2.0 Project Design and Construction Details

BEPC developed a detailed list of steps that would be taken from project design through decommissioning. Project-specific mitigation measures were compiled by applying best management practices (BMPs) that are typical for constructing a high-voltage transmission line. Project-specific mitigation measures are provided in **appendix D**.

2.1 Western's Substation Modifications

Western would be responsible for modifying the 230-kV bay at Williston Substation to accommodate interconnection of the new transmission line. Modifications at the Williston Substation were specifically addressed as part of the Wolf Point to Williston Transmission Line Rebuild EA (prepared August 2003).

2.2 Transmission Line Design Parameters

BEPC's proposed 230-kV, single-circuit transmission line would be constructed using steel single-pole self-supporting structures within a 125-foot-wide ROW. The single-pole transmission line structures would range in height from approximately 95 to 120 feet and average 110 feet, depending on span distances between structures and area topography. The span between structures would range from 700 feet to 950 feet and average approximately 800 feet, depending on topography; taller structures could be used for crossing existing distribution and transmission lines or where unusual terrain exists. The single-pole structures would be designed to support three conductors and an overhead optical groundwire (OPGW). The OPGW would provide lightning suppression and fiber optic communications between the Williston and Tioga substations for systems control. Tangent structures would be free-standing and directly imbedded into the soil. Angle structures (used where the transmission line changes direction) and dead-end structures (used to provide longitudinal stability along the length of the line) would be steel with concrete foundations. Guy wires and anchors would not be used.

BEPC's Project construction and design would meet the requirements of the National Electrical Safety Code (NESC) for the Heavy Loading District, BEPC design criteria, and other applicable local or national building codes. The Heavy Loading District refers to those areas (including North Dakota) that are subject to severe ice and wind loading. **Table 2-1** describes the typical physical design characteristics for the proposed transmission line, and a typical single-pole structure is shown on **figure 2-1**.

Minimum conductor clearance is measured at the point of greatest conductor sag and closest proximity to the ground. The Williston to Tioga Transmission Line would be constructed with clearances that exceed standards set by the NESC. Minimum conductor height would be 26 feet over agricultural land, 28 feet over rural roads, and 31 feet over paved highways.

2.3 Transmission Line Construction Activities

BEPC would likely commence construction of the transmission line in mid-2010 and extend throughout the North Dakota construction season, usually beginning in March or April and ending in November or December of each year. Construction would be temporarily delayed if soils become excessively saturated due to heavy precipitation. Private contractors retained by BEPC would construct the transmission line and haul away construction wastes associated with the proposed Project. BEPC's contractors also would be responsible for complying with mitigation measures and agency requirements.

2.3.1 Pre-construction Surveying and Geotechnical Analyses

BEPC must complete various studies and obtain permits acquired before construction begins, including completion of the EA process, Western approval of the interconnection request, NDPSC permitting of the transmission line, cultural resources (section 106 NHPA) clearance, section 7 ESA biological surveys and

biological assessment, transmission line engineering and design, ROW procurement, and final transmission structure siting.

Table 2-1 Transmission Line Characteristics

Design Component	Values
Voltage (kV)	230
Conductor Size (diameter in inches)	1.345
ROW width (feet)	125
Maximum and minimum span distances between structures (feet)	700 - 950
Average span (feet)	800
Maximum and minimum structure height (feet)	95 - 120
Average height of structures (feet)	110
Average number of structures (per mile)	6.6
Temporary work area disturbance per structure (square feet) (approximately 125-foot x 100-foot area)	12,500
Permanent disturbance per structure (acre) (approximately three-foot diameter)	<0.0002
Minimum conductor ground clearance to agricultural land at 100 degrees Celsius (°C) (feet)	26
Minimum conductor-ground clearance to rural roads at 100°C (feet)	28
Minimum conductor-ground clearance to paved highways at 100°C (feet)	31
Circuit configuration	Vertical

BEPC and/or its contractors would perform initial line survey work, consisting of survey control, route centerline location, profile surveys, and access surveys prior to construction. These surveys would likely be conducted concurrently with other pre-construction tasks.

Geotechnical analyses were conducted at transmission line angle points and other locations to determine engineering requirements for structures. A truck-mounted auger was transported to each site to drill small-diameter boreholes. Cuttings from each borehole were evaluated to determine soil characteristics. Geotechnical analyses was conducted to minimize impacts to agricultural activities; land disturbances were confined to a relatively small area needed for site access and equipment operations. Geotechnical drilling locations required an area totaling approximately 400 square feet for equipment setup and operations in addition to an access trail.

ROW Access and Construction Preparation

Crews would gain access from public roads and section line trails as well as within the transmission line ROW for constructing and maintaining the line. Access for line construction would be by truck travel within the ROW; structure sites located along section lines would be accessed directly from section line roads and trails, where possible. New graded surface access roads are not anticipated. Existing roads and trails would be left in comparable or better condition than what existed before construction. Gates would be installed where fences cross the ROW and locks would be installed at the landowner's request. Gates not in use would be closed but not locked, unless otherwise requested by the landowner.

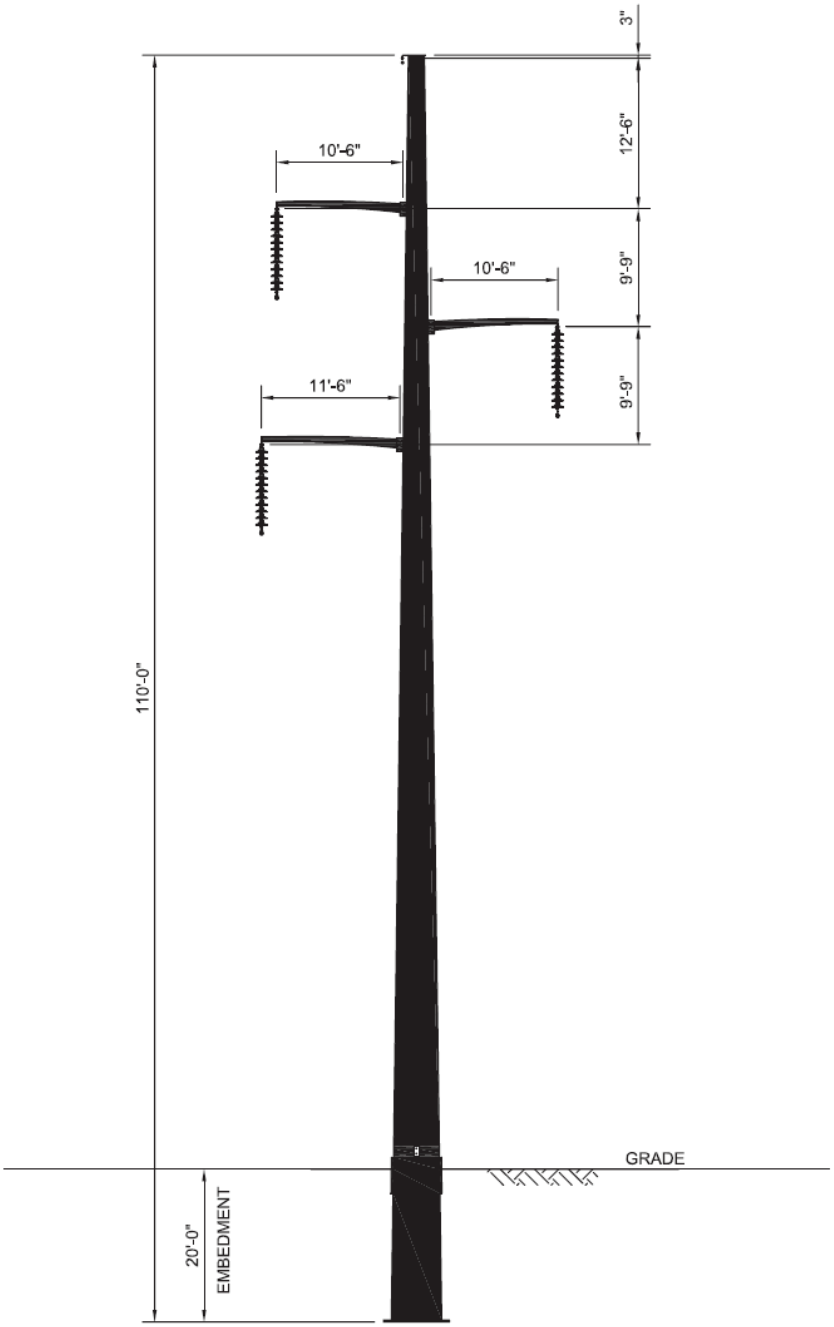

Figure 2-1 Typical Single-pole Structure

During construction, BEPC anticipates that three temporary material staging and equipment laydown areas, each averaging approximately 15 acres, would be used. If additional areas were needed, BEPC would conduct appropriate biological and cultural resource surveys before disturbance. Material staging site Number 1 would be located in the SW ¼, SW ¼, Section 14, T155N, R101W, approximately one mile south and west of the proposed transmission line. Material staging site Number 2 would be located in the NW ¼ of NW ¼, Section 15, T156N, R100W, adjacent to the proposed transmission line and US Route 2. Material staging site Number 3 would be located in the NE ¼, NW ¼, Section 17, T156N, R97W, approximately 0.5 mile from the proposed transmission line. All three sites have been previously disturbed by agricultural activities. BEPC would be responsible for returning staging areas to their previous condition when work is completed.

Tree and brush removal in the ROW would be minimal because the Project area consists largely of cultivated cropland and rangeland, and because woodlands and shelterbelts were avoided during the routing process. The ROW would only be cleared if trees and/or shrubs that are present would interfere with construction activities or the safe, reliable operation of the transmission line. Trees would be cut at ground level to provide access within the ROW and to allow vehicle access. Stumps and roots would remain in the ROW unless the landowner requests otherwise. Disposal of cut trees and brush would be consistent with the landowner's wishes and applicable State waste management rules. BEPC would replace trees removed at a 2:1 ratio, in accordance with NDPSC requirements.

2.3.2 Transmission Structure Site Preparation

Transmission structure site clearing would be minimal. The Project area and locations along all of the proposed transmission line routes are relatively flat; the need for structure site leveling is also expected to be minimal. It is anticipated that at some structure locations, BEPC may need to blade small areas (up to 40 feet by 40 feet for crane and manlift landings) to level the ground surface to allow the safe operation of the equipment. Blading would be confined to the ROW and accomplished using bulldozers or front-end loaders. Soil removed during leveling would be stockpiled and replaced following construction; special emphasis would be placed on salvaging topsoil to be used for reclamation. The ground would be re-graded to the approximate original contour and revegetated (rangeland) or tilled (cropland) when the work is completed. Approximately 12,500 square feet would be temporarily disturbed at each structure site for borehole excavation, structure laydown, structure assembly, and structure erection. Temporary disturbance to soils would be mitigated by returning the sites to grazing and farming.

2.3.3 Borehole Excavation

BEPC's contractor crews would use a truck-mounted auger or tracked vehicle equipped with a power auger to drill holes for the structures at appropriate locations along the ROW. Total disturbance at each structure location would vary depending on terrain and equipment; however, all disturbance would be confined to the ROW.

Borings for the pole holes would have an average diameter of five feet and an average depth of 20 feet. The single-pole structure would be lowered by crane into boreholes and the annulus around the structure would be backfilled with excavated material. Surplus material (expected to total approximately 15 cubic yards at each tangent structure site) would be spread around the base of structures or hauled to an offsite location (i.e., area landfills) for disposal, in accordance with landowner wishes.

Approximately 32 structures would require reinforced concrete foundations consisting of a six-foot-diameter boring to an average depth of 20 feet. Approximately 20 cubic yards of surplus material would be either spread in the vicinity of the structure or disposed of in accordance with landowner wishes. Large volumes of excess soil would be disposed of at local landfills. Landfills typically need additional fill as cover for waste material. BEPC would ensure that disposal of waste material, including concrete spoil, would be in compliance with applicable regulations and would not include placement in wetlands or aquatic sites. Site-specific borehole diameters, depth, and the use of reinforced concrete foundations would be determined during geotechnical and engineering evaluations.

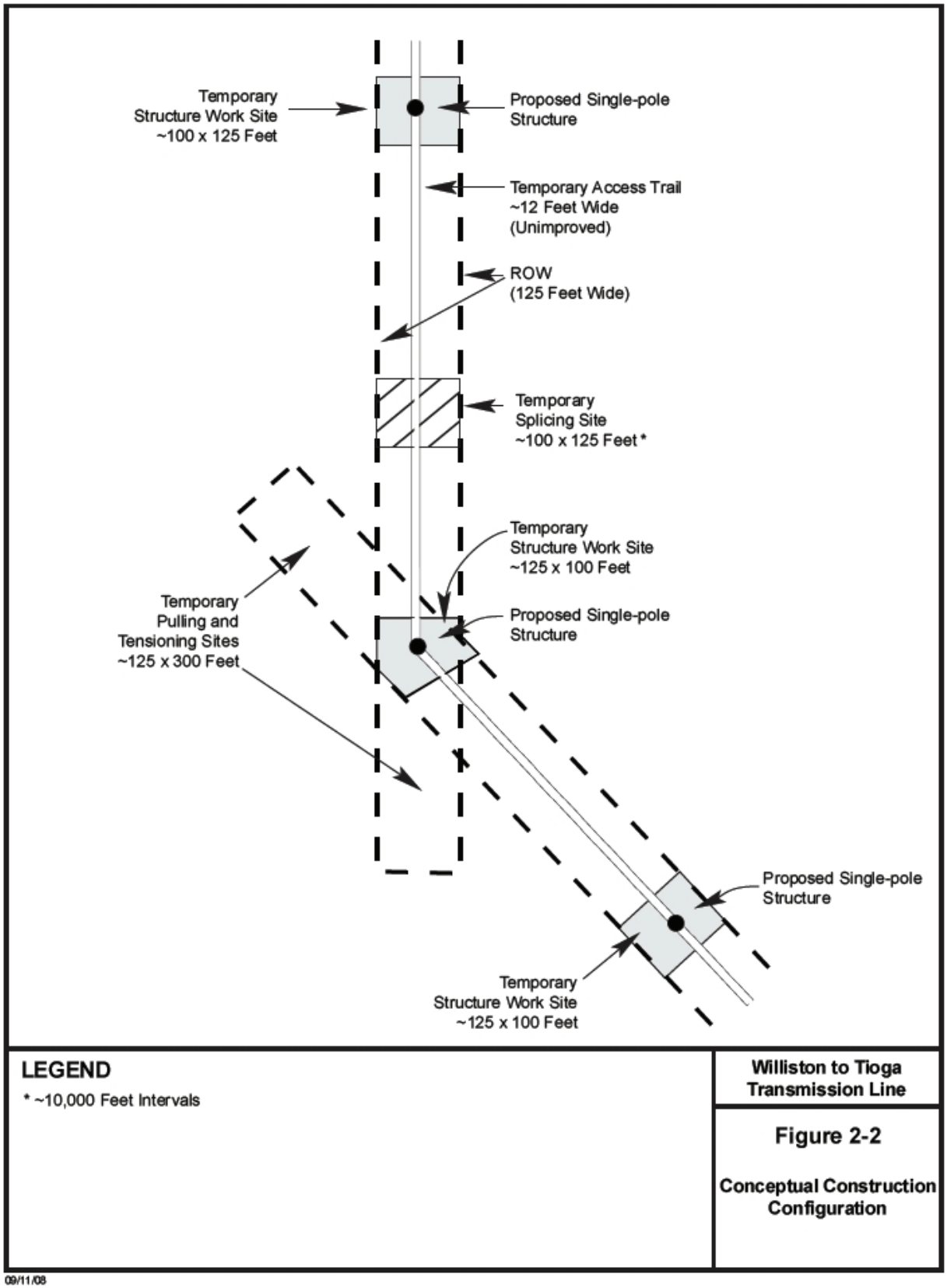

Figure 2-2 Conceptual Construction Configuration

2.3.4 Structure Assembly and Erection

Structure components (structure segments, davit arms, hardware, insulators, and related materials) would be trucked to structure work site locations and assembled. Davit arms, insulators, and other appurtenances would be attached to the poles while on the ground at each structure location, within the 125-foot-wide ROW. Erection crews would place the lower portion of the structure in the borehole (directly imbedded) or on reinforced foundations (i.e., self-supporting angle point and deadend structures) using cranes or large boom trucks. The structures would then be plumbed and the hole backfilled, as previously described. The upper portion of the structure would be lifted by crane and inserted onto the lower section. Both sections would then be bolted together.

2.3.5 Conductor Stringing and Tensioning

Following structure construction, crews would install the conductors and OPGW using conductor stringing sheave blocks and line pulling and tensioning equipment. The conductor and OPGW would be kept under tension during the stringing process to keep the conductor clear of the ground and obstacles that could damage the conductor and/or OPGW surfaces. Keeping tension on the conductors and OPGW also would prevent impacts to crops or environmental resources in the ROW between structures.

Pulling and tensioning sites are typically located at 10,000-foot intervals and at angle point structures. Sites along tangent structures are maintained within the ROW, those at angle points typically are partially outside of the normal 125-foot-wide ROW. Each site typically requires two 37,500-square-foot (0.9-acre) temporary use areas. Stringing equipment generally consists of wire pullers, tensioners, conductor reels, OPGW wire reels, and sheave blocks. About 10,000 feet of conductor and OPGW would be installed for each pull. After the conductor/ground wire is pulled for a section of line, it is tightened or sagged to the required design tension in compliance with the NESC. The process would be repeated until all of the conductor and OPGW is pulled through all sheaves. Conductor stringing also would require access to each structure for securing the conductor to the insulators or OPGW to each structure, once final line sag is established. A typical pulling and tensioning site, splicing site, and access road are shown schematically on **figure 2-2**.

For public safety and property protection, BEPC would install temporary wooden guard structures to provide support when stringing conductor and OPGW across existing power lines, roads, highways, railroads, and other linear obstacles. The structures would be removed when stringing is complete; the pole borings would be backfilled and the temporary support structure sites would be reclaimed. All temporary wooden guard structures would be installed within the transmission line ROW.

2.4 Structure Site Access and Traffic

Access would involve the use of existing roads where available, and temporary overland access trails where necessary. No new access roads would be constructed for the Proposed Project. The use of temporary overland access trails between structure sites would not require new construction, but would result in temporary disturbance. Occasional access from section line trails could result in temporary disturbance along the ROW; however, such disturbance would be limited to a 12-foot-wide track (approximately) and only long enough to provide vehicle access directly to structure locations. Some additional access disturbance could occur if truck or vehicle turnarounds are needed; however, BEPC would encourage the use of structure work sites for turnarounds.

Existing access roads (typically paved or maintained with a gravel or aggregate base) would be used in their original condition to the extent possible, or with minor road blading or other improvements as agreed upon by the county or township. BEPC would be responsible for repairing any damage caused by construction equipment movement and would return existing roads to original or better condition following construction. BEPC would not be responsible for maintaining roads following construction. BEPC would not be responsible for maintaining fences and gates following construction and restoration; however, access gates that would be installed during construction would be left in place following construction for maintenance access and landowner use.

Line segments that are parallel to section lines that do not have established roadways would utilize the 66-foot-wide public ROW to the extent practicable. A 33-foot-long, 12-foot-wide temporary access point to each structure site would temporarily disturb 0.009 acre. If blading or other minor improvements are needed (in localized areas) to ensure the safe movement of heavy equipment, such improvements would remain in place following construction and such areas would be restored to their original contour.

BEPC would restore disturbed areas to pre-construction conditions, to the extent practicable, but would not be responsible for the long-term maintenance of such section line trails. Any fences, gates, or similar features that would be removed during construction would be replaced or rebuilt. Gates and fences that would be installed during construction would be left in place for future use.

2.5 Temporary Overland Access

BEPC would use temporary overland access in areas without existing roads. Access through cultivated fields would be, to the extent practicable, during the non-growing season. BEPC would compensate landowners for loss of crops caused by construction activities. Any locations identified as having sensitive resources would be avoided by overland access routes. Permanent access roads to ROW or structures would not be maintained.

Temporary access routes would result in a 12-foot-wide swath of temporary disturbance and compaction of vegetation and soils. Natural vegetation along these temporary access routes would recover quickly, primarily because grading would be limited to very small, localized areas. BEPC would survey temporary overland access routes for cultural resource and vegetation surveys the same as the other ROWs. BEPC would compensate landowners for access route ROW where public access does not exist.

2.6 Reclamation

Following construction, BEPC would grade and/or re-slope disturbed areas to their approximate original contours where needed to minimize erosion and visual alteration. If grading is needed to ensure the safe movement and operation of heavy equipment, such areas would be restored following construction. In grassland or pasture areas, disturbed areas would be reseeded with native species. Cultivated land would be tilled and returned to production. Fences and gates damaged as a result of the Proposed Project would be repaired.

Rangeland from which vegetation has been removed, destroyed, or damaged would be reclaimed by BEPC and revegetated. Reclamation activities, weather permitting, would be ongoing throughout construction and would be undertaken as soon as construction activities are completed in a particular area. Drainage structures and similar improvements would be removed from areas to be reclaimed, where appropriate, and the area would be revegetated using a native seed mixture, as recommended by the County Agricultural Extension Service or the Natural Resources Conservation Service (NRCS).

BEPC would level ruts and scars from overland travel to break up compacted soils and aid in returning areas to approximate original contours. Cultivated areas disturbed by overland travel would be leveled and tilled to break up compacted soils (if necessary) and returned to production.

The optimal timing for revegetation success would be spring or fall to coincide with seasonal rains. BEPC may need to employ mulching or netting to protect seeded areas from erosion. Other erosion control measures would be applied, where needed. BEPC would conduct follow-up inspections during the next growing season. Areas that did not become revegetated would be reseeded again, as necessary. The reclamation procedures described above would be applied to disturbed areas including temporary access trails, and other areas disturbed by Proposed Project activities.

2.7 Construction Waste Management

Typical waste materials generated from construction activities include miscellaneous lumber and shipping materials used to protect equipment during transportation, paper products, soda cans, food-related materials, and sanitary waste. Waste from construction materials and rubbish from all construction areas would be

collected, hauled away, and disposed of in an approved landfill. BEPC would arrange for sanitary waste disposal through agreements with local municipal sanitary waste treatment facilities. Hazardous waste would not be stored or located near the ROW or in proximity to waterways or drainages at any time before, during, or after construction.

Material staging areas and vehicle maintenance and refueling areas would not be located near waterways. If any of the material staging areas include vehicle and equipment refueling, or storage of petroleum products in excess of 1,320 gallons, BEPC would develop a Spill Prevention, Control, and Countermeasures (SPCC) Plan. The SPCC Plan would address: 1) operating procedures to prevent spills; 2) control measures to prevent a spill from reaching navigable waters; and 3) countermeasures to contain, clean up, and mitigate the effects of a spill that reaches navigable waters. Additionally, spill containment and clean up materials (e.g., absorbent material, shovels) would be available at every work site. The materials would be used to contain and clean up oil and hydraulic spills that may result from equipment leaks. Workers would be trained in procedures to follow to contain and clean up released hazardous materials.

2.8 Construction Schedule, Work Force, and Equipment

Transmission line construction would take place over a one-year period and would generally follow a sequential set of activities performed by crews proceeding along the length of the line. BEPC would schedule activities that would impact nesting migratory bird species to avoid the nesting period (typically April 15 through July 31) to the extent practicable. However, some activities would coincide with the nesting period. In those cases, BEPC would carry out surveys during the nesting period to determine if species are present. If species are found to be present, activities would be rescheduled to avoid disturbance to nesting birds. **Table 2-2** lists construction activities. The proposed transmission line would take an estimated seven months to construct. Construction activities associated with the Project are estimated to begin during mid-2010. It is anticipated that the transmission line would be in service by late-2011. The sequential nature of construction would minimize activities at any given work site.

Table 2-2 Conventional Personnel, Equipment, and Time Requirements for Construction

Task	Number of Personnel	Equipment	Length of Time
Structure Site Clearing and Vegetation Management	4–6	Pickups, ATVs	1 month
Gate Installation	3	Flatbed and pickup trucks	1 month
Structure Assembly	6–8	Pickups, cranes, material trucks, rubber-tired crane, 4x4 pickups	4 months
Hole Excavation	2–3	Rotary drilling rigs, backhoes, pickups, rubber-tired digging equipment, ATVs, portable compressors	4 months
Structure Erection	6–8	Rubber-tired cranes, boom trucks, 4x4 pickups	5 months
Ground Wire and Conductor Stringing	16–20	Pickups, manlifts/boom trucks, hydraulic tensioning machines, reel trailers	3 months
Cleanup	4	Pickups, dump trucks, flatbed trucks	Duration of Project
Concrete Foundations	10	Excavators, concrete trucks, skid steer	1–2 months
Equipment Installation	10	Cranes and trucks	3–4 months

2.9 Operation, Maintenance, and Abandonment

BEPC would perform the following operation and maintenance activities throughout the life of the Proposed Project.

- BEPC's preventive maintenance program for the transmission line includes aerial and ground inspections. Aerial inspections would be conducted at least two times each year. Ground patrols would be conducted annually for the first three or four years, and less frequently thereafter. Climbing inspections of structures would be conducted on a five-year cycle with every fifth structure inspected each year. Inspections and patrols would involve the use of vehicles in areas where there is suitable vehicle access.
- Maintenance activities would include repairing damaged conductors, inspecting and repairing structures, replacing damaged and broken insulators, and tightening hardware.
- BEPC would maintain any gates it installs or uses for access.
- BEPC would trim trees that pose a clearance or safety problem to the operation of the transmission line. Specific requirements of the National Electric Reliability Council would be followed. This activity would be completed in accordance with the landowner easement.

If BEPC were to abandon or rebuild the transmission line in the future, decommissioning and removal of structures, conductor, and ancillary equipment would be in accordance with applicable regulations in place at the time.

Treatment of vegetation within the ROW would include the selective removal or trimming of trees to prevent their contact with the transmission line conductors. Some trees would have to be removed if they are classified as "danger trees" (trees that are 20 feet in height or taller which upon falling would come within 10 feet of the structure or conductors). Disposal of cut trees and brush would be in a manner acceptable to the landowner and in accordance with applicable State waste management rules. The need for tree removal is expected to be minimal as areas with trees were intentionally avoided by BEPC during detailed routing.

2.10 Project-specific Mitigation Measures

BEPC developed project-specific mitigation measures to avoid or reduce the severity of environmental impacts. The measures are applicable to Project construction and operation. Proposed mitigation measures are provided in **Appendix D**, Project-specific Mitigation Measures.

2.11 Worker Safety and Health Protocol

BEPC would carry out all construction and maintenance activities in compliance with applicable Federal worker safety regulations, such as defined under the Occupation Safety and Health Administration Act of 1979. Worker safety and health is administered by BEPC's Transmission Systems Maintenance Division, which is a member of the National Safety Council.