4.0 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

4.1 LAND USE IMPACTS

This section describes the impacts of site preparation and construction to the Callaway site and the surrounding area. Section 4.1.1 describes impacts to the site and vicinity. Section 4.1.2 describes impacts that could occur along transmission lines. Section 4.1.3 describes impacts to historic and cultural resources at the site.

4.1.1 THE SITE AND VICINITY

The Callaway site land use is presented in Table 2.2-1 and shown on Figure 2.2-1. The land use categories are consistent with USGS land use/cover categories. Land use/cover within the 8 mile (13 km) site vicinity is presented in Table 2.2-2 and shown on Figure 2.2-2. Highways and utility right-of-ways that cross the site and vicinity are shown on Figure 2.2-9 and Figure 2.2-7.

4.1.1.1 The Site

Callaway Plant Unit 2 and supporting facilities will be located on the 2,765 acre (1,119 hectare) Callaway site, to the northwest of and adjacent to Callaway Plant Unit 1. The Callaway site use activities will not change as the result of this action. The Callaway site acreage is owned by AmerenUE and used for the purpose of generating electricity. The action to construct and operate an additional power unit will not alter the site's current use. The Callaway site will continue to conform to all applicable local, state, and federal land use requirements and restrictions as they pertain to this action.

Approximately 6,600 acres (2,670 hectares) of the 7,354 acre (2,976 hectare) property owned by AmerenUE, which includes the Callaway site, are managed by the Missouri Department of Conservation (MDC) and are available for public use.

In cooperation with Union Electric (now doing business as (d/b/a) AmerenUE), the MDC prepared a plan in 1976 for the development and management of the forest, fish, and wildlife resources on the AmerenUE property. This area was originally known as the Reform Wildlife Management Area (now the Reform Conservation Area). Because of the need to implement evacuation procedures in the event of postulated accidental radiation releases, the land use programs ultimately recommended for the area were of a low-intensity nature. Recommendations included the following: forest management, agriculture, research, wildlife management, hunting, fishing, picnicking, vistas, and special areas. The plan was developed to be flexible, and recommended activities could be further emphasized or modified to accommodate additional priorities or restrictions.

In 1977, Union Electric (now d/b/a AmerenUE) and the MDC entered into an agreement for an initial 5-year management plan that could be self-supporting and less intensive than the 1976 plan. This plan allowed public recreational use on designated lands within the AmerenUE property boundaries; however, camping and use of firearms (firing a single projectile) were not permitted. In 1994 AmerenUE entered into a 10-year Management Agreement for the Public Use of Lands with the MDC for the management of the Reform Conservation Area (AUE, 1994) and still operates under this agreement. The Area may be closed to the public when the National Security Level reaches "orange" or higher.

No comprehensive land use or zoning plans exist covering the rural portions of Callaway County, including the Callaway site or vicinity. Legislation authorizing the establishment of

Regional Planning Commissions was enacted in 1969 and appears in Chapter 251 of the Revised Statutes of Missouri (RSMo) Part 160 (RSMo, 2007). The functions of a Regional Planning Commission are "solely advisory to the local governments comprising the region" (RSMo 251.300). A total of 19 Regional Planning Commissions have been established in accordance with this legislation (MACOG, 2007). Callaway County is represented by the Mid-Missouri Regional Planning Commission. Comprehensive plans covering unincorporated areas of the State, including the area comprising the site and vicinity, have not generally been prepared. Enabling legislation establishing County Planning Commissions with the authority to create, adopt, amend, and carry out a county plan (Senate Bill [SB] 193, 2007) became effective on August 28, 2007.

During construction, site activities will be authorized by the agencies and programs listed in Table 1.3-1. There is no recognized Native American Tribal Land use plan that would have jurisdiction over the Callaway site or within the vicinity of the Callaway site that could impact the Callaway site.

Figure 4.1-1 shows the portions of the AmerenUE property that will be impacted by construction activities, including temporary features such as laydown areas, stormwater retention ponds, and the construction parking area. Figure 4.3-4 through Figure 4.3-6 provides an estimate of the land areas that will be disturbed during construction of Callaway Plant Unit 2 and its supporting facilities. Approximately 14 acres (6 hectares) of the Callaway site will be temporarily disturbed by site preparation and construction activities. An additional 612 acres (248 hectares) will be permanently dedicated to Callaway Plant Unit 2 and its supporting facilities, and lost to other uses until after decommissioning.

Figure 4.3-4 through Figure 4.3-6 provides a breakdown by land use designation of the areas potentially impacted by Callaway Plant Unit 2 construction. Permanent and temporary impacts are listed separately on Figure 4.3-4 through Figure 4.3-6.

Section 2.2.1describes the land areas that are devoted to major uses within the Callaway site boundary and the Callaway site vicinity. These areas are depicted on Figure 2.2-1 and Figure 2.2-2, respectively. In addition, Section 2.2.1 describes the highways and utility right-of-way that cross the Callaway site and vicinity. The footprint for Callaway Plant Unit 2 and its supporting facilities will be located on previously disturbed and developed land. This area is not open to the public; thus, there would be no impact to those areas of the Callaway site available to the public as the result of the action. AmerenUE is not aware of any Federal action in the area that would have cumulatively significant land use impacts as discussed in Section 2.8.

Heavy equipment and reactor components will be transported via the Missouri River to the existing barge slip. Dredging to deepen the dredge slip is not anticipated, but may be necessary in the area immediately in front of the barge slip if silt has built up sufficiently to impede barge docking and offload. The existing heavy haul road from the barge slip will be modified as necessary to access the new construction site and lay down areas. A new construction parking lot will be built with entrances from existing Access Road D connecting to State Route CC and Access Road E, thus permitting contractor access to the construction areas without impeding traffic to the existing units. To provide an entrance from Access Road E, a portion of the existing site perimeter road will be rerouted through the new laydown area. Another road will be built going south from State Route 94 providing access to the Collector Well System water intake structures on Binggeli Island.

The new Collector Well System water intake and its access road, existing discharge, barge facilities and their access roads are located in the 100-year Missouri River floodplain. With those exceptions, construction activities would be outside the 500-year floodplain (FEMA, 1997).

The site on which Callaway Plant Unit 2 will be located is predominantly categorized as "Urban" or "Built-up" because it is on AmerenUE developed land. The only known mineral deposit currently being extracted in Callaway County is crushed and broken limestone as described in Section 2.2.1. There are no currently exploited mineral deposits on the Callaway site.

Construction activities would result in the permanent loss, through filling, of wetland habitat and wetland buffer. Section 4.3.1.3 provides a detailed discussion of construction impacts to wetlands. Figure 4.3-4 through Figure 4.3-6 includes a summary of wetland and wetland buffers potentially impacted by Callaway Plant Unit 2 construction.

It is concluded that the land use impacts to the Callaway site and vicinity of the Callaway site from construction of the new unit would be MODERATE, primarily due to the loss of wetlands and wetland buffers, and would require mitigation. The mitigation measures associated with the wetlands and wetland buffers are described in Section 4.3.1.6.

4.1.1.2 The Vicinity

Land in the vicinity of the Callaway site is rural. Land use within 8 miles (13 km) of the site is predominantly forest, grassland, and cropland as described in Section 2.2, and shown on Figure 2.2-2.

The construction activities that would degrade the visual aesthetics of the land would be limited to those activities potentially seen from local roads including State Route CC, State Route O, County Route 448, and County Road 459. Average daily traffic counts recorded by the Missouri Department of Transportation (MoDOT) in 2006 were 906 vehicles on the segment of State Route O adjacent to the Callaway site and 1,688 vehicles for the segment of State Route CC adjacent to the site (Haslag, D., 2007, personal communication). Because of the forested nature of the area surrounding the proposed site, the degree to which construction activities for the facilities could be seen directly from the adjacent highways can be expected to be higher in the winter when there is no foliage and lower during the summer months when the trees are leafed out. Once the facility construction extends above the tree line, construction will increasingly be seen from roadways or other areas in the vicinity of the site depending on the area's topography. However, because that portion of the Callaway site which will experience the greatest level of construction activity already contains Callaway Plant Unit 1, visual impacts from the project would be similar to existing site conditions.

Prime farmland is of importance in meeting the Country's short- and long-term needs for food and fiber. Prime farmland as defined is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses (USDA, 2007). Construction activities associated with the installation of the new Collector Well System will impact farmland along the north bank of the Missouri River. Figure 4.1-2 shows the prime farmland in the vicinity. shows soil types present between State Route 94 and the Missouri River from County Route 462 on the west to Logan Creek on the east with their farmland classification. Figure 4.3-4 through Figure 4.3-6 contains a list of the soil types present by soil association, and farmland classification.

Section 4.4.2.4 provides the details on potential population impacts on housing due to construction activities. Most of the temporary construction workforce are expected to maintain their permanent residences outside of Callaway, Boone, or Cole Counties. These workers would

commute or find temporary housing in or near Fulton in Callaway County, Jefferson City in Cole County, or Columbia in Boone County. No land use changes in the Callaway vicinity are expected to occur as a result of construction workforce related population changes.

Thus, it is concluded that impacts to land use in the vicinity of Callaway Plant Unit 2 would be SMALL, and not require mitigation.

4.1.2 TRANSMISSION CORRIDORS AND OFFSITE AREAS

In 2005, one of the two original Callaway-Bland circuits was split to allow routing power to a new Loose Creek substation and establishing a Callaway-Loose Creek transmission system. This change was made to reduce transmission line congestion to the south and provide additional power to Jefferson City. The new transmission line will route power at 345 kV from the Callaway Plant Unit 1 switchyard to a tie-in point on the Callaway-Loose Creek line 6.7 miles (10.8 km) south of the Callaway Plant Unit 1 switchyard. This action will allow the existing Callaway-Bland line to be restored to its original two-circuit design. The existing Callaway-Bland corridor will be widened by 150 ft (46 m) to accommodate the new section of the Callaway-Loose Creek transmission line. This will necessitate obtaining additional easements permitting the widening of the transmission corridor for that portion that is off AmerenUE property. New transmission towers supporting the 345 kV transmission lines will be installed in the widened corridor parallel to and west of the existing Callaway-Bland transmission line, crossing the Missouri River at river mile 116.6 (187.6 km). The transmission lines cross mostly secondary-growth hardwood forests, grassland, and farmland.

The transmission line work being considered to support this project would require new towers and transmission lines connecting the Callaway Plant Unit 1 switchyard to a tie-in point on the Callaway-Loose Creek line as described above. All federal, state, and local regulations will be met. Transmission system expansion planning will conform to the planning process established by the Midwest Independent Transmission System Operator (Midwest ISO).

There are no Federal actions that would have cumulatively significant land use impacts within the vicinity and region of the Callaway site activity and offsite areas as described in Section 2.8.

Because existing transmission corridors will be widened, it is concluded that there will be impacts to transmission corridor lands associated with the proposed construction of Callaway Plant Unit 2. No new access roads or modifications to existing roads are currently anticipated.

4.1.3 HISTORIC PROPERTIES

Table 2.5-43 and Table 2.5-44 include resources within the project's Area of Potential Effect (APE) potentially eligible or eligible for listing on the National Register of Historic Places (NRHP). These tables incorporate information received from the Missouri State Historic Preservation Office (SHPO) on 79 prehistoric sites and 29 historic sites on the Callaway site. A total of 20 prehistoric sites were evaluated as eligible for nomination to the NRHP. All are located at least one mile (1.6 km) from the Callaway Plant Unit 1 cooling tower and are expected to be outside any area to be disturbed by construction. None of the historic sites were evaluated as eligible for inclusion in the NRHP. There are two prehistoric sites and two architectural resources, listed on the NRHP that are located off of the Callaway property. None will be affected by construction.

Consultation on the Phase I cultural resources survey with Native American tribes is pending, to determine if there are any additional historic sites on the Callaway property.

As discussed in Section 2.5.3, there is potential for steamboat wrecks to be affected by the collector well construction.

Historically, the Missouri River supported a diverse ecosystem with abundant braided channels, riparian lands, chutes, sloughs, islands, sandbars, backwater areas and natural flood plain communities. These riverine and flood plain habitats were maintained by continuous bank erosion and deposition, which constantly reshaped the channel and flood plain. The river carried a high sediment load and had a propensity for flooding and changing the location of its channel. Typical river flows rose throughout the spring from rain and melting snow runoff, and then declined throughout the summer and fall, reaching their low point in late December. Attempts to control the river's unpredictable nature and its rich alluvial flood plain for transportation, farming, and urban development began in the late 19th century. In the 1940s two programs created by the U.S. Army Corps of Engineers and the Bureau of Reclamation transformed the free-flowing river into a system of main stem reservoirs and highly altered riverine reaches influenced by regulated flows, self channelization, and bank stabilization (USGS, 1998).

With construction activities, there is always the possibility for inadvertent discovery of previously unknown cultural resources or human remains. This may become a particular issue when working in the floodplain areas adjacent to the Missouri River. A Cultural Resources Discovery Plan (PCR, 2007) was prepared and submitted to the State Historic Preservation Office (SHPO) within the Missouri Department of Natural Resources (MDNR) pursuant to Section 106 of the National Historic Preservation Act (USC, 2007), and the Advisory Council on Historic Preservation's regulation (ACHC, 2004). This plan was developed prior to initiation of a soil boring program on Bingelli Island performed in conjunction with a program to investigate the feasibility and design of a Collector Well System accommodating the water intake requirements of the Callaway site. This plan was approved by the MDNR SHPO and will serve as a model for additional plans to be prepared and submitted prior to initiating other land disturbing activities. The procedure described in the Cultural Resources Discovery Plan complies with applicable Federal and State laws. These laws include the National Historic Preservation Act (USC, 2007) and the applicable sections of the Revised Statutes of Missouri (RSMo) Chapters 194 (RSMo, 2006a) and 253 (RSMo, 2006b). Phase 1 and 2 surveys will be conducted when the Collector Well System locations are finalized, and results will be used to avoid known historic sites during final design. Additionally, on-site monitoring during drilling activities will be implemented according to SHPO guidance and the Callaway 's Cultural Resources Discovery Plan.

It is concluded that although the potential is low, there may be adverse impacts to historic or cultural resources from construction. Should monitoring or further investigation identify the presence of historic or archaeological sites, then SHPO will be consulted regarding appropriate investigative and/or protective steps to minimize or mitigate any adverse effects, per Section 106 of the National Historic Preservation Act. Any identified measures would be delineated in a Memorandum of Agreement between NRC, the SHPO, and AmerenUE.

The magnitude of the impacts and requirements for mitigation are determined to be SMALL.

4.1.4 REFERENCES

ACHC, 2004. 36 CFR Part 800 – Protection of Historic Properties (incorporating amendments), August 2004.

AUE, 1994, Management Agreement for the Public Use of Lands

FEMA, 1997. Flood Hazard Boundary Map, Callaway County, Missouri, Federal Emergency Management Agency, July 15, 1997, Website: www.fema.gov/hazard/flood/index.shtm. Accessed October 2, 2007

MACOG, 2007. Missouri Association of Councils of Government, http://macog.mo-acte.org/mm.htm. Accessed June 25, 2007

PCR, 2007. Paul C. Rizzo Associates, Inc., Cultural Resources Discovery Plan for Archeological Monitoring of Soil Borings, Callaway Nuclear Plant COLA, Callaway County, Missouri, June 2007

RSMo, 2006a. Title XII Missouri Revised Statutes, Public Health and Welfare, Chapter 194, Death - - Disposition of Dead Bodies, August 2006

RSMo, 2006b. Title XVI Missouri Revised Statutes, Conservation, Resources and Development, Chapter 253, State Parks and Historic Preservation, August 2006

RSMo, 2007. Missouri Revised Statutes Chapter 251 Community Affairs, Planning and Development, http://www.moga.mo.gov/statutes/c251.htm - Last Modified: February 2007. Accessed June 25, 2007

SB 193, 2007. Missouri State Senate Economic Development, Tourism and Local Government Committee www.senate.mo.gov/07info/BTS_Web/Bill.aspx?SessionType=r&BillID=1208 - 17k. Accessed June 25, 2007

USC, 2007. Title 16, United States Code, Part 470, National Historic Preservation Act of 1966, as amended, 2007.

USDA, 2007. U.S. Department of Agriculture, Natural resources Conservation Service, National Cooperative Soil Survey, Web Soil Survey 2.0. Accessed October 25, 2007

USGS, 1998. Lower Missouri River Ecosystem Initiative FINAL REPORT 1994-1998, USGS Columbia Environmental Research Center, December, 1998

Personal Communications

Haslag, D., 2007. Missouri Department of Transportation, Jefferson City, Missouri, personal communication (May 11, May 15).

Table 4.1-1—Construction Areas Acreage and Operations Acreage, Land Use

Construction Area	Construction Acreage (hectares)	Current Land Use
Unit 2 Power Block (Including ESWEMS Makeup Pond)	50 (20.2)	Existing Site Developed
Unit 2 Switchyard	11 (4.5)	Existing Site Developed
Unit 2 Cooling Tower Area	15 (6.1)	Existing Site Developed
Permanent Laydown Area	20 (8.1)	Existing Site Developed
Permanent Laydown Area	160 (64.8)	Forest or Farm
Unit 2 Employee Parking Area	5 (2.0)	Existing Site Developed
Construction Parking Area	26 (10.5)	Forest or Farm
Connector Transmission Lines (Onsite)	28 (3.6)	Existing Site Developed
Transmission Lines (Offsite)	122 (49.4)	Forest or Farm
Permanent Warehouse	5 (2.0)	Existing Site Developed
Collector Wells, Piping, and associated Access Roads	115 (46.5)	Forest or Farm
Construction Access Roads	2 (0.8)	Existing Site Developed
Unit 2 Construction Landfill	34 (13.8)	Forest or Farm
Stormwater Ponds	9 (3.6)	Forest or Farm
Borrow Area	10 (4.1)	Existing Site Developed
Total Acreage of Disturbed Area for Permanent Construction Features	**612 (247.7)**	--
Concrete Batch Plant, Material Storage	14 (5.7)	Existing Site Developed
Total Acreage of Disturbed Area for Temporary Construction Features	**14 (5.7)**	--

Source: Burns & McDonnell

Notes:

(1) Existing Site Developed land was previously disturbed during or after Unit 1 construction for laydown, parking or facilities used during construction

Table 4.1-2—Prime Farmland Along the Missouri River

Soil Unit Symbol	Soil Unit Description	Farmland Classification	Acres	Hectares
13598	Booker silty clay, 0 to 2% slopes, occasionally flooded, frequently ponded.	Not Prime Farmland	326.88	132.28
66034	Hodge fine sane, loamy substratum, 0 to 2% slopes, frequently flooded.	Farmland of Statewide Importance	325.73	131.82
66043	Leta silty clay loam, sandy substratum, 0 to 2% slopes, occasionally flooded.	Prime Farmland	1264.47	511.71
66095	Grable very fine sandy loam, loamy substratum, 0 to 2% slopes, occasionally flooded.	Prime Farmland	895.34	362.33
66111	Waldron silty clay, loamy substratum, 0 to 2% slopes, occasionally flooded.	Not Prime Farmland	459.8	186.07
99001	Water	Not Prime Farmland	72.17 [1]	29.20 [1]

REFERENCES:

Soil Survey Geographic Database for Callaway County, Missouri, US Department of Agriculture, Natural Resources Conservation Service, June 2007

Note:

(1). Sum of area does not include the Missouri River.

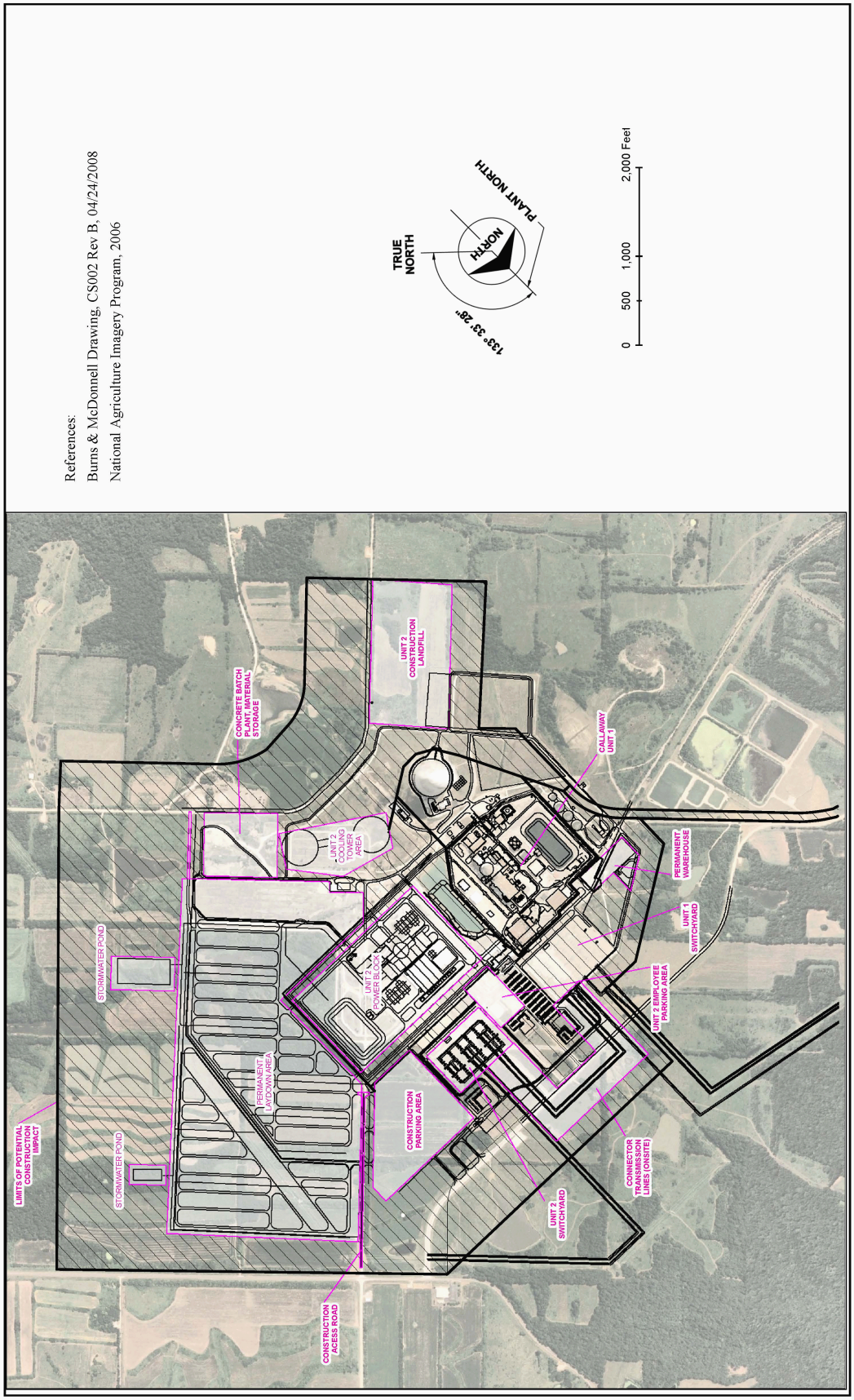
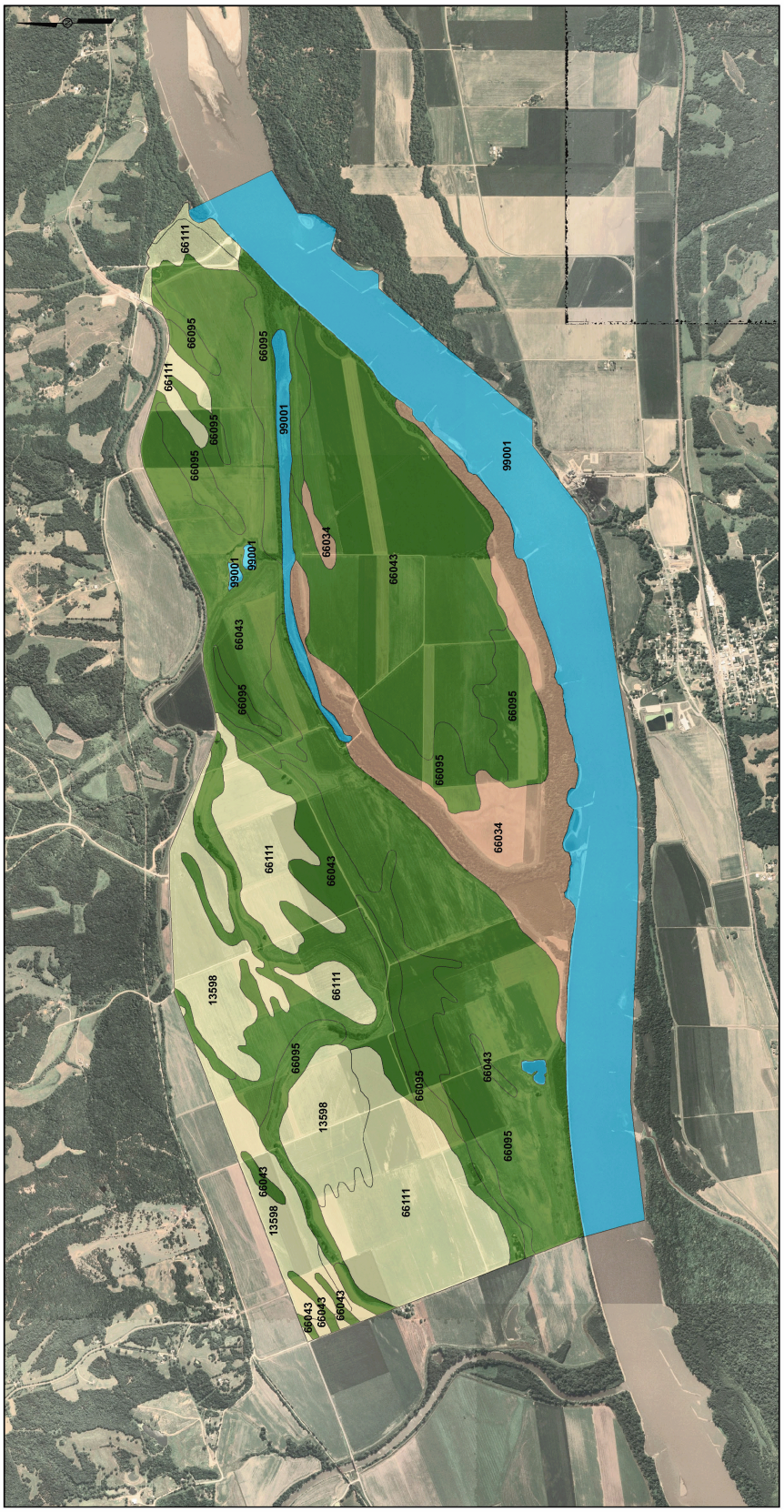


Figure 4.1-1—Callaway Site Layout

Figure 4.1-2—Prime Farmland along the Missouri River



4.2 WATER-RELATED IMPACTS

The following sections describe the hydrologic alterations and water use impacts that result from the construction of Callaway Plant Unit 2. Section 4.2.1 describes the hydrologic alterations resulting from construction activities including the physical effects of these alterations on other users, the best management practices to minimize any adverse impacts and how the project will comply with the applicable Federal, State and local standards and regulations. Section 4.2.2 describes the potential changes in water quality and presents an evaluation of the impacts resulting from construction activities on water quality, availability and use.

4.2.1 HYDROLOGIC ALTERATIONS

This section discusses the construction activities including site preparation, the resulting hydrologic alterations and physical effects of these activities on other water users, best management practices to minimize adverse impacts, and compliance with applicable Federal, State and local environmental regulations.

4.2.1.1 Description of Surface Water Bodies and Groundwater Aquifers

The Callaway site covers an area of approximately 2,765 acres (1,119 hectares) and is located in Callaway County, Missouri, approximately 10 miles (16 km) southeast of Fulton and 80 miles (129 km) west of the St. Louis metropolitan area. The 50 mile (80 km) region around the Callaway site is shown in Figure 2.1-2. Additional details on the Callaway site location and surrounding area are provided in Section 2.1.

The topography at the Callaway site is gently rolling upland, once part of an old glacial till plain. Erosion and downcutting of the Missouri River and its tributary streams have dissected the plain, leaving a nearly isolated plateau of approximately 8 sq mi (21 sq. km). The plateau has a maximum elevation of 858 ft (262 m) msl (mean sea level). The overall drop in elevation between the crest of the plateau and the Missouri River is about 350 ft (107 m).

Since the plateau is the topographic high in the area, surface runoff drains radially into small intermittent streams. These small streams are branches of local streams that include Logan Creek to the east, Mud Creek to the southwest, Cow Creek to the north, and Auxvasse Creek to the west. Mud Creek and Cow Creek are tributaries to Logan and Auxvasse Creek, respectively. Logan Creek and Auxvasse Creek have relatively steep channel gradients and drain directly into the Missouri River. The drainage areas and confluence points with the Missouri River for Logan Creek and Auxvasse Creek are illustrated on Figure 2.3-4.

Surface Water Bodies

The surface water bodies near the Callaway site are illustrated in Figure 2.3-4 and Figure 4.3-4 through Figure 4.3-6. Potential water bodies that may be affected by the construction of Callaway Plant Unit 2 are:

- Auxvasse Creek;
- Cow Creek;
- Logan Creek;
- Mud Creek;
- The Missouri River; and

- Existing Callaway Plant Unit 1 stormwater runoff ponds.

There are eight ponds, designated as P-1 through P-8 in Figure 4.3-4 through Figure 4.3-6, located in the vicinity of Callaway Plant Unit 1. Six of these ponds were created during construction of Callaway Plant Unit 1 to control sediment runoff and two existed prior to Unit 1 construction. The surface area of these ponds ranges from approximately 2 acres to 15 acres (0.8 hectares to 6.1 hectares) with depths generally 5 ft (1.5 m) or less. During construction of Callaway Plant Unit 2, runoff from the Callaway site will be diverted to onsite stormwater runoff ponds and new stormwater runoff ponds, thus minimizing the impacts on the surrounding streams including Logan Creek, Mud Creek, Cow Creek, and Auxvasse Creek. Because ponds P-2 through P-8 have a surface water connection to the unnamed streams which eventually flow into named streams and then the Missouri River, these stormwater ponds are considered jurisdictional waters of the U.S. Pond P-1 is isolated and, thus, is not a jurisdictional water of the U.S. Ponds P-1, P-2, P-7, and P-8 are actively managed by Missouri Department of Conservation (MDC).

Wetlands and streams were delineated on the Callaway site within the Callaway Plant Unit 2 construction zone, the Callaway Plant Unit 2 transmission line corridor and within the potential construction zone for the new water intake facilities in the well field area of the Missouri River. Wetlands were delineated in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual. In addition, wetlands were deemed jurisdictional waters of the United States if a direct hydrologic connection could be made to a Traditional Navigable Water, such as the Missouri River, in accordance with the U.S. Supreme Court ruling in Solid Waste Agency of Northern Cook County versus U.S. Army Corps of Engineers. Streams were identified as jurisdictional waters of the United States based on the presence of an ordinary high water mark (OHWM), bed and bank, and the presence of a surface water connection to Traditional Navigable Waters of the United States such as the Missouri River.

Because the Callaway was sited at the highest point in the local landscape, several small drainages radiate away from the plant to the north and south. As noted earlier, these small unnamed streams are tributary to several named streams in the site and vicinity including Auxvasse Creek, Mud Creek, and Logan Creek, all of which are tributary to the Missouri River. Since the small unnamed drainages and named streams are connected to the traditionally navigable waters of the Missouri River, all said drainages and streams are considered jurisdictional waters of the U.S.

In general, four wetland types were delineated at the Callaway site: isolated ponds, settling ponds, Logan Creek wetlands, and big river wetlands located within the Missouri River floodplain. Further information on the wetland types is presented in ER Section 2.4.2.

Additional details on the surface water drainage and hydrology are also presented in ER Section 2.3.1 and FSAR Section 2.4.

Groundwater Aquifers

The subsurface aquifers that could be impacted by project construction activities at the Callaway site are the shallow Graydon Chert aquifer (Mississippian or stratigraphically equivalent to the Mississippian aquifer), the Cambrian-Ordovician aquifer system, and the Missouri River alluvial aquifer (where a horizontal collector well system for cooling water intake will be constructed on the Missouri River floodplain). A schematic cross-section of the Missouri aquifer systems is shown in Figure 2.3-17. Aquifer systems of Northern, Western, and Southern Missouri are shown in Figure 2.3-18. The physical characteristics of the groundwater aquifers are provided in ER Section 2.3.1 and FSAR Section 2.4.12.

The Graydon Chert aquifer is isolated on the plateau and is not used for public or private well use. The uppermost aquifer in the Cambrian-Ordovician aquifer system is the Cotter-Jefferson City (CJC) aquifer. It is a minor aquifer with relatively low well yields that is used by private well users in the area surrounding the plateau. The deeper portions of the Cambrian-Ordovician aquifer system that have higher well yields are utilized by AmerenUE for Callaway Plant Unit 1 potable water needs and will also be utilized for Callaway Plant Unit 2 construction needs and post-construction potable water needs. The Missouri River alluvial aquifer is located along the floodplain approximately 5 miles (8 km) south of Callaway Plant Unit 2. It is planned that a collector well system will be constructed to provide approximately 50,000 gpm (189,300 lpm) for cooling water intake for both Callaway Plant Units 1 and 2. There are no known users of this aquifer in the vicinity of the collector well system.

The Callaway site is located in EPA Region 7 (Nebraska, Iowa, Kansas, and Missouri). There are no sole source aquifers in this region; thus there would be no impact to a sole source aquifer.

4.2.1.2 Construction Activities

The following construction activities that may alter site hydrology will take place:

Clearing, Grubbing, and Grading

Spoils, backfill borrow, and topsoil storage areas will be established on parts of the Callaway site. Clearing and grubbing of the site begins with harvesting trees, vegetation removal, and disposal of tree stumps. Topsoil will be moved to a storage area (for later use) in preparation for excavation. The general plant area will be brought to plant grade in preparation for foundation excavation and installation. As described inSection 4.1, 612 acres (248 hectares) of land will be cleared for road, facility construction, laydown and parking uses.

Road Construction

Public roadways will be used to transport most construction materials and equipment to the site. Heavy equipment and reactor components will be barged up the Missouri River and transported by truck to the site, a route that is largely along infrequently used roads but involves a small (a little more than 2 miles (3.2 km)) section of Route 94. The only road construction plan is to reroute a construction road internal to the Callaway site north of the Essential Service Water Emergency Makeup System (ESWEMS) retention pond area. This rerouting essentially expands the Owner Controlled Area (OCA) to allow for the pond construction and additional laydown area, and occurs entirely on AmerenUE property. There are no changes planned for County Roads 428, 448 and 459.

Temporary Utilities

Temporary utilities include above-ground and underground infrastructure for power, communications, potable water, wastewater and waste treatment facilities, fire protection, and for construction gas and air systems.

Temporary Construction Facilities

Temporary construction facilities include offices, warehouses, sanitary toilets, a changing area, a training area, and personnel access facilities. The site of the concrete batch plant includes the cement storage silos, the batch plant, and areas for aggregate unloading and storage.

Parking, Laydown, Fabrication, and Shop Preparation Areas

The parking, laydown, fabrication and shop areas include preparation of the parking and laydown areas by grading and stabilizing the surface with gravel. The shop and fabrication areas include the concrete slabs for formwork, laydown, module assembly, equipment parking

and maintenance, and fuel and lubricant storage. Concrete or timber pads for cranes and crane assembly will be installed.

Underground Installations

Concurrent with the power block earthworks, the initial underground fire protection, water supply, sanitary and hydrogen gas piping, and electrical power and lighting duct banks will be installed and backfilled. These installations will continue as construction progresses.

Unloading Facilities Installation

Heavy equipment and reactor components will be barged up the Missouri River to the existing barge slip. Dredging to deepen the dredge slip is not anticipated, but may be necessary in the area immediately in front of the barge slip if silt has built up sufficiently to impede barge docking and offloading.

Power Block Earthwork (Excavation)

The deepest excavations in the power block area are for the Callaway Plant Unit 2 Nuclear Island Building foundations that extend to approximately 40 ft (12 m) below plant grade. The next deepest excavations are for the Essential Service Water Emergency Makeup System (ESWEMS) foundation area which will be excavated approximately 23 ft (7 m) below plant grade with the circulating water piping excavation areas extending down to approximately 30 ft (9 m) below plant grade.

The excavations will take place concurrent with the installation of any required dewatering systems, slope protection, and retaining wall systems. At a minimum, drainage sumps will be installed at the bottom of the excavations from which surface drainage and groundwater infiltration will be pumped to a stormwater discharge point. Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater pollution prevention plan, the National Pollutant Discharge Elimination System (NPDES) permit, and other applicable permits obtained for construction. Excavated material will be transferred to the spoils and backfill borrow storage areas. Acceptable material from the excavations will be stored and reused as structural backfill.

Power Block Earthwork (Backfill)

The installation of suitable backfill to support structures or systems occurs as part of the site preparation activities. Backfill material will come from the concrete batch plant, onsite borrow pit and storage areas, or offsite sources. Excavated areas will be backfilled to reach the initial level of the building foundation grade. Backfill will continue to be placed around the foundation as the building rises from the excavation until final plant grade is reached. Backfill sources are discussed in more detail in FSAR Section 2.5.4.

Nuclear Island Base Mat Foundations

The deepest foundations in the power block are installed early in the construction sequence. Detailed steps include installation of the grounding grid, mud-mat concrete work surface, reinforcing steel and civil, electrical, mechanical/piping embedded items, forming, and concrete placement and curing.

Transmission Corridors

Callaway Plant Unit 2 would require the following new facilities and upgrades to connect to the existing transmission system:

- One new 345 kV, 16 breaker, breaker-and-a-half switchyard to transmit power from Callaway Plant Unit 2;
- two new 345 kV, 1,800 MVA (normal rating) circuits connecting the new Callaway Plant Unit 2 switchyard to the existing Callaway Plant Unit 1 switchyard;
- a extension of the Loose Creek 345 kV transmission line from a tie point on the Loose Creek transmission line near Chamois to the Callaway Plant Unit 1 switchyard resulting in approximately 6.7 miles (10.8 km) of new transmission line; and
- re-routing of the Callaway-Montgomery Lines 7 and 8 into the Callaway Plant Unit 2 switchyard from the Callaway Plant Unit 1 switchyard.
- The existing Callaway-Bland corridor will be widened by 150 ft (46 m) to accommodate the new section of the Callaway-Loose Creek transmission line. New transmission towers supporting the 345-kV transmission lines will be installed in the widened corridor parallel to and west of the existing Callaway-Bland transmission lines, crossing the Missouri River at river mile 116.6.

The routing of the new lines will be contained within the AmerenUE property lines or widened offsite easements. No new access roads or modifications to existing roads are currently anticipated.

Offsite Areas

Offsite areas impacted by construction activities for Callaway Plant Unit 2 are limited to the offsite transmission corridor. Section 3.7 provides a discussion of power transmission system construction needs.

4.2.1.3 Water Sources and Amounts Needed for Construction

For Callaway Plant Unit 1, presently only one well, Well #3 (DGLS # 028347), is utilized for potable water. Its estimated well yield is approximately 565 gpm (2,147 lpm). The estimated average total groundwater use is currently 50 gpm (190 lpm), with a break-down as follows: potable water usage is 15 gpm (57 lpm), fire make-up water is 6 gpm (23 lpm), demineralization make-up water is 15 gpm (57 lpm), and miscellaneous water use is 10 to 15 gpm (38-57 lpm). For Callaway Plant Unit 2, it is intended that the two wells, Wells #1 and #2 (DGLS # 027975 and 028076), will be used for construction. Their yields are estimated as approximately 200 gpm (760 lpm) each, such that the combined yield of the three wells is approximately 965 gpm (3,650 lpm). It is currently estimated that a peak water supply of up to 700 gpm (2,650 lpm) will be required during Callaway Plant Unit 2 construction activities (demands include those for the construction workforce, concrete mixing, dust control, and hydro testing and flushing). This is based on an estimate of 150 gpm (570 lpm) for normal operations of Callaway Plant Unit 1 and anticipated construction requirements for Callaway Plant Unit 2, de-mineralization plant full flow operations of 500 gpm (1,893 lpm), and concrete plant and miscellaneous construction usages of 50 gpm (190 lpm). Average construction demand would be less. Figure 4.3-4 through Figure 4.3-6 shows the estimated amounts of potable water needed by construction year.

4.2.1.4 Water Bodies Receiving Construction Effluents that Could Affect Water Quality

The surface water bodies directly downstream of the construction activities could be impacted during clearing, grubbing, and grading. The surface water bodies within the Auxvasse Creek

hydrologic system at the Callaway site that could receive effluents during Callaway Plant Unit 2 construction are discussed in Section 4.2.1.1.

Since most of the water for construction would be used for consumptive uses such as grading, soil compaction, dust control, and concrete mixing, little infiltration to groundwater would be expected (especially considering that the excavations will be kept as dry as possible). Any effluents that might infiltrate would potentially flow into the Graydon Chert aquifer. Subsequent groundwater flow from the Callaway Plant Unit 2 area is outward and downward to the underlying aquitard and Cotter-Jefferson City aquifer. However, groundwater travel times through the aquitard are very long, i.e., on the order of 1,000 years (refer to detailed discussion in ER Section 2.3.1). Groundwater that originates in the Callaway Plant Unit 2 area is not expected to discharge to onsite drainages; rather, it travels downward through the aquitard to the underlying aquifer.

The composition of possible construction effluents that could infiltrate into the Graydon Chert aquifer would depend on several factors related to the physical nature of the effluent material, i.e., solids versus liquids, solubility, vapor pressure, mobility, compound stability, reactivity in the surface and subsurface environments, dilution, and migration distance to groundwater. It is expected that proper housekeeping and spill management practices would minimize potential releases and volumes and physically contain any releases. Pesticides and herbicides are expected to be applied in limited site areas for insect and weed/brush control.

Two new stormwater runoff ponds, in addition to the existing stormwater runoff ponds in the vicinity of the Callaway site, are planned to catch stormwater and sediment runoff from the various construction areas. Modeling of the runoff from the probable maximum precipitation (PMP) during plant operation bounds the possible runoff amounts, characteristics, and impacts that might occur during construction due to unpaved surfaces allowing for greater stormwater infiltration into the ground. The stormwater runoff ponds will be sized so as to prevent fast flowing, sediment laden stormwater from reaching the nearby creeks or Missouri River prior to allowing the sediments to settle out. The flow velocities will be minimized to prevent erosion of creek and stream banks. The allowable flow rates and physical characteristics of stormwater runoff will be specified in the Missouri discharge permits. Additional information regarding PMP can be found in FSAR Section 2.4.2.

The results of the probable maximum flood (PMF) analysis for Auxvasse Creek Watershed (refer to FSAR Section 2.4.3) indicate a maximum PMF water surface elevation of 697 ft (212 m) for Logan Creek, 590.6 ft (180 m) for Mud Creek and 707 ft (215 m) for Auxvasse Creek. All safety-related structures, systems, and components of Callaway Plant Unit 2 are on an upland plateau at about El. 846.0 ft (257.9 m). Thus, the Callaway Plant Unit 2 site is about 149.0 ft (45.4 m) above the Logan Creek PMF, 255.4 ft (77.8 m) above the Mud Creek PMF and 139.0 ft (42.4 m) above the Auxvasse Creek PMF. As a result, the plant site is dry with respect to major flooding on the Auxvasse Creek, Logan Creek and Mud Creek. As described in FSAR Section 2.4.1, the highest flood of record on the Missouri River near the site at Chamois was 33.3 ft (10.1 m) on July 31, 1993, bringing the water level at Chamois to El. 535.8 ft (163.3 m) (gauge datum is set to 502.5 ft (153.2 m)). The Callaway site is still about 309.2 ft (94.2 m) higher. The plant site is dry with respect to major flooding on the Missouri River, and only a localized PMP storm was considered for flood design protection of safety-related facilities.

4.2.1.5 Construction Impacts

Surface Water Impacts

Construction of Callaway Plant Unit 2 with its associated cooling towers will impact several of the current drainages and impoundments at the Callaway site. Runoff from the finished grade of the Callaway Plant Unit 2 power block, switchyard, cooling towers, parking areas, and permanent laydown areas will be directed by sloping towards the stormwater runoff ponds. The site grading plan is shown in Figure 2.3-3. The information related to drainage at the Callaway Plant Unit 2 construction site is provided in ER Section 2.3.1.

Construction-related impacts to aquatic resources include 10,359 linear ft (3,157 m) of intermittent streams which are unnamed tributaries of Logan Creek, Mud Creek, and Auxvasse Creek that drain stormwater away from the Callaway site. These streams were impounded during construction of Callaway Plant Unit 1 to create settling ponds or catch basins (Figure 4.3-4 through Figure 4.3-6). These drainages are mapped by the U.S. Geological Survey (USGS) as dashed blue-line streams and are thus assumed to be under the jurisdictional authority of the USACE. Although they all have a significant nexus with the traditionally navigable waters of the Missouri River, some of these upland drainages lack bed, bank, or a consistent ordinary high water mark (OHWM). As such, a jurisdictional determination by the USACE would be required to evaluate the extent of jurisdictional stream. Therefore, stream impacts may be revised at a later date. Impacts to jurisdictional streams are presented in Figure 4.3-4 through Figure 4.3-6 and will require compensatory measures in accordance with USACE permit conditions.

Eight ponds, designated as P-1 through P-8 in Figure 4.3-4 through Figure 4.3-6, surround the Callaway site. As stated above, six of the stormwater runoff ponds were constructed as impoundments or catch basins during construction of Callaway Plant Unit 1 facilities and two existed prior to Unit 1 construction. Construction-related impacts are expected to be limited to one jurisdictional stormwater runoff pond (P-4) that will be permanently converted to structures, pavement, or other maintained exterior grounds to accommodate the power block, cooling towers, roadways, construction lay down area, borrow area, retention basins, and permanent parking lots. Altogether, construction activities will impact 4.3 acres (1.7 hectares) of impoundments or stormwater runoff ponds (Figure 4.3-4 through Figure 4.3-6). This represents 10.4% of the total pond surface area at the site. All other stormwater runoff ponds are expected to remain after construction. Should construction requirements dictate that additional ponds be filled, appropriate control measures will be implemented. MDC actively manages P-2, P-7, and P-8, which will remain open to the public for fishing. Furthermore, two additional stormwater runoff ponds may be constructed, one north of P-4 near the northeast corner of the laydown area and the other near the northwest corner of the laydown area, as needed, during construction of Callaway Plant Unit 2 facilities. These may be included as part of the overall control measures required for impacts to jurisdictional waters of the U.S.

Although not directly impacted by construction, stormwater runoff pond P-7 could be indirectly impacted with additional sedimentation and turbidity due to work upstream in intermittent drainages that feed into the pond. Downstream reaches of the impacted intermittent streams are also at risk to receive additional sediment deposition as a result of construction activities at the Callaway site. Therefore, sediment and erosion control practices such as temporary seeding, mulching, silt fences, and check dams will be used in order to minimize the indirect impacts of construction.

The overall site drainage areas are not directly affected by the site grading plan. Since the plant facilities are located on the crest of a plateau that has a well-developed natural drainage

system, and because final grading of the site area is integrated with this natural system, potential local flooding, even from extremely heavy rainfall, will be controlled by the plant site drainage system. The runoff from Callaway Plant Unit 1 will not impact Unit 2 because of the grade elevation difference between Callaway Plant Unit 1 (El. 840 ft (256 m) msl) and Unit 2 (El. 845 ft (258 m) msl). Likewise, the 72-hr PMP evaluation of the Callaway Plant Unit 2 site drainage concludes that there is no adverse impact to Unit 1 from the runoff results.

The Nuclear Island Buildings are located in the center and along the high point of the Callaway Plant Unit 2 power block area. From the high point, site grading is sloped to stormwater runoff ponds located near the construction lay down area.

Drainages are constructed with base materials that promote infiltration of runoff from low intensity rainfall events. However, for large storms, the infiltration capacity of the base materials would be exceeded and overflow pipes are provided to direct the runoff to the storm water basin located to the east of the Callaway Plant Unit 2 power block. FSAR Section 2.4.2 evaluates the impacts of a localized intense precipitation on the site drainage.

These impacts to surface water bodies are MODERATE, primarily due to the loss of wetlands and wetland buffers, and the stormwater runoff ponds covering the area of approximately 8.3 acres (3.4 hectares) of the Callaway Plant Unit 2 wetland assessment area. Therefore, they will require measures to minimize the impacts. The preventive measures associated with the wetlands and wetland buffers, and stormwater runoff ponds are described in Section 4.3.1.6.

Groundwater Impacts

The hydrologic alterations to groundwater that could result from the project related construction activities are:

- Creation of a local and temporary depression in the Graydon Chert aquifer potentiometric surface due to dewatering for foundation excavations (although the aquifer yield is very low, seepage is expected to be minimal, and groundwater dewatering is expected to be controlled by sump pumps and drainage);

- Disruption of the current Graydon Chert aquifer recharge and discharge areas by plant construction is not a concern. The construction area is relatively flat and clear of vegetated areas. Runoff is currently directed toward stormwater runoff ponds and during construction, runoff and water from dewatering of excavations will be directed toward these ponds and two additionally planned stormwater runoff ponds. Due to low-permeability soils, groundwater recharge is minimal, and construction activities are not expected to significantly alter groundwater recharge or discharge;

- Additional stress on the Cambrian-Ordovician aquifer is expected when the water needed for Callaway Plant Unit 2 construction is supplied by the Callaway onsite wells. Normal operation of Callaway Plant Unit 1 consumes 50 gpm (190 lpm) groundwater supplied from a single onsite well (refer to Section 4.2.1.3). Average construction potable water usage is estimated at 250 gpm (946 lpm) to be supplied by 3 onsite wells. Considering that the combined yield of three wells is approximately 965 gpm (3,650 lpm), it is estimated that approximately 26% of the onsite well capacity will be used for Callaway Plant Unit 2 construction. Therefore, the impact of potable water use on Cambrian-Ordovician aquifer during construction is expected to be SMALL; and

- No significant hydrologic alteration of the Missouri River Alluvial Aquifer during construction of the collector well system is anticipated. The caisson is constructed

"wet" and during projection and development of the lateral intake lines, flow to the caisson will be significantly less (not more than 300 gpm (1,136 lpm)) than what occurs during normal operation (average Callaway Plant Unit 2 water use is 24,160 gpm (91,446 lpm)). Operational changes to the alluvial aquifer are described in ER Section 2.3.1.

4.2.1.6 Identification of Surface Water and Groundwater Users

In the Callaway site area, the predominant water withdrawal from the Missouri River is for power generation by Callaway Plant Unit 1 and the Central Electric Power Cooperative Chamois Plant. Callaway Plant Unit 1 is the largest consumptive water user in the area; the Central Electric Power Cooperative Chamois Plant is the second largest user. Callaway Plant Unit 1 pumps 8.04E+09 gal per yr (3.04E+07 m^3 per yr) and Central Electric Power Cooperative Chamois Plant withdraws 2.49E+10 gal per yr (9.43E+07 m^3 per yr). Even though Central Electric Power Cooperative Chamois Plant withdraws more water than Callaway Plant Unit 1, the 2.40E+10 gal per yr (9.09E+7 m^3 per yr) of water pumped is largely returned to Missouri River after passing through the condenser.

Local streams are presently used for recreational purposes only. The major non-consumptive surface water uses of the Missouri River in the vicinity of the site are recreation, fishing, and navigation. The recreational activities include swimming, fishing, and boating along the Missouri River as discussed in Section 2.3.2.

Groundwater users in the vicinity of the Callaway site are identified in Section 2.3.2. Figure 2.3-63 shows the locations of the individual public and private water wells within the hydrogeologic study area boundary and within approximately 1 mile (1.6 km) of the boundary. The distance from Callaway Plant Unit 2 to the local groundwater wells is shown in Table 2.3-31. The closest non-AmerenUE well is an irrigation well that is located approximately 0.8 miles (1.3 km) north (and downgradient) of Callaway Plant Unit 2. This well is 375 ft (114.3 m) deep and is likely drawing water from the Cotter-Jefferson City aquifer.

4.2.1.7 Practices to Limit or Minimize Hydrologic Alterations

The following actions will be used to limit or minimize expected hydrologic alterations during construction:

- Replacing stormwater runoff ponds lost to construction with ponds of equivalent capacity as necessary for runoff control;
- Limiting wetland removal and disruptions to the areas where necessary;
- Minimizing disturbed areas by controlling and delineating the area; and
- Implementation of Best Management Practices (BMPs) as described in Section 4.2.1.9.

4.2.1.8 Compliance with Applicable Hydrological Standards and Regulations

The regulations guiding the implementation of Best Management Practices (BMPs) are provided by the Missouri Department of Natural Resources (MDNR, 2007). These regulations contain detailed requirements for the land disturbance general permit, through which the state enforces BMPs at construction sites. Monitoring of construction effluents and stormwater runoff will be performed as required in the stormwater pollution prevention plan, NPDES permit, and other applicable permits obtained for construction.

4.2.1.9 Best Management Practices

Best Management Practices will be implemented in accordance with regulations, as discussed in Section 4.2.2.10.

Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater management plan, NPDES permit, and other applicable permits obtained for construction.

In addition, Callaway Plant Unit 2 will comply with the requirements and conditions of the various permits issued to support construction. Environmental compliance personnel will monitor construction activities and provide direction to add, modify, or replace site practices to ensure compliance with hydrological standards and regulations.

In summary, the impact of construction on the hydrology and surface water bodies that will be present at the time of construction is SMALL due to design of the surface water retention systems and use of best management practices to control surface water runoff.

4.2.2 WATER USE IMPACTS

This section discusses the construction activities and resulting hydrologic alterations that could impact water use, an evaluation of potential changes in water quality resulting from construction activities and hydrologic changes, an evaluation of practices to minimize adverse impacts, and compliance with applicable Federal, State and local environmental regulations.

4.2.2.1 Description of the Site and Vicinity Water Bodies

The description of Callaway site, and the surface water bodies and groundwater aquifers that could be impacted by the construction of Callaway Plant Unit 2 are presented in Section 4.2.1.1.

4.2.2.2 Hydrologic Alterations and Related Construction Activities

Construction impacts to the existing surface water bodies and hydrologic alterations to groundwater that could result from the construction activities are described in Section 4.2.1.5.

A further discussion of related construction activities is provided in Section 4.2.1.2.

4.2.2.3 Physical Effects of Hydrologic Alterations

Impacts from the construction of Callaway Plant Unit 2 are similar to those associated with any large construction project. The construction activities that could produce hydrologic alterations to surface water bodies and groundwater aquifers are presented in Section 4.2.1.2. The potentially affected surface water bodies and groundwater aquifers are described in Section 4.2.1.1. The potential construction effects on surface water bodies and groundwater aquifers are presented in Section 4.2.1.5.

Surface Water Impacts

Because of the potential for impacting surface water resources, a number of environmental permits are needed prior to initiating construction. Table 1.3-1 in Chapter 1.0 provides a list of construction-related consultations and permits that have to be obtained prior to initiating construction activities.

The construction activities expected to produce the greatest impacts on the surface water bodies occur from:

- Reducing the available infiltration area;
- Grading and the subsequent covering of the 50 acre (20.2 hectare) Callaway Plant Unit 2 power block foundation (refer to Figure 4.3-4 through Figure 4.3-6 for construction areas acreage);
- Grading and covering of the 15 acre (6.1 hectare) Callaway Plant Unit 2 cooling tower pad;
- Grading and covering of the 11 acre (4.5 hectare) Callaway Plant Unit 2 switchyard/substation;
- Vegetation removal and grading of 550 acres (236.7 hectares) for construction of laydown areas, concrete batch plant, material storage, transmission lines, roads, collector wells, offices, parking, warehouses, and shop preparation areas. This includes all areas except Unit 2 Power Block (including ESWEMS makeup pond, Unit 2 Switchyard and Unit 2 Cooling Tower Area).
- Creation of stormwater runoff ponds;
- Elimination of one or two existing runoff ponds which is within the construction zone; and
- Excavation required to construct the collector wells.

Site grading and new building foundations will cover existing infiltration and recharge areas. However, the Graydon Chert aquifer recharge is not expected to be greatly altered due to the present minimal groundwater recharge caused by low permeability of shallow soils. Possible increases in runoff volume and velocity in the downstream creeks may cause erosion and adversely affect riparian habitat if not controlled.

Dewatering for the foundation excavations could also impact surface water bodies. Effluent from the dewatering system, and any stormwater accumulating during the excavation, would be pumped to a stormwater discharge point or into onsite stormwater runoff ponds. If pollutants (e.g., oil, hydraulic fluid, concrete slurry) exist in these effluents from construction activities, they could enter the runoff ponds, downstream channel sections, or other surface water bodies. Therefore, best management practices, as described in Section 4.2.1.9, will be implemented to prevent pollutants from entering waters. Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater management plan, NPDES permit, and other applicable permits obtained for the construction. Depending on the design of the stormwater runoff ponds and discharge systems, outflow rates into the surface streams could be altered.

The water bodies listed in Section 4.2.1.1 are potentially subject to receiving untreated construction effluents directly. It will be necessary to implement proper BMPs under state regulations, such as a General NPDES Permit for Stormwater associated with Construction Activity, Land Disturbance Permit, and a Storm Water Pollution Prevention Plan (SWPPP). Table 1.3-1 lists and presents additional information on the Federal, State and Local Authorizations associated with this project.

If proper BMPs are implemented under these permits, treated construction effluents could be released to the site water bodies without adverse impacts. Flow rates for untreated

construction effluents will depend upon the usage of water during site construction activities and the amount of precipitation contacting construction debris during construction activities. Flow rates and physical characteristics of the construction effluents are discussed in Section 4.2.1.4. A quantitative calculation and evaluation of the construction effluents and runoff will be done as part of the state construction permit process. BMPs would be implemented to control runoff, soil erosion, and sediment transport. Good housekeeping practices and engineering controls will be implemented to prevent and contain accidental spills of fuels, lubricants, oily wastes, sanitary wastes, etc.

BMPs are implemented under a Spill Prevention Plan, a SWPPP, and a Land Disturbance Permit, as described in Section 4.2.1.9 and Section 4.2.2.10. Environmental control systems installed to minimize impacts related to construction activities will comply with all Federal, state and local environmental regulations and requirements. Once the initial controls are in place, they are maintained through the completion of construction and during plant operation, as needed.

Surface water use impacts are SMALL primarily since there are few users of surface water as presented in Table 2.3-27. Surface water is not used as potable water for 50 miles (80 km) downstream of Callaway Plant Unit 2. In the Callaway site area, the predominant water withdrawal from the Missouri River is for power generation. However, since the site is located about 5 miles (8 km) away from the Missouri River, any construction impact on surface water use would be SMALL at this distance. The existing and stormwater runoff ponds are also effective in controlling pollution existing in the construction effluents or rainwater/precipitation runoff generated from the construction site. BMPs that will be implemented to control changes to both quantity and quality of runoff will also minimize possible adverse impacts on surface water use.

Groundwater Impacts

Dewatering foundation excavations will produce localized impacts on the Graydon Chert aquifer, although these are expected to be minimal. The deepest excavations anticipated are for the Nuclear Island Building foundations, which will extend approximately 40 ft (12 m) below plant grade. The dewatering system and activities are not expected to have any impact on the deeper Cambrian-Ordovician aquifer.

Increasing groundwater withdrawals for construction needs from the three onsite Cambrian-Ordovician aquifer system production wells could produce a local depression of the potentiometric surface in that aquifer. These increased withdrawals are not expected to exceed the well yields. The wells are open across multiple formations from casing depths of 380 ft to 405 ft (115.8 m to 123.4 m) below ground surface (bgs) to depths of approximately 1,100 ft to 1,510 ft (335 m to 460 m) bgs. These wells likely draw water from the deeper, higher yielding aquifers of the regional system. Generally, private wells in the area are shallower and are open within the top of the Cambrian-Ordovician aquifer system (the Cotter-Jefferson City (CJC) aquifer, which is a minor aquifer that was encountered at approximately 350 ft (107 m) bgs at the top of the plateau). Although ground surface elevations and private well depths vary, it is expected that the lower-yielding CJC aquifer is sufficient for private well supplies and drawdown is localized. It is not expected that withdrawals from the Callaway production wells will impact local private users.

Monitoring of construction effluents and stormwater runoff will be performed as required in the stormwater pollution prevention plan, NPDES permit, and other applicable permits obtained for construction.

The locally lowered Graydon Chert aquifer water level would be expected to eventually recover after the dewatering and other subsurface construction activities are completed. Although infiltration would be altered by buildings and paved areas, rainwater can still potentially recharge the aquifer. The lowered Cambrian-Ordovician aquifer water level would also recover as post-construction groundwater needs are much less than that needed for construction activities.

The impact to groundwater is SMALL and localized since changes to the Graydon Chert and Cambrian-Ordovician aquifer water levels are expected to eventually recover once construction is complete.

4.2.2.4 Water Quantities Available to Other Users

As described in Section 2.3.2.1.2, at present no surface water withdrawals are made in Callaway County for public potable water supply. Water use projections are assessed based on population trends in a given area. Since surface water is not a common source for drinking water in Callaway County, the actual surface water use projection in the county cannot be calculated. Excluding the plant water use of the Callaway Plant Unit 2, the future additional use of surface water will be extremely limited. The surface water use rate in the future will change with the additional withdrawal for Callaway Plant Unit 2, but there are still limited uses for water that principally comprise surface water in Callaway County, such as recreation, fishing and navigation.

Groundwater use and trends in central Missouri and at the Callaway site are presented in ER Section 2.3.2.2 and in FSAR Section 2.4.12.

Peak water demand for Callaway Plant Unit 2 construction is estimated at 700 gpm (2,660 lpm). This water is expected to come from the existing onsite wells into the Cambrian-Ordovician aquifer at the Callaway site.

The Graydon Chert aquifer is not used as a potable water source in the vicinity of the Callaway site. The impacts expected from foundation dewatering or other construction activities will not impact any local users.

4.2.2.5 Water Bodies Receiving Construction Effluents

Surface water bodies that could receive effluents during Callaway Plant Unit 2 construction are described in Section 4.2.1.1 and related discussion on the impacts of the construction effluents on these water bodies is presented in Section 4.2.1.4.

4.2.2.6 Baseline Water Quality Data

Baseline water quality data for surface water bodies is provided and discussed in Section 2.3.3. A summary of the water quality data for the onsite surface water bodies is presented in Table 2.3-33. Baseline water quality data for groundwater is provided in Section 2.3.3 and summarized in Table 2.3-34.

4.2.2.7 Potential Changes to Surface Water and Groundwater Quality

The following section describes the potential water quality impacts resulting from the construction of Callaway Plant Unit 2.

The Callaway site is a private facility and does not have any municipal water supplies with the exception of the Emergency Operations Facility (EOF). All water currently used onsite is drawn

from the Missouri River or subsurface aquifers. There are three groundwater supply wells onsite. The wells are listed in Table 2.3-31. Figure 2.3-63 shows the locations of the onsite supply wells. The groundwater supply wells to be used during the construction of Callaway Plant Unit 2 are provided in Section 4.2.1.3.

Potential Changes to Surface Water Quality

Potential surface water quality impacts are associated only with the site clearing and grading activities.

Without the use of BMPs, the addition of sediment and organic debris to the local streams resulting from clearing, grubbing, and grading could decrease water quality. Organic debris could dam or clog existing streams, increase sediment deposition, and increase potential for future flooding. Organic debris decomposing in streams can cause dissolved oxygen and pH imbalances and subsequent releases of other organic and inorganic compounds from the stream sediments. Sediment laden waters are prone to reduced oxygen levels, algal growth, and increases in pathogens. If heavy metals or chemical compounds spill and/or wash into surface waters, there could be a direct toxicity to aquatic organisms. These potential pollutant releases could impact aquatic species and in turn affect the recreational aspects associated with fishing, boating, or swimming.

Without the use of BMPs, the water bodies downstream of the construction areas could be directly and indirectly affected by construction activities onsite. Construction debris residing on the pads and temporary staging areas could mix with construction wash-down water or stormwater, exit the site via untreated runoff, and produce chemical reactions adverse to downstream ecology. Possible contaminants include sediment, alkaline byproducts from concrete production, concrete sealants, acidic byproducts, heavy metals, nutrients, solvents, and hydrocarbons (fuels, oils, and greases). There could be the potential for contaminants to mix with site wash-down water or rainwater/precipitation runoff and be washed downstream into surface water bodies existing on the Callaway site during summer and spring periods when precipitation might be intense. There could also be the potential for spills within the construction areas consisting of fuels, solvents, sealants, paints, or glues. Unsuppressed construction dusts could drift outside of the construction zones and contaminate nearby water supplies. If these contaminants were to enter the surface water bodies unchecked, there could be the potential for infiltration and subsequent groundwater contamination.

The removal of onsite wetlands could reduce the ability of microbiotic organisms and fauna to naturally attenuate contaminants and pollutants produced onsite. However, as discussed in Section 4.3.1, only a small percentage of wetlands (approximately 0.04% of site wetlands and ponds available on the Callaway site) are to be removed during the construction of Callaway Plant Unit 2.

The impacts to surface water quality downstream of the construction site are SMALL due to the use of BMPs to control dust, runoff, and spills; the small amount of wetlands impacted, and the use of surface water only for power generation purposes and some recreation.

Potential Changes to Groundwater Quality

No change to groundwater quality as a result of foundation excavations is expected.

4.2.2.8 Surface Water and Groundwater Users

Surface water users at, and in the vicinity of, the Callaway site area are discussed in ER Section 2.3.2. Surface water users downstream of the site may experience impacts from potential water quality changes if construction effluent concentrations and volumes are large enough and the release enters directly into a surface water body bypassing the stormwater runoff ponds. There will be no surface water users in ponds or on tributaries during construction of Callaway Plant Unit 2; therefore, possible water quality variations will not impact any users.

Groundwater users in vicinity of the Callaway site are identified in ER Section 2.3.2.

4.2.2.9 Predicted Impacts on Water Users

The impact of potential increased sediment loads in site runoff during construction would result in SMALL or no impacts to surface water users and affected areas as discussed in Section 4.2.2.3, Section 4.2.2.7 and Section 4.2.2.8.

Groundwater from Callaway Plant Unit 1 onsite wells will be used for construction, but this water is withdrawn from deeper, high yielding aquifers of the Cambrian-Ordovician aquifer system. Local groundwater users utilize the Cotter-Jefferson City aquifer, which is the uppermost aquifer of the Cambrian-Ordovician system. It is a minor aquifer that is separated from the deeper aquifers by an aquitard. Therefore, it is not anticipated that local users will experience an impact from Callaway Plant Unit 2 withdrawals from the Cambrian-Ordovician aquifer.

Potential construction effluent impacts on aquifer groundwater quality would first be manifested in the Graydon Chert aquifer. Construction activities are only expected to produce limited and temporary impacts in the Graydon Chert aquifer. As described in Section 2.3.1, the Graydon Chert aquifer is not used as a potable water source in the vicinity of the Callaway site. Therefore, potential groundwater quality changes would not be expected to have any impact on possible users. Potential impacts to the deeper aquifers are dependent on the nature of the hydraulic connection between aquifers described in Section 4.2.1.1. Groundwater quality impacts on users of the deeper aquifer users are minimal due to dilution and other contaminant attenuation effects that could occur along any effluent plume migration path.

Based on the above, the impacts of groundwater withdrawal and potential changes on groundwater quality during construction would result in SMALL impacts to groundwater users.

4.2.2.10 Measures to Control Construction Related Impacts

The following measures may be taken to avoid runoff from the construction areas entering and potentially impacting downstream surface water bodies and groundwater, as applicable:

- Implementation of a Stormwater Pollution Prevention Plan (SWPPP);
- Controlling runoff and potential spills using dikes, earthen berms, seeded ditches, and impoundments;
- Monitoring for contaminants within construction area impoundments and impoundments downstream of disturbed areas;

- Implementation of BMPs to protect against accidental discharge of contaminants (fuel spills, other fluids and solids that could degrade groundwater and surface water resources); and
- Performing additional onsite surface and groundwater monitoring compared to established water quality benchmarks and historical site data.
- Maintaining clean working areas;
- Removing excess debris and trash from construction areas;
- Properly containing and cleaning up all fuel and chemical spills;
- Installing erosion prevention devices in areas with exposed soils;
- Installing sediment control devices at the edges of construction areas;

Following the acquisition of the required permits and authorizations, site preparation activities include the installation or establishment of environmental controls to assist in controlling construction impacts to groundwater. These environmental controls may include:

- Stormwater management systems;
- Spill containment controls;
- Silt screens;
- Stormwater runoff ponds; and
- Dust suppression systems.

These controls assist in protecting the Graydon Chert aquifer by minimizing the potential for construction effluents to infiltrate directly into the subsurface or to carry possible contaminants to aquifer recharge areas.

Control measures for dredging in the area in front of the barge slip (if required) may include (as applicable to the selected dredging method):

- Restricting dredging only during certain times of the year to minimize impacts to aquatic species;
- Restricting dredging to only the areas identified for dredging;
- Installing a silt curtain around each dredge or active dredge area to minimize sediment release, as far as practicable;
- Ensuring clam-shell dredges are fully closed and hoisted slowly to limit the amount of spillage;
- Not filling spoils barges to levels which will cause overflowing of materials during loading and moving;

- Not allowing vessel decks to be washed in such a way that allows material to be released overboard; and
- Carrying out monitoring in accordance with any permit requirements.

Additional measures to minimize or contain accidental releases of contaminants may include the establishment, maintenance, and monitoring of:

- Solid waste storage areas;
- Backfill borrow, spoils, and topsoil storage areas; and
- Site drainage patterns.

Groundwater monitoring may be performed with selected existing onsite monitoring wells in accordance with the site-dewatering plan during construction.

Temporary construction groundwater use impacts are expected in the Cambrian-Ordovician aquifer and the groundwater withdrawals and potentiometric surface depression will be monitored. As explained in Section 4.2.2.9, any contamination that might be introduced into the Graydon Chert aquifer would be attenuated by the time it potentially reaches the deeper aquifer.

4.2.2.11 Consultation with Federal, State and Local Environmental Organizations

AmerenUE has had several meetings with MDNR to discuss the use of surface water and groundwater for construction and operation purposes, and has commenced discussions on revising the NPDES permit.

4.2.2.12 Compliance with Water Quality Standards and Regulations

The regulations guiding the implementation of Best Management Practices (BMPs) are provided by the Missouri Department of Natural Resources (MDNR, 2007). Monitoring of construction effluents and stormwater runoff would be performed as required in the stormwater management plan, NPDES permit, and other applicable permits obtained for the construction. The integrated permitting process for the applicable environmental permits will proceed independent of NRC review of the combined license application.

4.2.2.13 Water Quality Requirements for Aquatic Ecosystems and Domestic Users

Section 4.3.2 discusses information pertaining to water quality requirements for aquatic ecosystems. The Missouri River is considered to be an important aquatic habitat. Most of the species of concern within the ecological study area are residents of the Missouri River. Even so, none of them are endemic to the segment of the Missouri River near the plant. There is little or no submerged aquatic vegetation near the area, which would be important habitat for the larval and young-of-the-year fish. Existing impairments to the aquatic ecosystem including habitat degradation, establishment of TMDLs, or the resulting fish advisories are unrelated to Callaway Plant activities. In MDNR's 2006 Water Quality Report, the Missouri River (where the primary county is Callaway) was declared among potentially impaired classified waters due to habitat degradation. According to this classification, there is some indication that an impairment to some designated use may exist, but the current data or information indicating the impairment do not meet the data requirements set out by Missouri's Section 303(d) Listing Methodology. MDNR will conduct further monitoring on the potentially impaired classified waters in order to determine whether or not these impairments actually exist (MDNR, 2006).

Domestic users of groundwater, except for private well users, need to meet the State water quality standards for potable water systems. There are no water withdrawals from the Missouri River for domestic use within 25 miles upstream or 50 miles downstream of the Callaway Plant.

4.2.2.14 References

MDNR, 2006. Missouri Water Quality Report (Section 305(b) Report), Missouri Department of Natural Resources, Water Protection Program, Published in April 1, 2007.

MDNR, 2007. State of Missouri, Department of Natural Resources, Missouri Clean Water Commission, Missouri Land Disturbance General Permit MO-R101000.

Table 4.2-1—Estimated Amounts of Potable Water by Construction Year Needed for Callaway Plant Unit 2

Construction Year	1	2	3	4	5	6
People	8,550,000[a] gal (32,365,000 L)	25,650,000[b] gal (97,096,000 L)	25,650,000[b] gal (97,096,000 L)	25,650,000[b] gal (97,096,000 L)	25,650,000[b] gal (97,096,000 L)	
Concrete Mixing and Curing[c]	2,219,844 gal (8,403,000 L)	2,219,844 gal (8,403,000 L)	2,219,844 gal (8,403,000 L)	2,219,844 gal (8,403,000 L)	2,219,844 gal (8,403,000 L)	
Dust Control[d]	11,400,000 gal (43,154,000 L)	11,400,000 gal (43,154,000 L)	11,400,000 gal (43,154,000 L)	11,400,000 gal (43,154,000 L)	11,400,000 gal (43,154,000 L)	
Subtotal	22,169,844 gal (83,922,000 L)	39,269,844 gal (148,650,000 L)	39,269,844 gal (148,650,000 L)	39,269,844 gal (148,650,000 L)	39,269,844 gal (148,650,000 L)	26,179,896[e] gal (99,102,000 L)

Notes:

Water for construction would come from the existing onsite groundwater production wells, Well#1, #2 and #3 (DGLS#027975, 028076 and 028347, respectively).

(a) Estimated at 1,000 persons using 30 gal (113.6 L) per day for 285 days per year.
(b) Estimated at 3,000 persons using 30 gal (113.6 L) per day for 285 days per year.
(c) Estimated at 6,700 cubic yards (5,122.5 m3) per month using 27.61 gal (104.5 L) per cubic yard and 12 months per year.
(d) Estimated at 40,000 gal (151,400 L) per day for 285 days per year.
(e) Estimated at two-thirds of the amount used in any year 2 through 5.

4.3 ECOLOGICAL IMPACT

4.3.1 TERRESTRIAL ECOSYSTEMS

This section describes the impacts of construction on the terrestrial ecosystem. The anticipated construction schedule is discussed in Section 1.2.7. Construction would require the permanent or temporary disturbance of more than 600 acres (243 hectares) on the AmerenUE property as presented in Figure 4.3-1 through Figure 4.3-3. This area is assumed to be the maximum area of disturbed soil to be exposed at any time. Approximately 435 acres (176 hectares) of the affected terrestrial habitat (does not include Impervious, High Intensity Urban, or Low Intensity Urban cover types from Figure 4.3-4 through Figure 4.3-6) would be permanently converted to structures, pavement, or other intensively-maintained exterior grounds to accommodate the proposed power block, cooling tower, roadways, permanent construction lay-down area, borrow area, retention basins, permanent parking lots, collector wells, and transmission line facilities. Approximately 119.5 acres (48.4 hectares) of the permanent impacts will occur within developed areas of the AmerenUE property and thus will not affect natural terrestrial ecosystems.

In accordance with Figure 4.3-4 through Figure 4.3-6 a total of 55.5 acres (22.5 hectares) of impacts are considered temporary. Approximately 14 acres (6 hectares) of impacts will be considered temporary impacts associated with material storage and concrete batch plant. This area is already located within developed areas of the AmerenUE property and thus would not affect natural communities at the site. An additional 41.5 acres (16.8 hectares) of impacts will be considered temporary impacts associated with construction of the new overhead transmission line facility. Approximately 16 acres (6.5 hectares) of the temporary impacts will occur within developed areas of the site and will not affect natural terrestrial ecosystems. Impacts to terrestrial ecosystems and wetlands are summarized in Figure 4.3-4 through Figure 4.3-6 and Figure 4.3-4 through Figure 4.3-6, respectively.

The construction footprint was designed to minimize impacts to terrestrial and wetland ecosystems and any important species as identified in Section 2.4.1.2. The Unit 2 construction zone at the AmerenUE property was specifically designed to balance the need for efficient construction operations with the need to minimize impacts to terrestrial ecosystems, especially the large tracts of deciduous forest to the south of the plant.

It is not possible to construct the facilities without impacting terrestrial ecosystems, including wetlands. Construction activities will commence after the appropriate permits are acquired to start clearing and grading of the site. Construction is expected to be complete by 2017. The general schedule of construction activities is discussed in Section 1.2.7.

4.3.1.1 Vegetation

Impacts to site vegetation and vegetative communities are anticipated as a result of site clearing, grading and construction. Trees within the construction zone will be felled, stumps, shrubs, and saplings would be grubbed, and the groundcover and leaf litter would then be cleared to prepare the land surface for grading, as needed. Felled trees, stumps, and other woody material would be disposed of by burning, chipping (and spreading the chips), and/or disposal off site. Opportunities to recycle woody material for use elsewhere on the AmerenUE property will be considered. Recycling opportunities could include firewood, using wood chips for mulch or sediment/erosion control, and piling logs and brush in open fields to provide additional wildlife cover and habitat.

Clearing of forested wetlands for construction of the overhead transmission line will consist of cutting trees off at ground level followed by spot application of herbicide to the trunk as

needed. Although transmission line support towers have not yet been located, they will be strategically sited in order to avoid impacts to wetlands as much as possible. Clearing of forested wetlands within the transmission line corridor will not include grubbing or grading in order to minimize impacts. As such, wetland types within the transmission line corridor may be converted from forested to emergent but the wetlands themselves will remain.

Erosion control devices will be installed around the perimeter of the construction footprint to reduce the potential for sediment mobilization and transport into surrounding wetlands, ponds and streams. Detailed specifications for the erosion control and soil conservation measures will be presented in a soil erosion and sediment control plan which will be written in association with the site-specific construction plans. Monitoring of stormwater effluents during construction will be performed in accordance with the Land Disturbance Permit, NPDES Permit, and other applicable permits obtained for construction.

Construction activities would result in impacts to terrestrial habitat as presented in Figure 4.3-1 through Figure 4.3-3 and summarized in Figure 4.3-4 through Figure 4.3-6. Both permanent and potentially permanent impacts are presented in Figure 4.3-1 through Figure 4.3-3. Permanent impacts include those areas that will be converted to infrastructure associated with the Callaway Plant Unit 2 project whereas potentially permanent impacts include a larger footprint of impact in case additional development is desired or needed. Impacts to terrestrial vegetation include:

Cropland – Croplands occupy 1,220 acres (494 hectares) of the AmerenUE property and 11,370 acres (4,601 hectares) of the ecological study area. Approximately 114 acres (46.1 hectares) will be impacted within the Callaway Plant Unit 2 construction zone and an additional 76 acres (30.8 hectares) will be impacted within the collector well area for a total of 190 acres (76.9 hectares) of permanent impacts to cropland. An additional 38 acres (15.4 hectares) of site cropland will be traversed by the Callaway Plant Unit 2 transmission line. The transmission line will consist of overhead lines and thus only small portions, if any, of the 38 acres (15.4 hectares) will actually be impacted by installation of the support towers. Row crops will still be planted and harvested underneath the overhead transmission line, a practice that is in current use under the existing transmission lines around the site. As such, impacts to cropland as a result of transmission line construction are considered temporary. A total of 228 acres (92.3 hectares) or nearly 19% of the site's cropland will be either temporarily or permanently impacted. Cropland is a very common cover type within both the site and ecological study area and ample cropland will remain after construction.

Grassland – Grasslands occupy approximately 415 acres (168 hectares) of the AmerenUE property and 12,025 acres (4,866 hectares) of the ecological study area. Approximately 11 acres (4.5 hectares) of grassland will be impacted within the Callaway Plant Unit 2 construction zone and an additional 15 acres (6.1 hectares) of grassland will be impacted within the collector well area for a total of 26 acres (10.5 hectares) of permanent impacts to grassland. An additional 1.5 acres (0.6 hectare) of grassland may be affected within the Callaway Plant Unit 2 overhead transmission line and are thus considered temporary impacts. Altogether 27.5 acres (11.1 hectares) or nearly 7% of the site's grassland will be either temporarily or permanently impacted. Impacts to grassland within the Callaway Plant Unit 2 construction zone consist of small patches of mostly non-native cool season grassland and are not associated with the large tracts of native warm season grassland to the east of the plant. These impacts will be permanent conversions to industrial facilities and thus will not be restored after construction. Grassland within the transmission line corridor consists of a mixture of native and non-native species and is more representative of low-quality old field than high-quality native warm season grasslands.

Deciduous Forest –Deciduous Forest at the site consists primarily of upland deciduous oak-hickory forest as described in Section 2.4.1.1. This cover type occupies 3,542 acres (1,433 hectares) of the AmerenUE property and 36,934 acres (14,947 hectares) of the ecological study area and was the most common cover type identified. In total, 78.1 acres (31.6 hectares) or 2% of on-site deciduous forest will be cleared as a result of project activities. Approximately 43 acres (17.4 hectares) of deciduous forest will be impacted within the Callaway Plant Unit 2 construction zone and permanently converted to industrial facilities associated with Callaway Plant Unit 2. The vast majority of these impacts will occur within the small patches of deciduous forest immediately surrounding the existing Callaway Plant Unit 1. Approximately 1.1 acres (0.5 hectares) of deciduous forest will be permanently converted to infrastructure associated with the development of the collector wells and an additional 34 acres (13.8 hectares) of deciduous forest will be cleared for installation of the Callaway Plant Unit 2 transmission line. Areas affected by transmission line construction however, will be restored and maintained to other non-forested cover types and will therefore provide post-construction habitat functions. The transmission line to be cleared will be approximately 150 ft (45.7 m) in width and will parallel the existing transmission line corridor.

Evergreen Forest –This cover type occupies 13.5 acres (5.5 hectares) of the AmerenUE property and 2,027 acres (820 hectares) of the ecological study area. On site this vegetative cover type exists solely in the form of a pine plantation located adjacent to and northwest of the restricted access portion of the AmerenUE property. It was intentionally planted in the 1930s with red pine (Pinus resinosa) and eastern white pine (Pinus strobus) and is described in Section 2.4.1.1. The entire 13.5-acre (33.4 hectare) pine plantation will be removed and converted permanently to industrial facilities associated with Callaway Plant Unit 2. Since there are no pine trees native to Callaway County, the pine plantation is a man-made vegetative community. The 13.5-acre (33.4 hectare) impact to the pine plantation will be considered a permanent impact.

Deciduous Woody/Herbaceous – The Deciduous Woody/Herbaceous cover type consists of open woodland, including early successional forest, with less than 60% cover of deciduous trees and occupies 1,230 acres (498 hectares) of the AmerenUE property and 1,084 (439 hectares) acres of the ecological study area. Approximately 28 acres (11.3 hectares) of this cover type will be permanently impacted within the Callaway Plant Unit 2 construction zone, 1.0 acre (0.4 hectare) will be permanently impacted in the collector well area, and an additional 27 acres (10.9 hectares) will be cleared and maintained for installation of the Unit 2 transmission line. The transmission line to be cleared will be approximately 150 ft (45.7 m) in width and will parallel the existing transmission line corridor. In total, 56 acres (22.7 hectares) or almost 5% of the site's deciduous woody/herbaceous cover type will be cleared during construction of Callaway Plant Unit 2 and associated transmission line.

Evergreen Woody/Herbaceous – The Evergreen Woody/Herbaceous cover type consists of open woodland, including early successional forest, with less than 60% cover of evergreen trees and occupies 340 acres (138 hectares) of the AmerenUE property. There are no areas mapped as Evergreen Woody/Herbaceous within the ecological study area. At the site this land cover type consists primarily of eastern red cedar thickets that have invaded forest openings, pasture and old field habitat. Approximately 42 acres (17 hectares) of this vegetative community will be permanently impacted within the Callaway Plant Unit 2 construction zone and an additional 1 acre (0.4 hectare) will be cleared for installation of the Callaway Plant Unit 2 transmission line and maintained as a non-forested herbaceous cover type. In total, 43 acres (17.4 hectares) or nearly 13% of the evergreen woody/herbaceous cover type on site will be cleared during construction of Callaway Plant Unit 2 and associated transmission line.

Woody-Dominated Wetland – The Woody-Dominated Wetland cover type consists of forests with greater than 60% cover of trees with semi-permanent or permanent flood waters and occupies 166 acres (67 ha) of the AmerenUE property and 2,108 acres (853 hectares) of the ecological study area. At the AmerenUE property this land cover type includes both floodplain forests and true jurisdictional forested wetlands as defined in the 1987 Corps of Engineers Wetlands Delineation Manual. Approximately 8.5 acres (3.4 hectares) of this vegetative cover type will be cleared and permanently maintained for installation of the Callaway Plant Unit 2 transmission line and an additional 16.6 acres (6.7 hectares) will be permanently converted to infrastructure associated with collector well construction. Impacts within the Callaway Plant Unit 2 construction zone are not anticipated. Altogether, approximately 25.1 acres (10.2 hectares) or 15% of the woody-dominated wetland cover type on site will be permanently impacted. Impacts to jurisdictional wetlands are discussed in Section 4.3.1.3.

Herbaceous-Dominated Wetland - The Herbaceous-Dominated Wetland cover type consists of woody shrub land with less than 60% cover of trees with semi-permanent or permanent flood waters and occupies over 24 acres (9.7 hectares) of the AmerenUE property and 154 acres (62 hectares) of the ecological study area. At the AmerenUE property this cover type includes portions of the four settling ponds south of the existing Callaway Plant Unit 1 facilities as well as the emergent- and shrub-dominated wetlands delineated on site and on the fringe of the stormwater runoff ponds. Approximately 2 acres (0.8 hectares) of this cover type will be impacted within the Callaway Plant Unit 2 construction zone, 0.5 acres (0.2 hectares) will be impacted within the collector well area, and an additional 0.6 acres (0.2 hectares) will be cleared for installation of the Callaway Plant Unit 2 transmission line. In total, 3.1 acres (1.3 hectares), or 13% of the herbaceous-dominated wetland cover type on the AmerenUE property will be impacted. Impacts to jurisdictional wetlands are discussed in Section 4.3.1.3.

Limestone Glade – In accordance with Section 2.4.1.2.5, two terrestrial habitat types have been identified as important habitats at the AmerenUE property: limestone glade and USACE jurisdictional wetlands (see Figure 2.4-4). Impacts to jurisdictional wetlands are discussed in Section 4.3.1.3. Limestone glades occupy approximately 4 acres (1.6 hectares) of the AmerenUE property and are situated on narrow midslope bands on southwest-facing slopes within openings of upland deciduous oak-hickory forest. These glades are located more than one mile (1.6 km) south of the Unit 2 construction zone and are approximately 0.5 miles (0.8 km) east of Callaway Plant Unit 2 transmission line corridor. As such, no impacts to limestone glades are anticipated. In addition, there will be no impacts to glades within the ecological study area including the glade complex recently purchased by the MDC to the west of the plant.

Important Plant Species – There were no important plant species identified in Section 2.4 thus impacts to important plant species are not anticipated.

Summary of Impacts to Site Vegetation – The overall impact to site vegetation as a result of Callaway Plant Unit 2 construction activities is anticipated to be small due to the fact that there are no important plant species identified and because of the relatively low percentage of impacts to the various plant communities on site as shown in Figure 4.3-4 through Figure 4.3-6. Although 100% of the site's evergreen forest will be removed, this plant community is relatively small (13.5 acres or 5.5 hectares) and consists of pine species that are not native to either Callaway County or the state. In terms of impact area, cropland is the community with the greatest impact at 228 acres (92.3 hectares) but this plant community, consisting primarily of row crop monocultures, will remain plentiful after construction. Impacts to grasslands are located primarily within plant communities consisting of non-native cool-season grasses whereas the higher quality native warm-season grasslands located to the east of the plant will not be impacted.

4.3.1.2 Fauna

Impacts to terrestrial vegetation, as discussed above, will manifest as a reduction in available habitat for mammals, birds and other fauna that inhabit the AmerenUE property. Some smaller, less mobile fauna such as small rodents, frogs, and box turtles could be killed by heavy equipment used in clearing, grubbing and site grading. Larger, more mobile fauna will be displaced to adjoining terrestrial habitats. These adjoining habitats may therefore experience temporary increases in population density which could potentially result in localized competition for shared resources. Potential impacts to specific faunal species identified as important species in Section 2.4.1are discussed below.

White-Tail Deer: White-tail deer are considered an important species due to their game species status and recreational value to hunters. This important species is abundant throughout the site and ecological study area. Impacts occur within a variety of vegetative cover types as discussed in Section 4.3.1.1 at the AmerenUE property. However, a portion of the area to be impacted is located near the existing facility where buildings, pavement, and the noise of operations provide unsuitable wildlife habitat. Construction activities may also increase the potential for additional white-tail deer mortality due to vehicle collisions related to displacement. Due to the long-term habitat loss across a wide variety of habitat cover types and because of the potential for short-term displacement effects, construction-related impacts to the white-tailed deer are anticipated to be MODERATE.

Gray Bat: The gray bat is considered an important species at the AmerenUE property because it is listed as an endangered species by both the State of Missouri and the U.S. Fish and Wildlife Service (USFWS). This is the only species of bat in Missouri that lives in caves throughout the entire year. Winter hibernation caves typically have vertical openings creating lower temperatures necessary for slowing their metabolism during hibernation. In spring, female gray bats move to warmer maternity caves (MDC, 2000). Although gray bats were not observed in any of the 2007 field surveys, they have been observed historically in a cave along Auxvasse Creek which is approximately 3 miles (4.8 km) west of the Callaway Plant Unit 2 construction zone. Since there are no known caves located within the AmerenUE property and certainly none exist within the Callaway Plant Unit 2 construction zone, project-related impacts to potential maternity, bachelor or hibernation caves (hibernacula) are not anticipated.

Gray bats forage up to 12 miles (20.0 km) from their summer roosts and feed on aquatic and terrestrial flying insects generally over water or in adjacent riparian vegetation (MDC, 2008a). Foraging habitat for the gray bat is assumed to include riparian areas along Auxvasse Creek, Logan Creek, Mud Creek, Molly Dozier Chute, and the Missouri River. Appropriate best management practices (BMPs) will be implemented in accordance with Section 4.2 of this document in order to minimize construction-related impacts to gray bat foraging habitat. There are no plans to remove trees within the riparian zones of any of the above named streams except for small isolated areas where the 150 ft (46 meter) wide transmission line corridor crosses Logan Creek, the Mollie Dozier Chute and the Missouri River and in isolated areas where the new collector well system will be installed near the Missouri River. Measures that are beneficial in preserving foraging habitat for gray bat include avoidance of impacts to aquatic ecosystems, maintenance of buffer zones, and avoidance of pesticide application in riparian buffers and aquatic environments (MDC, 2008a). Ample undisturbed riparian habitat will remain within the large foraging range of the gray bat after project completion. Furthermore, herbicide use will be minimized in potential foraging areas and will be restricted to the 150 ft (45.7 meter) width of riparian zone at Logan Creek, Mollie Dozier Chute, and Missouri River that will be cleared for the new transmission line. Additionally, pesticides will not be used in these areas. Avoidance of impacts to aquatic ecosystems and minimization of

impacts to riparian zones will ensure that the proposed project will not adversely affect foraging habitat for the gray bat.

Due to the limited tree-clearing zone along the Missouri River and Mollie Dozier Chute, and because there are no anticipated impacts to the hibernacula along Auxvasse Creek, construction-related impacts to the gray bat are anticipated to be SMALL.

Indiana Bat: The Indiana bat is considered an important species at the AmerenUE property because it is listed as an endangered species by both the State of Missouri and the USFWS. Although Indiana bats were not observed during any of the 2007 field surveys, they are known to hibernate in the caves of the Ozarks and Ozark Border Natural Divisions of Missouri and thus could potentially exist within the AmerenUE property or ecological study area. Caves and karst habitat are used for winter hibernation sites, or hibernacula. Because there are no known caves located within the AmerenUE property, and certainly none exist within the Callaway Plant Unit 2 construction zone, project-related impacts to Indiana bat hibernacula are not anticipated.

Studies have shown that Indiana bats prefer riparian forested habitat for maternity roosts; however, they may also use upland forest habitat (MDC, 2008b). Foraging habitat for the Indiana bat is assumed to include riparian areas along Auxvasse Creek, Logan Creek, Mud Creek, Molly Dozier Chute, and the Missouri River. Appropriate BMPs will be implemented in order to minimize construction-related impacts to roosting and foraging habitat. There are no plans to remove trees within the riparian zones of any of the above named streams except for small isolated areas where the 150 ft (45.7 m) wide transmission line corridor crosses Logan Creek, the Mollie Dozier Chute and the Missouri River. Measures that are beneficial in preserving roosting and foraging habitat for Indiana bat include avoidance of impacts to riparian zones and preservation of shagbark hickory trees and other potential tree cavity roost sites (MDC, 2008b).

Construction activities associated with the proposed project will minimize alteration of upland habitats and riparian zones potentially used by Indiana bat for foraging. Due to the limited tree-clearing zone along the Missouri River and Mollie Dozier Chute thus minimizing effects to foraging habitat, and because there are no known hibernacula on site, construction-related impacts to the Indiana bat are anticipated to be SMALL.

Bald Eagle: Due to its successful recovery the bald eagle has been de-listed and is no longer a federally listed species by the USFWS. It is still protected, however, under the federal Bald Eagle Protection Act and the bald eagle is listed as endangered in the State of Missouri. Bald eagles have been observed at the AmerenUE property and are thus considered an important species. Although bald eagles were observed foraging in the riparian zone and floodplain of the Missouri River, there are no known bald eagle nests at the AmerenUE property. Should active nests be discovered, the Missouri Department of Conservation would be consulted and construction activities would cease within 1,500 meters of the active nests from January 1 st through July 15th in accordance with MDC recommendations (MDC, 2008c).

The AmerenUE property project is not expected to significantly impact any bald eagle roosting habitat which typically includes tall, mature trees within the floodplains and riparian zones of large rivers like the Missouri. Construction activities planned for the Missouri River floodplain include the 150 ft (45.7 m) wide transmission line corridor (adjacent to the existing transmission line) and installation of facilities associated with the new collector well system. Since the vast majority of the Missouri River floodplain in this area is agricultural, only a small amount of tree clearing will be required along the banks of the Mollie Dozier Chute and the Missouri River. Additionally, there is ample roost habitat upstream and downstream of the

project site on the Missouri River. Wintering eagles typically use a wide variety of habitat, display variable behavior, and are less faithful than nesting eagles in their use of particular roost sites (USFWS, 1983).

Due to the limited clearing of potential roost trees along the Missouri River and Mollie Dozier Chute, construction-related impacts to the bald eagle are anticipated to be SMALL. Ample roost habitat will remain after project completion.

Northern Harrier: Although the northern harrier is not a federally listed species, it is considered an important species because it is state listed in Missouri as an endangered breeding species. Their preferred habitat includes pastures, prairies, open fields, grasslands, marsh, and shrubby areas. Two northern harriers were observed within cropland in the Missouri River floodplain during the 2007 bird surveys at the AmerenUE property. Although northern harriers were observed foraging at the site, there are no known nesting sites.

Measures that are beneficial in preserving nesting and foraging habitat for northern harrier include maintenance of prairie, grassland and cropland habitats for nesting, avoidance of mowing prior to August 1, and avoidance of application of insecticides and rodenticides in nesting habitats (MDC, 2008d).

Most of the construction associated with the Callaway Plant Unit 2 project is located adjacent to the existing plant where periodic mowing and other plant activities do not provide ideal habitat for northern harriers. Although construction within the Missouri River floodplain will convert some forested land into maintained transmission line and collector well facilities, forest cover is not the preferred habitat for the northern harrier. Pasture and native grasslands to the east of the existing plant site will not be impacted by project-related construction activities. Furthermore, ample cropland will remain within the Missouri River floodplain after project completion. Because foraging and potential nesting habitats will not be significantly altered, construction-related impacts to the northern harrier are anticipated to be SMALL.

Northern Bobwhite Quail: Due to its game bird status, the northern bobwhite quail is considered an important species at the AmerenUE property. Preferred habitat includes tall grasslands, brushland, agricultural fields, and open woodlands. Construction impacts also include the conversion of 34 acres (13.8 hectares) of upland deciduous forest to grassland or old field habitat for installation of the new transmission line which could actually benefit bobwhites in the long term. Although construction activities will result in some permanent impacts to bobwhite habitat, their high reproductive rate (MDC, 2007e) coupled with the exploitation of newly available habitat associated with the conversion of forested habitats to old field habitats along the new transmission line corridor will provide some off-set of effects. Furthermore, there is ample preferred habitat, such as the native warm season grasslands to the east of the plant where there will be no impacts. Construction-related impacts to the northern bobwhite quail and its preferred habitat are therefore, anticipated to be SMALL.

Wild Turkey: Wild turkey is considered an important species due to its status as a game bird. Winter turkey habitat includes upland forests with acorns and other hard mast whereas summer/fall habitat usually consists of mowed hay fields, grazed pasture, grasslands, glades, or open woods. A portion of the construction area will be located near the existing facility where existing buildings, pavement, and the noise of operations do not provide ideal wildlife habitat. Wild turkeys are abundant within the AmerenUE property and were observed frequently during the 2007 bird surveys. Due to the long-term habitat loss across a variety of habitat cover types and the potential for short-term displacement effects, construction-related impacts to the wild turkey are anticipated to be MODERATE.

Mourning Dove: The mourning dove is a common game bird frequently observed at the AmerenUE property and is therefore considered an important species. This species utilizes a wide variety of habitat types for nesting, roosting, and foraging including grassland, cropland, and woodland. Ample mourning dove habitat should remain at the AmerenUE property after construction of Callaway Plant Unit 2. Mourning doves have been very successful at adapting to and prospering from human influence. The changes in land use that came with white man's arrival in North America actually increased the abundance of mourning doves. Agricultural practices such as crop farming, livestock grazing, forest clearing, burning and the introduction of exotic seed-bearing plants have been beneficial to dove populations (MDC, 2007f).

Due to the long-term habitat loss across a variety of habitat cover types and the potential for short-term displacement effects, construction-related impacts to the mourning dove are anticipated to be MODERATE.

4.3.1.3 Wetlands

The construction footprint for the proposed Callaway Plant Unit 2 facilities, including the new transmission line and the new collector wells, has been designed to minimize encroachment into areas delineated as waters of the U.S., including wetlands. Construction of the proposed facilities would not be possible, however, without permanently filling approximately 6,938 linear feet (2,115 m) of intermittent streams and approximately 10.04 acres (4.1 hectares) of wetlands and ponds. Impacts to intermittent streams are discussed in Section 4.3.2.1. Approximately 9.11 acres (3.7 hectares) of wetlands and ponds are considered jurisdictional waters of the U.S. (Figure 4.3-4 through Figure 4.3-6). This area of impact represents approximately 4.6% of the total of site intermittent streams (based on USGS mapping) and 4.7% of site wetlands and ponds (based on NWI mapping) available on the AmerenUE property. The project would therefore require an individual permit under Section 404 of the Clean Water Act from the Kansas City District of the U.S. Army Corps of Engineers (USACE). The project would not qualify for a nationwide permit because of the extent of the project and associated impacts to jurisdictional waters of the U.S. The project would also require a Section 401 water quality certification from the Missouri Department of Natural Resources.

Most of the impacts to jurisdictional wetlands occur within the Callaway Plant Unit 2 construction zone and the collector well system on the Missouri River floodplain. Because the proposed transmission line will consist of overhead facilities, most of the wetlands and streams located within the transmission line corridor will be avoided. Impacts to jurisdictional streams are described in Section 4.3.2.1. Wetland impacts are described below and are presented in Figure 4.3-4 through Figure 4.3-6.

Callaway Plant Unit 2 – The Callaway Plant Unit 2 construction zone is the area contiguous with Callaway Plant Unit 1 wherein Callaway Plant Unit 2 facilities – power block, switchyard, cooling towers, lay-down areas, parking areas, access roads, construction landfill, stormwater ponds, and borrow area – will be located. Both permanent and potentially permanent impacts are presented in Figure 4.3-1 through Figure 4.3-3. Permanent impacts include those areas that will be converted to infrastructure associated with the Callaway Plant Unit 2 project whereas potentially permanent impacts include a larger footprint of impact in case additional development is desired or needed. Permanent impacts within this assessment area include seven (7) non-jurisdictional isolated wetlands, one jurisdictional wetland (C4-WT-01), and one jurisdictional stormwater runoff pond (P-4).

The seven isolated wetlands are small and represent a total of 0.93 acres (0.4 hectares) of impacts. Because these wetlands are not connected via a significant nexus to the traditionally navigable waters of the Missouri River, they are not considered jurisdictional waters of the U.S.

and would not be regulated by the USACE. These isolated wetlands are classified by Cowardin et al. (1979) as palustrine unconsolidated bottom (PUB) wetlands. Most were constructed as small farm ponds and some have developed a fringe community of wetland vegetation as described in Section 2.4.2.1.1.4. These PUB wetlands are small vernal pools that do not support fish but do provide valuable breeding habitat for salamander, frog and toad species. Isolated ponds are scattered all over the AmerenUE property and ecological study area and these resources will remain abundant after construction.

Eight ponds, designated as P-1 through P-8 in Figure 4.3-4 through Figure 4.3-6, surround Callaway Plant Unit 1 and were constructed on the small unnamed drainages radiating away from the plant. Most of the stormwater runoff ponds were constructed as impoundments or catch basins during construction of Callaway Plant Unit 1. Pond P-1 does not have an organized surface water connection to other jurisdictional waters and is thus not considered a jurisdictional water of the U.S. The remaining Ponds (P-2 through P-8) do have a significant nexus with the traditionally navigable waters of the Missouri River and are thus within the jurisdiction of the USACE. Some of the stormwater runoff ponds have developed an emergent (PEM) or scrub-shrub (PSS) wetland fringe as described in Section 2.4.2.1.1.4. Because they are located in the headwaters of the various stream systems in the area, the settling ponds have played a valuable role in controlling runoff and retaining sediment.

It is anticipated that the entire 4.3 acres (1.7 hectares) of stormwater runoff pond P-4 will be drained and filled as a result of Callaway Plant Unit 2 construction activities. P-4 is a jurisdictional water of the U.S. and thus would be regulated by the USACE but this pond is not managed by MDC and is not open to the public for fishing. MDC actively manages P-1, P-2, P-7, and P-8 which will not be impacted by the project and will remain open to the public for fishing.

Wetland C4-WT-01 is a small 0.4-acre (0.2 hectare) jurisdictional emergent wetland that is hydraulically connected to stormwater runoff pond P-5 by a culvert pipe under the gravel road that separates the two resources. Because this wetland has a significant nexus to the traditionally navigable waters of the Missouri River it is under the jurisdiction of the USACE. This wetland is located within the potentially permanent impact area (Figure 4.3-4 through Figure 4.3-6) but permanent impacts to wetland C4-WT-01 is not anticipated as noted in Figure 4.3-4 through Figure 4.3-6.

Altogether, approximately 4.3 acres (1.7 hectares) of jurisdictional wetlands and 0.93 acres (0.4 hectares) of non-jurisdictional wetlands will be permanently impacted within the Callaway Plant Unit 2 wetland assessment area. Wetland impacts are provided in Figure 4.3-4 through Figure 4.3-6.

Secondary wetland impacts as a result of Callaway Plant Unit 2 construction activities may include sedimentation as a result of soil erosion, sediment mobilization and surface water runoff. Such secondary impacts will be minimized by implementing best management practices in accordance with Section 4.2 of this document, such as seeding, mulching, erosion control blankets, and silt fences. Measures used to minimize secondary impacts to wetlands are described in Section 4.3.1.6.

Transmission Line – One new overhead transmission line will be constructed in conjunction with the Callaway Plant Unit 2 project. This new facility will be approximately 6.7 miles (10.8 km) in length and constructed in a corridor 150 ft (45.7 m) in width, and will be located immediately adjacent to (and on the west side of) the existing transmission line which extends southward out of the plant and crosses the Missouri River (Figure 4.3-4 through Figure 4.3-6).

The new transmission line will terminate at the tie-in point with the Loose Creek transmission line in Osage County.

Six wetlands (H5-WT-01, H5-WT-02, H5-WT-03, I6-WT-01, J7-WT-01, and J7-WT-02) will be traversed by the new overhead transmission line proposed for Callaway Plant Unit 2 at the AmerenUE property (Figure 4.3-4 through Figure 4.3-6). Three of these wetlands are located within the Logan Creek floodplain and three are located within the Missouri River floodplain. Because they have a significant nexus with the traditionally navigable waters of the Missouri River, all six wetlands are under the jurisdictional authority of the USACE.

Although the locations of the support towers for the overhead transmission line have not yet been established, their locations will be designed to avoid and minimize impacts to wetlands within the transmission line corridor. Some trees may need to be cut off at ground level in order to clear the transmission line corridor but the root balls will not be grubbed out. As such, there may be a conversion of wetland types at H5-WT-01, H5-WT-02, H5-WT-03, I6-WT-01, and J7-WT-01 from forested to scrub shrub or emergent cover types but the wetlands themselves will remain.

The only wetland that may be impacted by construction of the transmission line is J7-WT-02 which is located on the south or right descending bank of the Missouri River. A support tower for the existing transmission line is located adjacent to this wetland and is built on fill. It is assumed that the support tower for the new transmission line will be built within this wetland and that approximately 1.2 acres (0.5 hectares) would be filled to create a stable foundation for tower construction. The corresponding transmission line tower on the north or left descending bank of the Missouri River in Callaway County will be located on the landward side of the levee in an agriculture field and therefore will not impact wetlands.

Altogether, approximately 1.2 acres (0.5 hectares) of jurisdictional wetlands will be permanently impacted within the transmission line wetland assessment area. Wetland impacts are provided in Figure 4.3-4 through Figure 4.3-6.

Secondary wetland impacts as a result of transmission line construction activities may include sedimentation as a result of soil erosion, sediment mobilization and surface water runoff. Secondary impacts will be minimized by implementing best management practices in accordance with Section 4.2 of this document, such as seeding, mulching, and the use of erosion control blankets and silt fences. Measures used to minimize secondary impacts to wetlands are described in Section 4.3.1.6.

Collector Wells

Project impacts to waters of the U.S. associated with collector well construction will primarily be associated with fill placed within wetlands during construction of the new collector well supply structures and associated access road.

Careful siting of the collector wells balanced the need for proximity to the Missouri River with avoidance and/or minimization of impacts to jurisdictional waters of the U.S. including the Missouri River and adjacent wetlands. Best management practices such as silt fence will be used to protect the Missouri River and control sediment runoff from construction activities. Because of the use of best management practices, impacts to the Missouri River are not anticipated. The narrow wetland complex adjacent to the collector wells will be protected with similar best management practices to avoid impacts. Best management practices are described in Section 4.2.

One of the three collector wells will be sited on the land side of the levee due to inadequate room between the levee and river to accommodate construction. At this collector well, the levee itself will act as a sediment control barrier between the construction site and the river.

The pipeline will be installed using traditional trenching methods except for the crossing of Highway 94 and Logan Creek. Directional boring techniques are anticipated to be used to install the pipe in these locations in order to avoid impacts to Logan Creek.

The access road will cross the Mollie Dozier Chute using culverts and then will traverse to the west of the large wetland complex (H6-WT-02) just north of the chute in order to minimize impacts to this jurisdictional water of the U.S. Approximately 2.9 acres (1.2 hectares) of wetland impacts will be incurred at the Mollie Dozier Chute (wetland I6-WT-01) as a result of culvert installation. Construction of the access road will also require the 0.04 acres (0.01 hectares) of impact at wetland H6-WT-02 and 0.6 acres (0.2 hectares) of impact at 6-WT-01, a degraded farmed wetland. In addition, construction of one of the three collector wells will require approximately 0.07 acres (0.03 hectares) of impact at wetland J6-WT-01. Refer to Figure 4.3-6) for the location of wetland impacts in the collector well area.

Altogether approximately 3.61 acres (1.5 hectares) of wetlands will be impacted by construction of the collector wells and associated intake line and access road.

Summary of Impacts to Wetlands – Construction of Unit 2 facilities, including the new transmission line and collector well system, is anticipated to incur 0.93 acres (0.4 hectares) of non-jurisdictional wetland impacts and 9.11 acres (3.7 hectares) of impacts to wetlands under the jurisdiction of the USACE for a total of 10.04 acres (4.1 hectares) of impacts. These impacts are moderately sized for a project of this magnitude and the project will require an individual permit from the USACE. As such, the overall construction-related impacts to wetlands at the AmerenUE property are anticipated to be MODERATE.

4.3.1.4 Other Projects within the Area with Potential Impacts

Callaway County is a rural county in central Missouri and there are no other known large construction projects within the area that would manifest additional impacts to terrestrial and wetland ecosystems.

4.3.1.5 Consultation

Affected Federal, State and Regional agencies will be contacted regarding the potential impacts to the terrestrial ecosystems resulting from plant construction. The Missouri Natural Heritage Program, operated by the Missouri Department of Conservation (MDC), was consulted for information on known occurrences of State-listed threatened, endangered, or special status species and habitat (Cave, 2007). The U.S. Fish and Wildlife Service (USFWS) was consulted via letter dated October 9, 2007 to which the USFWS replied on October 18, 2007 (Scott, 2007). Important species are identified in Section 2.4.1.2 (Terrestrial) and Section 2.4.2.2 (Aquatic) and impacts are discussed herein.

As project designs are finalized, the U.S. Army Corps of Engineers (USACE) will be consulted regarding the potential impacts to jurisdictional waters of the U.S., including wetlands and streams. The project will likely require an individual Clean Water Act Section 404 permit from the Kansas City District of the USACE and will also require a Section 401 water quality certification from the Missouri Department of Natural Resources.

4.3.1.6 Mitigation Measures

Opportunities for mitigating unavoidable impacts to terrestrial and wetland ecosystems involve restoration of natural habitats temporarily disturbed by construction, creation of new habitat types in formerly disturbed areas, as well as enhancement of undisturbed natural habitats. Mitigation plans will be developed in consultation with the applicable Federal, State and local resource agencies and will be implemented on the AmerenUE property site to the extent practicable. The description of mitigation measures is addressed below for upland areas (flora and fauna) and wetland areas.

Flora and Fauna: Mitigation of temporary and permanent impacts to upland areas (Figure 4.3-4 through Figure 4.3-6) may consist of reforestation as well as the planting of other habitat types such as native grassland and scrub shrub communities. Additional MDC wildlife management practices within the Reform Conservation Area may also be considered to enhance wildlife habitats. Potential mitigation sites at the AmerenUE property may include lawns, fallow agriculture fields, and fragmented forested areas that will be cleared for temporary construction access and lay down areas.

Reforestation is designed to ultimately generate a mature upland deciduous oak-hickory forest which is the climax vegetative community for uplands in Callaway County. Natural succession is the process by which cleared (unvegetated) land returns to the climax vegetative community. Left undisturbed, fallow agricultural land in central Missouri typically passes through a series of intermediate successional stages. In the early successional stages the vegetation is dominated by annual grasses and forbs which over time become mixed with perennial herbaceous species; then shrub and tree saplings including eastern red cedar and gray dogwood; then larger trees dominated by sycamore, sassafras, and black locust that grow rapidly in full sunlight; and finally a forest community dominated primarily by oak and hickory species.

An optimal mix of tree species for planting may include white oak, black oak, red oak, bur oak, and shagbark hickory. These species are slow growers and could be supplemented with faster growing species such as shingle oak and white ash. These tree species are available commercially and when planting 3-gallon container root production method (RPM) trees – a process of air root pruning that creates a dense fibrous root system – on 20-ft centers, the above species could possibly form a closed canopy in as little as 15 to 20 years (Lovelace, 2007). It is anticipated that understory trees and shrubs, such as flowering dogwood and service berry, would voluntarily establish over time but they could also be included in the mix of species planted. Reforestation areas would also be seeded with a native grass mixture to provide erosion control and cover while the trees are becoming established.

Native grassland is not the climax upland plant community in Callaway County but it does persist with occasional burning or mowing to remove encroaching woody species. Although nearly a third of the state was prairie prior to European settlement, only a fraction of a single percent of the original prairie remains today. In Callaway County, 139 square miles (88,960 acres or 36,000 hectares) of prairie existed in pre-settlement times (Schroeder, 1982). Prior to settlement of the area, Coate's Prairie was historically located in the northern half of the Reform Conservation Area before these lands were plowed and farmed (Newbold, 2007). Additional native warm season grassland or prairie plantings would add to the 481 acres of grassland already present at the site and would diversify and enhance the habitat for a number of faunal species. The fauna of native and restored tallgrass prairies includes several species of insects, amphibians, reptiles, birds, and mammals. Prairie landscapes with included wetland habitats provide excellent habitat for common waterfowl including mallard and blue-winged teal and upland birds like the dickcissel, killdeer, red-tailed hawk, eastern meadowlark, and field sparrows. Several species of butterflies, toads, snakes and grasshoppers thrive in prairie habitat.

Important terrestrial species identified at the AmerenUE property that would benefit most from native warm season grass or prairie plantings include the white-tailed deer, northern harrier (State endangered), northern bobwhite quail, wild turkey, and the mourning dove. An optimal mix of species that could be planted include big bluestem, little bluestem, Indian grass, side oats grama, switchgrass, Illinois bundleflower, round-headed lespedeza, compass plant, prairie doc, rattlesnake master, wild bergamot, and various coneflowers.

Wetlands

Wetland mitigation in Missouri is primarily driven by conditions established within permits (Sections 404 and 401 of the Clean Water Act) issued by the USACE and MDNR. Prior to engaging in mitigation activities to offset wetland impacts, AmerenUE must demonstrate an attempt to first avoid and then minimize project-related wetland impacts. Callaway Plant Unit 2 and collector well facilities are being sited in a manner that will avoid and minimize wetland impacts to the extent that is possible. Efforts undertaken to avoid and minimize impacts to wetlands have included the following: early identification of wetland resources prior to final facility site layout, siting Callaway Plant Unit 2 facilities in the proximity of Callaway Plant Unit 1, siting the new transmission line adjacent to the existing transmission line corridor, and siting the new collector well access road to avoid wetlands where possible. As such, the wetland impacts detailed in Section 4.3.1.3 are considered unavoidable. Specific avoidance and minimization efforts will be discussed with the USACE during the permitting phase of the project.

Several measures may be taken to minimize and control construction-related secondary impacts to site wetlands. The use of erosion control barriers, temporary and permanent vegetative stabilization, mulching, erosion control blankets, stormwater detention basins, and other soil erosion and sediment control practices may be used, as appropriate, to reduce the risk of sediment runoff into intact wetlands adjoining construction zones. The stormwater retention basins would be unlined impoundments, vegetated with native wetland herbaceous plant material, with simple earth-fill closure on the downstream end and could include discharge pipes as an outlet to adjacent watercourses.

Wetland mitigation methods may include creation compensation via construction of wetlands in upland areas, restoration or enhancement of degraded wetlands, and preservation of existing wetland areas. The USACE prefers and thus gives more credit for wetland creation. Restoration or enhancement of existing wetlands is less preferred and thus full compensatory wetland mitigation credits are not given. Preservation of existing wetlands as a mitigation measure is rarely allowed and is considered only when other mitigation methods are not feasible and when existing wetlands to be preserved are of such high quality that the USACE would desire preservation. Because creation and/or enhancement mitigation opportunities exist on site, and because existing high-quality wetlands do not exist on site, preservation is not considered a viable mitigation option at the AmerenUE property.

Opportunities for wetland creation exist in various locations throughout the AmerenUE property. Factors that may influence site selection for wetland creation include topography, soil types, watershed size, and the presence of adjacent streams as a source of additional hydrology. Various wetland types including emergent, scrub-shrub, forested, and open water could be constructed on site within the floodplains of Logan Creek or the Missouri River. Wetland creation could also occur in higher elevations of the site provided that sufficient hydrology is provided by a large watershed drainage area or through site runoff of impervious areas of the plant. Opportunities for wetland creation may also exist adjacent to one of the drainages that radiate away from the plant. The soils and hydrology of any candidate site for

wetland creation would require a detailed evaluation to determine the feasibility of constructing and maintaining a wetland system.

Because only partial credits are awarded for wetland enhancement, opportunities for this type of mitigation may only exist in the larger wetland systems along the Mollie Dozier Chute or within the floodplain of the Missouri River. Enhancement efforts may include modifying wetland hydroperiod, and management of plant communities including controlling exotic or invasive species such as reed canary grass (Phalaris arundinacea), Johnson grass (Sorghum halpense), or cattails (Typha sp.). Enhancement efforts may also include providing additional hydrology or planting several native species to increase native cover and species diversity.

Because wetland mitigation in Missouri is primarily driven by conditions established within Clean Water Act Section 404 permits issued by the USACE and Section 401 Water Quality Certifications issued by the MDNR, specific wetland mitigation efforts will be determined after such authorizations have been issued.

4.3.2 AQUATIC ECOSYSTEMS

Impacts to aquatic ecosystems have been assessed within the Unit 2 construction zone, the Unit 2 transmission line corridor, and within the area designated for the development of collector well facilities on the floodplain of the Missouri River. Because the transmission line will consist of overhead facilities, the support towers as practicable will be strategically located to avoid impacts to aquatic resources such as ponds and streams. As stated in Section 4.3.1.3, only one wetland (J7-WT-02) will be impacted as a result of transmission line construction. This wetland occasionally functions as aquatic habitat under conditions of high river stage when it may be needed for fish for feeding and/or reproduction.

Section 4.2 includes a footprint of the construction area and a description of the construction process. Construction activities associated with non-safety-related systems and structures may begin after the appropriate permits are issued for clearing and grading. The NRC combined license must be issued prior to commencement of construction activities associated with safety-related systems and structures. Construction activities for non-safety related systems and structures are expected to begin after all required permits are received. Construction is expected to be complete by 2017.

4.3.2.1 Impacts to Impoundments and Streams

Construction-related impacts to aquatic resources include 6,938 linear feet (2,115 m) of intermittent streams which are unnamed tributaries of Logan Creek, Mud Creek, and Auxvasse Creek that drain stormwater away from the AmerenUE property. These streams were impounded during construction of Callaway Plant Unit 1 to create stormwater runoff ponds or catch basins (Figure 4.3-4 through Figure 4.3-6). These drainages are mapped by the U.S. Geological Society (USGS) as dashed blue-line streams and are thus assumed to be under the jurisdictional authority of the USACE. Some of these upland intermittent streams lack a consistent bed, bank or ordinary high water mark (OHWM). As such, a jurisdictional determination by the USACE may be required to verify the extent of jurisdictional streams. Since site design details are not yet finalized, stream impacts may be revised at a later date. Impacts to jurisdictional streams are presented in Figure 4.3-4 through Figure 4.3-6 and will require compensatory mitigation in accordance with USACE permit conditions. Potential impacts will consist of permanently filling the small stream beds to accommodate the construction of roadways, parking lots, construction lay down areas, or other structures associated with the construction of Unit 2.

Eight ponds, designated as P-1 through P-8 in Figure 4.3-4 through Figure 4.3-6, surround the AmerenUE property and were constructed on the small unnamed drainages radiating away from the plant. As stated above, some of the stormwater runoff ponds were constructed as impoundments or catch basins during construction of Unit 1 facilities. Construction-related impacts will include one jurisdictional stormwater runoff pond (P-4) that will be permanently converted to structures, pavement, or other maintained exterior grounds to accommodate the proposed power block, cooling towers, roadways, construction lay down area, borrow area, retention basins, and permanent parking lots. The pond will be drained and filled in the following sequence. The dam will be notched, and the water level will be lowered in a slow, controlled manner in order to prevent or minimize scour downstream. If lake sturgeon are present, they will be relocated to the Missouri River. After the pond is drained, it will be filled with material appropriate for the construction of areas listed above. Impacts are quantified in Table 4.3-2. Additional stormwater runoff pond will be constructed north or downstream of P-4, as needed, during construction of Unit 2 facilities. This may be included as part of the overall mitigation required for impacts to jurisdictional waters of the U.S. The other seven stormwater runoff ponds remain after construction. MDC actively manages P-2, P-7, and P-8 which will remain open to the public for fishing. The other seven stormwater runoff ponds will remain after construction. MDC actively manages P-2, P-7, and P-8 which will remain open to the public for fishing. Furthermore, an additional stormwater runoff pond may be constructed north or downstream of P-4, as needed, during construction of Unit 2 facilities. This may be included as part of the overall mitigation required for impacts to jurisdictional waters of the U.S.

Although not directly impacted by construction, stormwater runoff pond P-7 could be indirectly impacted with additional sedimentation and turbidity due to work upstream in intermittent drainages that feed into the pond. Downstream reaches of the impacted intermittent streams are also at risk to receive additional sediment deposition as a result of construction activities at the AmerenUE property. Therefore, sediment and erosion control practices such as temporary seeding, mulching, silt fences, and check dams will be used in order to minimize the indirect impacts of construction.

As described in Section 4.2.2.2, construction at the AmerenUE property will permanently destroy some of the existing surface water bodies. Anticipated impacts to the water bodies listed above are summarized as follows:

- Infilling and eliminating stormwater runoff pond P-4 to the northwest of the plant;
- Eliminating the upper reaches of several unnamed intermittent tributaries in the Auxvasse, Mud and Logan Creek watersheds; and
- Potentially increasing sediment loads into other down-gradient intermittent streams and ponds.

However, it is possible that these activities will be changed in the final design.

When a small impoundment is filled by construction activities, impacts to aquatic life will be substantial. If the pond has an outlet, and the water level is lowered gradually, some fish may migrate out of the impact zone. However, construction impacts to the pond will invariably result in the loss of the fish and invertebrates due to draining and filling activities. Likewise, construction activity that fills an area formerly drained by an intermittent stream will potentially result in the loss of organisms, if any are present in the hyporheic zone. Impacts of construction activities on the upper sections of intermittent streams depend on whether the stream is holding water at the time. If the intermittent stream is dry, losses of fish and

invertebrates will be minimal. Some individuals of populations that are able to diapause in the egg or larval stage during dry periods may also be lost. Conversely, if the stream contains water, early successional stages of invertebrate and/or fish assemblages may be present. If construction impacts are gradual, some emigration of fish may occur but construction related activities will likely result in the mortality of less mobile invertebrates. Alternatively, if construction impacts are abrupt, both fish and invertebrates will likely be lost.

As discussed in Section 2.4.2, surveys of the onsite streams were conducted, and did not document the presence of rare or unique aquatic species in the construction zone. Only one of the three unnamed intermittent tributaries anticipated to be impacted consistently contained water during the sampling periods, and it was dominated by pollution-tolerant invertebrate taxa (worms, gastropods) and pioneering generalist fish species (stoneroller, creek chub, green sunfish). These species are common and readily found in other nearby aquatic habitats.

The only pond (P4) that will likely be drained and filled did not appear to contain substantial fish populations in the November gill net survey. Other impoundments that could potentially be indirectly affected by runoff or sedimentation from construction contain species (channel catfish, bluegill, and largemouth bass) that are readily found in ponds nearby and throughout much of Missouri. Additionally, lake sturgeon were stocked into five of the ponds in 1984. However, these ponds were surveyed for this species in November 2007 using gill nets, and no sturgeon were found. Since the habitat requirements for lake sturgeon are silt-free sand or gravel substrates (Evers, 1994), and extensive amounts of silt were present in these ponds, it is possible that the sturgeon may not have persisted. However, as discussed previously with MDC, if any sturgeon are found during construction activities, the MDC will be notified so that relocation of individuals into the Missouri River may be accomplished.

Proposed construction activities that will potentially affect impoundments and/or streams that are outside the construction footprint are described in Section 4.2. Effects to aquatic ecosystems will most likely result from sedimentation due to erosion of surface soil. The detrimental effects of increased sediment deposition on stream biological communities have been well documented (Gurtz, 1981; Noel et al., 1986; Christie and Fletcher, 1999). Three major groups of aquatic organisms are typically affected by the deposition of sediment in streams: aquatic plants, benthic macroinvertebrates, and fish. The effects of sedimentation correspond to particle size. Finer particles may remain suspended, blocking light necessary for photosynthesis by primary producers such as periphyton and/or rooted aquatic plants (Waters, 1995). Suspended sediments may also interfere with respiration, and reduce feeding efficiency by lowering visibility. Larger sediment particles will fall out of suspension and may fill the interstitial spaces between natural substrate particles, eliminating habitats for benthic macroinvertebrates and young fish. Losses in fish forage (macroinvertebrates) and decreases in reproductive success can lead to subsequent reductions in fish populations.

Soil erosion associated with construction activities can be prevented or minimized by using best management practices, in accordance with Section 4.2 of this document. Covering disturbed areas with straw or matting is a preferred method of controlling sedimentation. Silt fences, temporary or permanent vegetative stabilization, and/or retention ditches or ponds can be effective in intercepting and retaining sediment before it reaches stream segments.

The potential for sedimentation into streams in or near the AmerenUE property is generally dependant on the proximity of the stream to construction activities and is inversely proportional to the size and permanence of the stream. Segments that are the closest to construction activities are intermittent. Sediment that is not captured through best management practices will most likely be deposited in these stream segments. While

intermittent headwater streams are considered important, there is nothing of regional significance about these particular streams. Aquatic species encountered in surveys of these areas are common in the region. Thus, no loss of unique habitat is anticipated. Permanent segments of Logan Creek, Mud Creek, and Auxvasse Creek are relatively distant from proposed construction activities. It is unlikely, therefore, that significant amounts of sediment will be deposited in these segments. Moreover, the Missouri River, into which each of these streams empties, is even further from proposed construction activities.

Important Species within Ponds and Streams

Important species that were either collected from, or are considered to potentially reside in, streams near the AmerenUE property include the state and/or federally listed Topeka shiner, blacknose shiner, and plains topminnow. Three recreationally important species - channel catfish, bluegill, and largemouth bass - have been stocked into ponds P2, P7, and P8. Lake sturgeon, a state endangered species, was stocked in 1984 into ponds P-1, P-2, P-4, P-6, and P-7. Pond P-4 is anticipated to be completely filled and removed. It is assumed that lake sturgeon are no longer present in the stormwater runoff ponds because they were not collected during 2007 surveys and because the ponds do not provide ideal habitat for this species. Even so, it is possible that some individuals may still reside in one or more of ponds. If individuals are present, they would be killed by draining and filling activities unless they are transported to another location, most appropriately the Missouri River. Should any specimens be observed during the dewatering process, appropriate MDC personnel will be notified.

Topeka shiner (federal and state listed as endangered), blacknose shiner (listed as imperiled (S2) in Missouri), and plains topminnow (listed as vulnerable (S3) in Missouri) have not been collected in any fish surveys of the streams – Logan and Mud Creeks, and intermittent tributaries of Logan, Mud, and Auxvasse Creeks – near the AmerenUE property. However, the Topeka shiner and blacknose shiner have been collected from Auxvasse Creek within the ecological study area approximately 3 miles (4.8 km) west of the site. Plains topminnow has been collected from Tavern Creek within the ecological study area approximately 5 miles (8 km) east of the site. Since the creek segments where these species have been collected are relatively distant from construction activities, coupled with the commitment to utilize best management practices in accordance with Section 4.2 of this document in reducing runoff to intermittent streams of the plant site, it is unlikely that they will be negatively impacted.

Other important species include recreational species that are found in the permanent and intermittent stream segments on the AmerenUE property. These include channel catfish, bluegill, spotted bass, and largemouth bass. A portion of the stream habitat within the site is anticipated to be impacted by construction activities; however it consists entirely of intermittent stream segments that fish populations use only opportunistically. It is unlikely, therefore, that these species will be substantially harmed by construction activities. Moreover, an abundance of unimpacted stream habitat in the site and ecological study area will still be available for these species.

Summary of Impacts to Ponds and Streams

Impacts to ponds and streams in the AmerenUE property are anticipated to be small. Pond and stream permanent impacts are quantified in Table 4.3-2 and Table 4.3-3. With regard to direct impacts, the specific pond (P-4) is shallow and the stream sections are ephemeral, flowing only for short periods after rain events. No important species were encountered in either of these areas. Species resident in these habitats are generally opportunistic residents, and are common in similar habitats throughout the region. In the unlikely event that lake sturgeon are encountered while draining P-4, they will be relocated to the Missouri River.

In terms of indirect effects, impacts are likewise anticipated to be small. Soil erosion and consequent sedimentation effects should be inversely proportional to the size and permanence of the stream. Specifically, the aquatic communities are the least complex, and comprised of tolerant generalist taxa, nearest where construction activities are planned. It is unlikely that significant amounts of sediment will be deposited in more distant permanent segments.

4.3.2.2 Impacts to the Missouri River

As discussed in Section 2.4.2, the Missouri River is considered to be an important aquatic habitat. Most of the species of concern within the ecological study area are residents of the Missouri River. Even so, none of them are endemic to the segment of the river near the plant. There is little or no submerged aquatic vegetation near the area, which would be important habitat for larval and young-of-the-year fish.

Minimal effects of sedimentation on the Missouri River are expected with the construction of the collector well system. Additionally, sediment transport from tributary streams and subsequent deposition within the Missouri River is expected to be minimal due to the use of best management practices in controlling site runoff and due to the relatively great distance of the construction activities from the Missouri River.

Dredging is a construction activity that will potentially occur on the Missouri River in conjunction with the use of the barge unloading facility. If it is performed at all, dredging activity will be confined to a localized area near the shoreline. Fish will be able to avoid direct impacts of dredging. Benthic invertebrates, however, will not, and those in the sediment that is removed from the water will be killed. Collections taken from the near-shore sediments in 2007-2008 surveys did not find rare organisms in this habitat. Indeed, the macroinvertebrate populations typically found in these habitats are predominantly chironomids and oligochaetes that are tolerant of sub-optimum environmental conditions, and frequently increase in abundance in disturbed systems. Indirect effects of dredging will primarily be temporary suspension of sediment particles into the water column. Since the fish and macroinvertebrate communities in the consistently turbid Missouri River have presumably adapted to these conditions, indirect impacts are not anticipated to be substantial.

Important Species within the Missouri River

Important species that have been collected from the Missouri River in either the current study or in previous surveys include seven federal and/or state listed species and 14 species of sport or commercial importance. The listed species are lake sturgeon and flathead chubs (Missouri endangered), pallid sturgeon (federal and Missouri endangered), sturgeon chub and sicklefin chub (federal and Missouri vulnerable (G3 and S3)), and paddlefish and blue sucker (Missouri vulnerable (S3)). The species of sport or commercial importance are shovelnose sturgeon, smallmouth buffalo, bigmouth buffalo, blue catfish, channel catfish, flathead catfish, white bass, bluegill, spotted bass, largemouth bass, white crappie, black crappie, sauger, and freshwater drum.

Due to the use of best management practices in accordance with Section 4.2 of this document in controlling site runoff and the relatively great distance of the construction activities from the Missouri River, minimal adverse impacts to aquatic important species are anticipated. Further, none of the important species listed above are endemic to the segment of the Missouri River near the plant. An abundance of large river habitat would remain available to these species, even in the unlikely event of secondary construction-related impacts such as slightly increased levels of turbidity and sedimentation.

Summary of Impacts to the Missouri River

Impacts to the Missouri River near the AmerenUE property are anticipated to be small. The only direct impacts would be associated with dredging, which may not be performed. If dredging does occur, fish will likely temporarily avoid the area and will be minimally affected. Macroinvertebrates residing in the material removed, however, will be destroyed. Even so, these populations primarily consist of pollution-tolerant species that are adapted to sediment-rich, oxygen-poor depositional habitats, and they will continue to be common or abundant in the extensive areas of this type of habitat that will remain in the river.

With regard to indirect effects, impacts are likewise anticipated to be small. Soil erosion and consequent sedimentation effects should be minimized by best management practices, and those that remain are anticipated to occur in intermittent segments of streams far removed from the Missouri River. The small amount of construction-related sediment that reached the river would make little difference in an already turbid water system. And the resident organisms of the system, adapted to such conditions, should be minimally affected.

4.3.2.3 Other Construction Impacts

There is potential for birds to be involved in collisions with tall structures such as the containment building and cooling towers. The degree of risk varies with different species, depending on preferred habitat, flight corridors, weather conditions, etc. Large scale aviar mortality has not been observed at the Callaway site. The Unit 2 structures will be located relatively close to the existing Unit 1 structures, and will be similar in size and form. Therefore, based on current operating experience, the potential for extensive aviar mortality is small.

The noise to be expected during construction is discussed in Section 4.4.1. The noise levels may be as high as 102 dba at 50 ft (15 m) from the source. Animals and birds will tend to avoid construction activities. At 400 ft (122 m), the noise level is less than 80 dba, about the same as freeway traffic. It is possible that some small mammals and insects may be close to equipment when it starts up, and may be negatively impacted. These impacts will be occasional since the active construction area is already largely disturbed and not current habitat for wildlife. Therefore, because the potential for noise impact on wildlife is intermittent and temporary, the impact is considered to be SMALL and will not require mitigation.

4.3.2.4 Cumulative Impacts

4.3.2.4.1 Impacts on the Transmission Corridor and Offsite Areas

Impacts as a result of transmission line corridor construction are anticipated to be small. The new transmission line will consist of overhead facilities and thus will traverse but not impact aquatic resources. As stated in Section 4.3.1.3, one wetland on the right descending bank of the Missouri River will be impacted to create a stable foundation for a support tower but permanent aquatic resources will not be impacted as a result of transmission line construction. Although the locations of the support towers for the overhead transmission line have not yet been established, their locations will be designed to avoid and minimize impacts to aquatic resources within the transmission line corridor.

4.3.2.4.2 Collector Well Intake System Installation

As discussed in FSAR Section 2.4.12, AmerenUE is planning to construct a collector well intake system along the Missouri River to supply makeup cooling water for Callaway Plant Unit 2 (and water for Callaway Plant Unit 1). Conceptually, each collector well would be constructed of a 20 ft (6.1 m) diameter caisson extending through the alluvial aquifer to bedrock with approximately 14 well-screen laterals extending radially to 200 ft (61 m) from the caisson. Each

collector well could potentially supply 15,000 gpm to 20,000 gpm (57,000 lpm to 76,000 lpm). Three collector wells are being planned for the two units. Water would be pumped through a common line up the corridor and be split for usage by the two plants. The collector wells will be distributed along the edge of the Missouri River separated by approximately 1,500 ft (450 m) to limit interference of water production among wells. It is expected that 85% of the water will be derived from surface water recharge to the aquifer, while 15% will be derived from upgradient sources of groundwater.

The caisson is constructed "wet" in which the aquifer materials are excavated from beneath the caisson through the center. When the caisson reaches bedrock, a concrete floor is poured into the bottom to seal the collector well. During construction and development of the laterals, water enters the caisson one lateral at a time and is removed with a pump. This flow will be much less than what is derived during normal operation.

The construction of the collector well system will be conducted onshore. Precautions will be taken to prevent soil erosion and to control sediment runoff and discharges to the Missouri River. These may include BMPs such as stormwater runoff ponds, berms, check dams, and silt fences. Therefore, the impact on surface water from the collector well system construction is expected to be SMALL.

4.3.2.5 Summary

Construction activities for Callaway Plant Unit 2 which may cause erosion and lead to sediment deposition in aquatic habitats are expected to be of relatively short duration. They will be permitted and overseen by state and federal regulators, and will be guided by an approved Stormwater Pollution Prevention Plan. Best management practices for control of erosion and sedimentation will be applied, as discussed in Section 4.2. Unexpected spills of construction-related hazardous fluids (e.g., petroleum products) would be mitigated according to a Spill Prevention, Control, and Countermeasure Plan.

No important aquatic species are expected to be affected. Impacts to aquatic communities are expected to be small and preventable, in even the intermittent headwater streams by best management practices and even more unlikely in the permanent streams of the site and ecological study area due to their distance from the construction activities.

4.3.3 REFERENCES

Cave, 2007. Heritage Review Report from S. Cave of the Missouri Department of Conservation to E.M. Staten of MACTEC Engineering and Consulting re: Environmental Review for Ameren's COLA, Callaway County, Missouri, July 13, 2007.

Christie, T. and W.K. Fletcher. 1999. Contamination from forestry activities: Implications for stream sediment exploration programmes. Journal of Geochemical Exploration 67:210-210.

Cowardin, L.M., V. Carter V., F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service Report No. FWS/OBS/-79/31.Washington, D.C.

Lovelace, 2007. Personal communication between Wayne Lovelace, owner of Forest Keeling Nursery in Elsberry, Missouri, and Steve Stumne of MACTEC Engineering and Consulting, December 31, 2007.

Missouri Department of Conservation (MDC). 2000. Missouri Animals of Conservation Concern. Missouri Department of Conservation, Conservation Commission of the State of Missouri, 2000.

MDC, 2008a. Best Management Practices, Gray Bat, Myotis grisescens. http://mdc.mo.gov/documents/nathis/endangered/graybat.pdf Missouri Department of Conservation, January, 2008.

MDC, 2008b. Best Management Practices, Indiana Bat, Myotis sodalis. http://mdc.mo.gov/documents/nathis/endangered/indianabat.pdf Missouri Department of Conservation, January, 2008.

MDC, 2008c. Best Management Practices, Bald Eagle, Haliaeetus leucocephalus. http://mdc.mo.gov/documents/nathis/endangered/baldeagle.pdf http://mdc.mo.gov/documents/nathis/endangered/graybat.pdf Missouri Department of Conservation, January, 2008.

MDC, 2008d. Best Management Practices, Northern Harrier, Circus cyaneus. http://mdc.mo.gov/documents/nathis/endangered/n_harrier.pdf Missouri Department of Conservation, January, 2008.

MDC, 2007e. Northern Bobwhite, Colinus virginianaus. http://www.mdc.mo.gov/nathis/birds/birdatlas/maintext/0400213.htm Missouri Department of Conservation, December, 2007.

MDC, 2007f. The Mourning Dove in Missouri. http://www.mdc.mo.gov/nathis/birds/doves/distrib.htm Missouri Department of Conservation, December, 2007.

Newbold, 2007. Reform Conservation Area 2006-07 Annual Report. Missouri Department of Conservation.

Noel, D.S., C.W. Martin, and C.A. Federer. 1986. Effects of forest clear cutting in New England on stream macroinvertebrates and periphyton. Environmental Management 10:661-670.

Schroeder, Walter. 1982. Presettlement Prairie of Missouri. Missouri Department of Conservation.

Scott, 2007. Letter from C.M. Scott of the U.S. Fish and Wildlife Service to S.P. Stumne of MACTEC Engineering and Consulting re: Ameren's Callaway Nuclear Plant Unit 2 COLA in Callaway County, Missouri, October 18, 2007.

U.S. Fish and Wildlife Service (USFWS), 1983. Northern States Bald Eagle Recovery Plan. USFWS, Twin Cities, Minnesota.

Waters, T.F. 1995. Sediment in streams: Sources, biological effects and control. American Fisheries Society Monograph 7, Bethesda, MD.

Table 4.3-1—Vegetation (Plant Community) Impacts in Acres (Hectares) from Construction of Proposed Callaway Plant Unit 2

Habitat (Plant Community Type)s	On-Site Area in Acres (Hectares)	Includes USACE Jurisdictional Wetland	Potentially Permanent Impacts			Permanent Impacts			Temporary Impacts			Total Impact†	
			Unit 2	Transmission Line	Collector Wells	Unit 2	Transmission Line	Collector Wells	Unit 2	Transmission Line	Collector Wells	Acres (Hectares)	% of Cover Type Mapped Onsite
Impervious	331 (134)	No	137 (55.4)	0	0	51 (20.6	0	1.8 (0.7)	3.3 (1.3)	2.0 (0.8	0	58.1 (23.5)	18%
High Intensity Urban	114 (46)	No	100 (40.5)	0	0	53 (21.4)	0	0	4.0 (1.6)	0	0	57 (23.1)	50%
Low Intensity Urban	37 (15)	No	17.5 (7.1)[b]	0	0	15.5 (6.3)	0	0	6.7 (2.7)	0	0	22.2 (9.0)	59%
Cropland	1,220 (494)	No	259 (104.8)	0	0	114 (46.1)	0	76 (30.8)	0	38 (15.4)[a]	0	228 (92.3)	19%
Grassland	415 (168)	No	62 (25.1)	0	0	11 (4.5)	0	15 (6.1)	0	1.5 (0.6)[a]	0	27.5 (11.1)	7%
Deciduous Forest	3,542 (1,433)	No	101 (41.0)	0	0	43 (17.4)	34 (13.8)	1.1 (0.5)	0	0	0	78.1 (31.6)	2%
Evergreen Forest	13.5 (5.5)	No	13.5 (5.5)	0	0	13.5 (5.5)	0	0	0	0	0	13.5 (5.5)	100%
Deciduous Woody/Herbaceous	1,230 (498)	No	75 (30.4)	0	0	28 (11.3)	27 (10.9)	1.0 (0.4)	0	0	0	56 (22.7)	5%
Evergreen Woody/Herbaceous	340 (138)	No	69 (28.0)	0	0	42 (17)	1 (0.4)	0	0	0	0	43 (17.4)	13%
Woody-Dominated Wetland	166 (67.2)	Yes	0	0	0	0	8.5 (3.4)	16.6 (6.7)	0	0	0	25.1 (10.2)	15%
Herbaceous-Dominated Wetland	24 (9.7)	Yes	5.0 (2.0)	0	0	2 (0.8)	0.6 (0.2)	0.5 (0.2)	0	0	0	3.1 (1.3)	13%
Limestone Glade	4 (1.6)	No	0	0	0	0	0	0	0	0	0	0	0
Total			839 (339.5)	0	0	373 (151)	71.1 (28.8)[c]	112 (45.3)	14.0 (5.7)	41.5 (16.8)[c]	0		
			Total Potentially Permanent Impacts: 839 (339.5)			Total Permanent Impacts 556.1 (225)			Total Temporary Impacts 55.5 (22.5)			611.6 (247.6)	

(a) Impacts due to the overhead transmission line within cropland and grassland will depend on support tower locations which have not yet been designed. Impacts shown are considered temporary since cropland and grassland can persist under transmission lines.
(b) Includes approximately 10 acres (4.1 ha) for future borrow area within potentially permanent impact category
(c) Note: Total transmission line impact values do not include open water as open water will be spanned
† Temporary plus Permanent Impacts (does not include Potentially Permanent Impacts).

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Table 4.3-2— Wetland Impacts in Acres (Hectares) from Construction of Proposed Callaway Plant Unit 2

(Page 1 of 2)

Wetland Assessment Area	Wetland ID	Potentially Permanent Impacts				Permanent Impacts				[2]Conversion of PFO (Clearing Transmission Line)	Total Permanent Impacts	
											Acres (Hectares)	% of Wetlands Mapped Onsite*
		[1]PFO	[1]PEM	[1]PSS	[1]PUB	[1]PFO	[1]PEM	[1]PSS	[1]PUB	PFO		
Non-Jurisdictional Wetlands												
Unit 2 Construction Zone	B3-WT-02				0.1 (0.04)				0		0	
	C3-WT-01				0.7 (0.28)				0		0	
	C3-WT-02				0.2 (0.08)				0.2 (0.08)		0.2 (0.08)	
	C3-WT-03				0.3 (0.12)				0.3 (0.12)		0.3 (0.12)	
	C4-WT-02				0.1 (0.04)				0.1 (0.04)		0.1 (0.04)	
	C5-WT-01				0.1 (0.04)				0		0	
	C5-WT-02				1.4 (0.6)				0		0	
	C5-WT-03				0.1 (0.04)				0.1 (0.04)		0.1 (0.04)	
	D4-WT-02				0.1 (0.04)				0		0	
	D4-WT-03				0.03 (0.01)				0.03 (0.01)		0.03 (0.01)	
	D4-WT-04				0.2 (0.08)				0.2 (0.08)		0.2 (0.08)	
	Subtotal	**0**	**0**	**0**	**3.3 (1.3)**	**0**	**0**	**0**	**0.93 (0.4)**	**0**	**0.93 (0.4)**	**0.4%**
Transmission Line Corridor											0	
	Subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0%**
Collector Wells[3]												
	Subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0%**
Non-Jurisdictional Total					**0**				**0.93 (0.4)**		**0.93 (0.4)**	**0.4%**
Jurisdictional Waters of the U.S.												
Unit 2 Construction Zone	C4-WT-01		0.4 (0.2)								0.4 (0.2)	
	P-4								4.3 (1.7)		4.3 (1.7)	
	Subtotal	**0**	**0.4 (0.2)**	**0**	**0**	**0**	**0**	**0**	**4.3 (1.7)**	**0**	**4.3 (1.7)**	**2.0%**

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Table 4.3-2— Wetland Impacts in Acres (Hectares) from Construction of Proposed Callaway Plant Unit 2

(Page 2 of 2)

Wetland Assessment Area	Wetland ID	Potentially Permanent Impacts				Permanent Impacts				[2]Conversion of PFO (Clearing Transmission Line)	Total Permanent Impacts	
											Acres (Hectares)	% of Wetlands Mapped Onsite*
	H5-WT-01									0.2 (0.1)	0	
	H5-WT-02									0.6 (0.2)	0	
	H5-WT-03									0.04 (0.02)	0	
	I6-WT-01									1.6 (0.6)	0	
	J7-WT-01									0.2 (0.1)	0	
Transmission	J7-WT-02					1.2 (0.5)					1.2 (0.5)	
Line Corridor	**Subtotal**	**0**	**0**	**0**	**0**	**1.2 (0.5)**	**0**	**0**	**0**	**0**	**1.2 (0.5)**	**0.6%**
	H6-WT-01						0.6 (0.2)				0.6 (0.2)	
	H6-WT-02					0.04 (0.01)					0.04 (0.01)	
	I6-WT-01					2.9 (1.2)					2.90 (1.2)	
	J6-WT-01					0.07 (0.03)					0.07 (0.03)	
Collector Wells	**Subtotal**	**0**	**0**	**0**	**0**	**3.01 (1.2)**	**0.6 (0.2)**	**0**	**0**	**0**	**3.61 (1.5)**	**0%**
	Jurisdictional Wetland Total	**0**	**0.4 (0.2)**	**0**	**0**	**4.21 (1.7)**	**0.6 (0.2)**	**0**	**4.3 (1.7)**	**0**	**9.11 (3.7)**	**4.3%**
	Total Jurisdictional & Non-Jurisdictional	**0**	**0.4 (0.2)**	**0**	**3.3 (1.3)**	**4.21 (1.7)**	**0.6 (0.2)**	**0**	**5.23 (2.1)**	**0**	**10.04 (4.1)**	**4.7%**

(1) PFO = Palustrine Forested Wetland; PEM = Palustrine Emergent Wetland; PSS = Palustrine Scrub Shrub Wetland
PUB = Palustrine Unconsolidated Bottom Wetlands including ponds <ac (8 ha) with a water depth <6.6'(2 m) and lacking an active wave-formed shoreline. This includes small "farm ponds" and stormwater runoff ponds P-1 - P-8.

(2) Represents a conversion from PFO wetland to PEM but does not constitute a loss of jurisdictional wetland.

* Based on 214 acres (86.6 hectares) NWI wetlands mapped onsite.

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Table 4.3-3— Stream Impacts from Construction of Proposed Callaway Plant Unit 2

Assessment Area	Stream ID	Potentially Permanent Impacts		Permanent Impacts		
		feet	meters	feet	meters	% of Site Streams*
Unit 2 Construction Zone	C3-SC-01	232	70.7	0	0	
	C3-SC-02	3615	1102	2765	843	
	C4-SC-01	1176	358.4	1136	346.3	
	C4-SC-02	1835	559.3	1095	333.8	
	C5-SC-01	704	214.6	0	0	
	C5-SC-03	2145	163.7	1611	491	
	C6-SC-01	204	62.2	0	0	
	D3-SC-01	448	97.5	128	39	
	Subtotal	**10,359**	**2,628.4**	**6,735**	**2,053.1**	**4.4**
Transmission Line Corridor		0	0	0	0	
	Subtotal	**0**	**0**	**0**	**0**	**0**
Collector Wells	H5-SC-01	0	0	203	61.9	
	Subtotal	**0**	**0**	**203**	**61.9**	**0.1**
	Total Stream Impacts			**6,938**	**2,115**	**4.6**

* Based on 151,757 linear feet (46,730 m) of USGS streams mapped on site.

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Figure 4.3-1—Land Cover Impacts (Sheet 1)

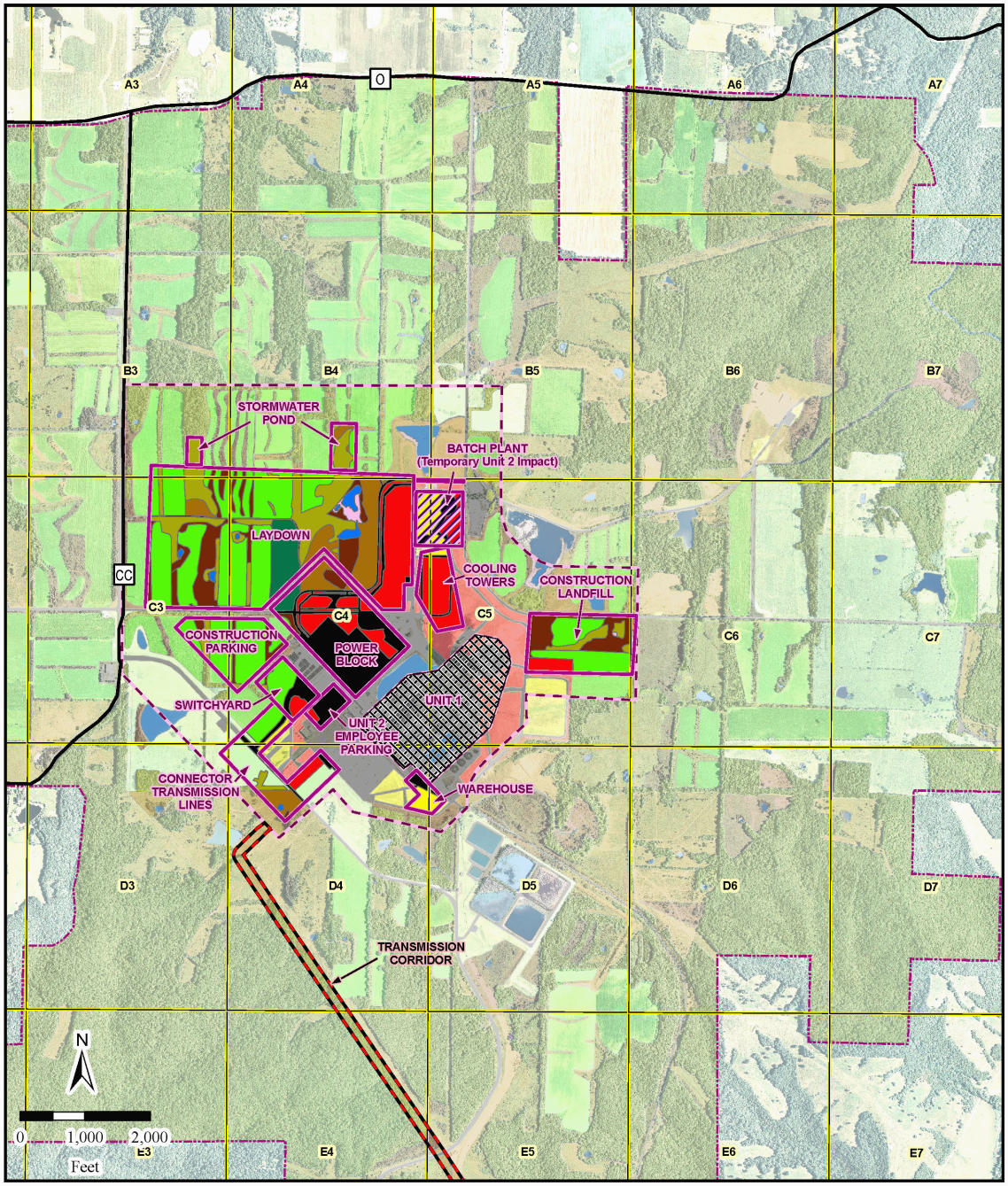


Figure 4.3-2—Land Cover Impacts (Sheet 2)

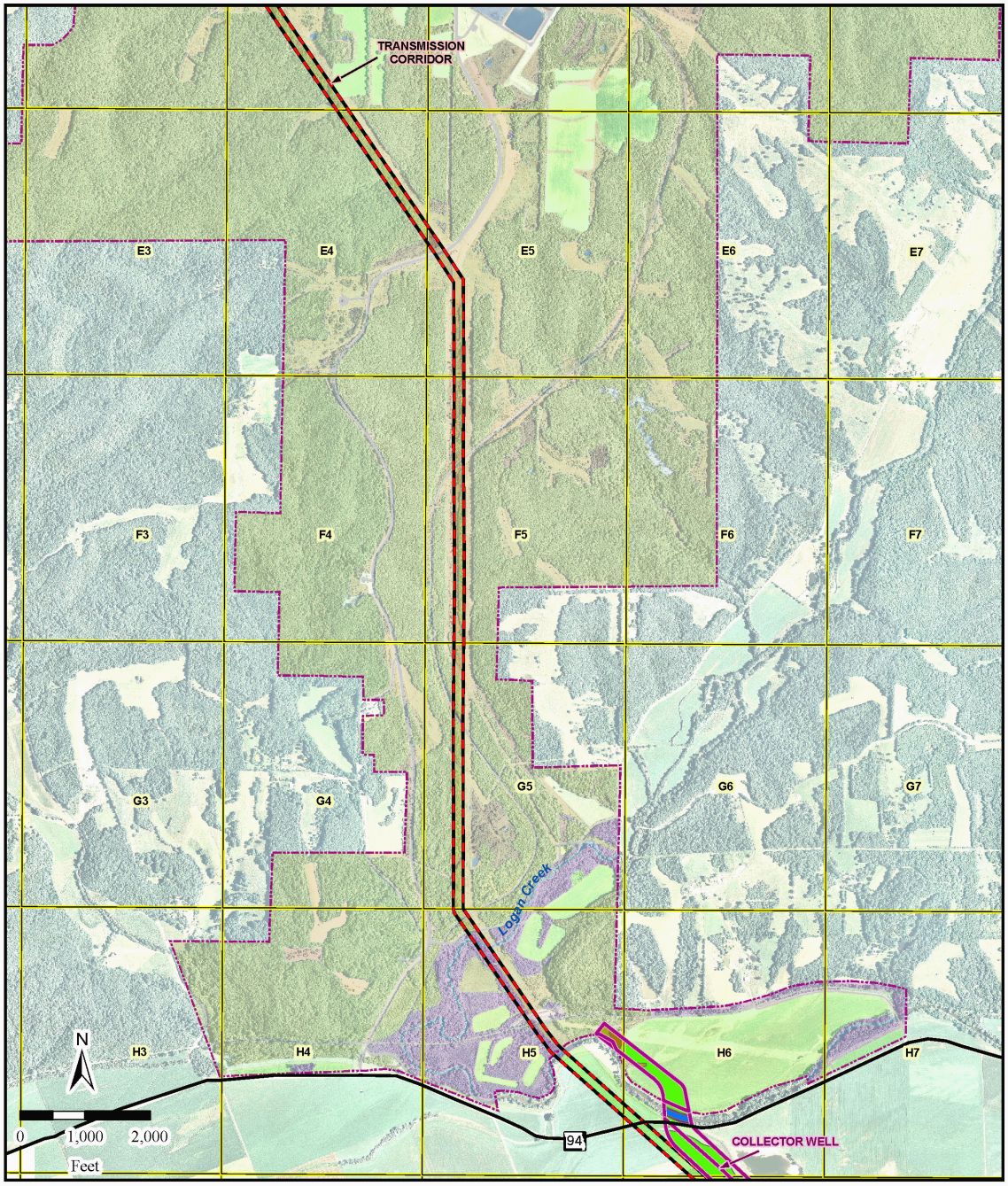


Figure 4.3-3—Land Cover Impacts (Sheet 3)

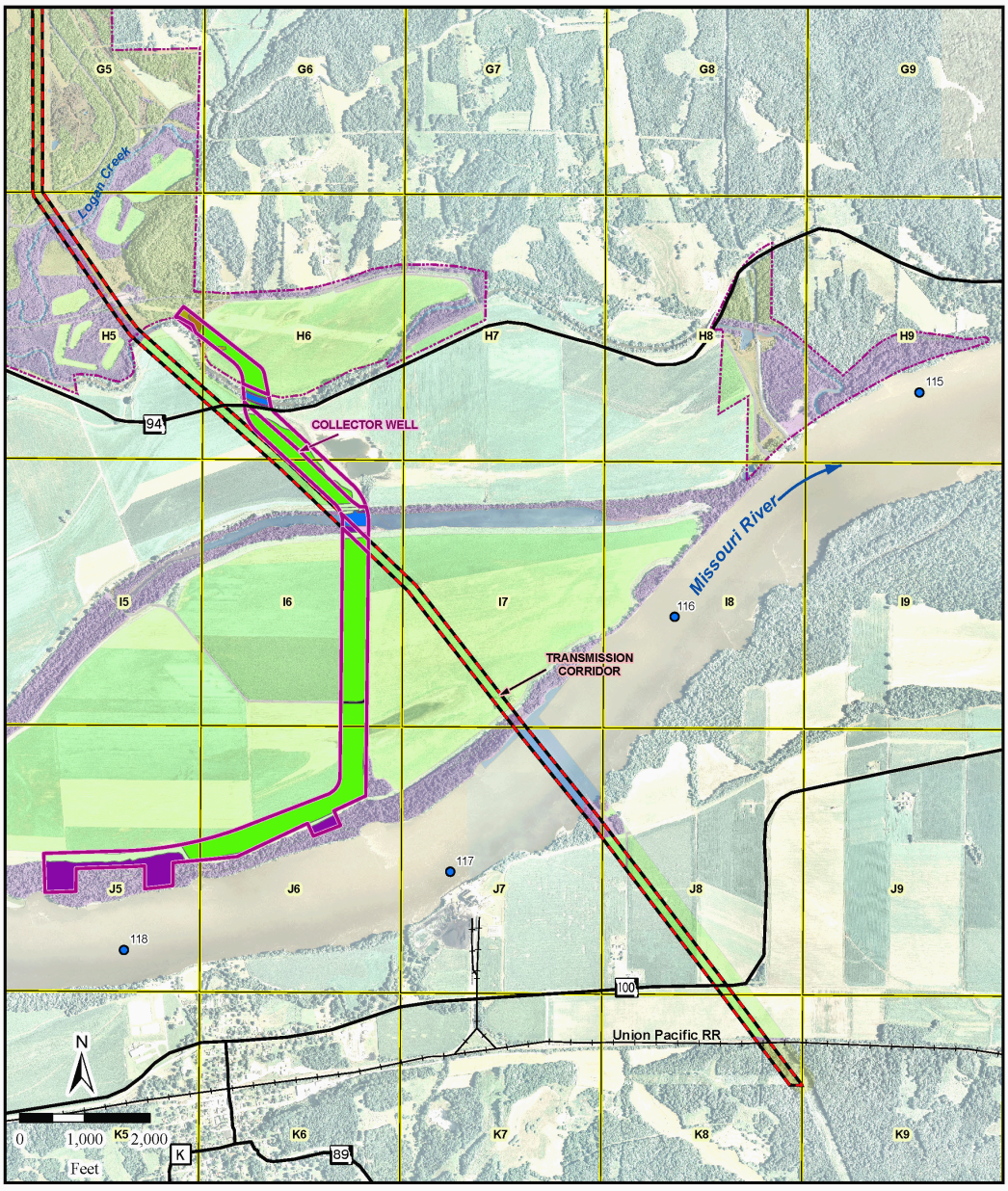


Figure 4.3-4—Waters of the U.S. Impacts (Sheet 1)

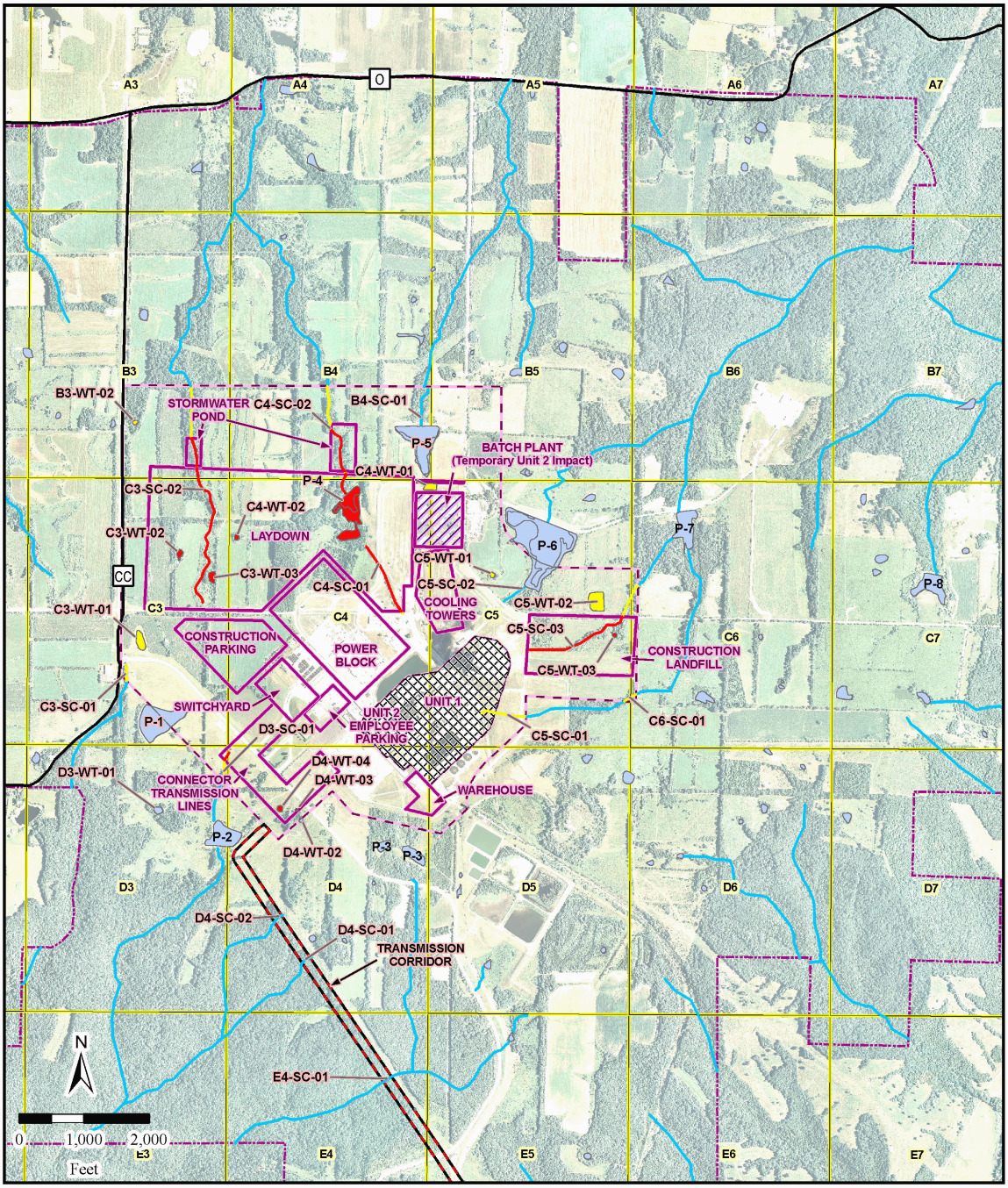


Figure 4.3-5—Waters of the U.S. Impacts (Sheet 2)

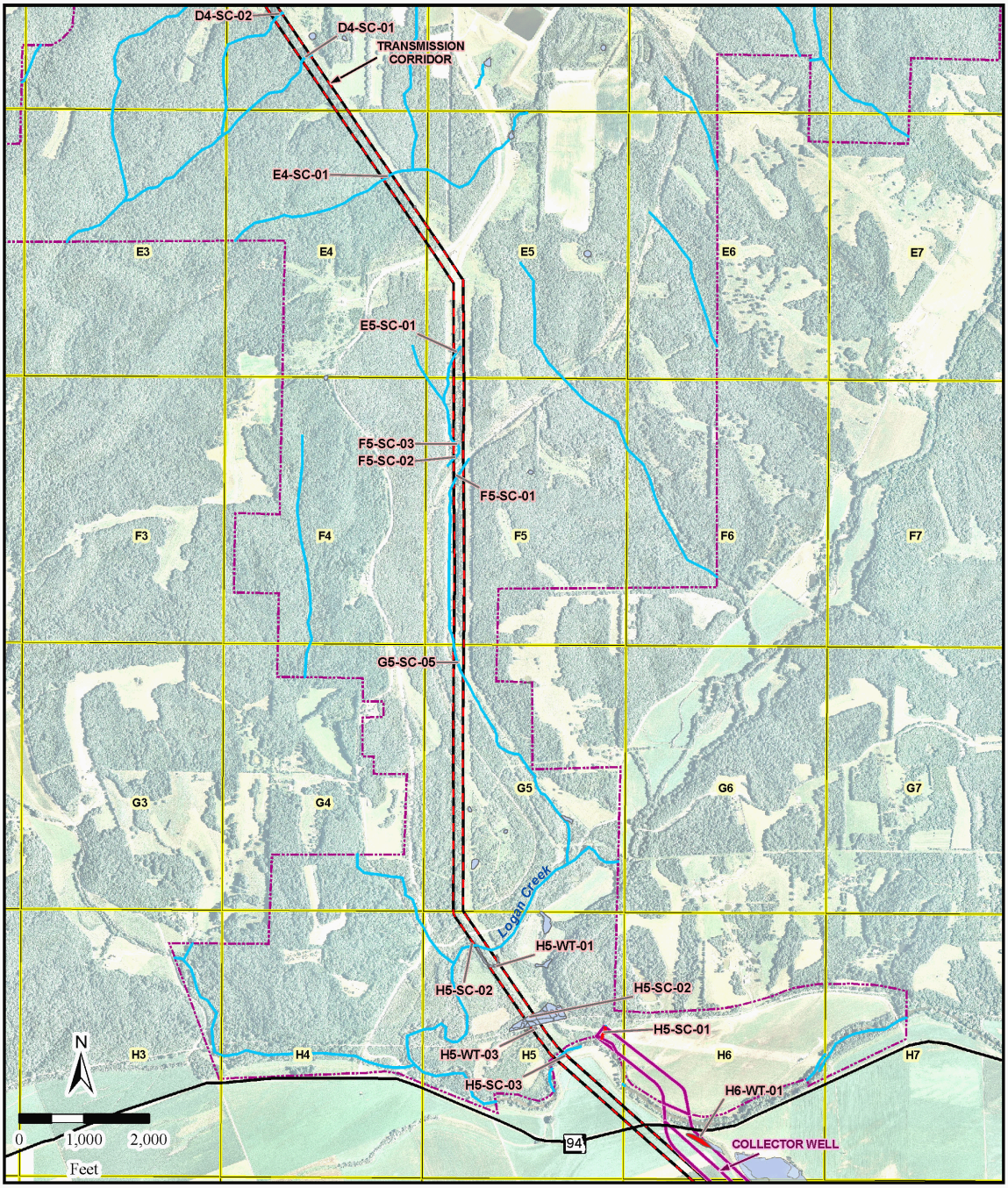
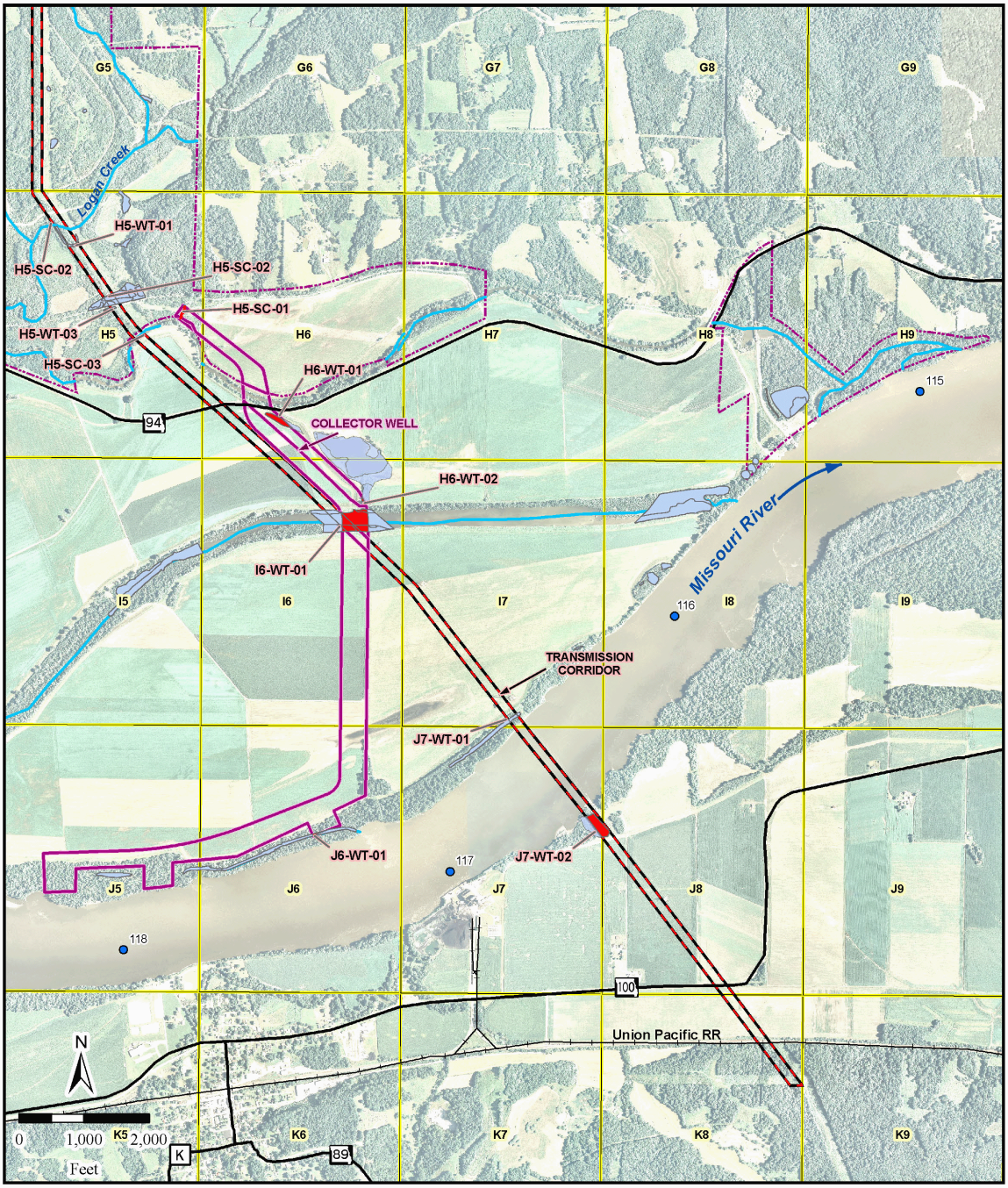


Figure 4.3-6—Waters of the U.S. Impacts (Sheet 3)



4.4 SOCIOECONOMIC IMPACTS

Construction activities at the Callaway site will cause temporary and generally localized physical impacts such as increased noise, vehicle exhaust, and dust. This section addresses these potential impacts as they might affect people (the local public and workers), buildings, transportation routes, and the aesthetics of areas located near the plant site.

A description of the Callaway site, location and surrounding community characteristics is provided in Section 2.1, Section 2.2, and Section 2.5. Chapter 3 describes the proposed facility including its external appearance.

As discussed below, the potential for direct physical impacts to the surrounding communities from plant construction is expected to be SMALL.

4.4.1 PHYSICAL IMPACTS

4.4.1.1 The Public and Workers

People who work at or live near the Callaway site will be subject to physical impacts resulting from construction activities. Onsite construction workers will be impacted the most, with workers at the existing adjacent operating unit subject to slightly reduced, similar impacts. People living or working adjacent to the site will be impacted significantly less due to site access controls and distance from the construction site where most activities will occur. Transient populations and recreational visitors will be impacted the least for similar reasons and the limited exposure to any impacts of construction.

4.4.1.2 Noise

Section 2.7 provides information and data related to the background noise levels that exist at the construction site.

Noise levels in the site area will increase during construction primarily due to the operation of vehicles; earth moving, materials-handling, and impact equipment; and other tools.

Typical noise levels from equipment that is likely to be used during construction are provided in Table 4.4-1 (Beranek, 1971). Onsite noise levels that workers will be exposed to are controlled through appropriate training, personnel protective equipment, periodic health and safety monitoring, and industry good practices. Good practices such as maintenance of noise limiting devices on vehicles and equipment, and controlling access to high noise areas, duration of emission, or shielding high noise sources near their origin will limit the adverse effects of noise on workers. Non-routine activities with potential to adversely impact noise levels such as blasting will be conducted during weekday business hours and utilize good industry practices that further limit adverse effects.

The exposure of the public to adverse effects of noise from construction activities will be reduced at the source by many of the same measures described above and the additional distance, interposing terrain, and vegetation which provide noise attenuation. Pile driving will occur during some construction activities. There are no state regulations that were found in the Missouri Code of State Regulations (CSR) limiting noise or vibration impacts at or beyond the construction boundary. However, reasonable efforts will be in place to minimize such effects. Noise is another potential construction-related activity that could impact wildlife at the Callaway Plant construction site. Although noise levels in construction areas can be up to 100 dBA at 100 feet from the sources of noise and of varying duration, these local noise levels would not be expected to propagate far beyond the boundaries of the construction site.

Table 4.4-1 shows the rapid attenuation of construction noise over relatively short distances. For example, a jack-hammer noise would be reduced by 20 dBA after 50 feet. After 400 feet, noise levels have generally dropped to 60-80 dBA, below levels known to startle small mammals and waterfowl (Golden 1980). Even with this attenuation, some displacement of local small mammals and birds due to noise may occur during construction activities. This displacement may be permanent for some species and temporary for others. These impacts are considered SMALL, generally short-term, localized, and not ecologically significant.

Traffic noise in the local area will increase as additional workers commute, and materials and waste are transported to and from the construction site. Noise impacts will occur primarily during shift changes and will not be extraordinary given the source and nature of vehicle noise and the normally varying nature of transient vehicle noise levels. Additionally, localized impacts will be reduced as distance from the construction site increases and traffic diverges outward.

In summary, good noise control practices on the construction site, and the additional attenuation provided by the distance between the public and the site, will limit noise effects to the public and workers during construction so that its impact will be small and temporary. Construction noise generation is directly linked with the conduct of construction activities which will end as the facility enters operation.

4.4.1.3 Dust and Other Air Emissions

Construction activities will result in increased air emissions. Fugitive dust and fine particulate matter will be generated during earth moving and material handling activities. Vehicles and engine-driven equipment (e.g., generators and compressors) will generate combustion product emissions such as carbon monoxide, oxides of nitrogen and, to a lesser extent, sulfur dioxides. Painting, coating and similar operations will also generate emissions from the use of volatile organic compounds (VOCs).

To limit and mitigate releases, emission-specific strategies, plans and measures will be developed and implemented to ensure compliance within the applicable regulatory limits defined by the primary and secondary National Ambient Air Quality Standards in 40 CFR 50 (CFR, 2007c) and the National Emission Standards for Hazardous Air Pollutants in 40 CFR 61 (CFR, 2007d). Air quality and release permits and operating certificates will be secured where required.

For example, a dust control program will be incorporated into the Storm Water Pollution Prevention Plan. A routine vehicle and equipment inspection and maintenance program will be established to minimize air pollution emissions.

The State of Missouri's Department of Labor and Industrial Regulations implement occupational health and safety regulations that set limits to protect workers from adverse conditions including air emissions. If localized emissions result in limits being exceeded, corrective and protective measures will be implemented to reduce emissions (or otherwise protect workers) in accordance with the applicable regulations.

Implementation of controls and limits at the source of emissions on the construction site will result in reduction of impacts offsite. For example, the dust control program will limit dust due to construction activities to the extent that it is not expected to reach site boundaries.

Transportation and other offsite activities will result in emissions due largely to use of vehicles. Activities will generally be conducted on improved surfaces and any related fugitive dust

emissions will be minimized. As with noise, impacts will be reduced as distance from the site increases.

In summary, air emission impacts from construction are expected to be SMALL because emissions will be controlled at the sources where practicable and maintained within established regulatory limits that were designed to minimize impacts, and the distance between the construction site and the public will limit offsite exposures. Construction air emissions impacts are temporary because they will only occur during the actual use of the specific construction equipment or conduct of specific construction activities, and surfaces will be stabilized upon completion of construction activities.

4.4.1.4 Buildings

The primary buildings in the immediate area with potential for impact from construction are those associated with Callaway Plant Unit 1. Some peripheral onsite buildings will be removed during construction. Related information about historic properties and the impacts of construction on them is provided in Section 2.5.3 and Section 4.1.3.

Many existing onsite buildings related to safety of the existing facility were constructed to meet seismic qualification criteria which make them resistant to the effects of vibration and shock similar to that which could occur during construction. Other onsite facilities were constructed to the appropriate building codes and standards which include consideration of seismic loads. Regardless of the applicable design standard, construction activities will be planned, reviewed, and conducted in a manner that ensures no adverse effect on the operating nuclear units and that buildings are adequately protected from adverse impact.

Construction activities are not expected to affect offsite buildings due to their distance from the construction site. For example, the nearest residence is located approximately 1.2 miles (1.9 km) from the construction site footprint.

The impact of construction activities on nearby buildings will be SMALL and temporary because of the design of onsite buildings and the administrative programs that will ensure no adverse interaction with the operating units, while offsite buildings are located at greater distances that isolate them from potential interaction.

4.4.1.5 Transportation Routes

The major transportation routes in the area are described in Section 2.5.1.

Traffic will increase on Missouri State Routes O, CC, and 94 during peak construction periods and will be at its highest during shift changes. People living in the area will experience the greatest effects on roads during shift changes with added noise and additional number of vehicles. However, the impact on the roads will be within the capacity limits after allowing for residential vehicle traffic (non-plant) of 6% of capacity (100 vehicles per hour).

There are three separate non-overlapping routes that workers can follow to reach the site, one from the south, one from the northeast, and one from the west. Construction workers will use the public highways in the area around the site to commute to work. Additionally, public roadways will be used to transport most construction materials and equipment to the site. Heavy equipment and reactor components will be barged up the Missouri River and transported by truck to the site, a route that is largely along little-used roads but involves a small (less than two miles (3.2 km) section of Route 94. Impact on area transportation resources

will generally decrease with increased distance from the site as varied routes are taken by individual vehicles.

To assess the expected increase in traffic around the site, the hourly and averaged daily traffic (ADT) for the state and county routes that would be used by the construction workforce was obtained (MoDOT 2007). Table 2.5-34 indicates the average daily traffic on State Routes O, VV, 94, CC, and D. The primary traffic flow is along Routes O, CC, and 94. ADT counts for the years 2004 through 2006 are described on these routes as follows: an ADT count of 1,482 vehicles was recorded on Route O east of Fulton, and an ADT count of 902 vehicles was recorded east of the junction of Routes CC and O. On Route CC, 2 miles (3.2 km) south of Route O at the immediate plant vicinity, the ADT was 1,688 vehicles. An ADT count of 2,540 vehicles was recorded on Highway 94 southwest of Mokane. The traffic counts indicate that the bulk of the traffic turned north onto Route CC as the ADT count decreased to 702 vehicles east of the Highway 94 and Route CC intersection. Further east (east of Route D), ADT count of 732 vehicles was recorded on Highway 94 (MoDot 2007).

As expected, the major concern identified from review of the traffic study related to the construction workers and the daily peak travel period and patterns in and around the start and end of the day shift. There are no major highway development or improvement projects planned within the area to influence the capacity of the roadway system (Haslag, 2007a). To support construction traffic, two new site access roads connecting Route 428 and Route 459 north of the plant will be built to reduce traffic impacts related to construction activities.

Traffic Impacts

Peak hourly traffic was considered to develop possible scenarios regarding transportation impacts in and around the site location. The Transportation Research Board specifies in its Highway Capacity Manual Special Report 209 (1985) that the capacity at an intersection is based on a maximum hourly vehicular flow of 1,400 vehicles per lane, with full assignment of the right-of-way and no cross traffic. However, the capacity is adjusted down approximately 15% to 1,200 vehicles to reflect the cross street traffic. Since most intersections around the plant are one lane each way, a maximum of 1,200 vehicles was assumed to be able to use each intersection. The maximum local hourly traffic rate was determined to be 100 vehicles per hour (MODOT 2007). Even though much of this documented traffic may be the Callaway Plant Unit 1 workforce, for the purpose of this traffic analysis it was assumed that the allowable capacity at any intersection would be reduced by 100 to account for possible non-plant traffic. Therefore, for this study, 1,100 vehicles per hour were assumed.

The highest number of workers that would be on the site at the same time would be during Callaway Plant Unit 2 construction. During refueling, a traffic management plan will be in place to alleviate potential traffic congestion resulting from the influx of the additional 1,500 refueling workforce. The Callaway Plant Unit 1 workforce is 867 workers. The construction workforce is estimated to be 3,950 at its maximum. In this maximum scenario, the highest number of workers would be on site during first shift where it was postulated that 85% of the plant workforce and 70% of the construction workforce would be present. Additionally, it was estimated that the construction workforce would carpool at an average rate of 1.12 (USCB, 2000) workers per vehicle, for a total number of 3,206 vehicles accessing the site: 737 Callaway Plant Unit 1 workforce vehicles and 2,469 construction workforce vehicles.

Current operating experience permits an assumption to be made that 85% of the plant workforce would be present on first shift, 10% on the second shift, and 5% on the third shift. Seventy percent of the construction workforce would report on the first shift, 25% would report on the second shift, and 5% would report on the third shift. A way to alleviate congestion is to

increase the number of entrances the workers could use. That would allow the workforce to access the site from three geographically different locations. Currently the only entrance that the plant workers use is off of County Route 459, to the west of the plant. For Callaway Plant Unit 2 construction, as seen in Figure 4.1-1, two separate entrances will be constructed besides the entrance off of Route 459, one permitting access further north off of County Route 428, and a third entrance off of County Route 448 at the northeast corner of the plant. Therefore, by utilizing the three separate entrances, the resulting simultaneous road capacity for plant-bound vehicles would be 3,300 per hour.

The first shift change is the time where the largest percentage of plant workers and the construction workforce travel to the plant. However, the maximum capacity of the individual roads is 1,100 vehicles per hour, and having three separate entrances, and non-overlapping routes for the vehicles to travel, the cumulative road capacity increases to 3,300 vehicles on the local roads around the plant site. As noted above, the first shift has the most vehicles traveling on the roads concurrently with 3,206. That represents 97% of the portion of the total maximum capacity of the road system around the plant site allocated for plant traffic in this traffic analysis (and 89% of the Transportation Research Board's (1985) maximum allowable capacity). With this number, the maximum capacity of the roads is not eclipsed and an additional vehicle count of 100 vehicles per hour is still permitted within the road capacity constraints.

There is potential for impacts on school bus traffic. Normal school bus patterns are expected to run later than the first shift. Some school bus patterns may be moved toward the end of the first shift change in the morning. However, the afternoon bus traffic patterns would not be interrupted because it would occur before the shift change at the plant.

The number of truck trips to bring supplies was estimated to be 40 to 50 per day at the construction peak. The effects of truck traffic are noise, air pollution, and the increase in traffic during the day and evening. However, truck traffic will be minimal during peak worker traffic. At other times, truck traffic will approach the maximum road capacity of 1,100 vehicles per hour.

In summary, traffic will increase on the local roads around the plant as well as on State Routes O, CC, 94, and D. Increasing the number of geographically separated entrances is the first step in completing a sound traffic management plan. With the traffic management plan in place, there will be no mitigation required as the impacts on roads will be below capacity. Traffic noise and increased traffic will be an unfavorable condition, but it will be temporary and intermittent. The overall effect on the surrounding population will be SMALL and no mitigation will be required.

Similarly it is not anticipated that the existing barge slip will need to be dredged to deepen the area. As noted earlier, heavy equipment and reactor components will be barged up the Missouri River to the existing slip. At the time of construction, the area immediately in front of the barge slip will be assessed to determine if silt has built up sufficiently to impede barge docking and offload, which might result in a requirement for limited dredging.

4.4.1.6 Aesthetics

Construction activities may be visible from points outside the Callaway site by transient visitors driving in the vicinity; however, due to distance of the nearest residence, and the low number of people driving on local roads 428 and 448, the impacts will be minimal. Section 3.1provides a detailed description of the site and figures that illustrate the appearance of the facility after completion. Most construction activities will be below the height of the screening vegetation. Construction activities will be visible on those portions of the facility seen in the illustrations in Section 3.1. Federal regulations require that any temporary or permanent structure, including

all appurtenances, that exceeds an overall height of 200 ft (61 m) above ground level be appropriately marked with lighting. The tallest new structures on the site will be the cooling towers that are 550 ft (168 m); additionally, temporary cranes will have heights greater than 200 ft (61 m) that will be marked with lighting.

Water turbidity in the ponds and ephemeral streams may be present during construction. Measures to control water turbidity or other related activity impacts include implementation of the Storm Water Pollution Prevention Plan (SWPPP), transportation of excavated material to an onsite spoils area, and compliance with required federal and state regulations and permit conditions (see Section 1.3). No impact is expected on the Missouri River.

Aesthetic impacts are expected to be SMALL and temporary because the Callaway site is set back from, and only limited portions of the construction will be visible from, publicly accessible areas.

4.4.1.7 References

Beranek, 1971. Noise and Vibration Control, Leo L. Beranek, ed., 1971.

CFR, 2007a. Title 29, Code of Federal Regulations, Part 1910.95, Occupational Noise Exposure, 2007.

CFR, 2007b. Title 29, Code of Federal Regulations, Part 1926.52, Occupational Noise Exposure, 2007.

CFR, 2007c. Title 40, Code of Federal Regulations, Part 50, National Primary and Secondary Ambient Air Quality Standards, 2007.

CFR, 2007d. Title 40, Code of Federal Regulations, Part 60, Standards for Performance for New Stationary Sources, 2007.

Golden, 1980. "Environmental Impact Data Book", Golden 1980 J., R.R. Ovellette, S. Saari, and P.N. Cheremisinoff, Ann Arbor Science Publishers, Ann Arbor, Michigan.

USCB, 2000. From Journey-To-Work Census Data (2000), CTPP 2000: Part 2 Table 9: Occupation by Means of transportation To Work-For the State of Missouri, 2000

4.4.2 SOCIAL AND ECONOMIC IMPACTS

This analysis presents information about the potential impacts to key social and economic characteristics that could arise from the construction of the Unit 2 Power Plant at the Callaway site. The analysis was conducted for the 50 miles (80 km) comparative geographic area and for the region of influence (ROI), which includes Boone, Callaway, and Cole Counties, Missouri) where appropriate and as described in Section 2.5.2. The discussion focuses on potential impacts to population settlement patterns, housing, employment and income, tax revenue generation, and public services and facilities.

4.4.2.1 Study Methods

Changes in regional employment can result in impacts to the region's social and economic systems. An estimate of direct full-time equivalent (FTE) personnel that would be needed to construct the new unit was determined and is provided in Table 4.4-2. "Direct" jobs are those new construction employment positions that would be located on the Callaway site. "Indirect jobs" are positions created off of the Callaway site as a result of the purchases of construction

materials and equipment, and the new direct workers' spending patterns in the ROI. Examples of indirect jobs that could be generated include carpenters and other construction jobs, teachers, barbers, restaurant personnel, gas station and auto repair jobs, convenience store cashiers, drying cleaning and laundry jobs, and so forth.

To estimate indirect employment that would be generated by construction of the power plant, a regional multiplier was generated by the RIMS II software provided by the Regional Economic Analysis Division of the U. S. Bureau of Economic Analysis (BEA, 1997). This model, based upon the construction industry in the ROI, generated a multiplier of 0.3431 indirect jobs created for each direct job. This multiplier was then applied to the (1,654) families that relocated into the ROI. See Table 4.4-5.

The potential demographic, housing, and public services and facilities impacts are discussed for the three-county region of influence because those impacts are an integral part of and derive from the impacts of the in-migrating construction workforce. Impacts to employment and tax revenues are discussed for the 50 mile (80 km) comparative geographic area and the ROI because they serve as a source of the construction labor pool and the collection and distribution of income and sales tax revenues will have impacts throughout the state.

4.4.2.2 Construction Labor Force Needs, Composition and Estimates

4.4.2.2.1 Labor Force Availability and Potential Composition

As shown in Table 4.4-2 the construction workforce is estimated to be a maximum of 3,950 workers constructing Callaway Plant Unit 2 between 2011 and 2017, representing a significant increase in the overall employment opportunities for construction workers. In comparison, Boone County had 4,173 construction jobs in 2006, Callaway County had 721 construction jobs in 2006, and Cole County had 2,737 construction jobs in 2006 (MERIC, 2007). As shown in Table 4.4-2, this peak is estimated to last for about 12 months, from about the third quarter of the fourth year of construction through about the second quarter of the fifth year. Over the course of the entire construction period, staffing needs are estimated to increase steadily from the third quarter of the first year until the peak is reached. Once the peak has passed, the staff levels again will drop steadily, until the last 5 months of construction when employment levels will drop significantly.

Relatively recent studies have shown that the availability of qualified workers to construct the power plant might be an issue, particularly if several nuclear power plants are built concurrently nationwide (DOE, 2004a). Competition for this labor could increase the size of the geographic area, from which the direct construction labor force would have to be drawn for Callaway Plant Unit 2. In its study of the construction labor pool for nuclear power plants, the U.S. Department of Energy (DOE, 2004a) stated that, "A shortage of qualified labor appears to be a looming problem…The availability of labor for new nuclear power plant construction in the U.S. is a significant concern."

These workforce shortages are most likely to occur with "managers, who tend to be older and close to retirement, and skilled workers in high-demand, high-tech jobs." The DOE (2005) anticipates that qualified boilermakers, pipefitters, electricians, and ironworkers might be in short supply in some local labor markets. Labor force shortages can be exacerbated by the fact that portions of the labor force might have to have special certifications for the type of work that they are doing, and because they might have to pass NRC background checks (DOE, 2004a). DOE also found that, "recruiting for some nuclear specialists (e.g., health physicists, radiation protection technicians, nuclear QA engineers/technicians, welders with nuclear certification, etc.) may be more difficult due to the limited number of qualified people within

these fields" (DOE, 2004b). However, meeting these needs is expected to be accomplished by hiring traveling craft workers from other jurisdictions or regions of the country, which is a typical practice in the construction industry.

Estimates about the composition of the Callaway Plant Unit 2 construction workforce (i.e., types of personnel needed) have not been developed for the power plant. However, existing studies of other nuclear power plant construction sites provide an indication about the potential composition of the Callaway Plant Unit 2 construction workforce. As shown in Table 4.4-3 (DOE, 2005), during the peak construction period an estimated 67% (2,635) of the construction workforce could be craft labor. Other less prevalent construction personnel could include about 8% (330) of AmerenUE's operation and maintenance staff, 7% (265) site indirect labor, and 6% (230) Nuclear Steam Supply System vendor and subcontractor personnel.

In more specifically reviewing only the potential craft labor force component of the entire construction workforce (see Table 4.4-4, DOE, 2005), the greatest levels of employment during the peak of construction could be about 18% (475) electricians and instrument fitters, 18% (475) iron workers, 17% (450) pipefitters, 10% (265) carpenters, and 10% (265) general laborers. Table 4.4-5 shows the percentage of each of these craft labor categories that would be needed during seven phases of construction. Carpenters, general laborers, and iron workers would comprise the greatest proportions of the workforce during the concrete formwork; rebar installation, and concrete pouring phase of construction. Iron workers would continue to be the greatest portion of the workforce during the installation of structural steel and miscellaneous iron work. General laborers and operating engineers would be most needed during the earthwork and clearing of the site, including excavation and backfilling. The installation of mechanical equipment would primarily require pipefitters and millwrights. Pipefitters would also be the primary craft labor category working during installation of piping. Electricians would be the most prevalent during installation of the power plant instrumentation and the electrical systems (GIF, 2005).

4.4.2.3 Demography

As stated above, it is estimated that a peak of 3,950 workers would be required to construct Callaway Plant Unit 2. Table 4.4-4 shows the composition of the total craft labor workforce, and Table 4.4-2 shows the total peak construction labor force. AmerenUE consulted with the local Building & Trades council to estimate the availability of the local construction workforce (Mark Fohey, 2007, personal communication). A survey was completed on crafts in the Columbia, Jefferson City and vicinity building and trades area. The results showed a total of 1,470 members of the craft labor would be in commuting distance to the Callaway site. A total of 826 of the craft labor force would commute to the plant site for a four or five day work week, stay at a local hotel and then return to their families on the weekend. It is also estimated that 350 in-migrating members of the craft labor would temporarily relocate their families for the duration of the construction project. Few of the management workers are expected to be close enough to the site to commute. It was estimated that 95% of the in-migrating workforce would rent apartments or townhouses; 5% replied that they would rent homes.

In addition, it is estimated that a maximum of 562 indirect jobs would be created within the ROI. All of these indirect jobs located within the ROI could be filled by the local labor force or by the spouses of the direct workforce. For example, the number of in-migrating family members would exceed the number of indirect jobs created by the in-migrating direct workforce.

There are no nuclear power plant sites that have a 50 mile (80 km) radius overlapping the Callaway site. The closest nuclear power plant is located 183 miles away in Clinton, Illinois. Therefore, there is no cumulative effect on the construction workforce originating from within

50 miles (80 km) of Callaway because of the distances to other nuclear power plants and intervening political and geographical features, and mitigation would not be required.

4.4.2.4 Housing

The Building & Trades Council was consulted to determine the likely housing requirements for the construction workforce (Mark Fohey, 2007, personal communication). From the survey, it was determined where the workers would most likely settle. From the 3,950 workers that would be required to construct Callaway Plant Unit 2, 2,635 are considered craft labor and the other 1,304 are made up of supervision, quality control inspectors, NSSS vendors, EPC contractor manager's, engineers, owner's O & M staff, start up personnel, and NRC inspectors. Of the 2,635 craft labor workforce required to build Callaway Plant Unit 2, 1,470 workers would be expected to be commuting from their existing homes. The in-migrating construction workforce (350 in-migrating craft and 1,304 other than craft labor, as shown in Table 4.4-6) would likely either rent apartments or townhouses. Non-migrating (i.e., weekly or monthly) workers (an estimated 826 total) would likely stay in area hotels, motels or campgrounds and recreational vehicle (RV) parks. Table 2.5-21 identifies the available apartments; Table 2.5-22 identifies the motels and hotels; and Table 2.5-19 identifies the number of houses for rent in the three county ROI. The number of apartments, hotels, and vacant houses that were available to rent in each county was applied to the workforce expected to seek permanent (in-migrating) or temporary (non-migrating) housing. Of the estimated 1,654 households migrating into the ROI and surrounding areas to construct Callaway Plant Unit 2, it is estimated that 877 households (53%) would reside in Boone County, 281 households (17%) would reside in Callaway County, and 480 households (29%) would reside in Cole County. It was determined that the ROI and each county within it would have enough rental units available to meet the needs of the workforce, based upon the most up to date information on existing apartments, townhouse rental units, and vacant houses as seen in Table 2.5-19, Table 2.5-21, and Table 2.5-22.

4.4.2.5 Employment and Income

4.4.2.5.1 50 mi (80 km) Comparative Geographic Area

As stated above, it is estimated that there will be a peak construction workforce of 3,950. The St. Louis MO-IL Metropolitan Statistical Area (MSA) is the closest metropolitan statistical area capable of providing construction, operations, and maintenance workers for the proposed Callaway Plant Unit 2. Table 2.5-14 (BLS, 2003) presents data about the construction and extraction occupational labor force (Standard Occupational Classification [SOC] code 47-0000) in the St. Louis MO-IL MSA. Callaway County and Cole County are part of the much smaller Jefferson City, MO MSA which is presented in Table 2.5-13 (which also includes Moniteau and Osage Counties) while Boone County is part of the much smaller Columbia, MO MSA presented in Table 2.5-12 (which also includes Howard County). In May 2003, 61,060 people were employed in construction and extraction jobs in the St. Louis MO-IL MSA. These workers earned mean salaries of $22.37 per hour and $46,540 per year, respectively (BLS, 2007).

The greater the distance the workforce would commute and the longer that they are employed on the construction site, the more likely the workforce would be to commute from home on a weekly or monthly basis and stay in area motels, or to temporarily relocate and become in-migrants into the ROI, as described in the housing section above. Because the employment opportunities and income would be spread over the 50 mi (80 km) radius, and an even larger geographic area and basis of comparison outside of the region, the beneficial impacts would be SMALL.

4.4.2.5.2 Three-County Region of Influence

Direct construction workforce employment is discussed in Section 4.2.2.3 above. In addition to the 3,950 direct workforce, a peak of 562 indirect workforce jobs would be created in the ROI as estimated using the RIMS II software provided by the Regional Economic Analysis Division of the U.S. Bureau of Economic Analysis (BEA, 1997). This would result in a peak increase of 128,817 to 131,035 employed people in the ROI. The peak increase in employment would be 1,188 people in Boone County, 381 people in Callaway County, and 649 people in Cole County. Unemployed or underemployed members of the labor force could benefit from these increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders) and are hired as part of the construction workforce. These increases would result in a noticeable but small impact to the area economy, representing a maximum 1.5% increase in the 77,099 total labor force in Boone County in 2006, 1.9% in the 20,526 total labor force in Callaway County, and a 1.7% increase in the 37,523 total labor force in Cole County (USCB, 2000).

It is estimated that the direct construction workforce will receive average salaries of $34.00/hour/worker (two-thirds of the estimated $50.00 per hour, including benefits), or about $70,720 annually. The annual total salary expenditure for the peak construction workforce of 3,950 people is $279.3 million. The average annual salary for the direct workforce would also be significantly more than the $41,417 median income for a household in Boone County in 2004 and the $47,715 median household income in Cole County. Callaway County reported a median household income of $40,242 in 2004 (as shown in Table 2.5-17). Boone County would experience an estimated $62 million increase in annual total personal income during peak construction, Callaway County would receive an estimated $19.9 million annually, and Cole County would experience an estimated $34 million annually. In addition, the working spouses of the direct construction workers, who filled indirect jobs created by the power plant, would contribute substantially to individual household incomes. The additional direct and indirect workforce income would result in additional expenditures and economic activity in the ROI. However, since the project related workforce represents a small percentage of the overall workforce in the ROI, it is concluded that the beneficial impacts to employment and income would be SMALL.

4.4.2.6 Tax Revenue Generation

4.4.2.6.1 50 mi (80 km) Comparative Geographic Area

State income taxes would be generated by the in-migrating construction residents, although the amount cannot be estimated because of the variability of investment income, retirement contributions, tax deductions taken, applicable tax brackets, and other factors. It is estimated that the 50 mile (80 km) radius and the state, would experience a $279.3 million increase in annual wages from the direct construction workforce. Relative to the existing total wages ($2.75 billion) for the state, it is concluded that the potential increase in state income taxes represent a small economic benefit.

Additional sales taxes also would be generated by the Callaway Plant Unit 2 Power Plant and the in-migrating construction residents. AmerenUE would directly purchase materials, equipment, and outside services, which would generate additional state sales taxes. Also, in-migrating construction residents would generate additional sales tax revenues from their daily purchases. The amount of increased sales tax revenues generated by the in-migrating construction residents would depend upon their retail purchasing patterns, but would only represent a small benefit to this revenue stream for the region and the 50 mile (80 km) radius.

Overall, the tax revenues generated by the Callaway Plant Unit 2 and the related construction workforce would be substantial in absolute dollars, as described above; they would be relatively small compared to the overall tax base in the state of Missouri and the ROI. Thus, it is concluded that the overall beneficial impacts to state tax revenues would be SMALL.

4.4.2.6.2 Three-County Region of Influence

In 2006 Union Electric Company paid approximately $8.6 million in Callaway County property taxes related to Callaway Plant Unit 1. For the construction period of 2012 through 2018, all property taxes will be locally assessed. It is estimated that Union Electric Company will pay in excess of $115 million to Callaway County. Once the unit is placed in service, property taxes will become primarily state-assessed, however, will retain some locally assessed components. It is estimated that once the unit is placed in service, Callaway County will continue to receive an estimate of $17 million on an annual basis with another $70 million annual estimate to be distributed among Union Electric Company's other 66 counties within their service territory. These estimates are based on an analysis of prospective annual levels of investment in plant construction, with their corresponding levels of assessed values of plant machinery, buildings, land, other equipment, and supplies.

The plant will be located in the South Callaway RII School District, which is headquartered in the town of Mokane. During construction, only the RII School District will be able to levy a tax on the plant property. After commercial operation begins, all school districts in the county will receive a pro-rata share (based on enrollment) of a levy that averages the tax rates of all school districts in the county. This tax, levied on the county's share of all Union Electric Company's distributable property, is assessed by the state. However, the South Callaway RII district will continue to tax the plant's land, buildings, and material and supplies.

In addition, as a result of the construction process and personnel needs, construction and employee jobs will be created and will result in an increase in state and local sales tax revenues relating to a variety of retail sales (i.e. hotel, restaurants, gas stations, entertainment, construction equipment, miscellaneous retail, etc.).

These increased property tax revenues would either provide additional revenues for existing public facility and service needs or for new needs generated by the power plant and associated construction workforce. The increased revenues could also help to maintain or reduce future taxes paid by existing non-project related businesses and residents, to the extent that project-related payments provide tax revenues that exceed the public facility and service needs created by Callaway Plant Unit 2. However, the payment of those taxes often lags behind the actual impacts to public facilities and services, or the time needed to plan for and provide the additional facilities or services. Thus, it is concluded that these increased power plant property tax revenues would be a LARGE economic benefit to Callaway County.

Additional county income taxes would be generated by the in-migrating construction residents though the amount cannot be estimated because of the variability of investment income, retirement contributions, tax deductions taken, applicable tax brackets, and other factors. It is estimated because of the availability of homes, apartments, townhouses, hotels, motels, and campgrounds that of the 1,654 families relocating, 53% would relocate to Boone County, 17% would relocate to Callaway County, and 29% would relocate to Cole County. Based on the number of people in each county, times the average income, Boone County would experience a $62 million increase in annual wages from the direct construction workforce, Callaway County would experience an estimated annual increase of $19.9 million from the direct construction workforce, and Cole County would experience a $29.3 million increase. Relative to the existing

total wages for these counties, it is concluded that the potential increase in county income taxes represent a small economic benefit to the jurisdictions.

As with the 50 mile (80 km) comparative geographic area, additional sales taxes also would be generated within the ROI by the power plant and the in-migrating construction residents. However, these purchases would be smaller within the ROI. The amount of increased sales tax revenues generated by the in-migrating construction residents would depend upon their retail purchasing patterns, but would only represent a small benefit to this revenue stream for Boone, Callaway, and Cole Counties.

Therefore all tax revenues generated by the Callaway Plant Unit 2 and the related workforce would be substantial, as described above. Thus, it is concluded that the overall beneficial impacts to tax revenues would be LARGE.

4.4.2.7 Land Values

Median home values quadrupled over the 60-year period since the first housing census in 1940. The median value of single-family homes in the United States rose from $30,600 in 1940 to $119,600 in 2000. Median home value increased in each decade of the 60-year period, rising fastest (43%) in the 1970's and slowest (8.2%) in the 1980's. These values refer to owner-occupied single-family housing units on less than 10 acres without a business or medical office on the property. The state of Missouri in the year 2000 census had a median household value of $89,900. In the year 2000, the U.S. census bureau supplied a figure of $85,500 for the median house price in Callaway County. The median house price in Callaway County is just below the median house price in Missouri. Since the median house in Callaway County price is just below the median house price in Missouri, it is determined that the house prices in and around Callaway Site are not adversely affected.

4.4.2.8 Public Services

Police, EMS, and Fire Suppression

Through an extensive communications endeavor with fire, EMS, and police services in Boone, Callaway, and Cole Counties, the availability and capacity of these public services were able to be determined. The majority, if not all, of survey respondents indicated that in the event Callaway Plant Unit 2 is built, their facilities will be able to take on the extra work load. Some respondents expressed that additional employees may need to be hired, but for the most part, these organizations are equipped to handle the additional work load with the resources they currently have. Thus, impacts on public services are expected to be small and no mitigation is required.

Educational System

As described above, an estimated 178 new households would in-migrate into Callaway County for operation of Callaway Plant Unit 2. The estimated $2.4 million in increased property taxes that would be paid to Callaway County annually by Ameren for Callaway Plant Unit 2, which include levies for the Callaway County Public School System, would provide additional funds to meet the educational needs of children for the in-migrating operational workforce. Because the number of in-migrating operational households is small and all except one of the Callaway County public schools are operating below capacity, the impacts of the power plant on the Callaway County School District would likely be SMALL and would not require mitigation.

The majority (all except for approximately 10) of the educational facilities in Boone County are operating at or near capacity. The in-migration of an estimated 58 new households into Boone

County from operation of the Callaway Plant Unit 2 would probably place greater demands on the already over-crowded system. However, when events such as this occur, the schools are prepared to supplement their existing facility with portable trailers serving as classrooms. Cole County Public School System has approximately 7 schools operating at or near capacity. The in-migration of an estimated 80 households in Cole County from operation of the Callaway Plant Unit 2 would not place greater demands on the system. Although the school district could receive some additional funding from property taxes generated by these new households (likely to be minimal because adequate housing units are already available in the county and those units are already being taxed), it would not receive additional funding directly from the power plant because Callaway Plant Unit 2 does not pay property taxes to Boone or Cole County during construction; however, after Callaway Plant Unit 2 is in operation, all counties would receive tax benefits where-by the average school tax rate in the county is applied to the total assessed value of distributable property of the company in the county. The resulting tax then allocated to all school districts in the county, primarily on the basis of enrollment. Based on the information discussed above, the impacts of the power plant on the Boone County School District would likely be MODERATE and would require mitigation in the form of portable classrooms and the impacts on the Cole County School District would likely be SMALL and would not require mitigation.

4.4.2.9 Public Facilities

As discussed above, there is a sufficient quantity of vacant housing units in Boone, Callaway, and Cole Counties to meet the housing needs of the in-migrating direct construction workforce for Callaway Plant Unit 2, so no new housing units would likely be required. The excess capacity in the water and sewage services as described in Section 2.5.2.9.2.1, Section 2.5.2.9.2.2, Section 2.5.2.9.2.3, and the lack of new construction resulting from the power plant would result in no effects to those services. Although an increase in the population would likely place additional demands on area transportation and recreational facilities, the facilities appear to have enough capacity to accommodate the increased demand and impacts would likely be small. Area highways and roads would have increased traffic levels, particularly during shift changes at the Callaway Site, resulting in a small traffic impact. These impacts are described in Section 4.4.1.5.

4.4.2.10 References

BEA, 1997. Regional Multipliers – A User Handbook for the Regional Input-Output Modeling System (RIMS II), Third Edition, U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis, March 1997.

DOE, 2004a. Volume 1, Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs, U.S. Department of Energy, Prepared by Dominion Energy Inc, Bechtel Power Corporation, TLG Inc, and MPR Associates, May 27, 2004.

DOE, 2004b. DOE NP2010 Construction Schedule Evaluation, MPR-2627, Revision 2, U.S. Department of Energy, Prepared by L. Crosbie and K. Kidwell, September 24, 2004.

DOE, 2005. DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment. MPR-2776, Revision 0, U.S. Department of Energy, October 21, 2005.

GIF, 2005. Cost Estimating Guidelines for Generation IV Nuclear Energy Systems, REV.2.02 Final, Generation IV International Forum (GIF), Economic Modeling Working Group (EMWG), September 30, 2005.

Fohey, Mark, 2007. Personal communication between Mark Fohey, President of the Columbia, Jefferson City, Missouri & Vicinity Building and Trades Council and Pat Cryderman, Assistant Manager Nuclear Generation Development Callaway Plant, Construction Workforce Estimates and Housing Patterns, November 20, 2007.

MERIC, 2007 Missouri Economic & Research Center, Missouri Department of Economic Development, www.missourieconomy.org/indicators/lehd/index/stm, December 4, 2007.

NRC, 1981. NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants – LWR Edition, Nuclear Regulatory Commission, July 1981.

NRC, 1981b. NUREG/CR-2002, PNL-3757, Volume 2, Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites, Profile Analysis of Worker Surveys. Prepared by S. Malhotra and D. Manninen, Pacific Northwest Laboratory, Nuclear Regulatory Commission, April, 2007

USCB, 2000. U.S. Census Bureau 2000, County-to-County Worker Flows, Website: http://www.census.gov/population/www/cen2000/commuting.html, U.S. Census Bureau, Date accessed: March 23, 2007.

4.4.3 ENVIRONMENTAL JUSTICE IMPACTS

This section describes the potential disproportionate adverse socioeconomic, cultural, environmental, and other impacts that construction of Callaway Plant Unit 2 could have on low income and minority populations within two geographic areas. The first geographic area is a 50 mile (80 km) radius of the Callaway Plant Unit 2 power plant, where there is a potential for disproportionate employment, income, and radiological impacts compared to the general population (NRC, 1999). This analysis also evaluates potential impacts within the region of influence (ROI), where more localized potential additional impacts could occur to transportation/traffic, aesthetics, recreation, and other resources compared to the general population. It also highlights the degree to which each of these populations would disproportionately benefit from construction of the proposed power plant, again compared to the entire population. There is a transient population at Missouri Department of Corrections located 4 miles to 5 miles (6.4 km to 8.1 km) from the location of construction. This population is not expected to be impacted by construction activities.

Section 2.5.1 provides details about the general population characteristics of the study area. Section 2.5.4 provides details about the number and locations of minority and low income populations within a 50 mile (80 km) radius of the Callaway site, and subsistence uses.

4.4.3.1 Minority and Low Income Populations and Activities

As discussed in Section 2.5, about 91% of the residential population that lives within a 50 mile (80 km) radius lives farther than 18 miles (29 km) from the site. Boone, Callaway, and Cole Counties have been defined as the ROI because 87% of the current Callaway Plant Unit 1 operational workforce resides there, and it is assumed that the in-migrating construction workforce for Callaway Plant Unit 2 would also primarily reside in and impact this geographic area.

As shown in Table 2.5-47, there are very few concentrations of low income populations within 50 miles (80 km) of the site.Figure 2.5-6 shows the locations of low income census block groups within a 50 mile (80 km) radius oft the Callaway site. There are 22 census block groups that have greater than 50% low income households or that exceed the average number of low income

households in the 50 mile (80 km) radius by 20 percentage points or more. Likewise, there are 27 minority census blocks described in the 50 mile (80 km) radius of the Callaway site that meet the same criteria.

The criteria for meeting a low income or minority census block group is the minority or low income population is greater than 50% of that block group or if the percentage in the ROI block group is 20 percentage points higher than that of the 50 mile (80 km) radius block group.

There are 15 minority census block groups in Boone County out of 83 total census block groups. The closest minority census block group is located 31.8 miles (51.2 km) to the northwest. There is 1 minority census block group in Callaway County located 8.2 miles (13.2 km) to the northwest. Cole County has 7 minority census block groups. The closest one is located 25.8 miles (41.5 km) to the southwest.

There are 16 low income census block groups in Boone County, out of 83 total census block groups. The closest census block is located 31.8 miles (51.2 km) to the northwest. There are 3 low income census block groups in Cole County, out of the total of 53 census block groups. The closest census block group is located 25.8 miles (41.5 km) to the southwest. There are 2 low income census block groups in Callaway County, out of the total of 35 census block groups located there. The closest is located 11.1 miles (17.9 km) to the northwest.

Because the power plant site is already developed and access is restricted, no minority or low income residences would be removed or relocated within the ROI. Additionally, the distance of the plant from area residents, in general, is great enough that none of these populations would be directly affected by construction of the power plant (i.e., noise, air quality, and other disturbances from the footprint of the facility).

4.4.3.1.1 50 Mile (80 km) Comparative Geographic Area

Employment and Income

There would be an estimated maximum 3,950-person workforce constructing the Callaway Plant Unit 2 Power Plant from 2011 to 2017, representing a significant increase in the overall employment opportunities for construction workers. Unemployed or underemployed members of minority and low income groups could benefit from increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders), are hired as part of the construction workforce, and have adequate transportation to access the construction site. These low income and minority populations primarily reside the St. Louis, Jefferson City, and Columbia, Missouri MSA's. The beneficial impacts of these potential new employment opportunities likely would be SMALL.

In addition, because of the demand for such skills, the proportion of low income and minority construction workers from the comparative geographic area that are currently employed could realize increased income levels, to the extent that they leave lower paying jobs, to work on Callaway Plant Unit 2. The beneficial impacts of these increased income levels for low income and minority populations likely would be SMALL.

There are no unique minority or low income populations within the comparative geographic area that would likely be disproportionately adversely impacted by construction of the proposed power plant because most are located more than 50 mi (80 km) from the Callaway site where no environmental impacts (e.g., noise, air quality, water quality, changes in habitat, aesthetic, etc.) would likely occur.

4.4.3.1.2 Three-County Region of Influence

Employment and Income

Unemployed or underemployed members of minority and low income groups within the ROI also could benefit from increased employment opportunities, to the extent that they have the craft skills required (e.g., laborers, carpenters, electricians, plumbers, welders) and are hired as part of the construction workforce. The beneficial impacts of increased employment opportunities are likely to be more noticeable for minority and low-income populations within the ROI because of the potential hiring levels relative to the smaller existing workforce base. As shown in Table 4.4-7, minority and low income populations that are located in the ROI are located at least 32 miles to the northwest in Boone County and 26 miles to the Southwest in Cole County. Because of their limited geographic extent and the level of impacts, the beneficial impacts of these potential new employment opportunities likely would be SMALL.

In addition, because of the demand for such skills, the proportion of low income and minority construction workers from the ROI that are currently employed could realize increased income levels, to the extent that they leave lower paying jobs to work on Callaway Plant Unit 2. These benefits might be greater for the low income populations within the ROI, relative to the benefits realized in the 50 mile (80 km) comparative geographic area, if construction related income currently is lower within the ROI. The beneficial impacts of these increased income levels for low income and minority populations likely would be SMALL.

Impacts on area businesses, and potentially related increased opportunities to obtain higher paying indirect jobs, could be realized from increased economic activity resulting from Callaway Plant Unit 2's purchase of materials from businesses within the ROI. The beneficial impacts of these potential new employment opportunities likely would be SMALL.

4.4.3.2 Subsistence Activities

The types and levels of subsistence activities occurring in the three-county region of influence (i.e., Boone, Callaway, and Cole Counties) are described in Section 2.5.4.

As stated in ER Section 2.4.1, white-tail deer and waterfowl populations are abundant throughout Missouri and on or near the Callaway site. These populations represent a valuable resource for hunters.

In addition, it is assumed that collection of plants for ceremonial purposes and as a food source (i.e., culturally significant plants, berries, or other vegetation) could be occurring in the three-county region of influence. Again, minority and low-income populations might be conducting these collection activities, near the Callaway site, more often than the general population. In addition, when conducting their collection activities, they also could be harvesting greater quantities of plants, than the general population. For safety and security reasons the general public is not allowed uncontrolled access to the Callaway site, but they are allowed on AmerenUE property, specifically the Reform Conservation Area. However, since the majority of the Reform Conservation Area will remain open during construction and operation of Callaway Plant Unit 2, the impact on any subsistence activities are expected to be SMALL.

Table 4.4-1—Typical Noise Levels of Construction Equipment

Equipment Type	Noise Level, (dBA)		
	Peak	at 50 ft (15.2 m)	at 3000 ft (914.4 m)
Earthmoving			
Loaders	104	73-86	38-51
Dozer	107	87-102	52-67
Scraper	93	80-89	45-54
Graders	108	88-91	53-56
Dump trucks	108	88	53
Heavy trucks	95	84-89	49-54
Materials Handling			
Concrete mixer	105	85	50
Crane	104	75-88	40-53
Forklift	100	95	60
Stationary			
Generator	96	76	41
Impact			
Pile driver	105	95	60
Jack hammer	108	88	53

Reference:

Beranek, 1971 Noise and Vibration Control, Leo L. Beranek, ed. 1971.

Table 4.4-2—Estimated Average FTE Construction Workers, by Construction Year/Quarter at the Callaway Site

Year / Quarter of Construction	Average FTE Construction Workforce
Year 1:	
1	350
2	800
3	1,250
4	1,600
Year 2:	
1	1,900
2	2,200
3	2,500
4	2,800
Year 3:	
1	3,050
2	3,200
3	3,350
4	3,500
Year 4:	
1	3,683
2	3,867
3	3,950
4	3,950
Year 5:	
1	3,950
2	3,917
3	3,700
4	3,400
Year 6:	
1	3,050
2	1,967
3*	768*

Note: The third "quarter" of construction year 6 has only two months; the length of the total construction period is estimated to be 68 months.

Table 4.4-3—Total Peak On-Site Nuclear Power Plant Construction Labor Force Requirements (based on an average of single power plants)

Personnel Description	DOE Percent of Total Peak Personnel, Average Single Unit	DOE Peak Total Personnel, Average Single Unit	Estimated Callaway Plant Unit 2 Total Peak Workforce Composition
Craft Labor	66.7%	1,600	2,635
Craft Supervision	3.3	80	130
Site Indirect Labor	6.7	160	265
Quality Control Inspectors	1.7	40	67
NSSS Vendor and Subcontractor Staffs	5.8	140	229
EPC Contractor's Managers, Engineers, and Schedulers	4.2	100	166
Owner's O&M Staff	8.3	200	328
Start-Up Personnel	2.5	60	99
NRC Inspectors	0.8	20	32
Total Peak Construction Labor Force	100.0%	2,400	3,950

Notes:

EPC = Engineering, Procurement, and Construction
O&M = operation and maintenance
NRC = Nuclear Regulatory Commission
NSSS = Nuclear Steam Supply System
Percentages and numbers may total slightly more or less than the total due to rounding.

Reference:

DOE (2005). DO5 NP 2010 Nuclear Power Plant Construction Infrastructure Assessment, MPR-2776, Revision 0, U.S. Department of Energy, October 21, 2005

Table 4.4-4—Peak On-Site Nuclear Power Plant Construction Craft Labor Force Requirements (based on an average of single power plants)

Craft Personnel Description	DOE Percent of Peak Craft Labor Personnel, Average Single Unit	DOE Peak Craft Labor Personnel, Average Single Unit	Estimated Callaway Plant Unit 2 Peak Craft Workforce Composition
Boilermakers	4.0%	60	105
Carpenters	10.0	160	264
Electricians/Instrument Fitters	18.0	290	474
Iron Workers	18.0	290	474
Insulators	2.0	30	53
Laborers	10.0	160	264
Masons	2.0	30	53
Millwrights	3.0	50	79
Operating Engineers	8.0	130	211
Painters	2.0	30	53
Pipefitters	17.0	270	448
Sheetmetal Workers	3.0	50	79
Teamsters	3.0	50	79
Total Craft Labor Force	100.0%	1,600	2,635

Notes: Percentages and numbers may total slightly more or less than the total due to rounding.

Reference:

DOE (2005). DO5 NP 2010 Nuclear Power Plant Construction Infrastructure Assessment, MPR-2776, Revision 0, U.S. Department of Energy, October 21, 2005

Table 4.4-5—Nuclear Power Plant Craft Labor Force Composition by Phases of Construction

Craft Labor	Construction Phase						
	Concrete Formwork, Rebar, Embeds, Concrete	Structural Strength Steel, Misc. Iron & Architectural	Earthwork Clearing, Excavation, Backfill	Mechanical Equipment Installation	Piping Installation	Instrument Installation	Electrical Installation
Boilermakers				15			
Carpenters	40	5					2
Electricians/Instrument Fitters						70	96
Iron Workers	20	75		10			
Laborers	30	5	60				1
Millwrights				25			
Operating Engineers	5	15	35	12	15	2	1
Pipefitters				35	80	28	
Teamsters			5	3	5		
Others	5						
Total Percentage of Craft Labor Force	100	100	100	100	100	100	100

Reference:

GIF, 2005. Cost Estimating Guidelines for Generation IV Nuclear Energy Systems, Rev. 2.02 Final Generation IV International Forum (GIF), Economic Modeling Working Group (EMWG), September 30, 2005.

Table 4.4-6—Estimates of In-Migrating Construction Workforce in Boone, Callaway, and Cole Counties, 2011-2015

In-migration Characteristics	Boone County	Callaway County	Cole County	Total ROI
Direct Workforce:				
In-Migrating Workforce				1,654
Percent of Current Callaway Plant Unit 1 Workforce Distribution	16%	49%	22%	87%
Percent of In-Migrating Construction Workforce Distribution[a]	53%[b]	17%[b]	29%[b]	99%
Estimated In-migrating Direct Workforce	877	281	480	1638
In-migrating Direct Workforce Population (@2.48 people/household)	2175	697	1,190	4,061[b]
Indirect Workforce:				
Estimated Distribution of Peak Direct Workforce	877	281	480	1,638[b]
Peak Indirect Workforce (@0.3431, BEA multiplier)	301	96	165	562[b]
Indirect Workforce Needs That Could Met by Direct Workforce Spouses (@54.5% working spouses)	478	153	262	893[b]

Notes:

It is assumed that 100% of the construction workforce in-migrating into the ROI will move their families with them.

U.S. Census Bureau 2000 census data indicate that the state of Missouri had 2.48 people per household.

U.S. Census Bureau 2000 census data indicate that, within the state of Missouri, 54.5% of households had a working spouse.

Percent of Current Callaway Plant Unit 1 workforce distribution adds up to 87%, that number represents the workers that live in the ROI.

(a) Percentages of In-Migrating Construction Workforce Distribution according to the percentages of housing availability.

(b) Because of rounding, may not equal 100%

Table 4.4-7—Minority and Low Income Populations Within About 50 Linear Miles (32 km) of the Callaway Site

(Page 1 of 2)

County	Type of Population	Number of Census Block Groups	Estimated Linear Distance from Callaway Site mi (km)	Direction from Callaway Site
Region of Influence:				
Boone	Minority	15	31.8 (51.2)	Northwest
	Low Income	16	31.8 (51.2)	Northwest
Callaway	Minority	1	8.2 (13.2)	Northwest
	Low Income	2	11.1 (17.9)	Northwest
Cole	Minority	7	25.8 (41.5)	Southwest
	Low Income	3	25.8 (41.5)	Southwest
Other Counties:				
Audrain	Minority	1	26.3 (42.3)	North
	Low Income	1	42.8 (68.9)	North
Cooper	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Crawford	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Franklin	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Gasconade	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Howard	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Lincoln	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Maries	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Miller	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Moniteau	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Monroe	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Montgomery	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Osage	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Phelps	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a
Pike	Minority	1	50 (80.5)	Northeast
	Low Income	0	n/a	n/a
Ralls	Minority	0	n/a)	n/a
	Low Income	0	n/a	n/a
Randolph	Minority	1	53.3 (85.8)	Northwest
	Low Income	0	n/a	n/a

Table 4.4-7—Minority and Low Income Populations Within About 50 Linear Miles (32 km) of the Callaway Site

(Page 2 of 2)

County	Type of Population	Number of Census Block Groups	Estimated Linear Distance from Callaway Site mi (km)	Direction from Callaway Site
St. Charles	Minority	1	51.0 (82.1)	East
	Low Income	0	n/a	n/a
Warren	Minority	0	n/a	n/a
	Low Income	0	n/a	n/a

Notes:

n/a = not applicable

A 50-mi (80 km) radius was selected because it includes all of the ROI. It also includes all counties that have a portion of the county line encompassed in the 50 mile radius.

References:

U.S. Department of Commerce, Bureau of the Census, Missouri, 2000 Census Block Groups, 2000 94-171 files.

Missouri Census Data Center, 2007

4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

This section discusses the exposure of construction workers building Callaway Plant Unit 2 to radiation from the normal operation of Callaway Plant Unit 1.

4.5.1 SITE LAYOUT

The physical location of Callaway Plant Unit 2 relative to the existing Callaway Plant Unit 1 on the Callaway site is presented on Figure 4.1-1. As shown, Callaway Plant Unit 2 would be located generally northwest geographically of the protected area of Callaway Plant Unit 1. Hence, the majority of construction activity would take place outside the protected area for the existing unit, but inside the Owner Controlled Area for the Callaway site.

4.5.2 RADIATION SOURCES AT CALLAWAY PLANT UNIT 2

During the construction of Callaway Plant Unit 2, the construction workers will be exposed to radiation sources from the routine operation of Callaway Plant Unit 1. Potential sources are discussed in the Offsite Dose Calculation Manual (ODCM) (AmerenUE, 2005), the annual Radiological Effluent Release Report (AmerenUE, 2006), and the Radiological Environmental Operating Report (AmerenUE, 2006a) for Callaway Plant Unit 1. The potential sources of radiation to Callaway Plant Unit 2 construction workers are gaseous effluents, liquid effluents, and direct radiation from Callaway Plant Unit 1. These sources are discussed below. Locations of gaseous releases and direct radiation affecting construction workers are shown on Figure 4.5-1.

All gaseous effluents flow out the Callaway Plant Unit 1 unit vent. The releases are reported annually to the NRC (AmerenUE, 2001, AmerenUE, 2002, AmerenUE, 2003, AmerenUE, 2004, AmerenUE, 2005a, AmerenUE, 2006). For example, over the past six years (2001 through 2006) the average annual gaseous releases from Callaway Plant Unit 1 were reported as 183 Ci (6.8E+12 Bq) of fission and activation gases, 3.9E-4 Ci (1.4E+07 Bq) of Iodines, 2.0E-4 Ci (7.5E+06 Bq) of particulates with half-lives greater than eight days, and 46.0 Ci (1.7E+12 Bq) of Tritium. A summary by isotope for each of the six years is provided in Table 4.5-1. Doses to the general population are also computed in accordance with the ODCM (AmerenUE, 2005) and reported annually.

Effluents from the liquid waste disposal system produce small amounts of radioactivity in the discharge to the Missouri River and will not affect workers as discussed further in Section 4.5.4.2. A review of the annual Radioactive Effluent Release Reports issued for Callaway Plant Unit 1 indicate direct radiation for on-site areas of public access of less than 0.1 mrem (0.001 mSv). Direct radiation in the amount of 0.1 mrem (0.001 mSv) has been added to the dose estimates. It should be noted that AmerenUE does not have an on-site interim dry spent fuel storage facility (often referred to as an ISFSI) at the Callaway site and has no plans to install such a facility until after the completion of construction of Callaway Plant Unit 2. The Old Steam Generator Storage Facility (OSGSF) represents a potential direct radiation source affecting construction workers. The OSGSF is located approximately 200 ft (60 m) geographically northeast of the Callaway Plant Unit 2 construction area. A survey conducted in November 2007 recorded a dose rate of less than the instrument detection limit of 0.5 mrem per hr (0.005 mSv per hr) from the OSGSF.

4.5.3 HISTORICAL DOSE RATES

The historical measured and calculated dose rates that were used to estimate worker dose are presented below.

4.5.3.1 Gaseous and Liquid Effluent Historical Measurements

Each year the exposure to the maximally exposed member of the public due to the release of gaseous and liquid effluents from Callaway Plant Unit 1 are calculated in accordance with the existing units' ODCM (AmerenUE, 2005). These maximum individual doses are provided in historical Callaway Plant Unit 1 Annual Radiological Environmental Operating Reports (AmerenUE, 2001a, AmerenUE, 2002a, AmerenUE, 2003a, AmerenUE, 2004a, AmerenUE, 2005b, AmerenUE, 2006a). These reports show that the plant releases generally result in doses to the maximally exposed member of the public of less than 1% of the limits. Doses due to liquid releases are also very low and are not expected to be of any significance to construction workers since they will not be permitted to ingest food (edible plants or fish) grown in effluent streams during their working hours. Therefore, only external pathways will be considered.

4.5.3.2 Historical Measurements

Thermoluminescent dosimeter (TLD) measurements are reported each year in the Annual Radiological Environmental Operating Reports for Callaway Plant Unit 1 (AmerenUE, 2001a; AmerenUE, 2002a; AmerenUE, 2003a; AmerenUE, 2004a; AmerenUE, 2005a; AmerenUE, 2006a). The closest TLDs to the location of Callaway Plant Unit 2 construction areas are located generally geographically WNW through N of the existing Callaway Plant Unit 1 at about one mile (1.6 km) (considerably beyond the construction areas). The most prevalent wind directions are also generally toward the NNW. Inspection of the TLD results for the six year period (2001 through 2006) show readings consistent with natural background activity. The REMP program will be modified to cover areas of construction closer to the existing plant.

4.5.4 PROJECTED DOSE RATES AT CALLAWAY PLANT UNIT 2

Dose rates from the gaseous releases from the plant vent were calculated for the general areas where construction activities will occur. No credit is taken for any shielding.

4.5.4.1 Gaseous Dose Rates

The annual dose rates from gaseous effluents to construction workers on the Callaway Plant Unit 2 construction site were computed using the XDCALC program with a semi-infinite gamma air dose plume model assuming a ground level release. Of the six-years of effluent release reports from Callaway Plant Unit 1, the releases in 2004 were highest and were used as the source term in the calculations. This source term is provided in Table 4.5-5. These isotopic release rates were used to compute dose for each hour of the three-year period of meteorological data (2004 through 2006). These doses were summed on a radial grid and averaged. The methodology found in NRC Regulatory Guide 1.109 (NRC, 1977) was used to determine the appropriate doses for evaluation against limits. Results are presented in Table 4.5-2 for plant vent effluents only for 2200 hour exposure.

The calculations discussed in the previous paragraph follow the methodology in 10 CFR 50, Appendix I. Since the issuance of that document more recent methodology for determining Total Effective Dose Equivalent (TEDE) has been issued by the EPA in Federal Guidance Reports 11 (EPA, 1988) and 12 (EPA, 1993). TEDE doses that result from the combined direct radiation from the plume and ground deposits as well as an effective dose due to inhalation are dominated by the plume contribution. A calculation was made using the 2004 source terms and the EPA methodology for TEDE where each of the pathways could be evaluated. This calculation showed the ground shine contribution to be very low and the inhalation of particulates and halogens to contribute about 13% more than the plume contribution. The Thyroid CDE dose was lower than the inhalation component of the TEDE. Therefore, the whole body doses resulting from direct radiation from plant sources and from the plume are

increased by a factor of 1.13 for comparison with standards involving TEDE doses as appropriate for routine operations. Results of the dose calculations for full time occupancy including the TEDE correction are provided in Table 4.5-3. This Table also includes a direct radiation dose of 0.1 mrem per year (0.001 mSv). Table 4.5-6 provides the TEDE doses including the direct radiation for 2,200 hour occupancy.

4.5.4.2 Liquid Dose Rates

There is no expected dose to construction workers from liquid effluents. A new discharge line was installed in 2007 and 2008 with sufficient capacity to accommodate the combined liquid effluents from Callaway Plant Units 1 and 2. If necessary, dredging to deepen the approach to the existing barge dock will occur upstream of the discharge line. On-shore work to install the collector well system will also take place upstream of the outfall.

4.5.5 COMPLIANCE WITH DOSE RATE REGULATIONS

Callaway Plant Unit 2 construction workers are, for the purposes of radiation protection, members of the general public. This means that the dose rate limits are considerably lower than the 100 mrem per year limit to be considered a radiation worker. The construction workers (with the exception of certain specialty contractors loading fuel or using industrial radiation sources for radiography) do not deal with radiation sources.

There are three regulations that govern dose rates to members of the general public. Dose rate limits to the public are provided in 10 CFR 20.1301 (CFR, 2007a) and 10 CFR 20.1302 (CFR, 2007b). Compliance with 10 CFR 20.1302 is discussed in Section 4.5.7. The design objectives of 10 CFR 50, Appendix I (CFR, 2007c) apply relative to maintaining dose as low as reasonably achievable (ALARA) for construction workers. Also, 40 CFR 190 (CFR, 2007d) applies as it is referred to in 10 CFR 20.1301. Note that 10 CFR 20.1201 through 20.1204 do not apply to the construction workers as they are considered members of the public and not radiation workers.

4.5.5.1 10 CFR 20.1301

10 CFR 20.1301 (CFR, 2007a) limits annual doses from licensed operations to individual members of the public to 0.1 rem (1 mSv) TEDE. In addition, the dose from external sources to unrestricted areas must be less than 0.002 rem (0.02 mSv) in any one hour. This applies to the public both outside of and within controlled areas. Given that the relevant sources are relatively constant in time, the hourly limit is met if the annual limit is met. The dose rates in construction areas are given in Table 4.5-6. For an occupational year, i.e., 2,200 hours onsite, the maximum dose would be generally NNW of Callaway Plant Unit 1 across the settling pond. At this location the TEDE dose would be 0.000209 rem (0.00209 mSv) and less than the limit of 0.002 rem (0.02 mSv) in any one hour. If the worker stood at that location for all working hours in one year from Table 4.5-3 the peak TEDE dose would be 0.000832 rem (0.00832 mSv). This value is less than the limits specified above for members of the public. Therefore, construction workers can be considered to be members of the general public for the purpose of not requiring radiation protection or monitoring.

4.5.5.2 10 CFR 50, Appendix I

The 10 CFR 50, Appendix I criteria (CFR, 2007c) apply only to effluents. The purpose of the criteria is to assure adequate design of effluent controls. The annual limits for liquid effluents are 3 mrems (30 μSv) to the total body and 10 mrems (100 μSv) to any organ. For gaseous effluents, the pertinent limits are 5 mrems (50 μSv) to the total body and 15 mrems (150 μSv) to organs including skin. Table 4.5-6 shows that there are no dose rates to workers in a construction area from effluents that exceed 1 mrem per year (10 μSv per year). Calculations for

peak organ dose confirmed that the whole body dose was more restrictive than the Thyroid dose. Therefore, the criteria have been met. Note that Callaway Plant Unit 2 occupational zones, during construction, are within the Owner Controlled Area, but treated, for purposes of these criteria, as unrestricted areas (personnel will not have individual exposure monitoring devices).

4.5.5.3 40 CFR 190

The 40 CFR 190 (CFR, 2007d) criteria apply to annual doses, here called dose rates because the units are in mrem per year, received by members of the general public exposed to nuclear fuel cycle operations, i.e., nuclear power plants. Therefore, these regulations apply to Callaway Plant Unit 2 construction workers on the Callaway site, just as they apply to members of the general public who live offsite. The most limiting part of the regulation states "The annual dose equivalent (shall) not exceed 25 millirems (0.25 mSv) (per year) to the whole body." In the case of Callaway Plant Unit 1 effluent releases, if this regulation is met for the whole body, then the thyroid and organ components will also be met.

Table 4.5-6 shows that the maximum dose rate in the construction areas is 0.209 mrem/2,200 hours (0.00209 mSv/2,200 hours). The units are expressed to be clear that occupancy of 2,200 hours is assumed. The use of 2,200 hours assumes the worker takes 2 weeks vacation or sick time per year, works 40 hours per week for 50 weeks per year, and works 10% overtime per year. Note, that this dose rate is for the maximum dose rate location across the settling pond to the NNW. The ALARA program described below will not allow workers to linger or work full shifts at these locations. The maximum dose rates for all other construction areas are less than 25 mrem per year (0.25 msievert per year). Therefore, the requirements of 40 CFR 190 will be met for all construction workers.

4.5.6 COLLECTIVE DOSES TO CALLAWAY PLANT UNIT 2 WORKERS

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The total worker collective dose for the combined years of construction is 1.8 person-rem (0.018 person-Sieverts). This is a best estimate and is based upon the worker census shown in Table 4.5-4 along with an estimated average dose rate from Table 4.5-6 in the zone of heaviest construction NW of Callaway Plant Unit 1 to be 0.1mrem per yr (0.001mSv per yr).

4.5.7 RADIATION PROTECTION AND ALARA PROGRAM

Due to the exposures from Callaway Plant Unit 1 normal operations, there will be a radiation protection and ALARA program for Callaway Plant Unit 2 construction workers. The Callaway Plant Unit 1 ODCM and ALARA Program will be revised as necessary to include the Callaway Plant Unit 2 Construction ALARA Program. Elements will include general radiation protection measures for Callaway Plant Unit 2 construction workers, establishment of dose rate projection plans and instruments, consideration of special work evolutions for Callaway Plant Unit 1, ALARA Committee meetings and reports to consider construction worker exposure, and other aspects to ensure that 40 CFR 190 regulations are met. This program will meet the guidance of Regulatory Guide 8.8 (NRC, 1978) to maintain individual and collective radiation exposures ALARA. This program will also meet the requirements of 10 CFR 20.1302.

Because the construction workers are not radiation workers, but are, for the purposes of radiation protection, members of the general public, individual monitoring and training of construction workers on Callaway Plant Unit 2 is not required. Construction workers will be treated, for purposes of radiation protection, as if they are members of the general public in unrestricted areas.

However, they are exposed to effluent radioactivity and direct radiation sources from Callaway Plant Unit 1. The most important reason for the ALARA program is that these source levels may vary over time from the projections made here. There may also be additional sources, unaccounted for by the above projections.

4.5.8 REFERENCES

AmerenUE, 2001. 2001 Callaway Plant Radioactive Effluent Release Report. April 25, 2002.

AmerenUE, 2001a. 2001 Annual Radiological Environmental Operating Report. April 25, 2002

AmerenUE, 2002. 2002 Callaway Plant Radioactive Effluent Release Report. April 29, 2003.

AmerenUE, 2002a. 2002 Annual Radiological Environmental Operating Report. April 29, 2003.

AmerenUE, 2003. 2003 Callaway Plant Radioactive Effluent Release Report. April 27, 2004.

AmerenUE, 2003a. 2003 Radiological Environmental Operating Report. April 27, 2004

AmerenUE, 2004. 2004 Callaway Plant Radioactive Effluent Release Report.

AmerenUE, 2004a. 2004 Radiological Environmental Operating Report.

AmerenUE, 2005. Callaway Plant Off-site Dose Calculation Manual, Revision 16, APA-ZZ-01003, Callaway Nuclear Power Plant, December 1, 2005.

AmerenUE, 2005a. 2005 Callaway Plant Radioactive Effluent Release Report.

AmerenUE, 2005b. 2005 Radiological Environmental Operating Report.

AmerenUE, 2006. 2006 Callaway Plant Radioactive Effluent Release Report.

AmerenUE, 2006a. 2006 Radiological Environmental Operating Report. January 1 to December 31, 2006, April 23, 2007

CFR, 2007a. Title 10, Code of Federal Regulations, Part 20.1301, Dose Limits for Individual Members of the Public, 2007.

CFR, 2007b. Title 10, Code of Federal Regulations, Part 20.1302, Compliance with Dose Limits for Individual Members of the Public, 2007.

CFR, 2007c. Code of Federal Regulations, Title 10 CFR 50, Appendix I, Numerical Guides for Design Objectives and Limiting Condition for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light Water Cooled Nuclear Power Reactor Effluents, 2007.

CFR, 2007d. Title 40, Code of Federal Regulations, Part 190, Environmental Radiation Protection Standards for Nuclear Power Operations, 2007.

EPA, 1988. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, Federal Guidance Report No. 11, Document Number EPA-52011-88-020, U.S. Environmental Protection Agency, September 1988.

EPA, 1993. External Exposure to Radionuclides in Air, Water, and Soil, Federal Guidance Report No. 12, Document Number EPA-402-R-93-08 1, U.S. Environmental Protection Agency, September 1993.

NRC, 1978. Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low As is Reasonably Achievable, Regulatory Guide 8.8, Revision 3, Nuclear Regulatory Commission, June 1978.

NRC, 1977. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, Regulatory Guide 1.109, Revision 1, Nuclear Regulatory Commission, October 1977.

NRC, 1986. LADTAP II – Technical Reference and User Guide, NUREG/CR-4013, Nuclear Regulatory Commission, April 1986.

Table 4.5-1—Historical Gaseous Releases for Callaway Plant Unit 1 2001 through 2006

(Page 1 of 2)

Nuclide	2001 Release Ci (Bq)	2002 Release Ci (Bq)	2003 Release Ci (Bq)	2004 Release Ci (Bq)	2005 Release Ci (Bq)	2006 Release Ci (Bq)
AR-41	5.33E-01 (1.97E+10)	3.71E-01 (1.37E+10)	1.14E+10 (4.21E+20)	2.89E-01 (1.07E+10)	4.44E-01 (1.64E+10)	2.27E-01 (8.40E+09)
XE-133	2.28E+02 (8.42E+12)	3.80E+00 (1.41E+11)	1.36E+12 (5.02E+22)	7.38E+02 (2.73E+13)	3.35E+00 (1.24E+11)	1.74E-01 (6.43E+09)
XE-135	1.02E+01 (3.79E+11)	5.94E-01 (2.20E+10)	1.61E+10 (5.96E+20)	1.62E+01 (5.98E+11)	1.13E+00 (4.17E+10)	5.93E-02 (2.19E+09)
KR-85	2.48E+00 (9.17E+10)	6.42E-01 (2.38E+10)	1.28E+10 (4.74E+20)	3.77E+00 (1.39E+11)	2.29E+01 (8.47E+11)	2.94E+00 (1.09E+11)
KR-85M	1.53E+00 (5.68E+10)	1.37E-02 (5.08E+08)	4.39E-03 (1.62E+08)	3.37E+00 (1.25E+11)	9.50E-02 (3.52E+09)	0.00E+00 (0.00E+00)
KR-87	7.79E-01 (2.88E+10)	2.06E-02 (7.62E+08)	3.72E-05 (1.38E+06)	1.01E+00 (3.73E+10)	2.02E-01 (7.48E+09)	0.00E+00 (0.00E+00)
KR-88	2.25E+00 (8.33E+10)	3.82E-02 (1.41E+09)	2.47E-02 (9.14E+08)	3.89E+00 (1.44E+11)	2.56E-01 (9.47E+09)	0.00E+00 (0.00E+00)
XE-135M	3.35E-01 (1.24E+10)	0.00E+00 (0.00E+00)	7.22E-03 (2.67E+08)	3.76E-01 (1.39E+10)	2.92E-01 (1.08E+10)	0.00E+00 (0.00E+00)
XE-138	1.71E+00 (6.33E+10)	1.20E-01 (4.45E+09)	1.59E-01 (5.90E+09)	2.63E-01 (9.71E+09)	1.96E+00 (7.25E+10)	0.00E+00 (0.00E+00)
XE-131M	2.93E+00 (1.09E+11)	1.62E-01 (6.00E+09)	9.81E+00 (3.63E+11)	3.43E+00 (1.27E+11)	3.90E+00 (1.44E+11)	1.02E-03 (3.77E+07)
XE-133M	8.74E-01 (3.23E+10)	2.52E-02 (9.32E+08)	5.28E-01 (1.95E+10)	7.84E+00 (2.90E+11)	9.37E-03 (3.47E+08)	7.94E-02 (2.94E+09)
I-133	3.42E-06 (1.27E+05)	2.08E-09 (7.70E+01)	6.59E-08 (2.44E+03)	5.04E-05 (1.87E+06)	2.23E-05 (8.26E+05)	0.00E+00 (0.00E+00)
I-131	4.98E-05 (1.84E+06)	3.34E-06 (1.23E+05)	2.08E-06 (7.69E+04)	2.36E-03 (8.75E+07)	1.43E-07 (5.29E+03)	0.00E+00 (0.00E+00)
I-132	3.23E-05 (1.19E+06)	1.47E-04 (5.45E+06)	1.65E-08 (6.11E+02)	1.37E-04 (5.07E+06)	2.06E-05 (7.61E+05)	0.00E+00 (0.00E+00)
I-135	5.21E-07 (1.93E+04)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	4.66E-06 (1.72E+05)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)
CS-137	4.00E-05 (1.48E+06)	6.23E-05 (2.31E+06)	2.39E-06 (8.84E+04)	2.96E-05 (1.10E+06)	6.24E-06 (2.31E+05)	0.00E+00 (0.00E+00)
SB-125	2.09E-04 (7.75E+06)	9.51E-05 (3.52E+06)	9.42E-06 (3.49E+05)	4.29E-05 (1.59E+06)	1.22E-06 (4.53E+04)	2.53E-07 (9.36E+03)
BA-140	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	8.70E-07 (3.22E+04)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)
CS-134	7.13E-06 (2.64E+05)	2.77E-05 (1.02E+06)	1.39E-08 (5.14E+02)	3.75E-05 (1.39E+06)	6.42E-06 (2.38E+05)	0.00E+00 (0.00E+00)
CS-136	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	4.47E-09 (1.65E+02)	3.17E-06 (1.17E+05)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)
NA-24	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	4.30E-08 (1.59E+03)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)
CO-58	2.15E-06 (7.96E+04)	9.72E-06 (3.60E+05)	2.02E-09 (7.47E+01)	9.63E-06 (3.56E+05)	2.35E-05 (8.71E+05)	0.00E+00 (0.00E+00)
CO-60	8.45E-05 (3.13E+06)	1.08E-04 (4.01E+06)	1.10E-04 (4.07E+06)	1.23E-04 (4.55E+06)	6.02E-05 (2.23E+06)	2.47E-05 (9.13E+05)
NB-95	0.00E+00 (0.00E+00)	8.31E-07 (3.07E+04)	5.34E-07 (1.98E+04)	4.25E-07 (1.57E+04)	1.93E-06 (7.13E+04)	0.00E+00 (0.00E+00)
CR-51	4.73E-06 (1.75E+05)	3.09E-06 (1.14E+05)	0.00E+00 (0.00E+00)	1.51E-06 (5.59E+04)	3.53E-06 (1.31E+05)	0.00E+00 (0.00E+00)

Table 4.5-1—Historical Gaseous Releases for Callaway Plant Unit 1 2001 through 2006

(Page 2 of 2)

Nuclide	2001 Release Ci (Bq)	2002 Release Ci (Bq)	2003 Release Ci (Bq)	2004 Release Ci (Bq)	2005 Release Ci (Bq)	2006 Release Ci (Bq)
MO-99	0.00E+00 (0.00E+00)	3.20E-08 (1.18E+03)	0.00E+00 (0.00E+00)	3.43E-10 (1.27E+01)	9.50E-07 (3.52E+04)	0.00E+00 (0.00E+00)
TC-99M	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	3.43E-10 (1.27E+01)	9.50E-07 (3.52E+04)	0.00E+00 (0.00E+00)
CE-144	0.00E+00 (0.00E+00)	5.67E-08 (2.10E+03)	1.00E-03 (3.70E+07)	4.73E-09 (1.75E+02)	5.86E-09 (2.17E+02)	0.00E+00 (0.00E+00)
CO-57	0.00E+00 (0.00E+00)	2.01E-08 (7.45E+02)	5.12E-08 (1.89E+03)	1.04E-07 (3.85E+03)	1.15E-08 (4.26E+02)	0.00E+00 (0.00E+00)
CE-141	0.00E+00 (0.00E+00)	2.39E-08 (8.84E+02)	0.00E+00 (0.00E+00)	1.07E-07 (3.96E+03)	1.79E-06 (6.60E+04)	0.00E+00 (0.00E+00)
CD-109	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	1.23E-05 (4.56E+05)	0.00E+00 (0.00E+00)
PR-144	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	5.86E-09 (2.17E+02)	0.00E+00 (0.00E+00)
TE- 132	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	1.06E-09 (3.92E+01)	0.00E+00 (0.00E+00)
SB- 124	7.19E-07 (2.66E+04)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	2.92E-09 (1.08E+02)	0.00E+00 (0.00E+00)
MN-54	0.00E+00 (0.00E+00)	6.88E+03 (2.55E+14)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	3.74E-07 (1.38E+04)	0.00E+00 (0.00E+00)
ZR-95	0.00E+00 (0.00E+00)	2.55E-07 (9.44E+03)	3.73E-07 (1.38E+04)	0.00E+00 (0.00E+00)	1.21E-06 (4.48E+04)	0.00E+00 (0.00E+00)
CS-138	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)	1.74E-07 (6.44E+03)	0.00E+00 (0.00E+00)	0.00E+00 (0.00E+00)
H-3	6.33E+01 (2.34E+11)	6.33E+01 (2.34E+11)	4.92E+01 (1.82E+12)	3.79E+01 (1.40E+12)	3.22E+01 (1.19E+12)	3.02E+01 (1.12E+12)

Table 4.5-2—Projected Gamma Air Dose Rates from Plant Vent Effluent for all Areas Around Callaway Plant Unit 1 (mrad per 2200 hours per year)

Period of Meteorological Record 12/31/2003 24:00 through 12/31/2006 23:00										
	Source Term Based on 2004 Release Rates (See Table 4.5-4)									
	Distance (meters) from Unit 1 Containment									
Direction (Toward)	200	250	300	350	400	500	700	800	1000	2000
S	8.62E-02	5.99E-02	4.42E-02	3.40E-02	2.70E-02	1.85E-02	1.08E-02	8.71E-03	6.14E-03	2.09E-03
SSW	8.07E-02	5.60E-02	4.13E-02	3.17E-02	2.52E-02	1.72E-02	1.01E-02	8.10E-03	5.72E-03	1.96E-03
SW	8.79E-02	6.12E-02	4.51E-02	3.47E-02	2.75E-02	1.88E-02	1.10E-02	8.79E-03	6.22E-03	2.13E-03
WSW	5.82E-02	4.01E-02	2.95E-02	2.25E-02	1.78E-02	1.22E-02	7.11E-03	5.71E-03	4.04E-03	1.41E-03
W	5.32E-02	3.67E-02	2.70E-02	2.06E-02	1.63E-02	1.11E-02	6.48E-03	5.20E-03	3.68E-03	1.28E-03
WNW	7.02E-02	4.84E-02	3.55E-02	2.72E-02	2.15E-02	1.46E-02	8.46E-03	6.76E-03	4.78E-03	1.67E-03
NW	1.36E-01	9.38E-02	6.91E-02	5.29E-02	4.19E-02	2.84E-02	1.63E-02	1.30E-02	9.12E-03	3.16E-03
NNW	1.77E-01	1.23E-01	9.04E-02	6.97E-02	5.53E-02	3.76E-02	2.16E-02	1.72E-02	1.20E-02	4.09E-03
N	1.21E-01	8.27E-02	6.05E-02	4.63E-02	3.66E-02	2.47E-02	1.41E-02	1.13E-02	7.97E-03	2.77E-03
NNE	8.96E-02	6.19E-02	4.55E-02	3.49E-02	2.76E-02	1.88E-02	1.07E-02	8.54E-03	5.96E-03	2.03E-03
NE	8.07E-02	5.54E-02	4.05E-02	3.10E-02	2.44E-02	1.65E-02	9.46E-03	7.53E-03	5.29E-03	1.84E-03
ENE	5.37E-02	3.68E-02	2.69E-02	2.04E-02	1.62E-02	1.09E-02	6.24E-03	4.99E-03	3.53E-03	1.25E-03
E	7.98E-02	5.46E-02	3.98E-02	3.04E-02	2.39E-02	1.62E-02	9.29E-03	7.45E-03	5.29E-03	1.88E-03
ESE	8.54E-02	5.89E-02	4.32E-02	3.31E-02	2.61E-02	1.77E-02	1.03E-02	8.20E-03	5.79E-03	2.01E-03
SE	9.04E-02	6.22E-02	4.55E-02	3.48E-02	2.75E-02	1.88E-02	1.09E-02	8.79E-03	6.22E-03	2.18E-03
SSE	8.17E-02	5.65E-02	4.15E-02	3.19E-02	2.53E-02	1.73E-02	1.02E-02	8.18E-03	5.81E-03	2.00E-03

	Construction Areas are Shaded

Table 4.5-3—Projected TEDE Dose Rates from All Sources in Construction Areas

(Maximum Dose Rate mrem/year (mSv/year) Assuming Full Time Occupancy										
Period of Meteorological Record 12/31/2003 24:00 through 12/31/2006 23:00										
	Source Term Based on 2004 Release Rates (See Table 4.5-4)									
	Distance (meters) from Unit 1 Containment									
Direction (Toward)	**200**	**250**	**300**	**350**	**400**	**500**	**700**	**800**	**1000**	**2000**
S	4.21E-01	3.03E-01	2.32E-01	1.86E-01	1.55E-01	1.17E-01	8.19E-02	7.25E-02	6.09E-02	4.28E-02
SSW	3.96E-01	2.85E-01	2.19E-01	1.76E-01	1.47E-01	1.11E-01	7.89E-02	6.98E-02	5.91E-02	4.21E-02
SW	4.29E-01	3.09E-01	2.36E-01	1.89E-01	1.57E-01	1.18E-01	8.27E-02	7.29E-02	6.13E-02	4.29E-02
WSW	2.95E-01	2.14E-01	1.66E-01	1.35E-01	1.14E-01	8.83E-02	6.53E-02	5.90E-02	5.15E-02	3.97E-02
W	2.73E-01	1.98E-01	1.55E-01	1.26E-01	1.07E-01	8.34E-02	6.25E-02	5.67E-02	4.99E-02	3.91E-02
WNW	3.49E-01	2.51E-01	1.93E-01	1.56E-01	1.30E-01	9.89E-02	7.14E-02	6.38E-02	5.48E-02	4.08E-02
NW	6.47E-01	4.55E-01	3.44E-01	2.71E-01	2.22E-01	1.61E-01	1.07E-01	9.17E-02	7.44E-02	4.76E-02
NNW	8.32E-01	5.87E-01	4.40E-01	3.47E-01	2.82E-01	2.02E-01	1.31E-01	1.11E-01	8.72E-02	5.17E-02
N	5.76E-01	4.05E-01	3.06E-01	2.42E-01	1.98E-01	1.44E-01	9.70E-02	8.42E-02	6.92E-02	4.58E-02
NNE	4.36E-01	3.12E-01	2.38E-01	1.90E-01	1.58E-01	1.18E-01	8.15E-02	7.18E-02	6.02E-02	4.25E-02
NE	3.96E-01	2.83E-01	2.16E-01	1.73E-01	1.43E-01	1.08E-01	7.59E-02	6.72E-02	5.71E-02	4.16E-02
ENE	2.75E-01	1.99E-01	1.54E-01	1.25E-01	1.06E-01	8.23E-02	6.14E-02	5.58E-02	4.92E-02	3.89E-02
E	3.92E-01	2.79E-01	2.13E-01	1.70E-01	1.41E-01	1.06E-01	7.51E-02	6.69E-02	5.71E-02	4.18E-02
ESE	4.18E-01	2.98E-01	2.28E-01	1.82E-01	1.51E-01	1.13E-01	7.97E-02	7.02E-02	5.94E-02	4.24E-02
SE	4.40E-01	3.13E-01	2.38E-01	1.90E-01	1.57E-01	1.18E-01	8.23E-02	7.29E-02	6.13E-02	4.31E-02
SSE	4.01E-01	2.88E-01	2.20E-01	1.77E-01	1.47E-01	1.11E-01	7.93E-02	7.01E-02	5.95E-02	4.23E-02

	Construction Areas are Shaded

Table 4.5-4—Projected Construction Worker Census 2012 to 2017 And Estimated Collective Dose

Year	Construction Workers on Site	Collective Dose (person-rem) (person-sievert) Based on Average TEDE Dose of 0.1mrem (0.001mSv) in NW Direction 2200 Hrs/year (See Table 4.5-6)
2012	531	0.053 (0.000531)
2013	2,281	0.228 (0.00228)
2014	4,000	0.400 (0.004)
2015	4,000	0.400 (0.004)
2016	4,000	0.400 (0.004)
2017	3,215	0.321 (0.00321)
	Totals	1.800 (0.018)

Table 4.5-5—Average Unit 1 Effluent Release Rates in 2004 Used to Estimate Conservative Dose to Workers

Nuclide	μCi/sec	(Bq/sec)
AR-41	9.16E-03	(3.39E+02)
XE-133	2.34E+01	(8.65E+05)
XE-135	5.13E-01	(1.90E+04)
KR-85	1.19E-01	(4.42E+03)
KR-85M	1.07E-01	(3.96E+03)
KR-87	3.19E-02	(1.18E+03)
KR-88	1.23E-01	(4.56E+03)
XE-135M	1.19E-02	(4.41E+02)
XE-138	8.32E-03	(3.08E+02)
XE-131M	1.09E-01	(4.02E+03)
XE-133M	2.48E-01	(9.19E+03)
I-133	1.60E-06	(5.92E-02)
I-131	7.50E-05	(2.77E+00)
I-132	4.35E-06	(1.61E-01)
I-135	1.48E-07	(5.47E-03)
CS-137	9.40E-07	(3.48E-02)
SB-125	1.36E-06	(5.03E-02)
BA-140	2.76E-08	(1.02E-03)
CS-134	1.19E-06	(4.40E-02)
CS-136	1.01E-07	(3.72E-03)
NA-24	1.36E-09	(5.05E-05)
CO-58	3.05E-07	(1.13E-02)
CO-60	3.90E-06	(1.44E-01)
NB-95	1.35E-08	(4.99E-04)
CR-51	4.79E-08	(1.77E-03)
MO-99	1.09E-11	(4.02E-07)
TC-99M	1.09E-11	(4.02E-07)
CE-144	1.50E-10	(5.55E-06)
CO-57	3.30E-09	(1.22E-04)
CE-141	3.39E-09	(1.26E-04)
CS-138	5.52E-09	(2.04E-04)
H-3	1.20E+00	(4.44E+04)

Table 4.5-6—Annual Average TEDE Dose Rates for 2200 Hour per Year Occupation Includes Direct Dose of 0.1 mrem/yr.

Period of Meteorological Record 12/31/2003 24:00 through 12/31/2006 23:00										
	Source Term Based on 2004 Release Rates (See Table 4.5-5)									
	Distance (meters) from Unit 1 Containment									
Direction (Toward)	200	250	300	350	400	500	700	800	1000	2000
S	1.06E-01	7.60E-02	5.83E-02	4.68E-02	3.88E-02	2.93E-02	2.06E-02	1.82E-02	1.53E-02	1.07E-02
SSW	9.96E-02	7.17E-02	5.50E-02	4.42E-02	3.68E-02	2.79E-02	1.98E-02	1.75E-02	1.48E-02	1.06E-02
SW	1.08E-01	7.75E-02	5.94E-02	4.75E-02	3.95E-02	2.97E-02	2.08E-02	1.83E-02	1.54E-02	1.08E-02
WSW	7.41E-02	5.37E-02	4.17E-02	3.38E-02	2.85E-02	2.22E-02	1.64E-02	1.48E-02	1.29E-02	9.96E-03
W	6.85E-02	4.98E-02	3.88E-02	3.16E-02	2.68E-02	2.10E-02	1.57E-02	1.42E-02	1.25E-02	9.82E-03
WNW	8.76E-02	6.30E-02	4.85E-02	3.91E-02	3.27E-02	2.48E-02	1.79E-02	1.60E-02	1.38E-02	1.03E-02
NW	1.63E-01	1.14E-01	8.64E-02	6.82E-02	5.57E-02	4.04E-02	2.68E-02	2.30E-02	1.87E-02	1.19E-02
NNW	2.09E-01	1.47E-01	1.11E-01	8.72E-02	7.09E-02	5.08E-02	3.28E-02	2.78E-02	2.19E-02	1.30E-02
N	1.45E-01	1.02E-01	7.68E-02	6.07E-02	4.97E-02	3.63E-02	2.44E-02	2.11E-02	1.74E-02	1.15E-02
NNE	1.10E-01	7.84E-02	5.97E-02	4.78E-02	3.96E-02	2.96E-02	2.05E-02	1.80E-02	1.51E-02	1.07E-02
NE	9.96E-02	7.10E-02	5.42E-02	4.34E-02	3.60E-02	2.70E-02	1.91E-02	1.69E-02	1.43E-02	1.05E-02
ENE	6.91E-02	4.99E-02	3.87E-02	3.15E-02	2.66E-02	2.07E-02	1.54E-02	1.40E-02	1.24E-02	9.78E-03
E	9.85E-02	7.00E-02	5.34E-02	4.27E-02	3.54E-02	2.66E-02	1.89E-02	1.68E-02	1.43E-02	1.05E-02
ESE	1.05E-01	7.49E-02	5.72E-02	4.57E-02	3.79E-02	2.84E-02	2.00E-02	1.76E-02	1.49E-02	1.06E-02
SE	1.11E-01	7.87E-02	5.98E-02	4.77E-02	3.95E-02	2.96E-02	2.07E-02	1.83E-02	1.54E-02	1.08E-02
SSE	1.01E-01	7.22E-02	5.53E-02	4.44E-02	3.69E-02	2.80E-02	1.99E-02	1.76E-02	1.49E-02	1.06E-02

	Construction Areas are Shaded

Figure 4.5-1—Source Locations on Callaway Plant Unit 1

4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

In general, potential impacts will be minimized through compliance with applicable Federal, Missouri, and local laws and regulations enacted to prevent or minimize adverse environmental impacts that may be encountered such as air emissions, noise, storm water pollutants, and spills. Principal among these will be the National Pollutant Discharge Elimination System (NPDES) Construction General Permit and the Corps of Engineers 404 Permit to minimize sediment erosion and protect water quality. The Site Resource Management Plan will address affected site lands and waters. Also included will be required plans such as a Storm Water Pollution Prevention Plan (SWPPP) and associated Best Management Practices (BMPs) as well as administrative actions such as a Traffic Management Plan.

Table 4.6-1 lists the potential impacts associated with the construction activities described in Section 4.1 through Section 4.5 and Section 4.7. The table identifies, from the categories listed below, which adverse impact may occur as a result of construction activities and its relative significance rating (i.e., [S]mall, [M]oderate, or [L]arge) following implementation of associated measures and controls. Table 4.6-1 also includes a brief description, by ER Section, of each potential impact and the measures and controls to minimize the impact, if needed.

- Erosion and Sedimentation
- Air Quality (dust, air pollutants)
- Wastes (effluents, spills, material handling)
- Surface Water
- Groundwater
- Land Use
- Water Use and Quality
- Terrestrial Ecosystems
- Aquatic Ecosystems
- Socioeconomic
- Aesthetics
- Noise
- Traffic
- Radiation Exposure
- Other (site specific)
  - non-radiological health impacts
  - Cultural Resources

Based on existing site conditions, in-place Callaway Plant Unit 1 programs and procedures, as well as the measures and controls, the potential adverse impacts identified from the construction of Callaway Plant Unit 2 are anticipated to be SMALL, if any, for all categories evaluated except: (1) surface waters, which is expected to be MODERATE and require mitigation due to the impact of wetlands and wetland buffers in the Missouri River flood plain; (2) traffic, which is expected to be MODERATE but manageable with the implementation of a Traffic Management Plan; (3) cultural resources which is expected to be SMALL and require monitoring and possible mitigation due to construction activities in the Missouri River flood plain.

Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 1 of 9)

ER Reference Section		Potential Impact Category and Description	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater (GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	Proposed Measures and Controls or Mitigating Circumstances
4.1	**Land Use Impacts**		S	S	S	M	-	S	-	S	S	-	S	S	S	-	M	
4.1.1	The Site and Vicinity	Clearing, grading, excavation, and re-contouring. (ES)(AQ)(L)(TE)(N)(T)																Comply with NPDES Construction General Permit, including EPA effluent limitations.
		Disturbance (temporary and permanent) of wetlands and streams in vicinity. (SW)(AE)																Use BMPs to protect resources such as wetlands and streams in vicinity.
																		Comply with individual Corps of Engineers 404 Permit if necessary.
																		Restore wetlands and wetland buffers temporarily disturbed during construction.
																		Construct new wetlands.
		Soil stockpiling and disturbance to natural drainage channels. (L)(ES)(AQ)																Implement Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control.
4.1.1 (Cont.)	The Site and Vicinity	Removal of existing trees and vegetation. (WS)(TE)(L)(N)																Use site Resource Management Plan and comply with BMP requirements; minimize disturbance to farmland of Statewide importance for construction of collector well system.
																		Unmerchantable trees and slash may be chipped and spread as wood chips, or disposed of at an offsite landfill.
																		Acreage will be restored following construction to the extent practicable.
		Construction of temporary and permanent structures. (AQ)(L)(TE)(A)(N)(T)																Acreage will be restored following construction to the extent practicable.
		Release of fuels, oils, or other chemicals. (WS)(TE)(AE)(L)(W)																Implement Spill Prevention Control and Countermeasures (SPCC) Plan.

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Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
4.1.2 Transmission Corridors and Off-site Areas	The existing transmission Callaway-Bland corridor will be widened by 150 feet (46 m) from the Callaway Plant Unit 1 substation to a tie in point on the Callaway-Loose Creek line south of the Missouri River. Off site rights-of-way will be widened and cleared for and new transmission tower and line construction. (L)(TE)(A)(T)(ES)	Use existing transmission corridor maintenance policies and practices to protect terrestrial and aquatic ecosystems.
		Use site Resource Management Plan and comply with BMP requirements; minimize disturbance to prime farmland for transmission corridor.
		Acreage will be restored following construction to the extent possible.
		Comply with NPDES Construction General Permit, including EPA effluent limitations.
4.1.3 Historic Properties (and Cultural Resources)	Disturbance of archaeological resources. (L)(O)	Perform Phase II Cultural Resource Survey.
		In consultation with the SHPO, develop plan and procedures to manage identified/unidentified historic/cultural resource.
		Take appropriate actions (e.g., stop work) following discovery of potential historic/cultural resource.

Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 3 of 9)

ER Reference Section	Potential Impact Category and Description															Proposed Measures and Controls or Mitigating Circumstances
	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater (GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	
4.2 Water-Related Impacts	S	-	S	M	S	S	S	-	S	-	-	-	-	-	-	
4.2.1 Hydrologic Alterations	Erosion, sediment, and storm water runoff (from on-site building, utilities, and road construction activities). (ES)(SW)(GW)(W)															Implement Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control, as part of the NPDES Construction General Permit requirements.
	Temporary increase in groundwater withdrawal. (GW)(W)															None required
	Temporary dewatering activities. (GW)(W)															Comply with individual Corps of Engineers 404 Permit, as needed.
																Comply with BMP requirements.
																Monitor shallow groundwater levels.
	Disturbance of wetlands and streams in vicinity. (SW)(AE)															Use site Resource Management Plan and BMPs to protect resources such as wetlands and streams in vicinity.
																Comply with individual Corps of Engineers 404 Permit as needed.
																Restore wetlands and wetland buffers temporarily disturbed during construction.
																Construct new wetlands.
	Shift of the Surficial aquifer recharge area(s). (GW)															Monitor shallow groundwater levels.

Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
4.2.2 Water Use Impacts	Temporary increase in groundwater withdrawal. (GW)(W)	None required
	Reduction in available pervious (infiltration) areas. (GW)(W)	Install sedimentation ponds to allow runoff to clarify prior to release.
	Temporary dewatering activities. (GW)	Comply with individual Corps of Engineers 404 Permit as needed.
		Comply with BMP requirements.
	Disturbance of wetlands and streams in vicinity. (SW)(AE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and streams in vicinity.
		Comply with individual Corps of Engineers 404 Permit as needed.
		Comply with BMP requirements
		Restore wetlands and wetland buffers temporarily disturbed during construction.
		Construct new wetlands.
	Construction of new impoundments and modification of existing impoundments. (L)(AE)(TE)	Use site Resource Management Plan and BMPs to protect resources such as wetlands and streams in vicinity.
	Release of fuel, oils, or other chemicals. (WS)(AE)(RE)(L)	Implement Spill Prevention, Control, and Countermeasures (SPCC) Plan.
	Temporary increase in sediment and silt. (ES)(W)(AE)	Implement Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control, as part of the NPDES Construction General Permit requirements.
	Temporary increase in turbidity. (ES)(W)(AE)	Comply with Corps of Engineers 404 Permit requirements as needed.

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Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

(Page 5 of 9)

ER Reference Section	Potential Impact Category and Description																Proposed Measures and Controls or Mitigating Circumstances
	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater (GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)		
4.3 Ecological Impacts	**S**	**-**	**-**	**-**	**-**	**-**	**S**	**S**	**S**	**-**	**S**	**-**	**-**	**-**	**-**		
4.3.1 Terrestrial Ecosystems	Loss of vegetation (i.e., oaks, hickories) and existing habitat for important fauna (i.e., white-tailed deer and other forest-interior dwelling species [FIDS]), as well as forest cover. (TE)(A)(S)																Use site Resource Management Plan and BMPs to protect resources.
																	To the extent practicable, design construction footprint to account for important habitat.
																	If any RTE species are found within the construction area, the Missouri Department of Natural Resources and U.S. Fish and Wildlife service will be contacted to determine the required mitigating actions.
																	Minimize cooling tower lighting, as practicable and allowed by regulation.
																	Create new habitats as practicable (i.e., unforested uplands to ultimately generate a mixed deciduous forest).
																	Maintain remaining unforested upland as old field habitat.
																	Acreage will be restored following construction to the maximum extent practicable.
	Disturbance (temporary and permanent) of wetlands and streams in vicinity. (ES)(AE)(A)																Use site Resource Management Plan and BMPs to protect resources such as wetlands and streams in vicinity.
																	Comply with BMP requirements.
																	Comply with individual Corps of Engineers 404 Permit.
	Limited mortality of wildlife (e.g., avian collisions with man-made structures.) (TE)(AE)																Use site Resource Management Plan and BMPs to protect resources.

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Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
4.3.2 Aquatic Ecosystems	Disturbance (temporary and permanent) of wetlands and streams in vicinity; however, on-site wetlands are not substantively distinguishable from other wetlands in the site vicinity and streams within the construction zone contain no rare or unique aquatic species. (SW)(ES)(AE)(A)	Use site Resource Management Plan and BMPs to protect resources.
		Implement Spill Prevention, Control, and Countermeasures (SPCC) Plan during construction.
		Comply with individual Corps of Engineers 404 Permit as needed.
		Comply with BMP requirements.
		Restore wetlands and wetland buffers temporarily disturbed during construction.
		Construct new wetlands.
	Temporary sediment and silt buildup. (ES)(AE)	Implement Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control and the construction of new impoundments, as appropriate.
	Temporary turbidity increase. (ES)(AE)(W)	Comply with Corps of Engineers 404 Permit requirements.
	Limited mortality of fish (i.e., resulting from sedimentation). (AE)	Comply with BMPs, including intercepting and retaining sediment before it reaches streams.

Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
4.4 Socioeconomic Impacts	**Erosion/Sediment (ES)** - **Air Quality (AQ)** S **Wastes (WS)** S **Surface Water (SW)** - **Groundwater (GW)** - **Land Use (L)** - **Water Use & Quality (W)** - **Terrestrial Ecosystems (TE)** - **Aquatic Ecosystems (AE)** - **Socioeconomic (S)** S **Aesthetics (A)** S **Noise (N)** S **Traffic (T)** M **Radiation Exposure (R)** - **Other (site specific) (O)** -	
4.4.1 Physical Impacts	Equipment and non-routine noise. (N)	Comply with applicable OSHA noise exposure limits.
	Air emissions (fugitive emissions and exhaust emissions) increase. (AQ)(WS)	Comply with applicable EPA and MDNR air quality regulations.
		Implement routine vehicle/equipment inspection and maintenance program.
	Local and regional traffic increase. (AQ)(T)(N)	Install new site perimeter and access road.
		Develop Traffic Management Plan.
	The site is aesthetically altered due to Callaway Plant Unit 1. Additional temporary impacts due to the visibility of construction activities. (A)	No mitigating measures required, because local residences and road traffic have limited visibility of site due to topography.
4.4.2 Social and Economic Impacts	Influx of large construction work force. (S)	Small aggregate socioeconomic impacts anticipated, mitigation not required.
	Public services need (housing, schools, land use) increase. (S)	Small aggregate socioeconomic impacts anticipated; mitigation not required.
	Spending and tax revenue increase. (S)	Beneficial impact to county tax revenues; small beneficial impact for other types of tax revenues. No mitigating measures or controls required.
4.4.3 Environmental Justice Impacts	No disproportionate adverse impacts to minority or low-income populations. (S)	No mitigating measures or controls required

Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater (GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)
4.5 Radiation Exposure to Construction Workers	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**	-

Potential Impact Category and Description	Proposed Measures and Controls or Mitigating Circumstances
Direct radiation exposure. (R)	Total Effective Dose Equivalent (TEDE) from all exposures has been determined to be below limits set in 10 CFR 20.1301.
	Implement ALARA practices at construction site.
Callaway Plant Unit 1 gaseous effluents exposure. (R)	Implement ALARA practices at construction site.
Callaway Plant Unit 1 liquid effluents exposure. (R)	Implement ALARA practices at construction site.

Table 4.6-1—Summary of Measures and Controls to Limit Adverse Impacts During Construction

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ER Reference Section	Potential Impact Category and Description															Proposed Measures and Controls or Mitigating Circumstances
	Erosion/Sediment (ES)	Air Quality (AQ)	Wastes (WS)	Surface Water (SW)	Groundwater (GW)	Land Use (L)	Water Use & Quality (W)	Terrestrial Ecosystems (TE)	Aquatic Ecosystems (AE)	Socioeconomic (S)	Aesthetics (A)	Noise (N)	Traffic (T)	Radiation Exposure (R)	Other (site specific) (O)	
4.7 Non-Radiological Health Impacts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	
	Risk to workers from accidents and occupational illnesses. (O)															Implement site-wide Safety and Medical Program, including safety policies, safe work practices, as well as general and topic-specific training.

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4.7 NON-RADIOLOGICAL HEALTH IMPACTS

4.7.1 PUBLIC HEALTH

Members of the public can potentially be put at risk by construction of a new power generation unit and associated new transmission lines. Non-radiological air emissions and dust can migrate offsite through the atmosphere to nearby residences or businesses. Noise can also propagate offsite. The increase in traffic from commuting construction workers and deliveries can result in additional air emissions and traffic accidents. Section 4.4.1, "Physical Impacts", addresses these potential impacts to the public from construction activities.

4.7.2 OCCUPATIONAL HEALTH

Construction of a new power generation unit and associated transmission lines would involve risk to workers from accidents or occupational illnesses. These risks could result from construction accidents (e.g., falls and burns), exposure to toxic or oxygen-replacing gases, and other causes.

During construction of Callaway Plant Unit 2, AmerenUE will require a safety and medical program for associated contractor personnel to promote safe work practices and respond to occupational injuries and illnesses. The safety and medical program will utilize an industrial safety manual providing a set of work practices with the objective of preventing accidents due to unsafe conditions and unsafe acts. These safe work practices address hearing protection, confined space entry, personal protective equipment, respiratory protection, heat stress, electrical safety, excavation and trenching, scaffolds and ladders, fall protection, chemical handling, storage, and use, and other industrial hazards. The safety and medical program provides for employee training on safety procedures. Site safety and medical personnel are provided to handle construction accidents and occupational illnesses.

Contractors, including construction contractors, will be required to review all safety policies/safe work practices applicable to their work with site personnel. The contractors will be required to comply with site safety, fire, radiation, security policies, procedures, safe work practices, and federal and state regulations.

The Bureau of Labor Statistics maintains records of a statistic known as total recordable cases (TRC), which are a measure of annual work-related injuries or illnesses that include death, days away from work, restricted work activity, medical treatment beyond first aid, and other criteria. The 2005 nationwide TRC rate published by the Bureau of Labor Statistics for utility system construction NAICS Code 2371 is 5.6 per 100 workers (BLS, 2005a). The same statistic for the State of Missouri is 5.2 per 100 workers (BLS, 2005b). AmerenUE calculated the TRC incidence for the construction site using the quarterly employment numbers derived from the U.S. EPR Craft Requirement distribution prepared by AREVA NP Inc. and including craft supervision and site indirect labor factors from the DOE Nuclear Power Plant Construction Infrastructure Assessment (AREVA, 2007) (DOE, 2005). Using national and Missouri TRC rates, monthly TRCs were estimated from which an average monthly rate was developed. The average monthly rate was then used to calculate the annual average TRCs over the 68 months of pre-construction and construction activities; the estimates are as follows:

	TRC Incidence	TRC Incidence
	Based on US Rate	**Based on MO Rate**
Average Annual	140	130

The Bureau of Labor Statistics published 2005 statistics for fatal occupational injuries (BLS, 2005c) and average employment (BLS, 2005a) that were used to calculate the nationwide annual rate of fatal occupational injuries for utility system construction. The Bureau of Labor Statistics provides users with the ability to obtain equivalent information for individual States (BLS, 2006). Using monthly construction employment predictions and the calculated U.S. and Missouri rates of 0.0273 fatalities per 100 man years (U.S.) and 0.0429 fatalities per 100 man years (Missouri), it is estimated that 4 construction deaths could occur over the pre-construction and construction period of 68 months at the U.S. rate and that 6 construction deaths could occur at the Missouri rate over the same period. AmerenUE will require all construction contractors and subcontractors working at the construction site to comply with all safety procedures in order to prevent and/or minimize the number of deaths, injuries, and illness during the construction of Callaway Plant Unit 2. Even with effective safety procedures, construction work carries the risk or injury, illness, and death. However, it is not expected that the construction of a new nuclear power generation facility will result in more construction deaths than other similarly sized non-nuclear heavy construction projects.

4.7.3 REFERENCES

AREVA, 2007, Table 4.4.2-1Potential Estimated Average FTE Construction Workers, by Construction Year/Quarter provided in response dated November 26, 2007 to RFI RIZZO 0042

BLS, 2005a. Table 1, Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2005, Bureau of Labor Statistics.

BLS, 2005b. Table 6, Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2005, Missouri, Bureau of Labor Statistics

BLS, 2005c. Table A-1, Fatal occupational injuries and even or exposure, All United States, 2005, Bureau of Labor Statistics.

BLS, 2006, Fatal occupational injuries in Missouri, http://www.bls.gov/iif/oshwc/cfoi/tgs/2005/iiffi29.htm. Accessed September 28, 2007

DOE, 2005, Department of Energy, DOE 2010 Nuclear Power Plant Construction Infrastructure Assessment, Rev 0, October 21, 2005