wyoming Geolibrary, updated July 29, 2008.
- 20 WDOT (Wyoming Department of Transportation). 2007a. Statewide Accident Statistics, 2002 –  
21 2003, <<http://www.dot.state.wy.us/wydot/>>.
- 22 WDOT (Wyoming Department of Transportation). 2007b. Wyoming Comprehensive Report on  
23 Traffic Crashes.  
24 <[http://www.dot.state.wy.us/webdav/site/wydot/shared/Highway\\_Safety/2007%20Comprehensive](http://www.dot.state.wy.us/webdav/site/wydot/shared/Highway_Safety/2007%20Comprehensive%20Report/2007%20Comprehensive%20Report%20on%20Traffic%20Crashes.pdf)  
25 [e%20Report/2007%20Comprehensive%20Report%20on%20Traffic%20Crashes.pdf](http://www.dot.state.wy.us/webdav/site/wydot/shared/Highway_Safety/2007%20Comprehensive%20Report/2007%20Comprehensive%20Report%20on%20Traffic%20Crashes.pdf)>
- 26 WGFD, 2004a. Atlas of birds, mammals, amphibians, and reptiles in Wyoming.
- 27 WGFD, 2004b. Fencing Guidelines for Wildlife, Revised Version, Habitat Extension Bulletin, No.  
28 53. Habitat Extension Services. Wyoming Game and Fish Department. Revised November  
29 2004.
- 30 WGFD, 2008. Stipulations for Development in Core Sage Grouse Population Areas. Wyoming  
31 Game and Fish Department. Buffalo, WY. July 31, 2008.
- 32 WGFD, 2009. Public Review Draft, Recommendations for Development of Oil and Gas  
33 Resources within Crucial and Important Wildlife Habitats. Version 2.0. Wyoming Game and Fish  
34 Department. Cheyenne, WY. Revised February 27, 2009.
- 35 Whitehead, 1996. Groundwater Atlas of the United States, Montana, North Dakota, South  
36 Dakota, Wyoming. USGS HA 730-1. Denver, Colorado: USGS 1996.
- 37 Wyoming Department of Employment, Research and Planning, 2009. Wyoming Unemployment  
38 Rate Increases to 5.0percent in May <<http://wydoe.state.wy.us/LMI/news.htm>>

## 5 CUMULATIVE IMPACTS

### 5.1 Introduction

The CEQ NEPA regulations, as amended (40 CFR Parts 1500-1508) define cumulative effects as “the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.” Cumulative effects or impacts<sup>1</sup> can result from individually minor but collectively significant actions taking place over a period of time. The proposed project could contribute to cumulative effects when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions. For this SEIS, other past, present, and future actions in the project area include (but are not limited to) coal mining, oil and gas production, other in-situ uranium recovery (ISR) operations, conventional uranium mining, wind farms, and cattle and sheep grazing.

The analysis of the cumulative impacts of the proposed action were based on publicly available information on existing and proposed projects, information in the GEIS (NRC, 2009), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable changes to existing conditions. The primary concern is the resurgence in interest in mineral mining and oil and gas development within the last few years. This resurgence has not necessarily translated into active projects as of yet, thus there is a lack of information available. It is estimated that there would be no long-term changes within about 8 km (5 mi) of the site, except for the possible installation of a small number of dirt roads. No long-term changes are anticipated within this area due to extensive restoration and reclamation activities planned by the applicant. Approximately 32 km (20 mi) from the site, there are several ISR and conventional uranium projects in the decommissioning, and pre-licensing stages, as well as oil and gas operations that could contribute to the cumulative effects in the area. At greater distances, it has been assumed that the resurgence in extractive industries along with government and industry efforts to develop infrastructure would continue.

The GEIS (NRC, 2009) provides an example methodology for conducting a cumulative impacts assessment. The methodology used in this SEIS is provided in Section 5.1.2.

#### 5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The Lost Creek project area is located within the Wyoming West Uranium Milling Region, which includes approximately 23,309 km<sup>2</sup> (9,000 mi<sup>2</sup>) of land, 61 percent of which is administered by BLM. Only 24 percent of the land area is privately owned. Land uses include BLM grazing land, wildlife habitat, wilderness areas, hunting, dispersed recreation and off-road vehicle use, oil and gas recovery, gas and carbon dioxide pipelines and transmission lines, and cultural and historic sites (NRC, 2009a). This region encompasses parts of Carbon, Fremont, Natrona, and Sweetwater Counties, and is part of the Rocky Mountain System.

There are various oil and gas, uranium, and other natural resource extraction and exploration that have been ongoing, and that are planned for future operation within the Great Divide Basin. The Lost Soldier Wertz oil fields are located proximate to the project area, and have been a significant source of exploratory drilling and oil extraction. These, along with other uses such as rangeland and recreational activities contribute to the overall cumulative impacts seen in the area.

---

<sup>1</sup> For the purposes of this analysis, “cumulative impacts” is deemed to be synonymous with “cumulative effects”

1 The various past, present, and reasonably foreseeable future actions in the Great Divide Basin  
 2 are discussed separately below. Applicable and relevant projects are listed in Table 5-1 of this  
 3 Section.

4 5.1.1.1 Uranium Recovery Sites

5 Past, existing, and potential uranium recovery sites in the Great Divide Basin are listed in Table  
 6 5-1. There are eight ISR facilities and seven conventional uranium milling facilities in the area  
 7 (see Table 5-1). Four of the eight conventional sites are in the decommissioning process, one  
 8 is licensed and on standby, one is listed as a potential site, and one is listed as a UMTRCA Title  
 9 I processing site.

10 Along with the proposed Lost Creek ISR project, there are other ISR and conventional uranium  
 11 (underground and pit) operations that are in various stages of the licensing process within the  
 12 Great Divide Basin. Some of the mining exploration sites in the area include; the Sweetwater  
 13 Uranium Project, which is operated by Kennecott Uranium Company, and owned by Green  
 14 Mountain Mining Venture. This operation is an open pit/conventional uranium mill. Other ISR  
 15 facilities that are in various stages of the licensing process are the West Alkali Creek, and the  
 16 Sweetwater ISR projects operated by Wildhorse Energy. The Lost Soldier Deposit is a planned  
 17 uranium ISR operation that is owned and operated by UR Energy. The JAB and Antelope site is  
 18 a proposed ISR facility that is currently under NRC review and would be operated by Energy  
 19 Metals Corporation (NRC, 2009a).

20

**Table 5-1. Uranium Recovery Sites<sup>1</sup> in the Wyoming West (Great Divide Basin) Uranium Milling Region**

Site Name	Company/Owner	Type <sup>2</sup>	County, State	Status <sup>3</sup>
Lost Soldier	UR-Energy Corp.	ISR	Sweetwater, WY	Potential site
West Alkali Creek	Wildhorse Energy	ISR	Sweetwater, WY	Potential site
Nine Mile Lake	Rocky Mountain Energy Co.	ISR <sup>1</sup>	Natrona, WY	License terminated
Gas Hills	Power Resources Inc.	ISR <sup>2</sup>	Natrona & Fremont, WY	Licensed - on standby
Bison Basin	Ogle Petroleum	ISR <sup>3</sup>	Fremont, WY	License terminated
Jab & Antelope	Uranium One	ISR <sup>2,3</sup>	Fremont, WY	Potential site - license application under review by NRC
Lucky MC	Pathfinder Mines Corp.	Conv.	Fremont, WY	Decommissioning
Split Rock	Western Nuclear, Inc.	Conv.	Fremont, WY	Decommissioning
Riverton	U.S. Department of Energy (DOE)	Conv.	Fremont, WY	UMTRCA Title I processing site
Gas Hills	Strathmore Minerals Corp.	Conv.	Natrona & Fremont, WY	Potential site

**Table 5-1. Uranium Recovery Sites<sup>1</sup> in the Wyoming West (Great Divide Basin) Uranium Milling Region**

Site Name	Company/Owner	Type <sup>2</sup>	County, State	Status <sup>3</sup>
Gas Hills	Umetco Minerals Corp.	Conv.	Natrona & Fremont, WY	Decommissioning
Sweetwater	Kennecott Uranium Co.	Conv.	Sweetwater, WY	Licensed - on standby
Sweetwater	Wildhorse Energy	ISR & Conv.	Sweetwater, WY	Potential site

<sup>1</sup> Information on potential future uranium recovery applications is based on indication from industry summarized in NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 3/11/2009" <<http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public.pdf>> (November 2009).

<sup>2</sup> Type:

1 = Research and Development/Pilot

2 = Satellite

3 = Commercial scale

Conv. = Conventional uranium mill

<sup>3</sup> Status: Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I and Title II sites are uranium mill processing or tailings sites that have been decommissioned. The U.S. Department of Energy is the long-term custodian of these sites.

1

## 2 5.1.1.2 Coal Mining

3 - Surface mining of coal can cause adverse impacts on land use, geology and soils, water  
4 resources, ecology, air quality, noise, historical and cultural resources, visual and scenic  
5 resources, socioeconomics, and waste management. Two surface coal mining operations in  
6 the Great Divide Basin are located in Sweetwater County (NRC, 2009a): the Bridger Coal mine  
7 (approximately 88 km [55 mi] to the southwest), which includes approximately 145 km<sup>2</sup> (56 mi<sup>2</sup>)  
8 of disturbed land, and the Black Butte Coal mine (approximately 97 km (60 mi) to the  
9 southwest), which encompasses approximately 181 km<sup>2</sup> (70 mi<sup>2</sup>) of disturbed land. Production  
10 for the two mines in 2008 was approximately 5.2 million tonnes (5.7 million tons) for Bridger  
11 Coal and 3.6 million tones (3.9 million tons) for Black Butte. The Bridger Coal Company  
12 submitted a coal "lease by application" to convert surface mining operations to underground  
13 mining to extend the life of the mine. The Carbon Basin Coal Lease is a proposed application  
14 that will involve a total of 1983 ha (4,896 ac) of surface disturbance throughout the life of the  
15 mine, which is projected at 11 years (BLM, 2008b). This same operation would include an  
16 underground mine that would last for approximately 17 years. The total coal projected from the  
17 Carbon Basin Coal Lease is 31.1 million tons for the surface operation and 112 million tons for  
18 the underground operation.

19

1  
2

Site Name	Company/Owner	Type	County, State	Production in 2008 – Tonnes (Tons)
Jim Bridger	Bridger Coal	Surface	Sweetwater, WY	5,157,000 (5,667,021)
Black Butte	Black Butte Coal	Surface	Sweetwater, WY	3,355,300 (3,687,169)

3 Wyoming Mining Association. "Wyoming Coal." 2008 <<http://www.wma-Mineline.com/coal/coalfrm/coalfrm1.htm>>  
4 (15 October 2009)

5 5.1.1.3 Oil and Gas Production

6 Regional oil and gas development activities (e.g., exploration, production, and pipeline  
7 development) have the likelihood to generate potential cumulative impacts (BLM, 2008b).  
8 Carbon County currently has 47 gas production units (13 active, 34 inactive) while Sweetwater  
9 County currently has 26 gas production units (23 inactive, 3 active). The Lost Soldier-Wertz Oil  
10 fields are the primary source for oil and gas extraction in the Great Divide Basin. The Rawlins  
11 RMP summarized oil and gas development projects previously or currently subject to NEPA  
12 analysis in Southwestern Wyoming; 6,469 producing wells, and 8,030 wells that can still be  
13 drilled/produced, encompassing approximately 121,405 ha (300,000 ac) of land (BLM, 2008b).

14 5.1.1.4 Wind Power

15 There is potential in the Great Divide Basin for wind power, and these facilities can contribute to  
16 meeting forecasted electric power demands. However, they are dependent on available  
17 transmission capacity to send power to users. The transmission capability is a constraining  
18 factor (BLM, 2008a). There are a total of 20 wind energy projects currently operating in  
19 Wyoming, ranging in capacity from 1 turbine (produces 2.0 to 2.5 MW) to 80 turbines (produces  
20 144 MW) (AWEA 2009). There are 4 additional projects under construction ranging in capacity  
21 from 20 turbines (produces 42 MW) to 66 turbines (produces 99 MW) (AWEA 2009).

22

Owner	Number of Turbines	Location	Capacity
Airforce	1	near Cheyenne	2 MW
PacifiCorp	26	near Cheyenne	39 MW
PacifiCorp	66	near Cheyenne	99 MW
PacifiCorp	66	near Cheyenne	99 MW
PacifiCorp	79	near Cheyenne	118.5 MW
Duke Energy	14	near Cheyenne	29.4 MW
Edison Mission Group	38	near Cheyenne	79.8 MW

Table 5-3. Wind Energy Projects in Wyoming <sup>1</sup>			
Owner	Number of Turbines	Location	Capacity
Edison Mission Group	29	near Cheyenne	60.9 MW
F.E. Warren Air Force Base	2	Cheyenne	1.32 MW
Clipper Windpower	1	Medicine Bow	2.5 MW
FPL Energy	80	Evanston	144 MW
Shell Wind Energy	50	Arlington/Carbon County	50 MW
Caithness	28	Carbon County	16.8 MW
Platte River Power Authority	2	Medicine Bow	1.32 MW
PacifiCorp/Eugene Water & Electric Board	69	Carbon County	41.4 MW
Caithness	3	Carbon County	1.8 MW
Caithness	33	Carbon County	24.75 MW
Platte River Power Authority	5	Medicine Bow	3.3 MW
Platte River Power Authority	2	Medicine Bow	1.2 MW
Platte River Power Authority	1	Medicine Bow	0.07
<sup>1</sup> Information on wind energy operations is from American Wind Energy Association (data through June 27, 2009). U.S. Wind Energy Projects – Wyoming. < <a href="http://www.awea.org/projects/Projects.aspx?s=Wyo">http://www.awea.org/projects/Projects.aspx?s=Wyo</a> > (September 15, 2009).			

1

## 2 5.1.1.5 EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

3 One indicator of present and reasonably foreseeable future actions (RFFAs) in the region of  
4 interest is the number of NEPA documents prepared by federal agencies within a recent time  
5 period. Using information in the GEIS Section 5.2.2 and publicly available information, several  
6 EISs were identified for the Great Divide Basin in addition to draft and final programmatic EISs  
7 for large-scale actions related to several states including Wyoming (See GEIS Tables 5.2-1 and  
8 5.2-2). The Rawlins BLM Field Office web site provides a list of projects in the Great Divide  
9 Basin along with the associated environmental documents. A list of projects is provided in  
10 Table 5-2. These projects could contribute to both local and regional cumulative impacts on air  
11 quality, land usage, terrestrial plants and animals, and groundwater and surface water  
12 resources.

<b>Table 5-4. Draft and Final National Environmental Policy Act (NEPA) Documents Related to the Great Divide Basin</b>	
January 31, 2003	<p><b>BLM, RMP, Great Divide RMP Revision</b></p> <p>Identifying resource issues and concerns, management alternatives, or other ideas in determining future land use decisions for the Rawlins Management Field Office. Refer to 1790.</p>
September 5, 2003	<p><b>BLM, EA, Hay Reservoir CBNG Pilot Project</b></p> <p>Proposed coalbed natural gas pilot project 40 km (25 mi) northwest of the town of Wamsutter in Sweetwater County, WY. Drilling and development of eight coalbed natural gas wells and a single water disposal well. Appurtenant facilities include roads, gas and water collection pipelines, water disposal system, and a power supply system.</p>
December 17, 2004	<p><b>BLM, EA, Wind Dancer Natural Gas Development Project (WDNGDP)</b></p> <p>Planned for an area approximately 48 km (30 mi) northwest of Wamsutter, WY. Drilling and development of up to 12 natural gas wells. Refer to 1790.</p>
March 17, 2004	<p><b>BLM, EA, Scotty Lake Coalbed Natural Gas (CNBG) Pilot Project</b></p> <p>Drilling and development of 18 exploratory coalbed natural gas wells 72 km (45 mi) northwest of the town of Wamsutter, WY. Appurtenance facilities include access roads, gas collection systems, and a possible power supply pipelines, produced water discharge system. Refer to 1790.</p>
March 24, 2004	<p><b>BLM, EA, Hay Reservoir Natural Gas Infill Development</b></p> <p>Natural gas infill development within the existing Hay Reservoir Federal Oil and Gas Unit. The Hay Reservoir Unit lies approximately 48 km (30 mi) northwest of the town of Wamsutter, in Sweetwater County, Wyoming. The proposed project includes the drilling and development of up to 25 additional infill natural gas wells within the Unit. Appurtenant facilities include access roads, gas collection pipelines, and gas production facilities on the well pads. Refer to 1790.</p>
December 17, 2004	<p><b>BLM, Draft EIS/Draft Resource Management Plan</b></p> <p>Rawlins (Great Divide) RMP, Description and analysis of alternatives for the planning and managing of public lands and resources administered by BLM Rawlins Field Office, Wyoming, WY-030-1610-DS (resource management)</p>
March 11, 2005	<p><b>BLM, EA for Cherokee West 3D Seismic Survey Project</b></p> <p>Conduct Geophysical Operations with the BLM, Rawlins, Rock Springs, and Little Snake River, Field Offices, for a seismic survey project on public, fee, and state lands within Sweetwater County, Wyoming and Moffat County, Colorado. The proposed project is located within Townships 12 and 13 North, Ranges 96, 97, 98, and 99 West, 6th Principal Meridian, in Wyoming and Colorado. Refer to 1790.</p>

<b>Table 5-4. Draft and Final National Environmental Policy Act (NEPA) Documents Related to the Great Divide Basin</b>	
March 20, 2006	<p><b>BLM, Continental Divide-Creston Natural Gas Development Project EIS</b></p> <p>Natural gas infill development proposal arose from BP America Production Company and several other companies to further develop natural gas resources within the existing Continental Divide and Creston Blue Gap natural gas fields. Refer to 1790.</p>
August 8, 2006	<p><b>BLM, Stewart Creek-Lost Creek Excess and Stray Wild Horses Removal</b></p> <p>The Great Divide Resource Management Plan (RMP), as amended, identifies two wild horse herd management areas (HMAs) within which wild, free-roaming horses will be managed in a humane, safe, efficient, and environmentally sound manner. North of I-80 and West of Hwy 287, EA# WY030-06-EA-165</p>
August 13, 2007	<p><b>BLM, Hay Reservoir Coalbed Natural Gas (CBNG) Infill and Impoundments Project</b></p> <p>Environmental Assessment (EA), Analyzes the impacts associated with the drilling of eight additional CBNG wells and the construction and operation of produced water disposal impoundments, north of Wamsutter, WY, 1790 (030), (CBNG)</p>
January 4, 2008	<p><b>BLM, Final EIS, Rawlins Field Office Planning Area Resource</b></p> <p>Management Plan, Addresses the Comprehensive Analysis of Alternatives for the Planning and Management of Public Land and Resources Administered by BLM, Albany, Carbon, Laramie, and eastern Sweetwater Counties, WY, WY-030-07-1610-DQ (resource management)</p>
June 12, 2009	<p><b>BLM, Red Desert Complex Wild Horse Gather</b></p> <p>(Antelope Hills, Crooks Mountain, Green Mountain, Stewart Creek and Lost Creek Wild Horse Herd Management Areas HMAs), 4700 (WYD03), BLM Rawlins and Lander Offices propose to gather approximately 968 wild horses in the various areas listed above, (Population Management Action)</p>

1

## 2 5.1.2 Methodology

3 In determining potential cumulative impacts, the following methodology was developed, based  
4 on the CEQ guidance (CEQ, 1997):

- 5 1. Identify for each resource area, the potential environmental impacts that would be of  
6 concern from a cumulative impacts perspective. These impacts are discussed and  
7 analyzed in Chapter 4.
- 8 2. Identify the geographic scope for the analysis for each resource area. This scope is  
9 expected to vary from resource area to resource area, depending on the geographic  
10 extent to which the potential impacts could be at issue. In this document, the scope for  
11 the different resource areas is found in both Chapters 3 and 4.
- 12 3. Identify the time frame over which cumulative impacts would be assessed. For this  
13 project, the time frame selected was the license period (i.e., the time from issuance of  
14 the license with subsequent commencement of construction to license termination and  
15 the end of site decommissioning and reclamation).

- 1 4. Identify existing and anticipated future projects and activities in and surrounding the  
2 project site. These projects and activities are identified in this chapter.
- 3 5. Assess the cumulative impacts for each resource area from the proposed action and  
4 reasonable alternatives, and other past, present, and reasonably foreseeable future  
5 actions. This analysis would take into account the environmental impacts of concern  
6 identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

7 In conducting this assessment, the staff recognized that for many aspects of the activities  
8 proposed by Lost Creek ISR, LLC (LCI), there is expected to be a SMALL impact on the  
9 affected resources. As defined previously in this SEIS, SMALL impacts are those for which the  
10 environmental effects "are not detectable or are so minor that they will neither destabilize nor  
11 noticeably alter any important attribute of the resource considered." Therefore, the staff  
12 considers that, for these resource areas (i.e., those for which all phases of the proposed ISR  
13 facility's would have a SMALL impact), the activities at the proposed ISR site would not be  
14 expected to provide a perceptible increase in potential impacts to the resource beyond those  
15 resulting from past, present, and anticipated future actions.

16 The following terminology was used to define the level of cumulative impact:

17 **SMALL:** The environmental effects are not detectable or are so minor that they will neither  
18 destabilize nor noticeably alter any important attribute of the resource considered.

19 **MODERATE:** The environmental effects are sufficient to alter noticeably, but not  
20 destabilize important attributes of the resource considered.

21 **LARGE:** The environmental effects are clearly noticeable and are sufficient to destabilize  
22 important attributes of the resource considered.

## 23 5.2 Land Use

24 Cumulative impacts to land use are assessed within the immediate vicinity of the Lost Creek  
25 ISR Project site and its access roads.

26 The Great Divide Basin encompasses approximately 10,250 km<sup>2</sup> (3,960 mi<sup>2</sup>) in land area and is  
27 one of the more promising areas of mineral exploration and extraction, including uranium, oil,  
28 and gas. Land use in much of the Great Divide Basin is used for multiple purposes (diversified  
29 and cooperative), with coal and oil and gas extraction activities sharing land with livestock  
30 grazing and herd management. Most rangeland is used for grazing cattle and sheep, and wild  
31 horse management. Most of the land is federally-owned, with some state-owned land, and  
32 scattered private land.

33 Land use impacts related from the Lost Creek ISR project are anticipated to be SMALL for all  
34 stages of the project and are described in detail in Chapter 4 of this SEIS. In addition to the Lost  
35 Creek ISR project, a variety of ongoing natural resource extraction and production facilities exist  
36 within the vicinity of the Lost Creek ISR Project site that potentially could impact land use.  
37 Currently, there are three grazing allotments that coalesce at the proposed Lost Creek project  
38 area; the Cyclone Rim, Green Mountain, and Stewart Creek allotments (Fig. 3-1). The  
39 proposed project area would directly affect approximately 115 ha (285 ac) of the grazing  
40 allotments, primarily by fencing off areas during operations. The three BLM grazing allotments  
41 together cover approximately 243,000 ha (600,000 ac) of land. Therefore, the impact of the  
42 Lost Creek facility on these allotments is less than 0.1 percent.

43 Land use impacts include interruption to, reduction or impedance of, livestock grazing and herd  
44 management areas, hunting areas, sagebrush habitat, open wildlife areas, overall land access,

1 and natural resource extraction activities related to active coal operations, and oil and gas  
2 production units. Other proposed uranium ISR facilities and wind energy operations are also  
3 located in the Great Divide Basin; however, only proposed ISR facilities are located within the  
4 near vicinity of the Lost Creek ISR Project. None of the more than 50 gas and oil extraction  
5 projects occur within the area around the proposed project.

6 Construction and operational improvements and activities such as roads and infrastructure  
7 systems associated with the multiple facilities represent a long-term impact, as they would likely  
8 be present throughout the Lost Creek ISR Project lifespan and would remain beyond this time to  
9 accommodate the processing of other potential projects in the vicinity of the site. However,  
10 most facility and road construction impacts to the project area are impermanent, since the land  
11 would ultimately be returned to its natural condition.

12 Cumulatively, the SMALL and mitigated impacts to land use from the Lost Creek ISR Project  
13 described in Chapter 4 are not expected to contribute to a perceptible increase in the  
14 MODERATE potential impacts to land use in the immediate vicinity of the Lost Creek ISR  
15 Project site and access roads when added to past, present, and reasonably foreseeable future  
16 actions. Therefore, is no cumulative effect on land use.

### 17 **5.3 Transportation**

18 Cumulative impacts to transportation are assessed within the immediate vicinity of the Lost  
19 Creek ISR Project site and access roads.

20 Project related transportation impacts include new road construction, elevated traffic counts on  
21 existing road networks and associated surface wear, and the potential for accidents involving  
22 the commuting workforce and/or the release of low-level radioactive materials. The principal  
23 access roads linking the existing Wamsutter-Crooks Gap and Sooner Roads with the central  
24 processing plant (CPP) represent long-term impacts, as they would be present throughout the  
25 project lifespan. Secondary roads from the CPP to the well fields and any tertiary, two-track  
26 roads are also long-term impacts. However, no road construction impacts to the project area  
27 can be considered permanent, since the land would ultimately be returned to its natural  
28 condition after approximately ten years, when production and decommissioning are complete.  
29 Transportation related impacts from the Lost Creek ISR Project are anticipated to be SMALL  
30 and are described in detail in Chapter 4 of this SEIS.

31 Like the Lost Creek ISR Project area, land use in much of the surrounding area is diversified  
32 and cooperative, with coal and oil and gas extraction activities sharing land with livestock  
33 grazing and herd management. Many unimproved, two-track dirt roads and gravel roads are  
34 present in the region, installed primarily for livestock grazing and herd management, but also  
35 facilitating access for natural resource exploration and extraction and hunting and off-road  
36 vehicle use. Oil and gas production facilities and coal mines have been, and continue to be,  
37 developed on both public and private lands throughout the Great divide Basin. All of these  
38 roads have low traffic volumes, and therefore cumulative effects on their capacity would be  
39 SMALL. The two existing mineral extraction facilities, Lost Soldier-Wertz Field oil and gas  
40 operation, to the east, and the Sweetwater Uranium Mill, to the south-southwest, are not  
41 expected to affect, or be affected by, the Lost Creek project with respect to transportation.

42 Because the preferred means of transporting the products of ISR operations is by road, future  
43 projects like the Lost Creek ISR Project would require the construction of new road surfaces or  
44 the improvement of existing roads within the vicinity of the Lost Creek ISR Project site and  
45 access roads. The number of roads and road networks can be expected to grow concurrently  
46 with the natural resource exploration and extraction activities. Current and future oil and gas

1 extraction projects would also require use of roadways, and traffic would likely increase as a  
2 result. There would also be an increase in vehicular traffic and risk of traffic accidents on  
3 existing roadways from daily travel by workers and their families. Demand for railroads,  
4 pipelines, and transmission lines would increase to meet the increased demand for capacity to  
5 move coal, oil and gas, and electricity from production locations in the area to markets outside  
6 the area.

7 Cumulatively, the roads at the Lost Creek ISR Project would be reclaimed and overall project-  
8 related transportation impacts are thus relatively minor. However, past and ongoing natural  
9 resource development and extraction activities in the vicinity of the Lost Creek ISR Project and  
10 access roads have resulted in an extensive network of roads. Future activities (ISR and  
11 otherwise) would require the construction of additional road surfaces and other transportation-  
12 related developments. The SMALL impacts to transportation from the Lost Creek ISR Project  
13 described in Chapter 4 are not expected to contribute to a perceptible increase in the  
14 MODERATE potential impacts to transportation in the area when added to past, present, and  
15 reasonably foreseeable future actions.

#### 16 **5.4 Geology and Soils**

17 Cumulative impacts to geology and soils are assessed within the immediate vicinity of the Lost  
18 Creek ISR Project site and access roads.

19 The principal impacts on geology and soils from the Lost Creek ISR Project would result from  
20 earth-moving activities associated with constructing surface facilities, access roads, well fields,  
21 and pipelines. Earth-moving activities that might impact soils include the clearing of ground or  
22 top soil and preparing surfaces for the central processing plant, satellite facility, header houses,  
23 access roads, drilling sites, and associated structures. As described in Chapter 4, all phases of  
24 the Lost Creek ISR are anticipated to have a SMALL impact to geology and soils.

25 Development activities from ongoing and future activities in the vicinity of the Lost Creek ISR  
26 Project site would continue to impact geology and soils. Past, ongoing, and inevitable future  
27 drilling into the earth for locatable minerals disturb the geology of the region, and, if not properly  
28 abandoned, leave opportunity for long-term problems. Increased vehicle traffic, clearing of  
29 vegetated areas, soil salvage and redistribution of ISR- produced groundwater, and construction  
30 and maintenance of project-specific components (e.g., roads, well pads, industrial sites, and  
31 associated ancillary facilities) are all activities that could cause impacts (BLM 2008c). Of the  
32 past, present, and reasonably foreseeable future activities, coal mining would create the most  
33 concentrated cumulative impacts to soils, due to the extensive acreage involved and nature of  
34 the operation as well as the tendency for mining operations to occur in contiguous blocks.

35 While there are numerous activities occurring in the eastern Great Divide Basin (grazing, herd  
36 management, hunting, mineral extraction), the only activities that potentially would affect the  
37 geology and soil resources in the area around the proposed project would be grazing, recreation  
38 (hunting) and herd management. The only mineral extraction-related activities would be those  
39 of the applicant (LCI), as there would be no exploration taking place on the newly-constructed  
40 access roads. The cumulative effect of the LCI action at Lost Creek, in combination with  
41 grazing, herd management and hunting, is not expected to impact geology and soils. On-site  
42 soil disturbing impacts, described earlier would only amount to 115 ha (285 ac), or about 7  
43 percent of the total project area. Access road development, to the east and to the west, would  
44 widen existing two-track roads to 30 feet (including drainage ditches on either side of the road.  
45 Overall, the cumulative effect of all activities in the defined geographic area, including the Lost  
46 Creek project, on geology and soils would be SMALL.

1 Long-term and short-term impacts to soil include accelerated wind or water erosion, declining  
2 soil quality factors, a decline in microbial populations, fertility, and organic matter, compaction,  
3 and the permanent removal of soil (BLM, 2005c). Some degree of soil reclamation is possible,  
4 although not all overburden materials can be used to reestablish vegetation.

5 Road development from future activities in the site vicinity would also continue to impact  
6 geology and soils, though, as discussed in Section 5.3, the roads at the Lost Creek ISR Project  
7 would be reclaimed and would not contribute significantly to the cumulative impact from other  
8 road development.

9 Cumulatively, the SMALL impacts to geology and soils from the Lost Creek ISR Project  
10 described in Chapter 4 are not expected to contribute to a perceptible increase in the potentially  
11 MODERATE impacts to geology and soils in the immediate vicinity of the Lost Creek ISR  
12 Project site and access roads when added to past, present, and reasonably foreseeable future  
13 actions.

## 14 **5.5 Water Resources**

### 15 **5.5.1 Surface Water**

16 The Lost creek ISR Project is located in the Battle Springs Flat drainage areas, which consists  
17 mainly of ephemeral streams that flow after snow melt or heavy rains. Surface water related  
18 impacts from the Lost Creek ISR project are anticipated to be SMALL and are described in  
19 detail in Chapter 4 of this SEIS.

20 Coal extraction, natural gas, uranium extraction, and cattle ranching in the area may  
21 cumulatively affect surface water resources. There are four ISR projects proposed in the vicinity  
22 of the Lost Creek ISR Project: Antelope and JAB, West Alkali Creek, Lost Soldier, and  
23 Sweetwater. These projects have the potential to degrade water quality in the area and cause  
24 erosion and subsequent siltation of streambeds by the construction of new roads, power lines,  
25 underground piping, and well drilling, all of which could have negative effects on surface waters.  
26 Cattle ranching is a source of nonpoint pollution to waterways in the Battle Springs Flat drainage  
27 area.

28 Operational practices to mitigate impacts and prevent erosion and water quality degradation on  
29 a regional basis would be an important component to the future of surface waters and wetlands.  
30 Compliance with applicable federal and state regulations, permit conditions, the use of best  
31 management practices, and required mitigation measures would reduce construction impacts to  
32 surface waters.

33 Cumulatively, the SMALL impacts to surface waters from the Lost Creek ISR Project discussed  
34 in Chapter 4 are not expected to contribute to a perceptible increase in the SMALL to  
35 MODERATE potential impacts to the Battle Springs Flat drainage area when added to past,  
36 present, and reasonably foreseeable future actions.

### 37 **5.5.2 Groundwater**

38 Potential environmental impacts to groundwater resources in the Lost Creek ISR Project can  
39 occur during each phase of the ISR facility's lifecycle. ISR activities can impact aquifers at  
40 varying depths (separated by aquitards) above and below the uranium-bearing aquifer as well  
41 as adjacent surrounding aquifers in the vicinity of the uranium-bearing aquifer. Surface  
42 activities that can introduce contaminants into soils are more likely to impact shallow (near-  
43 surface) aquifers while ISR operations and aquifer restoration are more likely to impact the  
44 deeper uranium-bearing aquifer, any aquifers above and below, and adjacent surrounding

1 aquifers. ISR facility impacts to groundwater resources can occur from surface spills and leaks,  
2 consumptive water use, horizontal and vertical excursions of leaching solutions from production  
3 aquifers, degradation of water quality from changes in the production aquifer's chemistry, and  
4 waste management practices involving evaporation ponds or deep well injection

5 The principal activities that have occurred in the past, that are currently taking place, and that  
6 are expected to continue in the future, include grazing, herd management, hunting and mineral  
7 extraction. The Rawlins RMP EIS evaluated the potential impacts of past, present, and  
8 reasonably foreseeable future actions in the Great Divide Basin on groundwater resources  
9 (BLM, 2008b). The primary impacts anticipated were consumptive use and degradation of  
10 water quality. Impacts to groundwater quality would depend in large part on the quality and  
11 maintenance of oil and gas wells as well as in-situ or other extractive use activities (mostly  
12 exploration). Existing levels of mineral extraction activities, combined with the reasonably  
13 foreseeable future development, would increase the potential for such impacts. Impacts of  
14 drawdown from past, present, and reasonably foreseeable future activities was noted as less of  
15 a concern due to the depths of many water formations in the region (305 to 3,050 m; 1,000 to  
16 10,000 ft), and their resulting impracticality for use. Impacts to groundwater from past, present,  
17 and reasonably foreseeable future activities in the Lost Creek area of the Great Divide Basin are  
18 thus anticipated to be MODERATE. The cumulative effects of the Lost Creek ISR project, when  
19 added to these MODERATE impacts of current and future use, are expected to be MODERATE.

## 20 **5.6 Ecological Resources**

21 Land disturbance resulting from the construction of the Lost Creek ISR Project and  
22 accompanying roadways would be the primary source of impacts to ecological resources.  
23 Ecology-related impacts from the Lost Creek ISR Project are anticipated to be SMALL and are  
24 described in detail in Chapter 4 of this SEIS.

25 Land disturbance resulting from other development activities in the Great Divide Basin are likely  
26 to have similar ecological impacts as those described earlier for the Lost Creek ISR Project.  
27 However, the cumulative result of land disturbances and alterations has likely cause habitat  
28 fragmentation, reduced habitat ranges for certain species, and an increased susceptibility to  
29 invasive species in these areas. Past and continued reduction in natural brush and grass  
30 communities can change light, wind, and temperature conditions on a small scale. For species  
31 with specialized habitat requirements, future population viability would be strongly influenced by  
32 the quality and composition of the remaining habitat. Other activities occurring in the area of the  
33 Lost Creek project boundary include grazing and herd management, hunting, mineral  
34 exploration and the Sweetwater Uranium Mill. The added impact from the Lost Creek site upon  
35 vegetation would be SMALL as only 115 ha (285 ac) out of the approximate 40,000 ha (100,000  
36 ac) area within a 8-km (5-mi) radius would be disturbed.

37 Land disturbance resulting from other development activities in the vicinity of the project area  
38 have similar ecological impacts described earlier for the Lost Creek ISR facility and may be  
39 SMALL individually. However, assuming that adjacent habitats for each disturbed parcels of  
40 land would be at, or near, carrying capacity, and considering the fact that there would be an  
41 unavoidable reduction or alteration of the habitats, development activities in this portion of the  
42 Great Divide Basin would create some unquantifiable reduction in wildlife populations including  
43 plant species and alteration of population structure cumulatively. For some species that may  
44 require specific conditions for their habitats, future use would be strongly influenced by the  
45 quality and composition of the remaining habitats. Additionally, since grasses and noxious  
46 weeds tend to replace sagebrush after disturbances, cumulative impacts to sagebrush habitat  
47 that occur in the area and wildlife species that occupy the habitat could be MODERATE.

1 Therefore, overall impacts to ecological resources from past, present, and reasonably  
2 foreseeable future actions are anticipated to be MODERATE.

3 However, the potential cumulative effect upon wildlife could be MODERATE, as new roads into  
4 the area would result in additional hunting opportunities, as well as the potential for additional  
5 road kills. The addition of the Lost Creek site would result in a decrease in habitat, particularly  
6 for smaller mammals and other less mobile wildlife, as well as reduce the amount of habitat for  
7 sage grouse.

8 Cumulatively, the SMALL impacts to ecology from the Lost Creek ISR Project discussed in  
9 Chapter 4 are not expected to contribute to a perceptible increase in the SMALL to MODERATE  
10 potential impacts to habitats within the Great Divide Basin when added to past, present, and  
11 reasonably foreseeable future actions.

## 12 **5.7 Meteorology, Climatology, and Air Quality**

13 Air quality impacts from the Lost Creek ISR Project are anticipated to be SMALL and are  
14 described in detail in Chapter 4 of this SEIS. Regional air quality in Sweetwater County, in  
15 which the Lost Creek ISR Project is located is in attainment status for all National Ambient Air  
16 Quality Standards (NAAQS) criteria pollutants. Sweetwater County is not within an Air Quality  
17 Control Region, as designated by the U.S. Environmental Protection Agency (EPA). Generally,  
18 limited air pollution emissions sources and effective atmospheric dispersion conditions result in  
19 good air quality conditions throughout the Great Divide Basin. Individual surface coal mines  
20 within the Great Divide Basin, however, may show some exceedance of the 24-hour PM<sub>10</sub>  
21 standard, but are usually the product of high wind conditions and low precipitation, which results  
22 in a short-term elevation in PM<sub>10</sub> levels (WDEQ, 2006).

23 Air quality impacts from construction, typical operations, aquifer restoration, and  
24 decommissioning activities at the project area were analyzed as part of this SEIS, and are  
25 anticipated to be SMALL (Chapter 4). During all phases of the project transportation-related  
26 would be the primary air pollution sources that would affect off-site receptor locations. This  
27 incremental increase is not expected to be noticeable on the well-traveled, paved roadways in  
28 the area, such as I-80, SR 287, and SR 73, but would be especially noticeable on the less-  
29 traveled, unpaved roads (LCI, 2008a). Air pollution sources from on-site equipment used during  
30 all phases of the proposed project are expected to be unnoticeable to the nearest residential  
31 receptors. Due to the rural and remote location of the project area, nearest residential receptor  
32 would be expected to experience no change in pollution levels equivalent to existing  
33 background levels with the on-site activities in operation.

34 The GEIS (NRC, 2009) did not address human-induced climate change given the imprecise  
35 state of the science for making human-induced climate predictions and the relatively short  
36 timeframe of the ISR facility lifecycle. Public comments during scoping for the GEIS addressed  
37 the potential for ISR facilities to release carbon dioxide (CO<sub>2</sub>) and other greenhouse gas  
38 emissions, methane (CH<sub>4</sub>), water vapor, ozone (O<sub>3</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons  
39 (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). The following discussion  
40 discusses this potential relative to other industries that could produce these greenhouse gas  
41 emissions.

42 Section 3.6 of the GEIS provides a discussion of the meteorology and climatology within the  
43 Wyoming West Uranium Milling Region, where the Lost Creek Project is located. Further  
44 discussion is provided in Section 3.7 of this SEIS. The entire Wyoming West Uranium Milling  
45 Region (including Lost Creek), is classified as in attainment for all primary pollutants under the  
46 National Ambient Air Quality Standards (NAAQS) (NRC, 2009). Other past, present, and

1 reasonably foreseeable activities that may contribute to pollutant emissions and greenhouse  
2 gas emissions are identified in Section 5.1 of this SEIS.

3 As discussed in Section 4.7 of this SEIS, air-quality impacts throughout the lifecycle of the  
4 proposed Lost Creek Project would come primarily from fugitive dust and engine exhaust  
5 emissions. Fugitive dust would be generated by vehicular traffic, earth-moving activities during  
6 construction, and wind erosion of disturbed areas. As discussed, these types of emissions are  
7 not expected to be significant as they would be intermittent (temporary), quickly dispersed and  
8 would not cause any exceedance of any applicable air quality standards. Additionally, LCI may  
9 use best management practices (e.g., wetting of dirt roads and cleared land areas) to reduce  
10 fugitive dust and emissions.

11 Additionally, gaseous emissions during ISR operations may come from the release of  
12 pressurized vapor from well field pipelines, and during resin transfer or elution. These gases  
13 come from two sources: (1) the liquefied gases such as oxygen and carbon dioxide used in the  
14 lixiviant that come out of solution and (2) gases in the underground environment that are  
15 mobilized. Venting the well pipeline system allows the release of naturally occurring radon gas.  
16 Gaseous emission levels from the proposed Lost Creek facility are expected to comply with  
17 applicable regulatory limits and restrictions, and would not be expected to reach levels that  
18 result in the Lost Creek facility being classified as a major source under the operating (Title V)  
19 permit process.

20 Other actions causing a potential cumulative impact in the region that may generate pollutants  
21 and emissions are surface coal mining activities. Surface coal mining activities generate fugitive  
22 dust particulates, and gaseous emissions from large mining equipment. Activities such as  
23 blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed  
24 and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling  
25 facilities are the most common stationary or point sources associated with surface coal mining  
26 and preparation. Particulate matter is the pollutant emitted from coal mine point sources,  
27 although small amounts of gaseous pollutants are also emitted from small boilers and off-road  
28 vehicles (BLM, 2009a). Overburden and coal blasting can produce gaseous clouds that contain  
29 nitrogen dioxide (NO<sub>2</sub>).

30 Other air pollutant emission sources potentially having a cumulative impact within the region  
31 include carbon monoxide (CO) and nitrogen oxides (NO<sub>x</sub>) from internal combustion engines  
32 used at natural gas and CBNG pipeline compressor stations; CO, NO<sub>x</sub>, particulates (PM<sub>10</sub> and  
33 PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>), and volatile organic compounds (VOCs) from gasoline and diesel  
34 vehicle tailpipe emissions; particulate matter (dust) generated by vehicle travel traffic on  
35 unpaved roads, agricultural activities, and application of sand to paved roads in winter; NO<sub>2</sub> and  
36 PM<sub>10</sub> emissions from railroad locomotives; SO<sub>2</sub> and NO<sub>x</sub> from other power plants; and air  
37 pollutants transported from emission sources located outside the basin (BLM, 2009a).

38 The Center for Climate Strategies (CCS) estimates that activities in Wyoming will account for  
39 approximately 60.3 million metric tons (tonnes) of gross CO<sub>2</sub> equivalent emissions in Year 2010  
40 and 69.4 million tons in Year 2020 (CCS, 2007). Using those projections, the Year 2007  
41 emissions from the three applicant coal mines reviewed by the staff total represents 2.22  
42 percent of the Year 2010 statewide emissions. With the addition of the expected six new coal  
43 mines, the estimated total emissions at the three applicant mines would represent 3.61 percent  
44 of the projected Year 2020 state-wide emissions (BLM, 2009a).

45 The proposed Lost Creek ISR facility is not expected to be a major contributor of greenhouse  
46 gases due to the size of the facility, small construction and decommissioning workforce, and  
47 relative short term of operation. Additionally, it is expected that greenhouse gas emissions  
48 associated with the proposed Lost Creek Project would be much lower than other actions in the

1 Great Divide Basin region associated with natural resource-based extraction facilities (i.e.,  
2 surface coal mining) and would represent a small fraction of the greenhouse gas emissions in  
3 the State of Wyoming.

4 A Wyoming Statewide Emission Inventory cited in the Rawlins Resource Management Plan EIS  
5 (BLM, 2008c) indicated that levels of NO<sub>x</sub>, SO<sub>2</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub> in the Rawlins RMP area and  
6 the State of Wyoming are anticipated to increase. Increases in concentrations, however, were  
7 not anticipated to exceed any federal or state ambient air quality standards. The area  
8 surrounding the Lost Creek ISR project area (northeastern Sweetwater County, northwestern  
9 Carbon County and southeastern Fremont County) is a rural setting with air quality classified as  
10 an attainment (clean air) area for all the primary pollutants. The hilly terrain with sparse  
11 sagebrush vegetation and windy conditions lends itself to good conditions for dispersion of air  
12 pollutants (Section 3.7). Air quality monitoring stations in Wamsutter, Casper, Lander, and  
13 Murphy Ridge were analyzed to get an idea of the regional air quality. The analysis found that  
14 all ambient data was consistent with the area's attainment status with one exception Section  
15 3.7). Air quality impacts in the region from past, present, and future activities are thus  
16 considered to be SMALL.

17 Uranium exploration in the project vicinity has recently increased in response to the current  
18 uranium market. Additional ore reserves and resources areas are known to exist within the  
19 project area, but they have not yet been evaluated for ISR purposes. At present, Carbon,  
20 Fremont and Sweetwater Counties are experiencing considerable natural resource  
21 development, much of which is related to uranium, oil and gas exploration and production. For  
22 a comparative analysis, available information regarding oil and gas installations in the Powder  
23 River Basin (about 240 km (150 mi) to the northeast) indicates that maximum fugitive dust  
24 concentrations generated during construction (24-hour PM<sub>10</sub>) are estimated to be 55 µg/m<sup>3</sup>  
25 (DOI, 2003), or approximately one third of the NAAQS (DOI, 2003). Maximum potential near-  
26 field CO emissions (8-hour concentration) are estimated to be 156 µg/m<sup>3</sup>, which is also less  
27 than the NAAQS of 10,000 µg/m<sup>3</sup> (DOI, 2003).

28 Cumulatively, the SMALL impacts to air quality from the Lost Creek ISR Project described in  
29 Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential  
30 impacts to air quality in Sweetwater County when added to past, present, and reasonably  
31 foreseeable future actions.

## 32 **5.8 Noise**

33 Noise impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described  
34 in detail in Chapter 4 of this SEIS.

35 Noise associated with construction of the Lost Creek ISR Project is anticipated to be greater  
36 than other phases. However, because some noise can be detected beyond the project  
37 boundary, a radius of 8 km (5 mi) was considered as a conservative radius for the assessment  
38 of cumulative noise impacts. (The nearest receptor [residence] is 24 km (15 mi) northeast of the  
39 Lost Creek site in Bairoil.) Past, present, and reasonably foreseeable future noise-generating  
40 activities in the vicinity of the Lost Creek ISR Project are primarily traffic noise, oil and gas  
41 operation, and mineral exploration. At present, both Carbon County and Sweetwater County  
42 (where the Lost Creek ISR Project is located) are experiencing considerable natural resource  
43 development, much of which is related to oil and gas exploration and production. Oil and gas  
44 operations would generate noise during well drilling and operation of compressor stations.  
45 However, noise levels at these activities attenuate to ambient levels at distances of 488 m  
46 (1,600 ft) and beyond (BLM, 2003). Noise related impacts are generally limited to the 610 m  
47 (2,000 ft) immediately surrounding each discrete source (e.g., drill rig, compressor station).

1 However, within the 8-km (5-mi) radius considered for this analysis, additional energy-related  
2 operations are not likely to increase significantly in density.

3 Cumulatively, the SMALL impacts to noise from the Lost Creek ISR Project described in  
4 Chapter 4 are not expected to contribute to a perceptible increase in the SMALL potential  
5 impacts to noise in the 8 km (5 mi) vicinity when added to past, present, and reasonably  
6 foreseeable future actions. Additionally, noise levels would be mitigated by administrative and  
7 engineering controls in order to maintain noise levels in work areas below Occupational Safety  
8 and Health Administration (OSHA) regulatory limits.

9 The Lost Creek ISR Project is located in a remote and rural area of northeastern Sweetwater  
10 County.

### 11 **5.9 Historical and Cultural Resources**

12 Historical and cultural impacts from the Lost Creek ISR Project are anticipated to vary from  
13 SMALL to MODERATE, depending on the specific issue, and are described in detail in Chapter  
14 4 of this SEIS.

15 The GEIS considers cumulative impacts to four regions including the Wyoming East Uranium  
16 Milling Region which encompasses Campbell and Johnson counties. Fourteen projects, mostly  
17 related to minerals extraction, are considered in the analysis. The impact of these current or  
18 proposed projects on cultural resources would be similar. The GEIS also considers the  
19 cumulative effects of traditional land uses, wildlife/fisheries/forest management, recreation,  
20 government lands and land management, mineral extraction and energy development (including  
21 coal), and cultural resources preservation. Despite the fact that the many of the actions require  
22 inventory, evaluation, mitigation, avoidance, or protection of the cultural resources, it is  
23 acknowledged that adverse impacts to cultural resources would occur (NRC, 2009). These  
24 impacts are anticipated to be MODERATE.

25 Ninety-three archaeological resource sites were identified in the Lost Creek ISR Project area.  
26 Three were determined eligible to include in the National Register of Historic Places (NRHP).  
27 The analysis of cumulative impacts on historic and cultural resources would be focused on  
28 these identified cultural resources, which are described in more detail in Chapter 3 of this SEIS.  
29 An EIS for the Great Divide Basin, Resource Management Area (BLM, 2009b) lists various  
30 actions which have the greatest potential for cumulative effects on cultural resources in the  
31 Great Divide Basin region. These actions include: coal extraction actions, oil and gas  
32 operations, utility transmission and distribution actions, other mining/milling actions including  
33 uranium, wind power activities, reservoir development, various non-energy related  
34 developments including transportation, and county-level economic development actions. Of  
35 these actions, coal extraction, oil and gas operations, other mining actions, reservoir  
36 development, and wind power activities most closely resemble the actions that are likely to take  
37 place in the vicinity of the Lost Creek ISR Project, and which have the potential to affect the  
38 identified cultural resources. Impacts to cultural resources are likely to be minimized for projects  
39 that are on federal or state lands or are funded in part by a government entity because they  
40 would be subject to the National Historic Preservation Act (NHPA), Section 106 consultation  
41 process, and other applicable statutes, whereas actions that are on private land pose the threat  
42 of irrevocable loss of cultural resources. The Rawlins Resource Management Plan  
43 Amendment/Environmental Assessment (BLM, 2004) describes and analyzes alternatives for  
44 managing public lands that cumulatively, may indirectly affect cultural resources by activities  
45 such as erosion, destabilization of land surfaces, increased area access, and increased  
46 vibration from truck traffic. Such activities can degrade cultural resources.

1 Cumulatively, the SMALL to MODERATE impacts to historic and cultural resources from the  
2 Lost Creek ISR Project described in Chapter 4 may contribute to a perceptible increase in the  
3 MODERATE potential impacts to nearby historic and cultural resources when added to past,  
4 present, and reasonably foreseeable future actions. However, mitigation would likely take place  
5 for the three cultural resources in the Lost Creek ISR Project area that are recommended as  
6 eligible to be included in the NRHP, as described in Chapter 4 of this SEIS. Additionally, any  
7 past, present, or future actions that occur on federal lands or require a federal permit would  
8 require a Section 106 Consultation, which would ensure that historic and cultural resources are  
9 adequately considered.

## 10 **5.10 Visual and Scenic Resources**

11 Visual and scenic impacts from the Lost Creek ISR Project are anticipated to be SMALL and are  
12 described in detail in Chapter 4 of this SEIS.

13 The Wyoming West Uranium Milling region, in which the Lost Creek ISR Project is situated, is  
14 extensively developed with oil and gas, coal mining, uranium mining, and related development.  
15 Developments within the Great Divide Basin region, in which the Lost Creek ISR Project is  
16 situated, are expected to continue over the next 15 to 20 years and would involve construction  
17 of railroads, coal-fired power plants, major (230kV) transmission lines, coal technology projects,  
18 and oil and gas transportation pipelines and refineries. Expectations are that this area would  
19 see additional ISR, coal mining, and oil and gas activities as the nationwide need for energy  
20 sources continues to swell. New roads, power lines, underground piping, and well drilling would  
21 have adverse effects on visual and scenic resources. Additionally, increased vehicle traffic,  
22 clearing of vegetated areas, soil salvage and reclamation, and construction of these facilities are  
23 all activities that could cause impacts. The impact of these developments on the visual  
24 resources of the region could be MODERATE, if not mitigated.

25 Cumulatively, the SMALL impacts to visual resources from the Lost Creek ISR Project  
26 described in Chapter 4 are not likely to contribute to a perceptible increase in the MODERATE  
27 potential impacts to the Lost Creek ISR Project viewshed when added to past, present, and  
28 reasonably foreseeable future actions.

## 29 **5.11 Socioeconomics**

30 Socioeconomic impacts from the Lost Creek ISR Project are anticipated to vary from SMALL to  
31 MODERATE, depending on the specific issue, and are described in detail in Chapter 4 of this  
32 SEIS.

33 Wyoming's population is projected to grow modestly from 2010 to 2020 (from 519,886 to  
34 530,948 respectively) then decrease to 522,979 by 2030 (USCB, 2009). These relatively flat  
35 population projections do not take into account the current recession, climate change legislation  
36 (including cap and trade components) and future technological changes (e.g., clean coal  
37 innovations). Projected increases in employment in the Great Divide Basin from increases in  
38 the coal mining operations, oil and gas development, and other mineral extraction activities,  
39 however, are expected to be modest. While Sweetwater County and the entire Great Divide  
40 Basin region have been described as possessing an enhanced capacity to respond to and  
41 accommodate growth, periods of rapid growth have been known to stress communities and their  
42 social structures, housing resources, and public infrastructure and service systems (BLM,  
43 2005a, 2005b, 2005c). This demand is anticipated to exert substantial pressure on housing  
44 markets, prices, and the real estate development and construction industries, all at a time when  
45 demand for labor and other resources would be high overall. School capacity shortages may

1 result from the increase in the mineral extraction industry, as well as could limitations in public  
2 services.

3 Ad valorem taxes are anticipated to provide a beneficial impact, and beneficial social effects are  
4 also anticipated to follow the expanding economy and employment opportunities associated  
5 with project energy development increases.

6 Cumulative impacts to socioeconomics could be more severe, however, if extractive industries  
7 and power production were to increase above average historic levels of growth. These impacts  
8 would be both adverse and beneficial. Cumulative adverse impacts to the local housing  
9 inventory and real estate market could occur if demand for labor in the extractive industries  
10 were to increase during the economic life of the proposed project. There could be long-term  
11 adverse impacts to local schools, health care facilities, fire and police services, and  
12 infrastructure, including waste management facilities, if large industrial projects create a  
13 demand for labor in the Great Divide Basin. However these impacts would be met by over 40  
14 years of experience in dealing with rapid population changes, a more sophisticated planning  
15 system and a taxing system that helps capture tax revenue during construction, operation and  
16 decommissioning of most all industrial facilities.

17 Casper, the largest city in the state, has the greatest and most diverse services to offer the  
18 potential new workforce. Casper, and its surrounding communities, would likely be where most  
19 of the construction workforce would live, if only temporarily. The cumulative effect on the real  
20 estate market and on schools would be SMALL, as construction activities are generally short-  
21 termed, and workers, even if from out-of-state, would not likely bring their families. The  
22 cumulative effect on retail and personal services would be beneficial, and could be  
23 MODERATE. The economic benefit to the city would also be beneficial, but SMALL, as much of  
24 the monies spent by construction workers would be used for increased public services  
25 (infrastructure upgrades, police, fire and emergency services, and health services).

26 If the population remains stable or grows within an annual rate of growth that area has managed  
27 well in the past (approximately 2 percent/year), the local economy could be positively affected  
28 by multiple mining operations that would bring in local and state economic revenue.

29 As potential extractive industries come on-line and begin to operate, the workforce would  
30 become more stable and commute back and forth to their long-term workplace. It is likely, then,  
31 that an operational workforce may live closer to their place on work and become active in their  
32 community. The City of Rawlins, and the Towns of Bairoil and Wamsutter may see an increase  
33 in population. The City of Rawlins would be a more likely place for a family to settle than Bairoil  
34 or Wamsutter, because of its greater amount of services it has to offer (schools, retail  
35 establishments, places of worship, leisure time activities, etc.). Rawlins is a much smaller city  
36 than Casper, so the impacts on real estate, schools, infrastructure, and the service industries  
37 would be potentially MODERATE, particularly if other extractive industries become active in the  
38 area.

39 Cumulatively, the SMALL to MODERATE impacts to socioeconomics from the Lost Creek ISR  
40 Project described in Chapter 4 are not likely to contribute to a perceptible increase in the  
41 MODERATE potential impacts to local socioeconomics when added to past, present, and  
42 reasonably foreseeable future actions.

### 43 **5.12 Environmental Justice**

44 There are no concentrations of people living below the poverty level near the project area, and  
45 no concentrated minority populations are located near the project area. there are no  
46 disproportionately high or adverse impacts arising from the proposed action. Impacts relating to

1 environmental justice for the Lost Creek ISR Project are described in more detail in Section 4.12  
2 of this SEIS.

3 The GEIS identified no minority populations in the Wyoming West Uranium Milling Region, but  
4 did identify the Wind River Indian Reservation in northern Fremont County as a low-income  
5 population (NRC, 2009). However, the Wind River Indian Reservation is more than 100 (road)  
6 miles from the Lost Creek site, and for this reason, it was determined that there were no  
7 environmental considerations expected for the area around the Lost Creek site.

8 The relative homogeneity of Wyoming, despite 40 years of energy/natural resource  
9 development, indicates that environmental justice issues would not be a problem. Because the  
10 economic base of the study area is largely ranching and resource extraction, low-income areas  
11 are not only dispersed within the study area, but are small in size. Families with incomes below  
12 the poverty level may reside within the study area, but not are disproportionately represented.  
13 At the present time, there is no significant concentration of people living below the poverty level  
14 and no significant concentration minority populations located near the project.

### 15 **5.13 Public and Occupational Health and Safety**

16 Public and occupational health and safety impacts from the Lost Creek ISR Project are  
17 anticipated to vary from SMALL to MODERATE, depending on the specific issue, and are  
18 discussed in detail in Chapter 4 of this SEIS. During all phases of normal operation, health and  
19 safety impacts are expected to be SMALL. Annual doses to the population within 80 km (50 mi)  
20 of the project are expected to be far below applicable NRC regulations. For accidents, impacts  
21 are expected to range from SMALL to MODERATE. Impacts could be MODERATE in the  
22 unlikely event that mitigation measures and other procedures intended to ensure worker safety  
23 are not followed.

24 The proposed project would make a minor contribution to cumulative impacts in terms of  
25 radiation doses in the environment to both the public and workers. There is no impact during  
26 the construction phase of the project, and a negligible increase during the operation and  
27 decommissioning phases. Annual doses to the population outside the boundaries of the project  
28 are far below any applicable limits, for both occupationally exposed workers and members of  
29 the public.

30 As stated in the GEIS (NRC, 2009) the Lost Creek site is located in the Wyoming West Uranium  
31 Milling Region, which contains 16 previous, current or potential uranium mining or milling sites.  
32 None of the 16 identified sites are currently involved in uranium processing, although four are in  
33 the decommissioning phase. One, the Kennecott Sweetwater Mine and Mill, is located within 8  
34 km (5 mi) of the perimeter of the Lost Creek site. Although this facility is not currently operating,  
35 it is currently licensed and could resume operations in the future. The GEIS (NRC, 2009a)  
36 identified 10 draft or final EIS' submitted from January 2005 to February 2008 whose proposed  
37 actions could contribute to a cumulative impact on public and occupational health and safety  
38 and were specific to the Wyoming West Uranium Milling Region. In addition, the GEIS identified  
39 ten large scale, programmatic EIS' whose proposed actions could that have an impact over the  
40 entire state of Wyoming. Given the proposed activities of the submitted EIS', the addition of the  
41 Lost Creek ISR facility will have a negligible impact on public and occupational health and  
42 safety. A follow-up review for any proposed "new" projects (since February 2008 as addressed  
43 in the GEIS) did not identify any projects that would likely increase cumulative impacts on  
44 radiological public health and safety for the study area.

45 Studies of the existing radioactivity levels in the environment have been conducted and  
46 presented in Section 3.12 of this SEIS. The identified radioactivity concentrations in the soil, air

1 and water are consistent with other background concentrations in the region. This indicates that  
2 currently, prior to activities at the proposed Lost Creek facility, there is not a public and  
3 occupational health and safety impact concern. The past, present, and reasonably foreseeable  
4 future activities mentioned above are anticipated to have a SMALL impact on radiological public  
5 health and safety for the study area.

6 The maximum expected exposure to any member of the public from the Lost Creek facility, as  
7 with other operating ISR facilities in the U.S., is expected to be on the order of less than 10  
8 mrem per year, at the site boundary. This exposure, combined with exposures from other  
9 facilities, is expected to remain far below the public limit of 100 mrem/year and have a negligible  
10 contribution to the 620 mrem average yearly dose received by a member of the public from  
11 exposure to natural background radiation. Cumulatively, the public health and safety impacts  
12 from the Lost Creek ISR Project combined with the past, present and reasonably foreseeable  
13 future activities of the Powder River Basin are anticipated to be SMALL.

14 When considering the contribution of the Lost Creek project to the overall cumulative impacts to  
15 public and occupational health and safety in the Wyoming West Uranium Milling Region, the  
16 Lost Creek ISR occupational health and safety impacts are SMALL in scale.

17 When considering the contribution of the Lost Creek project to the overall cumulative impacts to  
18 public and occupational health and safety in the Wyoming West Uranium Milling Region, the  
19 Lost Creek ISR occupational health and safety impacts would be SMALL in scale.

#### 20 **5.14 Waste Management**

21 Waste management impacts from the Lost Creek ISR Project are anticipated to be SMALL and  
22 are described in detail in Chapter 4 of this SEIS.

23 Past, present, and reasonably foreseeable future activities in the area around the Lost Creek  
24 ISR Project site that could generate hazardous or radioactive wastes include uranium  
25 mining/milling activities and oil and gas exploration. Each of these facilities would be  
26 responsible for complying with regulations and site-specific license agreements that manage  
27 any wastes generated. Because hazardous and radioactive wastes are so closely monitored  
28 throughout the United States, the impact from these activities is anticipated to be SMALL.

29 Some current activities within the project area, such as grazing and herd management, would  
30 not use any of the proposed waste disposal facilities because they produce no waste that needs  
31 to be disposed. Others, such as mineral exploration, generally produce non-radiological waste  
32 that would be disposed at a solid waste landfill such as SWCSWD #1. The same would be true  
33 of the Lost Soldier-Wertz Oil Field – no radiological wastes, only solid wastes.

34 Proposed new ISR facilities (Antelope and JAB, Lost Soldier, West Alkali Creek, and  
35 Sweetwater) would produce the same types of radiological waste (i.e., 11e.(2) byproduct  
36 material), and about the same quantities, as the Lost Creek ISR facility. It is likely that these  
37 ISR facilities would use the same waste disposal facilities.

38 Because of the small amounts of wastes generated by the types of activities that occur and  
39 would occur in the geographic scope area, the cumulative impact on the waste disposal facilities  
40 would be SMALL. For deep-well injected radiological liquid wastes, the receiving aquifer would  
41 be located below the lowest aquifer used for drinking water. Therefore, the cumulative effect on  
42 groundwater from the Lost Creek facility is expected to be SMALL.

43 Cumulatively, the SMALL impacts to waste management from the Lost Creek ISR Project  
44 described in Chapter 4 are not likely to contribute to a perceptible increase in the SMALL

1 potential impacts to waste management in the vicinity of the Lost Creek ISR Project site when  
2 added to past, present, and reasonably foreseeable future actions.

3  
4  
5  
6  
7  
8  
9

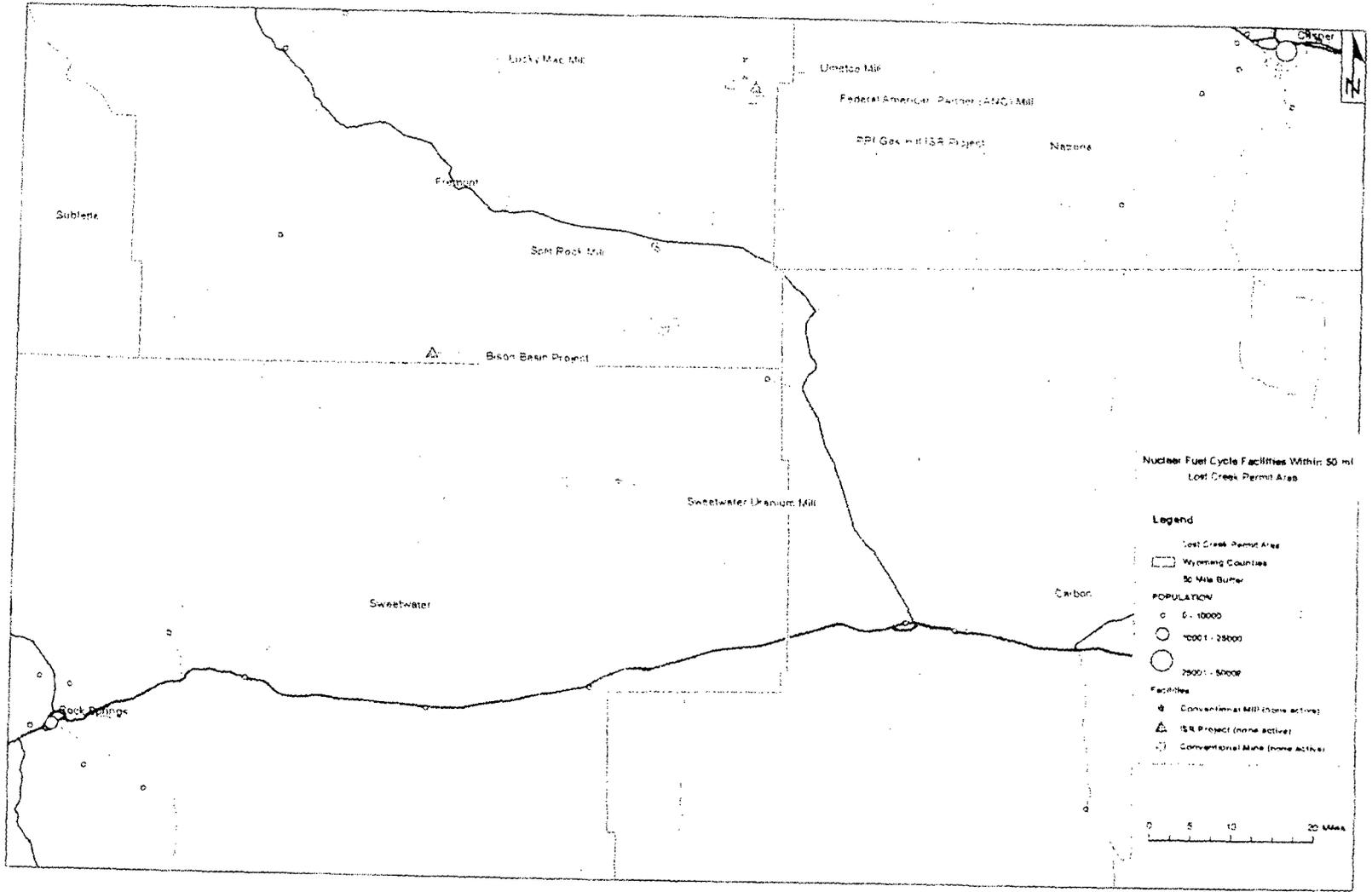


Figure 5-1. Nuclear Fuel Cycle Facilities within a 50-mile Radius of the Lost Creek Site

## 5.15 References

- 40 CFR 1500 to 1508. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Parts 1500-1508, "Council on Environmental Quality."
- AWEA, 2009. American Wind Energy Association (data through June 27, 2009). U.S. Wind Energy Projects – Wyoming. <<http://www.awea.org/projects/Projects.aspx?s=Wyoming>> (September 15, 2009).
- BLM, 2008a. U.S. Department of the Interior, Bureau of Land Management, Draft Environmental Impact Statement for the South Gillette Area Coal Lease Applications WYW172585, WYW173360, WYW172657, WYW161248, October 2008.
- BLM, 2008b. U.S. Department of the Interior, Bureau of Land Management, Rawlins Proposed Resource Management Plan and Final Environmental Impact Statement, Wyoming.
- BLM (Bureau of Land Management). 2008c. Final Environmental Impact Statement for West Antelope II Coal Lease Application WYW163340. Casper Field Office. December 2008.
- BLM (Bureau of Land Management). 2009a. Draft Environmental Impact Statement for Wright Area Coal Lease Applications. High Plains Office. June 2009.
- BLM, 2009b. Rawlins Field Office NEPA Documents Online. July, 2009. <<http://www.blm.gov/wy/st/en/info/NEPA/rfodocs.html>>
- Center for Climate Strategies (CCS), 2007, Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990-2020, report for Wyoming Department of Environmental Quality, available from website on the Internet: <<http://www.climatestrategies.us/ewebeditpro/items/O25F18230.pdf>>, accessed October 1, 2009.
- Council on Environmental Quality (CEQ). 1997b. 40 CFR 1500–1508.
- CEQ, 1997. "Considering Cumulative Effects Under the National Environmental Policy Act." January 1997.
- EPA (U. S. Environmental Protection Agency). 2009. "Climate Change – Science – State of Knowledge." Available URL: <http://www.epa.gov/climatechange/science/stateofknowledge.html#ref> (accessed September 11, 2009).
- LCI, 2008a. Lost Creek ISR, LLC. Lost Creek Project Environmental Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket No. 40-9068). March 2008.
- LCI, 2008b. Lost Creek ISR, LLC. Lost Creek Project Technical Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket No. 40-9068). March 2008.
- NRC, 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. NUREG-1910, Vol. 1 and 2. May 2009.
- U.S. Census Bureau, 2009. U.S. Census Bureau Data. <[www.census.gov](http://www.census.gov)>



## 6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

### 6.1 Introduction

As described in the GEIS (Section 8.0), monitoring programs, in general, are developed for *in-situ* uranium recovery (ISR) facilities to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and environment beyond the facility boundary (NRC, 2009). Monitoring programs provide data on operational and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected. In this regard, these programs help to limit potential environmental impacts at ISR facilities.

Monitoring programs can be modified to address unique site-specific characteristics by the addition of license conditions resulting from the conclusions of the NRC's safety and environmental reviews.

The description of monitoring programs for the Lost Creek project is organized in the following manner:

- Radiological monitoring (Section 6.2)
- Physiochemical monitoring (Section 6.3)
- Ecological monitoring (Section 6.4)

### 6.2 Radiological Monitoring

This section describes Lost Creek ISR, LLC's (LCI) proposed radiological monitoring program as described in its license application (LCI, 2008a and 2008b). The purpose of this monitoring program is to: 1) characterize and evaluate the radiological environment; 2) provide data on measurable levels of radiation and radioactivity; and 3) provide data on the principal pathways of radiological exposure to the public (NRC, 2003).

In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, a pre-operational monitoring program is required for establishing facility baseline conditions. Following this baseline program, operators of ISR facilities are required to conduct an operational monitoring program to measure or evaluate compliance with standards and to evaluate environmental impact of operations. Although not a requirement, NRC Regulatory Guide 4.14 "Radiological Effluent and Environmental Monitoring at Uranium Mills" (NRC, 1980) provides a monitoring program that is acceptable to the NRC staff for establishing a radioactive effluent and environmental monitoring program for uranium mills, which includes ISR facilities.

The results of LCI's baseline monitoring (sampling) program are presented in Chapter 3. The following provides a brief description of the applicant's proposed operational monitoring program a more detailed description is presented in NRC's Safety Evaluation Report [SER] for the Lost Creek ISR Application).

#### 6.2.1 Airborne Radiation Monitoring

LCI proposes to implement an airborne radiation monitoring program that includes routine and non-routine operations, maintenance, and cleanup. The results from the program would be used to calculate personnel exposure and to ensure radioactive releases and exposures due to

1 airborne radiation are as low as reasonably achievable (ALARA). LCI would implement this  
2 program in conjunction with the respiratory protection program. Figure 6-1 shows the routine  
3 airborne radioactivity sampling locations within the central processing plant (CPP) proposed by  
4 LCI. Figures 6-2 and 6-3 show the radon, gamma, and air particulate monitoring locations in the  
5 project area. Air sampling would be conducted in accordance with, or equivalent to, NRC  
6 Regulatory Guide 8.25, *Air Sampling in the Workplace* (NRC, 1992), and would be consistent  
7 with NRC Regulatory Guide 8.30, *Health Physics in Uranium Recovery Facilities* (NRC, 2002).

8 Airborne uranium particulate monitoring would include both breathing zone (lapel air sampler  
9 worn by worker) and area sampling (portable air sampler or fixed location sampler). The  
10 breathing zone air samplers would measure the worker's intake of uranium. Area samplers  
11 would be placed in areas where there is the potential for generation of airborne radioactive  
12 materials. These samplers would verify the effectiveness of confinement, or containment, and  
13 provide warning of elevated concentrations for planning or response actions. Area sampling  
14 frequency would be conducted in accordance with NRC Regulatory Guide 8.30 (NRC, 2002).  
15 Breathing zone air and area samples would be used for both routine (drying and packaging  
16 activities, maintenance, cleanup) and non-routine operations as required by operating  
17 procedure and/or Radiation Work Permit.

18 LCI has established a program to perform continuous environmental monitoring for radon gas at  
19 seven separate locations within and on the border of the site (Figure 6-2). The monitoring  
20 would be conducted with alpha track etch detectors and the samplers would be analyzed  
21 quarterly. This methodology is expected to detect radon at levels at, or above, 0.33 pCi/L,  
22 based on a 90-day sample. Direct gamma radiation measurements would also be sampled  
23 quarterly at specific passive locations (Figure 6-4).

24 Besides radon, airborne release of radioactive material could occur from a spill of yellowcake  
25 slurry or pregnant lixiviant under the proposed action. A spill of yellowcake slurry would most  
26 likely occur in the operating areas of the facility, so that installed workplace air sampling  
27 equipment would quickly monitor the airborne hazards. A spill of pregnant lixiviant, however, is  
28 a credible hazard, and is described by NUREG/CR-6377 (NRC, 2001).

### 29 **6.2.2 Soils and Sediment Monitoring**

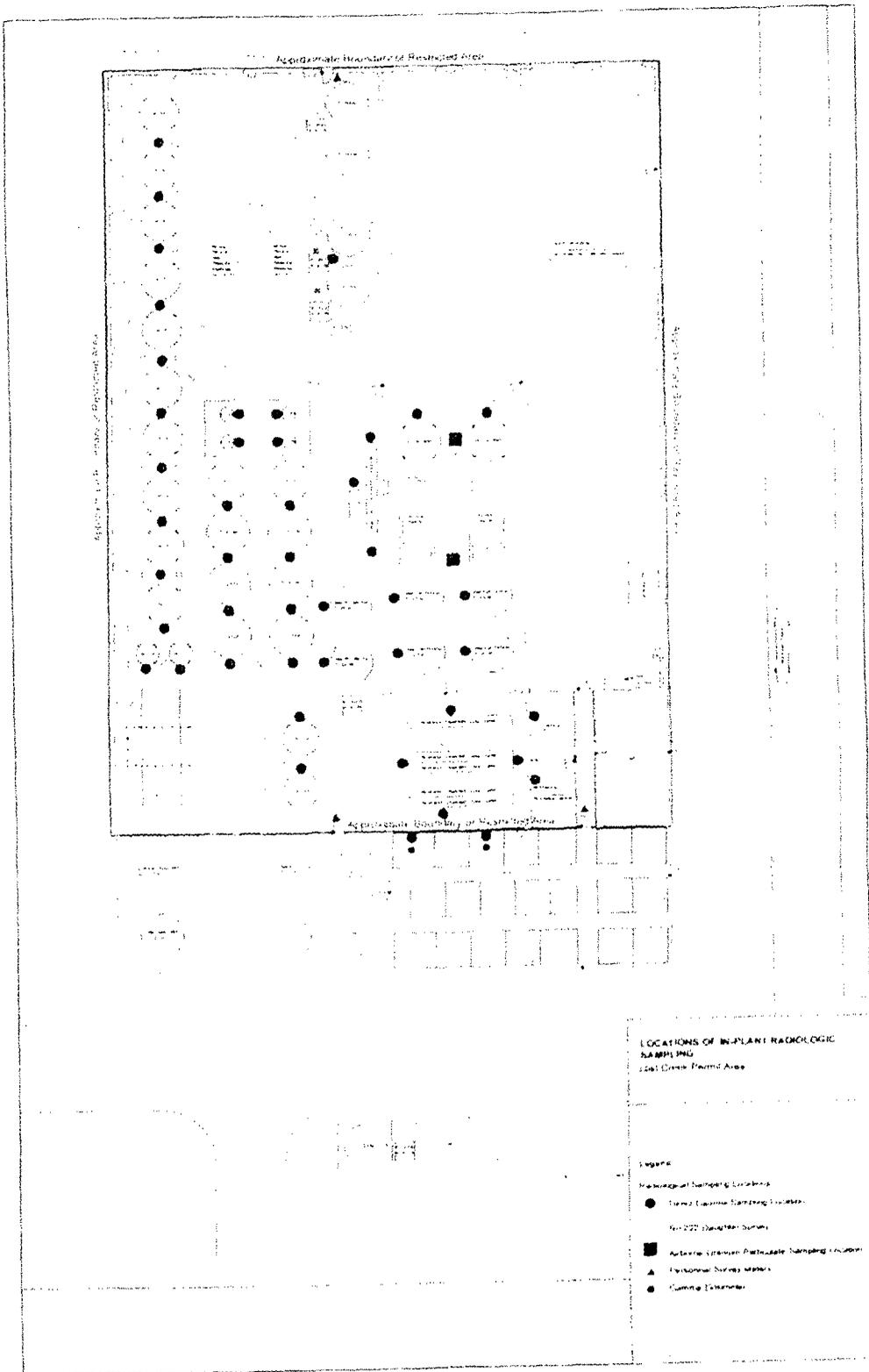
30 LCI is not proposing either soil or sediment monitoring.

### 31 **6.2.3 Vegetation, Food, and Fish Monitoring**

32 Because the only vegetation in the study area is sagebrush, which is not considered forageable  
33 for cattle and is not expected to rapidly absorb surface contamination, LCI does not plan to  
34 monitor vegetation or food supply. The only nearby source of food is grazing cattle. While cattle  
35 may approach the site up to the fenced areas, such as the CPP, header houses and drill rigs,  
36 they are not expected to spend significant time in these areas. In addition, cattle are only in the  
37 area for approximately 6 months out of the year, and graze over large areas due to the limited  
38 food supply. Food (beef) would be sampled to perform a baseline assessment of radiological  
39 conditions.

40 Fish monitoring would also not be performed, because there are no surface waters in the Battle  
41 Springs Flat drainage area.

42



1  
2

Figure 6-1. In-Plant Radiological Monitoring Locations

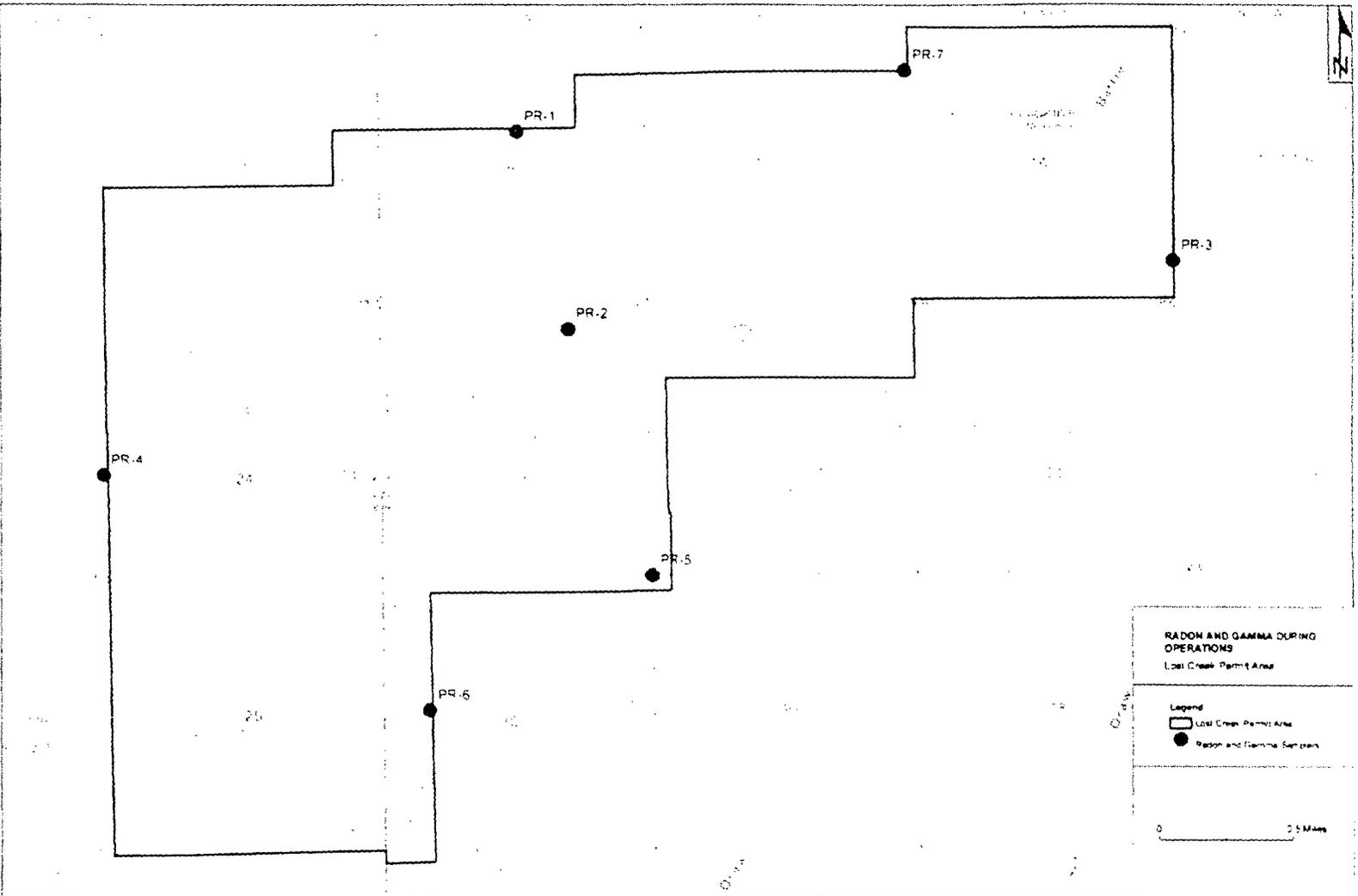


Figure 6-2. Radon and Gamma Monitoring Locations

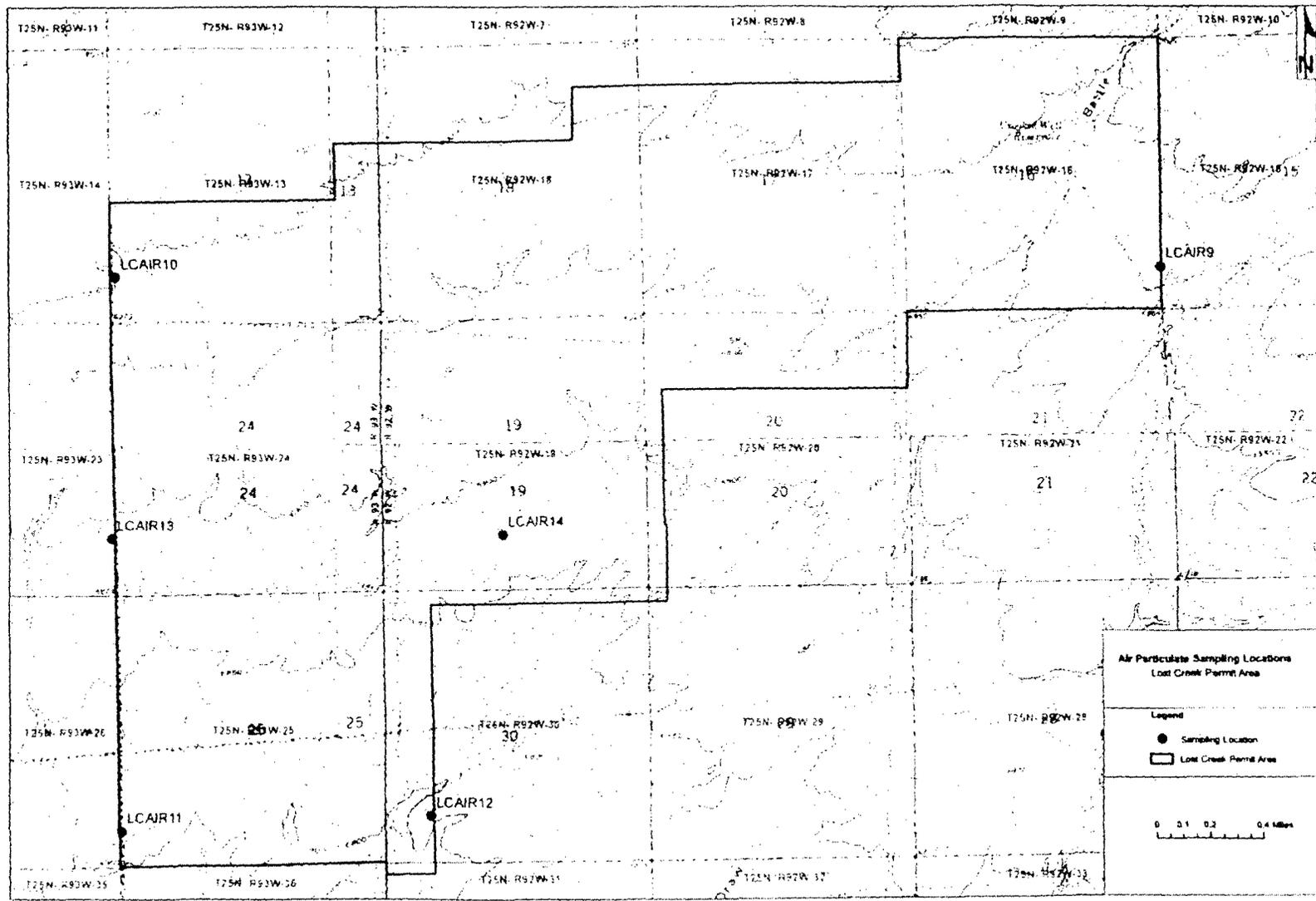


Figure 6-3. Air (Particulate) Monitoring Locations

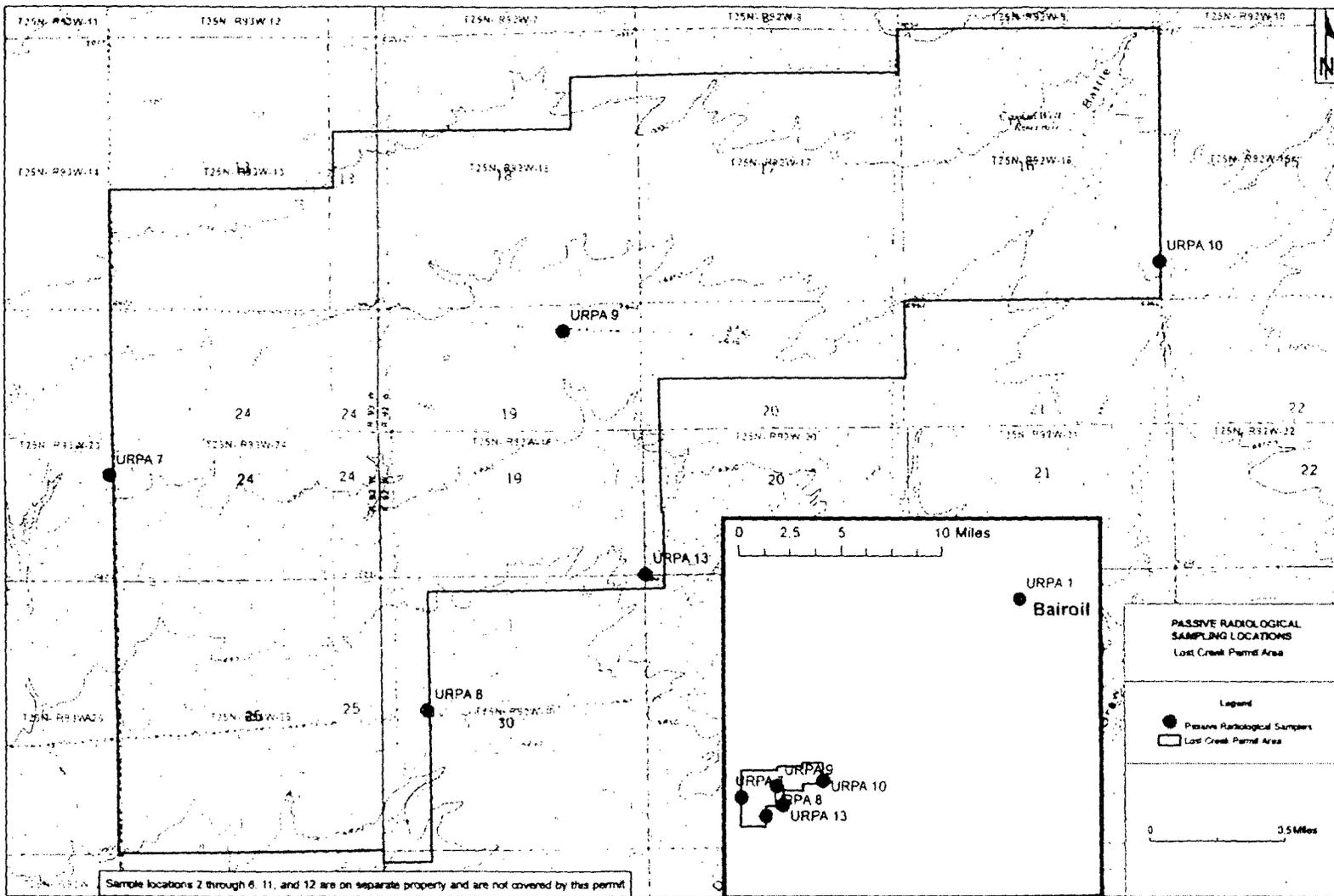


Figure 6-4. Passive Radiological Monitoring Locations

1 The north-central portion of the Great Divide Basin lacks any perennial, or even intermittent  
2 surface waters, and as such, no surface water monitoring program is proposed. Samples,  
3 however, would be collected in the event of spill or accidental release of contaminants. If no  
4 surface water is present at the time of a spill that could potentially impact an ephemeral  
5 drainage, only the soil would be sampled. However, sampling of the surface water would occur  
6 the next time that surface water is present.

### 7 **6.2.5 Groundwater Monitoring**

8 Groundwater environmental monitoring would be conducted at private and BLM-owned wells  
9 within 2 km (1.2 mi). of the permit area on a quarterly basis, with the owners' consent. Samples  
10 would be analyzed for uranium and Ra-226. Of the 17 monitoring wells already drilled, and the  
11 one private well sampled, more than two-thirds show elevated radionuclide concentrations  
12 (Table 3-3). None of these wells, however, are used for drinking or agricultural purposes, and  
13 the elevated radionuclide concentrations are consistent with uranium ore within the aquifer.

## 14 **6.3 Physiochemical Monitoring**

15 This section describes the proposed monitoring program to characterize and evaluate the  
16 chemical and physical environment. The purpose is to provide a basis for evaluating changes in  
17 the environment resulting from the proposed action. Two aspects must be considered: 1)  
18 baseline monitoring, used to support a pre-operational description of the environment; and 2)  
19 operational monitoring, used to support potential changes (impacts) to the environment as a  
20 result of uranium milling.

### 21 **6.3.1 Well Field Groundwater Monitoring**

22 As described in Section 8.3 of the GEIS (NRC, 2009), ISR production processes directly affect  
23 groundwater in the operating well field. For this reason, groundwater conditions are extensively  
24 monitored before, during and after operations. The pre-operational groundwater monitoring that  
25 occurred at Lost Creek is described below in Section 6.3.1.1. The groundwater quality  
26 monitoring that would occur during and after operation is described in Section 6.3.1.2.

#### 27 *6.3.1.1 Pre-Operational Groundwater Sampling*

28 A licensee must establish baseline groundwater quality before beginning uranium production in  
29 a well field (NRC, 2009). This is done to characterize the water quality in monitoring wells that  
30 would be used to detect lixiviant excursions from the production zone, to recover excursions,  
31 and to establish standards for aquifer restoration after uranium recovery is complete. The  
32 requirements and details of sampling programs to establish pre-operational groundwater quality  
33 are described in Section 8.3.1.1 of the GEIS (NRC, 2009).

34 LCI installed a monitor well network to provide an evaluation of pre-mining (baseline) conditions  
35 within the Lost Creek project area. The baseline groundwater monitoring program is described,  
36 in detail, in Section 5.7.8.1 of the applicant's Technical Report (TR), and the results of that  
37 monitoring program are described, in detail, in Section 2.7.3 of the TR. To establish baseline  
38 groundwater quality, quarterly groundwater samples were collected from 17 monitoring wells  
39 and one water supply well. These wells were completed in the production aquifer (designated  
40 as the HJ Horizon), the underlying aquifer (designated as the UKM horizon), and in the  
41 overlying aquifer (designated as the DE and LFG horizons). Sampling of all the wells began in  
42 September 2006, with the exception of four well in which sampling was begun in 2007. This  
43 sampling program provided a preliminary baseline analysis of groundwater quality and is  
44 intended to describe the overall quality of groundwater that now exists beneath the project area.

1 It should be noted that this does not, necessarily, provide the final basis for establishing  
2 restoration criteria for the individual well fields in which uranium milling would be conducted.

3 *6.3.1.2 Groundwater Quality Monitoring*

4 A baseline water quality assessment and restoration goal for each well field would be provided  
5 prior to beginning uranium recovery. This assessment would be provided to the WDEQ after  
6 being reviewed and approved by the LCI's Safety and Environmental Review Panel (SERP) and  
7 the NRC. A detailed description of the monitoring program that would be used to establish  
8 baseline water quality is provided in Section 5.7.8.2 of the LCI's TR. Production zone wells  
9 (injection and production pattern area) would be sampled four times with a minimum of two  
10 weeks between samplings during baseline characterization. The production wells would be  
11 selected based on a density of one well per three acres of well fields. During the first two  
12 sampling events, each well would be sampled for the full set of constituents required by the  
13 WDEQ (Table 6-1). The constituent list may be reduced during subsequent sampling events  
14 based on the result of the first two sampling events.

15 As described in the GEIS (NRC, 2009), monitoring wells would be placed around the perimeter  
16 of well fields, in the aquifers both overlying and underlying the ore-bearing (production) aquifers,  
17 as well as within the production aquifer for the early detection of potential horizontal and vertical  
18 excursions of lixiviants (Figure 2-7). Monitoring well placement is based on what is known  
19 about the nature and extent of the confining layer and the presence of drill holes, hydraulic  
20 gradient and aquifer transmissivity, and well abandonment procedures used in the region. The  
21 ability for a monitoring well to detect groundwater excursions is influenced by several factors,  
22 such as the thickness of the aquifer monitored, the distance between the monitoring wells and  
23 the well field, the distance between the adjacent monitoring wells, the frequency of groundwater  
24 sampling, and the magnitude of changes in chemical indicator parameters that are monitored to  
25 determine whether and excursion has occurred. As a result, the spacing, distribution, and  
26 number of monitoring wells at a given ISR facility are site-specific and established by license  
27 conditions. The factors that control the spacing, distribution and number of monitoring wells are  
28 described in greater detail in Section 8.3.1.2 of the GEIS (NRC, 2009).

29 LCI has documented the groundwater monitoring program that would be implemented at the  
30 Lost Creek ISR project in Section 5.7.8 of its TR. Monitoring well locations and spacing are  
31 described in Section 3.2.2.2 of LCI's TR. Monitoring wells would be located in a perimeter ring  
32 around the well field, with the completion interval of each well targeted to the mineralized zones  
33 adjacent to the well. Distances from the perimeter monitor wells to the injection/production  
34 patterns in each well field are anticipated to be on the order of 152 m (500 ft). The distance  
35 between each of the monitoring wells in the ring is also anticipated to be on the order of 152 m  
36 (500 ft). The results of pumping tests indicate that the radius of influence of a single pumping  
37 well is much greater than 152 m (500 ft). Consequently, the proposed monitoring well rings  
38 should be in hydraulic connection with the production well fields and the proposed monitoring  
39 should allow adequate detection so that production fluids could be controlled within 60 days, as  
40 required by the NRC. LCI must further demonstrate the hydraulic interconnection between the  
41 monitoring wells and production pattern at each well field. The distances between the  
42 monitoring ring and the production wells and between each well within the ring would be based  
43 on the aquifer characteristics of that well field, and actual distances would be refined at a later  
44 time when more data becomes available for that well field.

45 Monitoring wells would also be completed in the aquifers immediately above and below the  
46 uppermost and lowermost mineralized zone, in the UKM and FG horizons, respectively. As  
47 previously described in Section 3.5.3 and 4.5.3, aquifer testing conducted in the project area  
48 have indicated a potential for hydraulic connection between the production zone (HJ Horizon)

1 and the overlying FG and underlying UKM aquifers. LCI anticipates that the overlying and  
2 underlying monitoring wells would be installed at a density of approximately one well for each  
3 four acres of mine area. However, they further indicate that the actual density would be based  
4 on the aquifer characteristics of the mineralized zone and the overlying or underlying aquifer.  
5 Specific locations would be targeted depending on the thickness and continuity of the shale  
6 separating the mineralized zone and the underlying and overlying aquifer. LCI is required to  
7 demonstrate the adequacy of the monitoring program for the overlying and underlying aquifers  
8 at each mine unit.

9 A fault passing through the project area also complicates the design of an effective monitoring  
10 program. As previously described in Section 3.5.3 and 4.5.3, while the fault acts as an  
11 impediment to groundwater flow, it does not appear to act as an impermeable barrier. In  
12 addition, the strata are displaced across the fault. Monitoring well locations and depths must be  
13 specified that adequately represent the existing conditions and ensure adequate operational  
14 monitoring in the vicinity of the fault. The location and depth of monitoring wells intended to  
15 characterize flow across the fault, but would be determine based on individual mine unit testing.

16 The constituents chosen for indicators of lixiviant migration and for which UCLs would be set,  
17 are chloride, conductivity, and total alkalinity. Chloride was chosen due to its low natural levels  
18 in the native groundwater and because chloride is introduced into the lixiviant from the ion  
19 exchange process. Chloride is also a very mobile constituent in groundwater. Conductivity was  
20 chosen because it is an indicator of overall groundwater quality. Total alkalinity concentrations  
21 should be affected during an excursion as bicarbonate is the major constituent added to the  
22 lixiviant during mining.

23 Operational monitoring would consist of sampling the excursion monitoring wells at least twice  
24 monthly and at least ten days apart and analyzing the samples for the excursion indicators  
25 chloride, conductivity and total alkalinity. If two of the three UCL values are exceeded in a well  
26 during a monitoring event, the well is re-sampled within 24 hours of that determination. If results  
27 of the confirmatory sampling are not completed within 30 days of the initial sampling event, the  
28 excursion is considered confirmed. If the second sample does not exceed the UCLs, a third  
29 sample is taken. If neither second nor third round sample results exceed the UCLs, the first  
30 sample is considered in error. If the second or third round samples verify the exceedence, the  
31 well in question is place on excursion status. The NRC Project Manager and the WDEQ-LQD  
32 are notified by telephone or email within 24 hours and notified in writing within thirty days of a  
33 confirmed excursion. Corrective actions are undertaken at this point. A written report  
34 describing the excursion event, corrective actions, and corrective action results are to be  
35 submitted to the NRC within 60 days of the excursion confirmation.

36 Following the installation of each production pattern and monitor well network, the Well Field  
37 Hydrologic Data Package is assembled and submitted to the WDEQ for review. The contents of  
38 the data package would meet the extensive requirements established by the WDEQ. SERP  
39 would review the data package to ensure that the results of the hydrologic testing and planned  
40 mining activities are consistent with technical requirements and do not conflict with any  
41 requirement stated in NRC regulations. The Well Field Hydrologic Data Package would also be  
42 reviewed and approved by the NRC to ensure that the specific monitoring program establish for  
43 each well field would be adequate to provide a timely indication of any horizontal or vertical  
44 excursion that may occur.

45

<b>Table 6-1. Baseline Water Quality Monitoring Parameters</b>	
<b>Parameters Major Ions</b>	<b>Trace Constituents</b>
Calcium	Aluminum
Magnesium	Ammonia
Potassium	Arsenic
Sodium	Barium
Bicarbonate	Boron
Chloride	Cadmium
Carbonate	Chromium
Sulfate	Copper
Nitrate (Total)	Iron
Fluoride	
<b>General Water Chemistry</b>	Manganese
Alkalinity 1	Mercury
Total Dissolved Solids	Molybdenum
pH (field measured)	Nickel
pH (lab measured)	Selenium
Specific Conductance (field measured)	Silica
Temperature (field measured)	Vanadium
Zinc	
<b>Radionuclides</b>	
Gross Alpha 1	
Gross Beta 1	
Radium-226	
Radium-228 1	
Uranium	

1 The 1982 sampling did not include these parameters Lost Creek October 2007

2 **6.3.2 Well Field and Pipeline Flow and Pressure Monitoring**

3 Section 8.3.2 of the GEIS (NRC, 2009), indicates the facility operator typically would monitor  
 4 both injection and production well flow rates to manage water balance for the entire well field.  
 5 Additionally, the pressure of each production well and the production trunk line in each well field  
 6 header house would also be monitored. Unexpected losses of pressure may indicate  
 7 equipment failure, a leak, or a problem with well integrity.

8 The program planned for the well field and pipeline flow and pressure monitoring is described in  
 9 detail; in Section 3.2.7.1 of the LCI's TR. Injection well and production well flow rates and

1 pressures would be monitored at each header house in order that injection and production can  
2 be balanced for each pattern and the entire well field. The flow rate of each production and  
3 injection well is continuously monitored by monitoring individual electronic flow meters in each  
4 well field header house. The pressure of each production and injection trunk line would be  
5 monitored at the header house with electronic pressure gauges. The flow meters and pressure  
6 gauges would be tied into the header house control panel, which would be in communication  
7 with the CPP control room.

8 High and low pressure, as well as flow alarms would be installed to alert well field and plant  
9 operators if specified ranges are exceeded in conjunction with automatic shutoff valves to stop  
10 flow if significant changes in flow or pressure occur.

### 11 **6.3.3 Surface Water Monitoring**

12 LCI is not proposing any operational surface water monitoring for the project area because it  
13 concluded all of the drainages are ephemeral. In their application, LCI stated that runoff to the  
14 drainages only occurs during major precipitation events, and only a portion of it infiltrates to the  
15 surficial aquifer. NRC staff notes, however, it is possible that spills from wellheads or piping in  
16 the project area may be captured by runoff, be carried to drainages, infiltrate into the  
17 subsurface, and potentially affect the water quality in the surficial aquifer. For this reason, LCI  
18 has established several surface water sampling points within, and at, the borders of the project  
19 area with storm water samplers which were effective at measuring surface water quality during  
20 major precipitation events (Figure 6-5). NRC staff concludes these samplers would be  
21 adequate evaluate surface water runoff during precipitation events.

### 22 **6.3.4 Meteorological Monitoring**

23 The only air quality parameter proposed for monitoring at the Lost Creek site is particulate  
24 matter (PM<sub>10</sub>). Monitoring would be conducted by continuous visual inspection within the project  
25 boundary.

## 26 **6.4 Ecological Monitoring**

27 Site-specific monitoring programs need to be implemented in accordance with WDEQ, USFWS,  
28 WGFD, and BLM guidelines. Regular inspections on the status of mitigation installments also  
29 need to be incorporated into the ecological monitoring plan.

### 30 **6.4.1 Vegetation Monitoring**

31 Vegetation at the Lost Creek project area would be monitored by observing disturbed areas for  
32 the presence of undesirable (noxious) weedy species. If noxious weed species are noted, they  
33 would be controlled either by manual removal, mowing, or by herbicide applications.

34 Disturbed areas that have been reclaimed, and where indigenous (native) vegetation is  
35 developing, the areas would be monitored according to BLM and WDEQ guidance. These  
36 areas would continue to be monitored until the vegetation cover values (exclusive of noxious  
37 weeds) become comparable to the surrounding native shrub land areas.

38

39



## 6.4.2 Wildlife Monitoring

Wildlife resources in, and near, the project area would be monitored on an annual basis throughout the life of the project, and would document key wildlife species, population trends, and habitats.

### 6.4.2.1 Annual Report and Meetings

The monitoring program would be coordinated with the Rawlins BLM Field Office, and the Wyoming Game & Fish Department (WGFD). Consultation with the BLM and WGFD would be conducted prior to initiating monitoring, and would be documented in a work plan, with concurrence by the BLM and WGFD.

An annual monitoring report would be prepared by LCI and submitted to the BLM, WGFD, and other interested parties by November 15 of each year, and would include: 1) survey methods, results, any trends, an assessment of protection measures implemented during the past year; 2) recommendations for changes in protection measures for the coming year; 3) recommended modifications to monitoring or surveying; and 4) recommendations for additional species to be monitored (e.g., a newly listed species). Data and mapping would be formatted to meet BLM requirements (i.e., geographic information systems [GIS] data and maps).

### 6.4.2.2 Annual Inventory and Monitoring

Wildlife inventory and monitoring would be completed by the BLM or WGFD biologists, or a third-party contractor paid for by LCI (approved by BLM prior to completing any work).

### 6.4.2.3 Raptors

Monitoring of known raptor nests would be completed each year between April and July to determine nest status. Surveys can be completed by helicopter or from the ground, and would be conducted using WGFD protocol to minimize adverse effects to nesting raptors. Observations would be scheduled for as late in the nesting season as possible to avoid disturbance during the incubation and early brood rearing periods.

Surveys for new nests would also be conducted within the project area, but would extend to a 1.6-km (1 mi) radius outside of the project area at least once every five years. For areas of new disturbance, a survey for new raptor nests would be completed prior to the disturbance.

### 6.4.2.4 Sage-grouse

A survey for new (undocumented) leks would be completed within the project area and within a surrounding 3.2-km (2 mi) radius outward from the project area boundary once every five years, or as deemed appropriate by BLM and WGFD. Just as with raptors, surveys may be completed by aerial or by ground methods, following standard WGFD protocol.

All documented and known leks would be monitored on an annual basis to determine its attendance and trends in activity. Monitoring would occur three times during the appropriate season (late March to early May), and following WGFD standard protocol.

### 6.4.2.5 Big Game

No monitoring of big game is proposed LCI. Only the number of road kills for each of the major species would be recorded. To determine the extent of big game road kills all wildlife/vehicle collisions on project access roads would be recorded and reported in the annual monitoring report. Other big game mortality resulting from project activities would also be recorded and reported.

1 6.4.2.6 *General Wildlife*

2 No monitoring of other wildlife species is being proposed. Known mortality of wildlife species  
3 resulting from project activities would be recorded and reported. Large die-offs, or evidence of  
4 possible wildlife exposure to toxic chemicals, would be reported immediately to the BLM,  
5 WGFD, and USFWS.

6 6.4.2.7 *Sensitive Species*

7 Specific monitoring of sensitive species (except as noted above for raptors and sage-grouse) is  
8 not proposed.

9 Known mortality of sensitive wildlife species due to project activities would be recorded and  
10 reported. Significant die-offs or other evidence of possible wildlife exposure to toxic chemicals  
11 would be reported immediately to the BLM, WGFD, and USFWS.

12 **6.4.3 Noise**

13 Noise is not being proposed for monitoring because the nearest receptor is more than 15 miles  
14 away.

15 **6.4.4 Historic and Cultural Resources Monitoring**

16 No specific on-going monitoring plan is required for this project. A treatment (mitigation) plan,  
17 however, was prepared for a pre-historic site identified in the project area that is potentially  
18 eligible for inclusion on the *National Register of Historic Places*. In addition, should  
19 unanticipated cultural resources be uncovered during the construction, operation, aquifer  
20 restoration, or decommissioning phases, an Unanticipated Discovery Plan would be  
21 implemented by the Site Supervisor. The plan would be prepared prior to license approval, and  
22 would outline the process of notification, evaluation, and actions to be taken should  
23 unanticipated cultural resources be found during the development of the facility.

24 **6.5 References**

25 10 CFR Part 40 Appendix A. *Code of Federal Regulations*, Title 10, Energy, Part 40  
26 Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of  
27 Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores  
28 Processed Primarily from their Source Material Content.

29 36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*,  
30 Part 60, "National Register of Historic Places."

31 LCI, 2008a. Lost Creek ISR, LLC. Lost Creek Project Environmental Report, Volumes 1 through  
32 3 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License  
33 (Docket No. 40-9068). March 2008.

34 LCI, 2008b. Lost Creek ISR, LLC. Lost Creek Project Technical Report, Volumes 1 through 3  
35 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket  
36 No. 40-9068). March 2008.

37 NRC, 1980. Radiological Effluent and Environmental Monitoring at Uranium Mills. Regulatory  
38 Guide 4.14. April 1980.

39 NRC, 1992. Air Sampling in the Workplace. Regulatory Guide 8.25. June 1992.

40 NRC, 2002. Health Physics Surveys in Uranium Recovery Facilities. Regulatory Guide 8.30.  
41 May 2002.

- 1 NRC, 2003. Standard Review Plan for In-situ Leach Uranium Extraction License Application.
- 2 NUREG-1569. June 2003.
- 3 NRC, 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling
- 4 Facilities. NUREG-1910, Vols. 1 and 2. June 2009.



## 7 COST-BENEFIT ANALYSIS

This chapter summarizes benefits and costs associated with the proposed action and the No-Action alternative. Chapter 4 of this Supplemental Environmental Impact Statement (SEIS) discusses the potential socioeconomic impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek Project by Lost Creek ISR, LLC (LCI).

The implementation of the proposed action primarily would generate regional and local benefits and costs. The regional benefits of constructing and operating the proposed Lost Creek ISR Project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Sweetwater County, Wyoming, where the proposed ISR facility would be located, and the towns of Bairoil and Wamsutter, and the cities of Rock Springs and Green River. Other benefits may extend to the neighboring Carbon County, Wyoming, and to the Town of Rawlins. Costs associated with the proposed Lost Creek Project are, for the most part, limited to the area surrounding the site. Examples of these environmental impacts would include changes to current land use, wildlife habitat, and increased road traffic.

### 7.1 No-Action Alternative

Under the No-Action alternative, the NRC would not approve the license application for the proposed Lost Creek Project. The No-Action alternative would result in LCI not constructing, operating, restoring the aquifer, or decommissioning the proposed Lost Creek Project. No facilities, road, or well fields would be built; no pipeline would be laid as described in Section 2.1.1.2. No uranium would be recovered from the subsurface orebody; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced in the subsurface and no buildings would be constructed to process extracted uranium or store chemicals involved in that process. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. As a result, the proposed site would not be disturbed by the proposed project activities, and ecological, natural, and socioeconomic resources would remain unaffected. All potential environmental impacts from the proposed action would be avoided. Similarly, all project-specific socioeconomic impacts (e.g., related to employment, economic activity, population, housing, local finance) would be avoided.

### 7.2 Benefits from the Proposed Action

Under the proposed action, LCI would construct, operate, and decommission and conduct aquifer restoration at the proposed Lost Creek Project site in Sweetwater County, Wyoming. Construction of the central processing plant, access roads, and initial development of the well fields for the proposed Lost Creek Project would take place over a 21-month period, with the CPP and supporting structures expected to take approximately 6 months to construct. Operation of the central plant for uranium recovery and processing would be expected to occur over 8 years, with aquifer restoration activities and associated stability monitoring following restoration is expected to occur over a 3.5-year period. LCI expects to conduct final well field and site decommissioning within one year.

The principal socioeconomic impact or benefit from the proposed Lost Creek Project would be an increase in the jobs in Sweetwater County, Wyoming and the surrounding counties. LCI expects that from 70 to 90 workers (including both full-time employees and subcontractors)

1 would be employed during the life of the proposed project. LCI anticipates that most would  
2 commute from larger communities in Wyoming, such as Casper, Rawlins and Rock Springs, but  
3 some (if they are specialized in a particular trade) could come from out-of-state.

4 If it is assumed that the majority of the employment requirements is filled by a workforce from  
5 outside the region, assuming a multiplier of about 0.7 (see text box) there could be an influx of a  
6 minimum of 49 jobs (i.e., 70x0.7) and a maximum of 63 jobs (i.e., 90 x 0.7). In the region of  
7 influence the nearest towns to the proposed project site are the Towns of Bairoil (population of  
8 96), Wamsutter (population of 269), and Rawlins (population of 8,740) (U.S. Census Bureau,  
9 2008). Given their relative size and proximity to the proposed site, Bairoil (24 km [15 mi] from  
10 the proposed project site) and Wamsutter (43 km [27 miles]), the new jobs could have a LARGE  
11 positive impact in the unemployment of the Towns of Bairoil and Wamsutter, but only a SMALL  
12 to MODERATE impact in the Town of Rawlins (61 km [38 mi] from the proposed site). The  
13 influx of these jobs along with the reduction of unemployment should have a MODERATE  
14 benefit to the businesses of the Towns of Bairoil and Wamsutter, but only a SMALL to  
15 MODERATE impact to the businesses in the Town of Rawlins.

16 In addition to job creation, the project's operations and its employees would contribute to local,  
17 regional, and state revenues through the purchase of goods and services and through the taxes  
18 levied on such goods and services. Additionally, severance taxes associated with uranium  
19 mining in Sweetwater County are levied by the State of Wyoming, Mineral Tax Division of the  
20 Department of Revenue has a 4% uranium severance tax of taxable market value coming from  
21 mining operations (Wyoming Department of Revenue, 2009). LCI estimates that the proposed  
22 project will produce 454,500 kg (1,000,000 lb) of  $U_3O_8$  per year for 8 years. If these were sold at  
23 nominal market price for  $U_3O_8$  of \$45, the severance tax would yield approximately \$1,800,000  
24 in net economic benefits per year and \$14,400,000 over the life of the operation. This figure  
25 excludes potential reserve resources and does not include potential benefits derived from taxes  
26 on royalties or lease payments to local landowners stemming from the operation of the  
27 proposed Project. LCI also expects to pay \$1,600,000 in county property taxes.

### 28 **7.2.1 Benefits from Potential Production**

29 Both the employment generated and the taxes paid by LCI would depend on the production of  
30 yellowcake. The amount of yellowcake produced would depend on the market price for  
31 yellowcake (as  $U_3O_8$ ) and the cost of production. Since 2007, the spot-market price for  $U_3O_8$  has  
32 fluctuated significantly, from a high of over \$130 in 2007 to as low as \$40 in 2009. As of  
33 September 8, 2009, the price was \$46 per pound.

34 The project's potential benefits to the local community depend on LCI's operating costs being  
35 lower than the future price of  $U_3O_8$ . If the price of  $U_3O_8$  is less than the costs of operation, then  
36 operations may be suspended and/or discontinued.

### 37 **7.2.2 Costs to the Local Communities Associated with the Proposed Lost Creek Project** 38 **Activities**

39 Table 7-1 identifies the towns within 40 km [25 mi] and towns within commuting distance from  
40 the proposed project site. The table also presents the towns' population and distance from the  
41 project site.

1

**Table 7-1. Communities Closest to the Proposed Project**

Communities	Population *	Distance from Project Site - km (mi)
<b>Within 25 miles from the project site</b>		
Bairoil (T)	96	24 (15)
<b>Between 25 and 50 miles from the project site</b>		
Wamsutter (T)	269	43 (27)
Rawlins (T)	8,740	61 (38)
<b>Beyond 50 miles of the project site</b>		
Rock Springs (C)	20,200	134 (84)
Casper (C)	54,047	145 (91)

2

\*U.S. Census Bureau, 2008

3

As stated in Section 7.2, the proposed project is expected to employ from 70 to 90 workers, and, if the majority of operational requirements are filled by a workforce from outside the region, there could be an influx of 49 to 63 jobs. These new jobs would have an influx of 122 to 156 people, based on 2.48 persons per household for the State of Wyoming (U.S. Census Bureau, 2000). As discussed previously, it is expected that a large fraction of these new workers and their households would prefer to reside in larger communities, such as the Town of Rawlins. If it were assumed that all new households resided in the Town of Rawlins, then that would lead to a population increase of 1.4 percent (i.e., 122 ÷ 8,740) to 1.8 percent (i.e., 156 ÷ 8,740) for the town. However, it is expected that not all the new households would reside in the Town of Rawlins and may prefer other large communities. Therefore, the impact to housing demand and health and social services is estimated to be SMALL to MODERATE.

4

5

6

7

8

9

10

11

12

13

14

15

The local communities would require minimal increase in emergency response and medical treatment capabilities because of the small risk of industrial accident due the proposed project.

16

**Table 7-2. Estimated Project Costs to the Local Communities**

<b>Summary of Costs and Benefits of the Proposed Lost Creek Project</b>	
<b>Cost-Benefit Category</b>	<b>Proposed Action</b>
<b>BENEFITS</b>	
Capacity Produced	1.0 million pounds of U3O8 for 8 years
Other Monetary	\$14.4 million (estimated for severance tax)
Non-Monetary (50% of jobs will be from Campbell County)	70-90 jobs—during construction, operation aquifer restoration, and decommissioning 49-63 jobs—local jobs from economic multiplier during operation and aquifer restoration
<b>COSTS</b>	
Education Infrastructure	SMALL to MODERATE
Health and Social Services	SMALL to MODERATE
Housing Demand	SMALL to MODERATE
Emergency Response	SMALL

1 **7.3 Evaluation of Findings for the Proposed Lost Creek ISR Project**

2 Implementation of the proposed action would have a SMALL to MODERATE overall economic  
3 impact on the region of influence. The implementation of the proposed action would generate  
4 primarily regional and local benefits and costs. The regional benefits of building the proposed  
5 Lost Creek ISR Project would be increased employment, economic activity, and tax revenues in  
6 the region around the site. Some of these regional benefits, such as tax revenues, would be  
7 expected to accrue specifically to Sweetwater County. Other benefits may extend to neighboring  
8 counties in the State of Wyoming. Costs associated with the proposed Lost Creek ISR Project  
9 are, for the most part, limited to the area surrounding the site and the communities within  
10 commuting distance. Table 7-2 summarizes the costs and benefits.

11 **7.4 References**

12 Economic Policy Institute, 2003, "Updated Employment Multipliers for the U.S. Economy,"  
13 Washington, DC: Economic Policy Institute. 2003.

14 NRC, 2009, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling  
15 Facilities," Washington, DC: NUREG-1910. May 2009.

16 NRC, 1996, U.S. Nuclear Regulatory Commission, "Generic Environmental Impact Statement  
17 for License Renewal of Nuclear Plants," Washington, DC: NUREG-1437, Office of Nuclear  
18 Reactor Regulation. May 1996.

19 U.S. Census Bureau, 2008, U.S. Census Bureau, 2008 Population Estimates,  
20 <http://factfinder.census.gov>

21 U.S. Census Bureau, 2000, State and County Quick Facts,  
22 <http://quickfacts.census.gov/qfd/states/56000.html>

23 Wyoming Department of Revenue. 2009. State of Wyoming Department of Revenue 2009  
24 Annual Report. < [http://revenue.state.wy.us/PortalVBVS/uploads/Department%20of%20  
25 Revenue%20%2010.29.2009.pdf](http://revenue.state.wy.us/PortalVBVS/uploads/Department%20of%20Revenue%20%2010.29.2009.pdf)> (11 November 2009).

## 8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the potential environmental impacts and consequences of the proposed action and reasonable alternatives, including the No-Action alternative. In doing so, the potential impacts and consequences are discussed in terms of: 1) the unavoidable adverse environmental impacts; 2) the relationship between local short-term uses of the environment and the maintenance of long-term productivity; and 3) the irreversible and irretrievable commitment of resources. The information is presented for the proposed action and each alternative for the 13 resource areas and discussed by stage of the proposed facility's lifecycle (i.e., construction, operation, aquifer restoration and decommissioning). These conclusions are provided in the tables below.

NRC's NUREG-1748 (NRC, 2003) defines the following terms:

- **Unavoidable adverse environmental impacts:** impacts that cannot be avoided and for which no practical means of mitigation are available
- **Irreversible:** commitments of environmental resources that cannot be restored
- **Irretrievable:** applies to material resources and would involve commitments of materials that, when used, cannot be recycled or restored for other uses by practical means
- **Short-term:** represents the period from pre-construction to the end of the decommissioning activities, and therefore generally affect the present quality of life for the public.
- **Long-term:** represents the period of time following the termination of the site license, with the potential to affect the quality of life for future generations.

As described in Chapter 4, the significance of potential environmental impacts is categorized as follows:

**SMALL:** The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

**MODERATE:** The environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource

**LARGE:** The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

### 8.1 Proposed Action (Alternative 1)

NRC would issue Lost Creek ISR, LLC (CLI) a license for the construction, operation, aquifer restoration, and decommissioning of facilities for in-situ recovery (ISR) uranium milling and processing at the Lost Creek ISR Project site as proposed in the license application and related submittals.

One identified archaeological site, eligible for inclusion on the National Register of Historic Places may be potentially affected. A Memorandum of Agreement (MOA) has been developed, and is currently in the process of being executed. The potential environmental impacts of this alternative are summarized in Table 8-1.

1 **8.2 No-Action (Alternative 2)**

2 LCI would not be issued a license for the construction and operation of ISR facilities related to  
3 the Lost Creek ISR Project. As a result, no uranium ore would be recovered from this site under  
4 the LCI license application.

5 Alternative 2 would result in no impacts to any of the 13 resources areas. Therefore, no  
6 unavoidable adverse environmental impacts would occur, no relationship between local short-  
7 term uses of the environment and the maintenance of long-term productivity irreversible or  
8 irretrievable commitments would result, and there would be no irreversible and irretrievable  
9 commitment of resources.

10 **8.3 Dry Yellowcake (Alternative 3)**

11 NRC would issue LCI a license for the construction, operation, aquifer restoration, and  
12 decommissioning of facilities for ISR uranium milling and processing as proposed by LCI, and  
13 would include a vacuum dryer to produce a dry yellowcake as the final product.

14 The potential environmental impacts for Alternative 3 on each of the 13 resource areas are  
15 similar to, or nearly the same as, the impacts from the proposed action (summarized in Table 8-  
16 1). The same area of land would be disturbed, which would not result in any additional impacts  
17 to geology and soils or ecological resources. Additional equipment, and potentially additional  
18 workers, may be needed, which could affect transportation and air quality.

19

1

<b>Table 8-1. Summary of Environmental Consequences of the Proposed Action</b>				
<b>Impact Category</b>	<b>Unavoidable Adverse Environmental Impacts</b>	<b>Irreversible and Irretrievable Commitment of Resources</b>	<b>Short-term impacts and uses of the environment</b>	<b>Long-term impacts and the maintenance and enhancement of productivity</b>
<b>Land Use 4.2.1</b>	During construction, there would be a SMALL impact from use of earth-moving equipment, removal of topsoil, grading and clearing of land to create access roads, and creation of wells. Impacts during other phases would be similar.	During all phases, there would be a SMALL commitment of energy resources and water resources to project activities. In addition, a small amount of grazing and herd management land would be affected, irretrievably, for a period of about 10 years.	During all phases, there would be a SMALL impact from temporary alteration of rangeland leases, and short-term restricted access to neighboring lands. During decommissioning, there would be a SMALL impact from land disturbances from earth-moving equipment, regarding, and reseeded of land.	During all phases of the project there would be a SMALL long-term impact from vegetation removal, affecting grazing and herd management. During decommissioning, wells, though abandoned, would remain on the site.
<b>Transportation 4.3.1</b>	During all phases, there would be a SMALL increase in local traffic counts and dust and noise associated with project-related traffic	During the life of the project, fuel, necessary for vehicle and equipment operation, as well as heating, would be irreversibly committed. In addition, labor, from on-site and service personnel, would be irreversibly committed.	During all phases, there would be a SMALL increased risk of chemical spills on roadways. During periods of intense project development, such as construction and decommissioning, there would be a noticeable increase in traffic on local roads	Because no project-related transportation impacts would persist after the life of the project, no long term impacts would result.

Summary of Environmental Consequences

**Table 8-1. Summary of Environmental Consequences of the Proposed Action**

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
<b>Geology and Soils</b> <b>4.4.1</b>	During construction, and again, during decommissioning, disturbance of soil would cause SMALL impacts. Spills causing contamination, and alteration of soil horizons would result in MODERATE impacts, unless mitigated.	During all phases, disturbance to the soil layers would be irreversible, though SMALL. Reseeding and re-contouring would mitigate this impact.	During construction, disturbance of soil would cause SMALL impacts. Spills causing contamination, and alteration of soil horizons would result in MODERATE impacts, unless mitigated.	Because project area would be returned to its original condition during decommissioning, no long-term impacts to geology and soils are expected.
<b>Surface Waters and Wetlands</b> <b>4.5.1.1</b>	Not applicable	Not applicable	Not applicable	Not applicable
<b>Groundwater</b> <b>4.5.2.1</b>	Impacts could occur throughout the life cycle of the project. There is the potential to affect drawdown in wells outside the project boundaries that are drilled into the ore-bearing aquifer. There is the potential to alter groundwater chemistry from spills, leaks and excursions	Stock wells in the area may be irretrievably affected by drawdown from the aquifer, particularly during operation and restoration. Change in aquifer chemistry may be an irreversible impact.	Consumptive use – drawdown of the aquifer would be most noticeable during aquifer restoration. Impacts to surrounding wells would be affected for a short-term. There is the potential for contamination to surficial aquifers from spills and leaks, and to lower aquifers from excursions.	There is the potential to alter the chemistry of an aquifer due to operation.

**Table 8-1. Summary of Environmental Consequences of the Proposed Action**

<b>Impact Category</b>	<b>Unavoidable Adverse Environmental Impacts</b>	<b>Irreversible and Irretrievable Commitment of Resources</b>	<b>Short-term impacts and uses of the environment</b>	<b>Long-term impacts and the maintenance and enhancement of productivity</b>
<p><b>Ecological Resources</b> 4.6.1</p>	<p>During construction, removal of vegetation and clearing of land, possible introduction of invasive species, and displacement of wildlife species would result in SMALL impacts. During all other phases, limited access of wildlife to wintering habitat would result in SMALL impacts.</p>	<p>During the life of the project, a small amount of vegetation would be lost to buildings, storage areas, roads and well pads. Habitat removed for project development constitutes an irretrievable commitment of resources, as would be the displacement of some wildlife species</p>	<p>Impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL. Reseeding after decommissioning would restore native vegetation.</p>	<p>During all phases, altered wildlife patterns and changes to the vegetative community would result in SMALL impacts.</p>
<p><b>Air Resources</b> 4.7.1</p>	<p>During all phases, fugitive dust, and vehicle and equipment emissions would result in SMALL impacts.</p>	<p>During all phases of the project, for short periods of time, the quality of the air would be degraded, mostly by dust, but would not be irreversible.</p>	<p>During all phases, impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL.</p>	<p>Because emissions are expected to be SMALL, no long-term impacts are expected.</p>
<p><b>Noise</b> 4.8.1</p>	<p>During construction, noise levels would be elevated on, and in the vicinity of, the site, but would result in SMALL impacts. During other phases, noise levels would be elevated, but to a lesser extent than during construction.</p>	<p>Not applicable</p>	<p>During all phases, impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL.</p>	<p>Because noise impacts would not persist past the life of the project, no long-term impacts would result.</p>

Summary of Environmental Consequences

<b>Table 8-1. Summary of Environmental Consequences of the Proposed Action</b>				
<b>Impact Category</b>	<b>Unavoidable Adverse Environmental Impacts</b>	<b>Irreversible and Irrecoverable Commitment of Resources</b>	<b>Short-term impacts and uses of the environment</b>	<b>Long-term impacts and the maintenance and enhancement of productivity</b>
<b>Historical, Cultural, and Paleontological Resources</b> 4.9.1	During construction, potential disturbance of archaeological sites could result in MODERATE impacts unless mitigated.	If archaeological sites are not avoided during construction, this would result in an irreversible commitment of resources and could result in MODERATE to LARGE impacts, if not mitigated.	During all phases, restricted access to identified historical and cultural sites would be short-term and would result in a SMALL impact.	If potential impacts from construction activities are not mitigated, then long-term MODERATE to LARGE impacts to archaeological sites would likely result.
<b>Visual and Scenic Resources</b> 4.10.1	During construction, minor visual impacts from equipment and dust/diesel emissions would result in a SMALL impact. During all phases, impacts from buildings, structures and activities would be SMALL.	During the life cycle of the project, impact upon the landscape would be irretrievable, but not irreversible.	During all phases, all impacts associated with visual/scenic resources would be short-term.	Because project area would be returned to its original condition after during decommissioning, no long-term impacts would result.
<b>Socioeconomic</b> 4.11.1	During operation, increased demand for housing may increase housing costs in the local area and could result in a MODERATE impact. During all phases, increased demand for education and health and social services could put a strain on these resources and result in a MODERATE impact, particularly if it is a small community.	The operation phase of the ISR project may cause an irretrievable commitment of housing and education resources, and health and social services, depending on the community affected.	During all phases, increased demand for housing, educational services, and health and social services would result in a short-term and SMALL impact.	No long-term socioeconomic impacts are expected.

**Table 8-1. Summary of Environmental Consequences of the Proposed Action**

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
<b>Environmental Justice</b> 4.12.1	Not applicable <sup>(1)</sup>	Not applicable <sup>(1)</sup>	Not applicable <sup>(1)</sup>	Not applicable <sup>(1)</sup>
<b>Public and Occupational Health and Safety</b> 4.13.1	During operation, the potential radiological impacts from accidents would be SMALL to MODERATE for workers, but SMALL to the public, but only from accidents related to the transportation of yellowcake. During other phases, the impacts would be SMALL.	Not applicable	During all phases, all impacts associated with public and occupational health would represent a short-term and SMALL impact.	No long-term public and occupational health impacts are expected.
<b>Waste Management</b> 4.13.1	During all phases, generation of low volumes of wastes would result in a SMALL impact. Construction wastes would be mostly solids, operations wastes would include solids and liquids (brine, plant wash-down water, and others), and decommissioning wastes would include some radioactive wastes.	During all phases, energy and space used to properly handle and dispose of all types of waste would represent an irreversible commitment of resources resulting in a SMALL impact. On-site, temporary storage of wastes would result in an irretrievable commitment of space resources.	During all phases, hazards associated with handling and transport of wastes would represent a short-term and SMALL impact.	During all phases, permanent disposal or storage of wastes would represent a long-term, but SMALL, impact to facilities licensed to handle such wastes.

<sup>(1)</sup> Section 4.12.1 of this SEIS concluded that there are no disproportionately high and adverse impacts to minority or low-income populations from the Lost Creek Project.

1 **8.4 References**

- 2 NRC (U.S. Nuclear Regulatory Commission). NUREG-1748, "Environmental Review Guidance
- 3 for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August 2003.

## 9 LIST OF PREPARERS

This section documents all individuals who were involved with the preparation of this draft Supplemental Environmental Impact Statement (SEIS). Contributors include staff from the U.S. Nuclear Regulatory Commission (NRC) and consultants. Each individual's role, education, and experience are outlined below.

### 9.1 U.S. Nuclear Regulatory Commission Contributors

Alan B. Bjornsen: Environmental Project Manager  
M.S., Silviculture, SUNY College of Forestry, 1971  
M.S., Forestry, Syracuse University, 1971  
B.S., Geology, Wheaton College, 1968  
Years of Experience: 37

Jennifer A. Davis: Assistant Environmental Project Manager  
B.A., Historic Preservation and Classical Civilization (archaeology), Mary Washington College, 1996  
Years of Experience: 9

Allen Fetter: Senior Project Manager  
Ph. D., Geology, University of Kansas - Lawrence, 1999  
M.S., Geology, University of North Carolina at Chapel Hill, 1994  
B.A., Geology, Guilford College, 1988  
Years of Experience: 15

Johari Moore: Health and Safety Specialist  
B.S., Florida A&M University, 2003  
M.S., University of Michigan, 2005  
Years of Experience: 4

James Park: Reviewer  
M. Ed., Marymount University, 1999  
M.S., Structural Geology & Rock Mechanics, Imperial College, University of London, England, 1988  
B.S., Geology, Virginia Polytechnic Institute and State University, 1986  
Years of Experience: 16

Asimios Malliakos: Cost-Benefit Analysis  
PhD., in Nuclear Engineering with a Minor degree in Probability and Statistics, University of Missouri-Columbia, 1980  
MS., in Nuclear Engineering, Polytechnic Institute of New York, New York, NY, 1977.  
BS., in Physics, University of Thessaloniki, Greece, 1975.  
Years of Experience: 29

1 **9.2 Environet, Inc. (Environet) Contributors**

2 Ray Clark: Analyst, Program Manager  
3 B.A., Jacksonville State University, 1974  
4 M.A., Environmental Management, Duke University, 1984  
5 Years of Experience: 35  
6

7 Colette Sakoda: Project Manager, QA/QC  
8 M.C.P., City and Regional Planning, University of California at Berkeley, 1981  
9 M.P.A., Public Administration, California State University at Fullerton, 1979  
10 B.A., Journalism, University of Hawaii at Manoa, 1975  
11 Years of Experience: 28  
12

13 Sonia Garcia: Environmental Specialist/Planner – Socioeconomics, Visual and Scenic  
14 Resources, Cumulative Impacts. Environmental Justice  
15 M.S., Biology, University of Guam, 2002  
16 B.S., Biology, Environmental Science and Policy, Duke University, 1999  
17 Years of Experience: 10  
18

19 Stephanie Davis: Environmental Specialist – Ecological Resources  
20 B.S., Environmental Science, The Evergreen State College, 1996  
21 Years of Experience: 11  
22

23 Nicole Scheman: Geologist/Hydrologist – Geology and Soils, Groundwater  
24 Ph.D. Candidate, Natural Resource & Environmental Mgmt, University of Hawaii  
25 at Manoa  
26 M.S., Environmental Science, University of Guam, 2002  
27 B.S., Geology, College of Charleston, S.C., 1999  
28 Years of Experience: 14  
29

30 Max Solmssen: Environmental Planner – Land Use, Socioeconomics, Document  
31 Management, Administrative Record  
32 Presently Enrolled, University of Hawaii at Manoa: Masters in Urban & Regional  
33 Planning  
34 B.A., English Literature, University of Hawaii at Manoa, 2002  
35 Years of Experience: 3  
36

37 Anthony Silvia: Environmental Planner – Document Management  
38 J.D., University of San Diego, School of Law, 2004  
39 B.A., History, minor concentration in Environmental Science, Stonehill College, 2001  
40 Years of Experience: 2

### 9.3 Environet Subcontractor Contributors

#### Chesapeake Nuclear Services, Inc.

J. Stewart Bland: Radiation Health Physicist – Public and Occupational Health (Radiological), Waste Management M.S., Nuclear Science, Georgia Institute of Technology, 1974

B.S., Physics, Georgia Institute of Technology, 1973

Years of Experience: 35

Richard H. Kuhlthau: Geologist/Hydrogeologist – Groundwater, Geology and Soils Ph.D., Civil Engineering, Colorado State University, 1994

M.S., Environmental Science, University of Virginia, 1979

B.S., Physics, Georgia Institute of Technology, 1971

Years Experience: 35

John "Jack" E. Buddenbaum: Analyst – Public and Occupational Health (Radiological), Waste Management

M.S., Public Health (Radiation Health), University of Pittsburgh, 1991

B.S., Environmental Health (Health Physics), Purdue University, 1983

Years of Experience: 25

#### Vanasse Hangen Brustlin, Inc.

Nancy Barker: Environmental Specialist – Task Manager; Document Management

M.S., Botany, Louisiana State University, 1983

B.S., Botany, Louisiana State University, 1980

Years of Experience: 26

Tracy Hamm: Environmental Planner – Document Management, CAD/GIS

M.E.M. (Master of Environmental Management), Ecosystem Science & Management, Duke University, 2008

B.S., Biology, Mary Washington College, 2004

Years of Experience: 3

Carol Weed: Cultural Resources Specialist – Historical and Cultural Resources; Tribal Coordination

M.A., Anthropology/Archaeology, University of Arizona, 1975

B.A., Anthropology, Prescott College, 1970

Years of Experience: 42

Andy Boenau: Traffic Engineer – Transportation

A.A.S. in Engineering Technology, Northern Virginia Community College (Annandale Campus), 1996

B.S., Civil Engineering, Virginia Tech, 1998

Years of Experience: 11

R. Timothy Davis: Environmental Scientist – Surface Waters, Wetlands

Masters of Forestry, Clemson University, 1985

B.S., Forest Management, Clemson University, 1983

Years of Experience: 25

List of Preparers

---

- 1  
2 Thomas Wholley: Environmental Specialist – Noise and Air Quality  
3 B.S., Civil Engineering, Lowell Technological Institute (Now University of Massachusetts  
4 Lowell), 1972  
5 Years of Experience: 37  
6  
7 Quan Tat: Environmental Specialist – Noise and Air Quality  
8 B.S., Civil Engineering, Northeastern University, Boston, MA, 1999  
9 Years of Experience: 13  
10  
11 Brad Ketterling: Environmental Specialist – Surface Waters, Wetlands, QA/QC  
12 M.S., Physical Geography, University of Western Ontario, London, Ontario, 1995  
13 B.S., Geography (Specialization Geoscience), Concordia University, Montreal, Quebec,  
14 1992  
15 Years of Experience: 14

## 10 DISTRIBUTION LIST

1

2 The U.S. Nuclear Regulatory Commission (NRC) is providing copies of this draft Supplemental  
3 Environmental Impact Statement (SEIS) to the organizations and individuals listed below. The  
4 NRC will provide copies to other interested organizations and individuals upon request.

### 5 **10.1 Federal Agency Officials**

6 Bureau of Land Management  
7 Wyoming State Office  
8 Cheyenne, WY

9

10 Bureau of Land Management  
11 Rawlins Field Office  
12 Rawlins, WY

13

14 Environmental Protection Agency  
15 Region \* Office  
16 Denver, CO

17

18 Fish & Wildlife Service  
19 Wyoming Ecological Services  
20 Cheyenne, WY

21

22 Bureau of Indian Affairs  
23 Wind River Agency  
24 Fort Washakie, WY

### 25 **10.2 Tribal Government Officials**

26 Eastern Shoshone  
27 Tribal Historic Preservation Office  
28 Fort Washakie, WY

29

30 Northern Arapaho  
31 Tribal Historic Preservation Office  
32 Fort Ethete, WY

### 33 **10.3 State Agency Officials**

34 Department of Environmental Quality  
35 Land Quality Division  
36 Cheyenne, WY

37

38 Department of Environmental Quality  
39 Land Quality Division – District 2  
40 Lander, WY

41

## Distribution List

---

- 1 State Parks & Cultural Resources
- 2 State Historic Preservation Office
- 3 Cheyenne, WY
- 4
- 5 Game & Fish Department
- 6 Lander Regional Office
- 7 Lander, WY

### 8 **10.4 Local Agency Officials**

- 9 Sweetwater County
- 10 Engineering Department
- 11 Green River, WY
- 12
- 13 Sweetwater County
- 14 County Clerk
- 15 Green River, WY
- 16
- 17 City of Rock Springs
- 18 City Clerk
- 19 Rock Springs, WY
- 20
- 21 City of Rawlins
- 22 City Clerk
- 23 Rawlins, WY
- 24
- 25 City of Lander
- 26 City Clerk
- 27 Lander, WY

### 28 **10.5 Other Organizations and Individuals**

- 29 Wyoming Outdoor Council
- 30 Lander, WY
- 31
- 32 Sierra Club – Glen Canyon Group
- 33 Salt Lake City, UT
- 34
- 35 Biodiversity Conservation Alliance
- 36 Laramie, WY

1  
2  
3

**APPENDIX A**

**CONSULTATION CORRESPONDENCE**



1. **A.1. Consultation Correspondence**

2 The Endangered Species Act of 1973, as amended, and the National Historic Preservation Act  
3 of 1966 require that Federal agencies consult with applicable state and federal agencies and  
4 groups prior to taking action that may affect threatened and endangered species, essential fish  
5 habitat, or historic and archaeological resources, respectively. This appendix contains  
6 consultation documentation related to these federal acts.

7

---

**Table A-1. Chronology of Consultation Correspondence**

---

<b>Author</b>	<b>Recipient</b>	<b>Date of Letter</b>
Wyoming State Parks and Cultural Resources (J. Daniele)	U.S. Department of Interior, Bureau of Land Management (P. Madigan)	July 24, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming State Historic Preservation Office (M. Hopkins)	October 3, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	U.S. Fish and Wildlife Service (B. Kelly)	October 3, 2008
U.S. Department of Interior, Bureau of Land Management (W. Hill)	Centennial Archaeology, Inc. (C. Zier)	October 16, 2008
U.S. Fish and Wildlife Service (B. Kelly)	U.S. Nuclear Regulatory Commission (G. Suber)	November 12, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming Game and Fish Department (T. Christiansen)	October 29, 2008
U.S. Nuclear Regulatory Commission (A. Kock)	Shoshone Business Council (I. Posey)	January 28, 2009
U.S. Nuclear Regulatory Commission (A. Kock)	U.S. Department of Interior, Bureau of Indian Affairs (R. Nation)	January 28, 2009
U.S. Nuclear Regulatory Commission (I. Yu, B. Shroff, and A. Bjornsen)	U.S. Nuclear Regulatory Commission (A. Kock)	March 2, 2009

---

8

9

# ARTS. PARKS. HISTORY.

Wyoming State Parks & Cultural Resources

State Historic Preservation Office  
Barrett Building, 3rd Floor  
2301 Central Avenue  
Cheyenne, WY 82002  
Phone: (307) 777-7697  
Fax: (307) 777-6421  
<http://wyoshpo.state.wy.us>

Jul 24, 2008

Patrick Madigan  
Bureau of Land Management *PRM 8-11-08*  
Rawlins Field Office  
P.O. Box 2407  
1300 North Third  
Rawlins, WY 82301-2407

Re: Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming (SHPO File # 0708JRD021)

Dear Mr. Madigan:

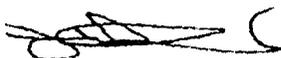
Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your determination that site 48SW16604 is eligible for listing in the National Register of Historic Places.

We agree that site 48SW16604 will be adversely impacted. We recommend the BLM/SHPO Protocol be followed:

1. Data Recovery Plan: If the historic property is eligible for inclusion in the National Register under Criterion D only, and the adverse effect will be minimized by data recovery, then the BLM will prepare a data recovery plan and follow the procedures in Section VII.A of this Protocol. A Memorandum of Agreement is not required to implement the data recovery plan.

Please refer to SHPO project #0708JRD021 on any future correspondence regarding this project. If you have any questions, please contact Joseph Daniele, Archaeologist/Review and Federal Consultation at 307-777-8793.

Sincerely,



Joseph Daniele  
Wyoming State Historic Preservation Office

**RECEIVED**

AUG 11 2008

1  
2

October 3, 2008

Ms. Mary Hopkins  
State Historic Preservation Officer  
Wyoming State Historic Preservation Office  
Department of State Parks  
& Cultural Resources  
2301 Central Avenue, Barrett Building  
3<sup>rd</sup> Floor  
Cheyenne, Wyoming 82002

SUBJECT: INITIATION OF SECTION 106 PROCESS FOR LOST CREEK ISR, LLC'S  
LOST CREEK URANIUM RECOVERY PROJECT LICENSE REQUEST  
(Docket 040-09068)

Dear Ms. Hopkins:

The U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC for a new radioactive source materials license to develop and operate the Lost Creek Uranium Recovery Project (an *in-situ* leach operation) located in Sweetwater County, WY. The project area consists of approximately 4,200 acres of public land, administered by the U.S. Bureau of Land Management (BLM) and the State of Wyoming. The project area lies within Township 25 north and ranges 92 and 93 west of the Sixth Principal Meridian, and is centered approximately at 42 degrees 8 minutes North latitude and 107 degrees 51 minutes West longitude. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations*, Part 51 (10 CFR 51) is the NRC regulation that implements the National Environmental Policy Act of 1969, as amended. The agency is currently preparing an environmental assessment (EA) for the proposed action that would tier off a Generic Environmental Impact Statement currently undergoing public review. In accordance with Section 106 of the National Historic Preservation Act, the EA would include an analysis of potential impacts to historic and cultural resources. To support the environmental review, the NRC is requesting information from the State Historical Preservation Officer to facilitate the identification of historic and cultural resources that may potentially be affected by the Lost Creek Uranium Recovery Project license application. Any information you provide would be used to enhance the scope and quality of NRC staff's review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

Lost Creek ISR, LLC's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at <http://www.nrc.gov/reading-rm/adams.html>. The accession number for the application is ML073190550.

3  
4  
5  
6  
7

M. Hopkins

2

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan Bjornsen of my staff by telephone at 301-415-1195 or by email at [alan.bjornsen@nrc.gov](mailto:alan.bjornsen@nrc.gov). Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief  
Environmental Review Branch  
Environmental Protection and  
Performance Assessment Directorate  
Division of Waste Management and  
Environmental Protection  
Office of Federal and State Materials and  
Environmental Management Programs

Docket No.: 040-09068

Enclosure:  
Lost Creek ISR, LLC Proposed Area

1  
2  
3  
4  
5  
6  
7

October 3, 2008

Brian T. Kelly, Field Supervisor  
U.S. Fish and Wildlife Service  
Mountain-Prairie Region  
Wyoming Field Office  
5353 Yellowstone Road  
Cheyenne, WY 82009

SUBJECT: REQUEST FOR INFORMATION REGARDING ENDANGERED OR  
THREATENED SPECIES AND CRITICAL HABITAT FOR THE PROPOSED  
LICENSE APPLICATION FOR LOST CREEK ISR, LLC'S LOST CREEK  
URANIUM RECOVERY PROJECT (Docket 040-09068)

Dear Mr. Kelly:

The U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC for a new radioactive source materials license to develop and operate the Lost Creek Uranium Recovery Project (an *in-situ* leach operation) located in Sweetwater County, WY. The project area consists of approximately 4,200 acres of public land, administered by the U.S. Bureau of Land Management (BLM) and the State of Wyoming. The project area lies within Township 25 north and ranges 92 and 93 west of the Sixth Principal Meridian, and is centered approximately at 42 degrees 8 minutes North latitude and 107 degrees 51 minutes West longitude. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations*, Part 51 (10 CFR 51) is the NRC regulation that implements the National Environmental Policy Act of 1969, as amended. The agency is currently preparing an environmental assessment (EA) for the proposed action that would tier off a Generic Environmental Impact Statement currently undergoing public review. In accordance with Section 7 of the Endangered Species Act, the EA would include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC is requesting information from the U.S. Fish and Wildlife Service to facilitate the identification of endangered or threatened species or critical habitat that may potentially be affected by the Lost Creek Uranium Recovery Project license application. Any information you provide would be used to enhance the scope and quality of NRC staff's review in accordance with 10 CFR 51 and 50 CFR 402. After reviewing all the information collected, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

Lost Creek ISR, LLC's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at <http://www.nrc.gov/reading-rm/adams.html>. The accession number for the application is ML073190550.

1  
2  
3

B. Kelly

2

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan Bjornsen of my staff by telephone at 301-415-1195 or by email at [alan.bjornsen@nrc.gov](mailto:alan.bjornsen@nrc.gov). Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief  
Environmental Review Branch  
Environmental Protection and Performance  
Assessment Directorate  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

Docket No.: 040-09068

Enclosure:  
Lost Creek ISR, LLC Proposed Area

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

*Rawlins*



United States Department of the Interior

BUREAU OF LAND MANAGEMENT  
Wyoming State Office  
P.O. Box 1828  
Cheyenne, Wyoming 82003-1828



In Reply Refer To:  
8151 (930)  
568-WY-AR09  
RCapron

OCT 16 2008

Dr. Christian J. Zier  
Centennial Archaeology, Inc.  
300 East Boardwalk, Building 4-C  
Fort Collins, CO 80525

Dear Dr. Zier:

We are pleased to provide you with a Wyoming Bureau of Land Management (BLM) Cultural Resource Use Permit No. 568-WY-AR09. This permit authorizes data recovery at 48SW16604, associated with the Lost Creek IR project. The specific location is identified on the permit. This archaeological site is on land administered by the Wyoming Bureau of Land Management, Rawlins Field Office. All activities should be coordinated with Tim Marshall. Work is authorized from October 20, 2008, through October 19, 2009.

All work and reporting requirements must follow the approved data recovery plan unless prior approval for modification is made with BLM RFO. Mr. Christopher C. Kinneer is required to carry a copy of the permit with him while in the field.

If you have any questions about this permit, please contact Ranel S. Capron at (307) 775-6108 or via e-mail at [Ranel\\_Capron@blm.gov](mailto:Ranel_Capron@blm.gov).

Sincerely,

*Ranel Stephenson Capron*

for William M. Hill  
Deputy State Director,  
Resources Policy and Management

Attachment



## United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services  
5353 Yellowstone Road – Suite 308  
Cheyenne, Wyoming 82009

In Reply Refer To:

ES/61411/W.26 /WY09SL0021

NOV 12 2008

Mr. Gregory F. Suber  
U.S. Nuclear Regulatory Commission  
Environmental Review Branch  
Environmental Protection and  
Performance Assessment Directorate  
Division of Waste Management and  
Environmental Protection  
Office of Federal and State Materials and  
Environmental Programs  
Washington, D.C. 20555-0001

Dear Mr. Suber:

Thank you for your letter of October 3, 2008 requesting information on endangered or threatened species and critical habitat for the proposed Lost Creek uranium in-situ recovery facility (docket 040-09068) in Sweetwater County, Wyoming.

In response to your letter, the Service is providing you with information on (1) federally listed species, (2) migratory birds, (3) wetland and riparian areas, and (4) sensitive species. The Service provides recommendations for protective measures for federally listed species in accordance with the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j.

### Threatened and Endangered Species

The following threatened and endangered species may occur in Sweetwater County, and could also occur on or near this project site. If you determine that the proposed project may affect any of the following listed species, please contact our office to discuss consultation requirements under the Act.

SPECIES	STATUS	HABITAT
Black-footed ferret ( <i>Mustela nigripes</i> )	Endangered	Prairie dog towns
Ute ladies'-tresses ( <i>Spiranthes diluvialis</i> )	Threatened	Seasonally moist soils and wet meadows of drainages below 7000 feet

Black-footed ferret: Black-footed ferrets may be affected if prairie dog towns are impacted. Please be aware that black-footed ferret surveys are no longer recommended in black-tailed prairie dog towns statewide. However, we encourage you to protect all prairie dog towns for their value to the prairie ecosystem and the myriad of species that rely on them.

If a field check indicates that prairie dog towns may be affected, you should contact this office for guidance on ferret surveys.

Ute ladies'-tresses: Ute ladies'-tresses is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically include fine silt/sand, gravels and cobbles, and highly organic, peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens.

### Migratory Birds

Please recognize that consultation on listed species may not remove your obligation to protect the many species of migratory birds, including eagles and other raptors, protected under the MBTA and BGEPA. Of particular focus are the species identified in the Service's *Birds of Conservation Concern 2002*. In accordance with the Fish and Wildlife Coordination Act (16 USC 2912 (a)(3)), this report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Act. This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners and is available at <http://www.fws.gov/migratorybirds/reports/bcc2002.pdf>.

The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

In order to promote the conservation of migratory bird populations and their habitats, the Service recommends that your agency implement those strategies outlined within the Memorandum of Understanding directed by the President of the U.S. under the Executive Order 13186, where possible. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

### In situ Uranium Mining

High selenium concentrations can occur in wastewater from in situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of a grassland irrigated with wastewater from an *in situ* uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the *in situ* wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving *in situ* wastewater. Waterborne selenium concentrations  $\geq 2 \mu\text{g/L}$  are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than  $20 \mu\text{g/L}$  is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994) which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508  $\mu\text{g/g}$  in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350  $\mu\text{g/L}$ .

### **Wetlands/Riparian Areas**

Wetlands perform significant ecological functions, which include: (1) providing habitat for aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. The Service recommends measures be taken to avoid and minimize wetland losses in accordance with Section 404 of the Clean Water Act, and Executive Order 11988 (floodplain management) as well as the goal of "no net loss of wetlands." If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins,

erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and stream banks.

### **Sensitive Species**

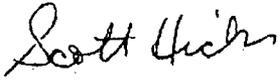
Mountain Plover: Although the Service has withdrawn the proposal to list the mountain plover (*Charadrius montanus*) and we will no longer be reviewing project impacts to this species under the Act, we continue to encourage conservation of this species as it remains protected under the MBTA. Measures to protect the mountain plover from further decline may include (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. We strongly encourage the development of protective measures with an assurance of implementation should mountain plovers be found within the project area.

Greater Sage-grouse: The Service has determined that the greater sage-grouse (*Centrocercus urophasianus*) does not warrant listing at this time. However, the Service continues to have concerns regarding sage-grouse population status. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations range-wide (Braun 1998, Wisdom *et al.* 2002). Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting or brood rearing habitat) is present in the project area, the Service recommends no project-related disturbance March 1 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage-grouse persistence within these areas. Likewise, if important winter habitats are present, we recommend no project-related disturbance from November 15 through March 14.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the project area, and appropriate mitigation to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning, to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act, MBTA or BGEPA, please contact Pedro 'Pete' Ramirez at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,

  
 for Brian T. Kelly  
 Field Supervisor  
 Wyoming Field Office

Enclosure (1)

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)  
 WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (V. Stelter)

#### Literature Cited

- Boon, D.Y. 1989. Potential selenium problems in Great Plains soils. In L.W. Jacobs, ed. Selenium in agriculture and the environment. American Society of Agronomy, Inc, and Soil Science Society of America. SSSA Special Pub. No. 23. Madison, WI. pp: 107-121.
- Braun, C.E. 1998. Sage grouse declines in western North America: What are the problems? Proceedings of the Western Association of Fish and Wildlife Agencies 78:139-156
- Fairbrother, A.F., M. Fix, T. O'Hara, and C.A. Ribic. 1994. Impairment of growth and immune function of avocet chicks from sites with elevated selenium, arsenic, and boron. Journal of Wildlife Diseases. 30(2):222-233.
- Lemly, A.D. 1996. Selenium in aquatic organisms. Pages 427-445 in W.N. Beyer, G.H. Heinz, and A.W. Redmon-Norwood (eds.). Environmental contaminants in wildlife: Interpreting tissue concentrations. Lewis Publishers, Boca Raton, Florida.
- Ohlendorf, H.M. 2002. Ecotoxicology of selenium. In *Handbook of Ecotoxicology*, 2<sup>nd</sup> ed.; Hoffman, D.J., Rattner, B.A., Burton Jr., G.A., Cairns, Jr., J., Eds.; Lewis Publishers, Boca Raton, FL, 2003; pp 465-500.
- Ramirez, P. and B. Rogers. 2000. Selenium in a Wyoming grassland community receiving wastewater from an in situ uranium mine. U.S. Fish and Wildlife Service Contaminant Report # R6/715C/00. Cheyenne, WY. Scpt. 31.

- Ramirez, P. Jr. and B.P. Rogers. 2002. Selenium in a Wyoming grassland community receiving wastewater from an *in situ* uranium mine. *Arch. Environ. Contam. Toxicol.* 42:431-436.
- See, R.B., D.L. Naftz, D.A. Peterson, J.G. Crock, J.A. Erdman, R.C. Severson, P. Ramirez, Jr., and J.A. Armstrong. 1992. Detailed study of selenium in soil, representative plants, water, bottom sediment, and biota in the Kendrick Reclamation Project Area, Wyoming, 1988-90. U.S. Geological Survey Water Resources Investigations Report 91-4131. 142 pp.
- Skorupa, J.P., and H.M. Ohlendorf. 1991. Contaminants in drainage water and avian risk thresholds: Pages 345-368 in A. Dinar and D. Zilberman (eds.). *The economics and management of water and drainage in agriculture*. Kluwer Academic Publishers, Boston, MA.
- U.S. Fish and Wildlife Service. 1989. Black-footed ferret survey guidelines for compliance with the Endangered Species Act, April 1989. U. S. Fish and Wildlife Service, Denver, Colorado and Albuquerque, New Mexico. 15pp.
- Wisdom, M.J., B.C. Wales, M.M. Rowland, M.G. Raphael, R.S. Holthausen, T.D. Rich, and V.A. Saab. 2002. Performance of Greater Sage-Grouse models for conservation assessment in the Interior Columbia Basin, USA. *Conservation Biology* 16: 1232-1242.

January 28, 2009

1  
2  
3  
4  
5 Mr. Ivan Posey  
6 Chairman  
7 Shoshone Business Council  
8 P. O. Box 538  
9 Fort Washakie, WY 82514

10  
11  
12 SUBJECT: REQUEST FOR INFORMATION REGARDING TRIBAL HISTORIC AND  
13 CULTURAL RESOURCES POTENTIALLY AFFECTED BY THE PROPOSED  
14 LICENSE APPLICATION FOR UR-ENERGY USA'S LOST CREEK URANIUM  
15 RECOVERY PROJECT IN SWEETWATER COUNTY, WYOMING  
16 (DOCKET NO. 040-09068)  
17

18  
19 Dear Mr. Posey:

20  
21 The U.S. Nuclear Regulatory Commission (NRC) has received an application from UR-Energy  
22 USA for a new radioactive source materials license to construct and operate the Lost Creek  
23 Uranium Recovery Project (an *in-situ* recovery operation) located in Sweetwater County,  
24 Wyoming. The Lost Creek Project consists of one large unit, with the central processing plant  
25 located in the north-central portion of the permit area. Additional facilities associated with the  
26 proposed project include well fields, header houses, waste storage ponds, deep disposal wells,  
27 ancillary buildings, and materials storage.  
28

29 Lost Creek site is located approximately 70 miles southeast of the City of Lander, and  
30 approximately 40 miles northwest of the City of Rawlins. The project site covers approximately  
31 4,220 acres, of which approximately 3,580 acres are federally owned Bureau of Land  
32 Management land, and the State of Wyoming, Office of State Lands and Investment own 640  
33 acres. Access to the Lost Creek site would either be via Wamsutter Crooks Gap and Bairoil  
34 Roads, south from Jeffrey City, off US Highway 287, or from Bairoil, off State Route 73, via  
35 Bairoil and Sooner Roads. The Lost Creek site is located in Township 25N, Range 92 West,  
36 Sections 16-19, and Range 93W, Sections 13, 14 & 25, and is situated in the Battle Spring  
37 Draw, which drains to Battle Spring Flat, approximately nine miles southwest of the site. A map  
38 showing the site location of the Lost Creek Project is shown in Figure 1 (enclosed).  
39

40 As established in Title 10 Code of Federal Regulations Part 51 (10 CFR Part 51), the NRC  
41 regulation that implements the National Environmental Policy Act of 1969, as amended, the  
42 NRC is preparing an Environmental Assessment (EA) for the proposed action that will tier off a  
43 Generic Environmental Impact Statement currently under development. The NRC's EA process  
44 includes an opportunity for public and inter-governmental participation in the development of the  
45 EA. In accordance with Section 106 of the National Historic Preservation Act, the EA will include  
46 an analysis of potential impacts to historic and cultural properties. To support the environmental  
47 review, the NRC is requesting information to facilitate the identification of Tribal historic sites or  
48 cultural resources that may be affected by the proposed Lost Creek Uranium Recovery Project.  
49 Specifically, the NRC is interested in learning of any sites that you believe have traditional  
50 religious or cultural significance. Any input you provide will be used to enhance the scope and  
51 quality of our review in accordance with 10 CFR Part 51 and 36 CFR 800.

1 I. Posey 2

2  
3 After reviewing all of the information collected, the NRC will prepare a draft EA and will provide  
4 your office an opportunity to comment.

5  
6 The UR-Energy USA's Lost Creek Uranium Recovery Project license application is publicly  
7 available in the NRC Public Document Room located at One White Flint North, 11555 Rockville  
8 Pike, Rockville, Maryland 20852, or from the NRC's Agency-wide Documents Access and  
9 Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at  
10 <http://www.nrc.gov/reading-rm/adams.html>. The docket number for the application is 040-09068.  
11 Please submit any comments/information that you may have regarding this environmental  
12 review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission  
13 ATTN: Mrs. Andrea L. Kock, Mail Stop T-8F05, Washington, DC 20555. If you have any  
14 questions, please contact Mr. Alan B. Bjornsen of my staff by telephone at 301-415-1195 or by  
15 email at [Alan.Bjornsen@nrc.gov](mailto:Alan.Bjornsen@nrc.gov). Thank you for your assistance.

16  
17  
18 Sincerely,

19  
20 */RA/*

21  
22  
23 Andrea L. Kock, Branch Chief  
24 Environmental Review Branch  
25 Environmental Protection and Performance  
26 Assessment Directorate  
27 Division of Waste Management  
28 and Environmental Protection  
29 Office of Federal and State Materials  
30 and Environmental Management Programs  
31

32  
33 Docket No.: 040-09068

34  
35  
36 Cc: Mr. Reed Tidzump  
37 Tribal Historical Preservation Officer  
38 Shoshone Oil & Gas Commission  
39 P.O. Box 538  
40 Fort Washakie, WY 82514

41  
42 Mr. Richard Brannan, Chairman  
43 Arapaho Tribal Business Council  
44 P.O. Box 396  
45 Fort Washakie, WY 82514

46  
47 Ms. Amanda White  
48 Arapaho Tribal Preservation Officer  
49 533 Ethete Road  
50 Fort Ethete, WY 82520  
51

1



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

January 28, 2009

Mr. Ramon A. Nation  
Deputy Superintendent  
BIA - Wind River agency  
P.O. Box 158  
Fort Washakie, WY 82514

SUBJECT: DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR *IN-SITU*  
LEACH URANIUM MILLING FACILITIES

Dear Mr. Nation:

In response to your request for the Draft Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities at our meeting on Thursday, January 15, 2009, I am enclosing, on behalf of the U.S. Nuclear Regulatory Commission (NRC), a compact disk containing the GEIS. You should know that the comment period for this document closed on November 7, 2008, and that the comments that were received are currently being addressed by the NRC staff and its consultant. Should you have any questions about what the document contains, I or Mr. James Park, Project Manager for the document, would be happy to respond.

Sincerely,

A handwritten signature in cursive script that reads "Alan B. Bjornsen".

Alan B. Bjornsen, Project Manager  
Environmental Review Branch  
Environmental Protection  
and Performance Assessment Directorate  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

Enclosure: Compact Disk (Document)

2  
3  
4  
5

June 30, 2009

Mr. Richard L. Currit  
Senior Archaeologist and NEPA Coordinator  
Wyoming State Historic Preservation Office  
2301 Central Avenue  
Barrett Building, Third Floor  
Cheyenne, WY 82002

SUBJECT: TREATMENT PLAN FOR MITIGATIVE EXCAVATION OF PREHISTORIC SITE  
48SW16604 FOR THE PROPOSED LOST CREEK ISR PROJECT IN  
SWEETWATER COUNTY, WYOMING (SHPO FILE # 0708JRD021)

Dear Mr. Currit:

Lost Creek ISR, LLC (LCI), a subsidiary of UR-Energy, Inc. of Denver, Colorado, is proposing to develop a 4,220-acre site about 15 miles southwest of Bairoil in northeastern Sweetwater County, Wyoming, for *in-situ* uranium recovery. In March 2008, LCI resubmitted an application for license to the U.S. Nuclear Regulatory Commission (NRC) to construct, operate, and decommission a source and by-product materials facility at the Lost Creek site. The submittal was made in accordance with the Atomic Energy Act of 1954, as amended, and Title 10 of the Code of Federal Regulations (CFR) (Parts 20, 40, 51, and 70), as well as other applicable laws and regulations, and NRC guidelines. The purpose of this letter is to inform you of NRC's review and concurrence of the treatment plan for the referenced site. A Memorandum of Agreement (MOA) will be executed between the NRC, Bureau of Land Management (BLM) – Rawlins Field Office, Lost Creek ISR, LLC and the Wyoming State Historic Preservation Office regarding the mitigation of the adverse effect, in accordance with 36 CFR Part 800.6(b)(1)(iv) and NUREG-1569, Section 2.4.2. The MOA will be structured in accordance with the guidance outlined in the Advisory Council on Historic Preservation's *Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites* published in the *Federal Register* on May 18, 1999 (Vol. 64, No. 95, p. 27085).

The NRC, as the federal agency that issues licenses to facilities authorizing the possession and use of regulated radioactive materials is currently reviewing the license application for the proposed Lost Creek ISR Project. The NRC has reviewed both the subject treatment plan (Kinneer 2008, *Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming*), and the original Class III inventory report for the project area (Kinneer et al. 2007, *A Cultural Resource Inventory of the Lost Creek Property for the Proposed Lost Creek ISR, LLC Project in Sweetwater County, Wyoming*), and the passed data recovery method approved by BLM, prepared by LCI and its consultant. The NRC concurs with the BLM's determinations of site eligibility and project effect regarding archaeological site 48SW16604, and support BLM's acceptance of the "Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Lost Creek ISR Project in Sweetwater County, Wyoming" and the phased data recovery method proposed. The mitigation document was submitted by the BLM Rawlins Field Office on May 27, 2008, and reviewed by your office on July 24, 2008, stating that a data recovery plan be prepared, and that specific procedures be followed (according to protocol).

1

R. Currit

- 2 -

The NRC can require as a condition of any license issued to LCI, that LCI comply with the MOA and treatment plan. The NRC will reference the treatment plan and MOA in the draft supplemental environmental impact statement to provide an opportunity for public comment. However, the treatment plan will not be available to the public because disclosure of site locations is prohibited under 43 CFR 7.18.

The Lost Creek Prehistoric (48SW16604) site was visited on September 19, 2008, by Reed Tidzump, a member of the Wind River Agency and Tribal Historic Preservation Officer (THPO) for the Eastern Shoshone Tribe. Three other tribes were invited (Northern Cheyenne, Northern Arapaho, and Ute Tribal), but did not attend. The Eastern Shoshone found the proposed treatment plan adequate, meeting the approval of tribal elders. The NRC has maintained communication with Arlen Shoyo, the new THPO for the Eastern Shoshone Tribe.

If you have any questions, or require additional information, please contact Alan Bjornsen at (301) 415-1195, or at [alan.bjornsen@nrc.gov](mailto:alan.bjornsen@nrc.gov).

Sincerely,

**/RA By Patrice Bubar, Acting For/**

Larry W. Camper, Director  
Division of Waste Management  
and Environmental Protection  
Office of Federal and State Materials  
and Environmental Management Programs

cc: P. Walker, BLM, Rawlins  
J. Cash, LCI, Casper  
D. McKenzie, DEQ, Cheyenne

2  
3  
4  
5



**BIBLIOGRAPHIC DATA SHEET**

(See instructions on the reverse)

NUREG-1910  
Supplement 3

2. TITLE AND SUBTITLE

Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County,  
Wyoming  
Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling  
Facilities  
Draft Report for Comment

3. DATE REPORT PUBLISHED

MONTH YEAR

December 2009

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

6. TYPE OF REPORT

Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Division of Waste Management and Environmental Protection  
Office of Federal and State Materials and Environmental Programs  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)

10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

By letter dated March 20, 2008, Lost Creek ISR, LLC (LCI), submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Lost Creek in-situ uranium recovery (ISR) project. LCI is proposing to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the Lost Creek project site, to be located in Sweetwater County, Wyoming. In this draft Supplemental EIS (Draft SEIS), the NRC staff evaluated the potential environmental impacts of the proposed action and its reasonable alternatives, described the environment potentially affected by LCI's proposed site activities, and described LCI's environmental monitoring program and proposed mitigation measures.

In preparing this Draft SEIS, the NRC staff evaluated site-specific data and information to determine whether the LCI's proposed activities and existing site characteristics were consistent with those evaluated in NUREG-1910, "Generic Environmental Impact statement for In-Situ Leach Uranium Milling Facilities" (GEIS). The NRC staff, then determined findings and conclusions in the GEIS and relevant sections of the GEIS that could be incorporated by reference in the Draft SEIS, and areas that needed additional analysis.

This Draft SEIS was prepared in compliance with the National Environmental Policy Act of 1969 and NRC regulations for implementing the Act found at Title 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (10 CFR Part 51).

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Uranium Recovery  
In-Situ Leach Process  
Uranium  
Environmental Impact Statement

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)

unclassified

(This Report)

unclassified

15. NUMBER OF PAGES

16. PRICE



Federal Recycling Program