Appendix A

Project Elements Common to All Action Alternatives

Appendix A Project Elements Common to All Action Alternatives

This appendix describes project elements that would be applied to all action alternatives considered in the analysis: Alternatives 1R, 2, 3, and 4 (discussed in Chapter 2.0). Details contained in the following sections are derived from the information provided by the Power Company of Wyoming (PCW) in the revised draft Plan of Development (POD) dated January 2012 (PCW 2012a), which incorporates information from the Draft EIS and supersedes the March 2009 POD, the December 2009 *PCW Response and Data on BLM Alternatives*, and April 2010 *Applicant Proposed Alternative and BLM Response Letter* as well as modifications that occurred through ongoing discussions with the applicant.

While the referenced documents outlined in this section serve as the basis for analysis in this document, micro-siting of turbine locations, roads, transmission lines, and support facilities has not been completed. The information provided for each alternative assumes the greatest potential for disturbance, and therefore it is assumed that impacts identified at the time of micro-siting would not exceed those described in this document.

Upon completion of this project-wide level National Environmental Policy Act (NEPA) analysis, PCW would then submit up to four separate PODs for the internal haul road, transmission line between the two sites, Sierra Madre development, and Chokecherry development. The site-specific POD proposals would be tiered to the analysis and decision described in the Record of Decision (ROD) associated with this project-wide level environmental impact statement (EIS). Right-of-way (ROW) grants for these PODs must comply with the NEPA analysis and would include site-specific terms and conditions tiered back to the project-wide level EIS. Upon review of the individual PODs, additional NEPA analysis may be required prior to issuance of any ROW grants. The final turbine layout would adhere to the terms and conditions of the ROD and any ROW grants issued by the Bureau of Land Management (BLM). A NEPA tiering review procedure to guide subsequent site-specific NEPA approvals is provided as **Appendix B**.

Background

In January 2012, PCW submitted a revised draft POD to accompany the ROW applications for the Chokecherry Sierra Madre (CCSM) Wind Energy Project (PCW 2012a). The POD includes descriptions of and guidelines for the design, construction, operation, reclamation, and maintenance of the wind farm, access roads, electric gathering lines, transmission lines, and electric substations that would be constructed as part of the project.

Due to the technical nature of wind turbine layout siting, the BLM also requested that PCW provide technical data and develop a conceptual model of turbine layouts to show where turbines could potentially be sited for a set of BLM-provided alternatives and environmental constraints that the BLM may consider for further analysis. This information was presented to the BLM in December 2009 as the report entitled *PCW Response and Data on BLM Alternatives* (PCW 2009b). The January 2012 revised draft POD provides a project description associated with a conceptual layout for the Applicant Proposed Alternative, included in the EIS as Alternative 1R, and is an acceptable alternative to their original project concept, which was determined to be not in conformance with the 2008 Rawlins RMP (discussed in Chapter 2.0).

A.1 Environmental Constraints and Applicant Committed Measures

The environmental constraints and applicant committed measures (ACMs) discussed in Chapter 2.0 that would be applied to all action alternatives are detailed in **Appendix C**. In addition to the BLM's environmental constraints (**Table C-1**), ACMs (**Table C-2**), best management practices (BMPs; **Table C-3**), and mitigation measures identified in the project-wide level NEPA analysis (**Table C-4**) described in **Appendix C**, additional constraints may come through development of a reclamation and monitoring plan (**Appendix D**), Programmatic Agreement (PA) for cultural and Native American resources (**Appendix E**), an Avian Protection Plan (APP; **Appendix J**), and a Biological Opinion (BO [**Appendix L**]). These documents have not yet been completed, and consultation with other regulatory agencies including the USFWS and the Wyoming SHPO is ongoing. However, environmental constraints that may come through development of each of these documents would be incorporated into the selected alternative. These constraints would then in turn be considered as stipulations of approval in the ROW grants.

A.2 Pre-construction Activities

Pre-construction activities apply to all components of the CCSM Wind Energy Project. These activities are on-going to attain a final layout and associated site-specific NEPA analysis. Activities include final siting of project features, conducting pre-construction surveys, acquiring all applicable permits and easements, and planning construction transportation.

A.2.1 Wind Potential

PCW has been monitoring the long-term wind resource and energy production potential at the CCSM sites since June 2007. Initially, 10 meteorological towers were installed in the Application Area at an elevation of approximately 196-262 feet (80-100 meters) above the ground to collect site-specific meteorological data. Additional meteorological towers (totaling 34 as of January 2012) have been installed within the Application Area. The collected information is interpreted to provide mean wind speed, annualized average wind speed, shear exponent, turbulence intensity, Weibull parameters, prevailing wind direction, and air density (see glossary). PCW also is measuring the wind conditions up to 200 meters above ground level with a sonic detection and ranging (SODAR) unit to carefully map the wind shear characteristics across the site in conjunction with data from the met towers. **Figure A-1** displays wind potential within the Application Area.

A.2.2 Constructability Field Verification

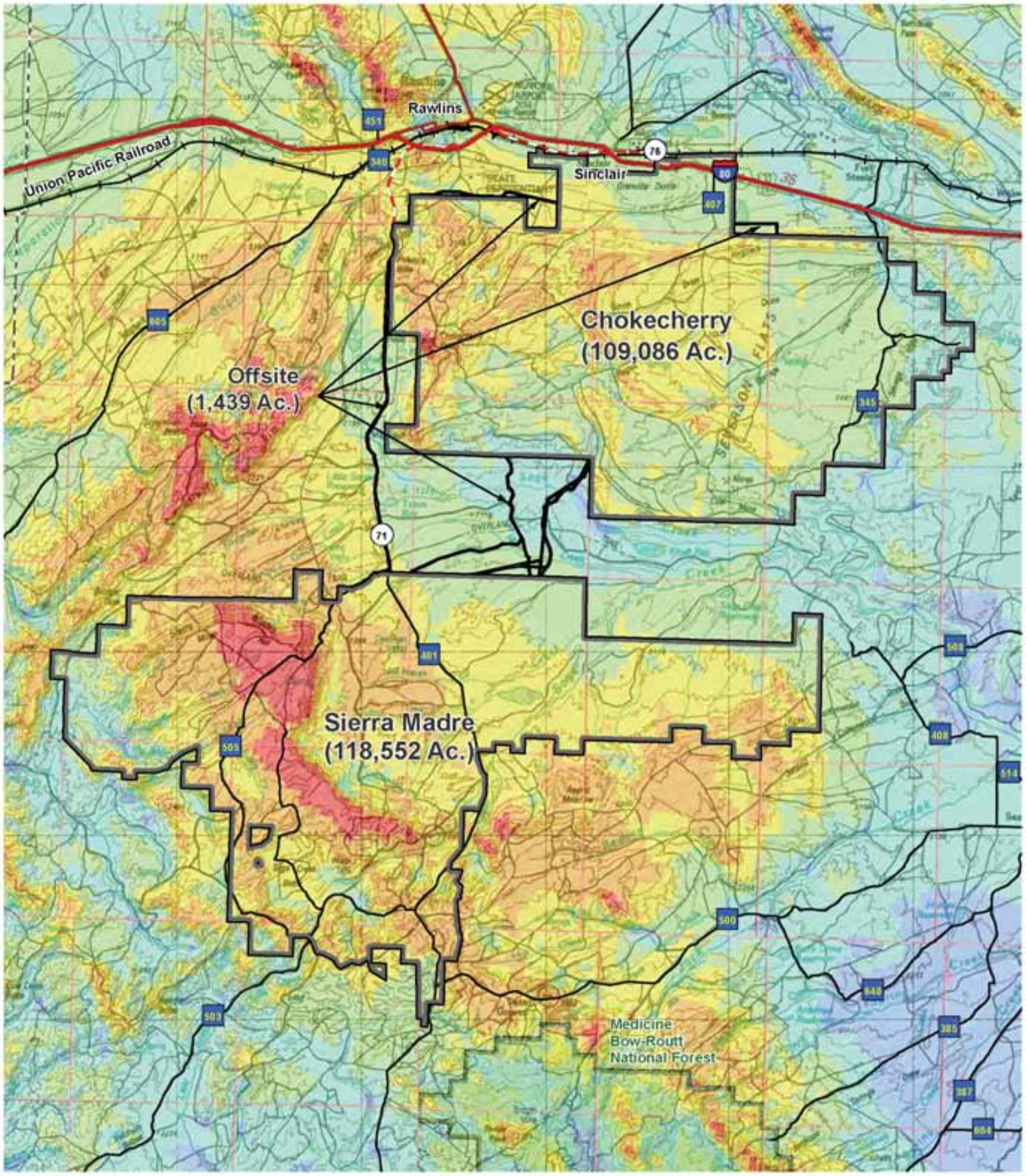
PCW conducted an aerial survey of the Application Area in July and August 2010, which included the acquisition of orthophotography and light detection and ranging (LiDAR) elevation data. Using the meteorological data in combination with the site topography, known technical design factors, and environmental constraints, a wind model was developed to maximize wind potential in the conceptual WTG layout. PCW used an iterative process considering wind data and topography collected from the Application Area to develop a conceptual wind turbine generator (WTG) layout that possesses the design characteristics summarized in Section 1.5. As micrositing is performed and the layout is further refined, PCW will continue to revise these conceptual designs with subsequent ROW applications.

A.2.3 Pre-construction Surveys

Prior to construction, site surveying would be completed to mark the locations of the WTG towers, WTG pad boundaries, electric substations, transmission lines and tower locations, electrical collection cable centerlines, the operations and maintenance building, concrete batch plants, laydown areas, and access and internal resource roads.

From June to August 2011, PCW completed a survey along the utility corridor in the northern portion of TOTCO Ranch to determine the location of existing utility infrastructure. The survey included those portions of Township 21N, Ranges 85W to 87W located south of the Union Pacific Railroad tracks. Underground pipelines were located and their positions were recorded using a real-time kinematic survey unit. All aboveground structures, including pipeline markers, valve assemblies, cathodic protection units, and utility poles were surveyed. As the design for the Project evolves, PCW will perform additional ground surveys for ownership and ground-verification of the LiDAR elevation data as needed. Such surveys are expected to occur in areas near the Ranch boundary or where a high degree of topographical accuracy is needed (such as substation locations).

As a part of the field verification, project surveyors will identify utility features near construction areas and have them surveyed and marked. The depth of any underground utilities near construction areas will be determined by potholing or similar methods. Design engineers will then review the field flagging to verify



Legend

- Interstate Highway
- U.S. Highway
- State Highway
- County Road
- Application Area
- National Forest

Wind Power Classification

- 1 - Poor
- 2 - Marginal
- 3 - Fair
- 4 - Good
- 5 - Excellent
- 6 - Outstanding
- 7 - Superb

Source: NREL, Rawlins Field Office Wind Potential, 2007.

Chokecherry and Sierra Madre Wind Energy Project

Figure A-1

Wind Potential within the Application Area

1:320,000

that the actual locations of roads, WTG pads, and the center of each WTG and transmission line structure align with design expectations. If any issues are discovered, they will be addressed through alignment corrections or design updates. Avoidance areas would be delineated, where applicable, to minimize resource disturbance.

A.2.4 Geotechnical Analyses

To facilitate the project's design, a detailed geotechnical investigation will be necessary to determine the geology and soil conditions at each wind turbine site and where other project facilities will be located. A typical detailed geotechnical investigation includes a single boring at each proposed turbine location, compaction tests along roadways, and test pit excavations near the proposed substations, rail facility, and along the collection system routes. PCW also is considering alternative methods for completing the detailed investigation, such as a decreased number of boring locations combined with multi-channel analysis of surface wave and seismic refraction testing in areas that are suspected to have similar soil and/or bedrock conditions (e.g., along turbine rows within the same mapped geologic units). Any alternative approaches to the detailed geotechnical investigation will require approval from the turbine vendor and must meet manufacturer specifications and warranty requirements. Some preliminary geotechnical testing, associated with the siting of meteorological towers, has been completed. Additional geotechnical investigations would commence once the BLM issues a ROD if the project were approved.

Initial geotechnical information has found that there may be some locations on-site where blasting may be advantageous for trench, foundation or road construction. PCW has developed an initial Blasting Plan as part of the revised draft POD (PCW 2012a) and will include detailed plans for blasting in the site-specific PODs.

A.2.5 Resource Surveys

Additional resource surveys would need to be completed based on final project design to support the site-specific NEPA analysis before any ROW grants could be authorized.

A.3 Project Facility Components and Construction Activities

All applicable geotechnical design parameters, wind turbine manufacturer design requirements, site climate conditions, and industry standards, such as those developed by the American Wind Energy Association and National Electric Safety Code (NESC), for wind energy facilities and transmission lines would be adhered to during construction and installation of the project. The standard construction and operation procedures, with minor modifications to allow for site-specific circumstances, are summarized in the following sections.

A.3.1 Construction Schedule and Set-up

Wind farm construction entails the following activities. A detailed description of planned construction activities and sequencing is provided in the revised draft POD (PCW 2012a).

- Surveying and staking;
- Constructing the rail distribution facility (RDF);
- Constructing the haul road;
- Clearing and grading laydown areas;
- Constructing operations and maintenance buildings;
- Constructing wind farm internal resource roads and WTG pads;
- Excavating foundations;
- Trenching for underground utilities;

- Constructing reinforced concrete foundations for WTG towers, transformer pads, substations, and batch plants;
- Erecting WTGs;
- Placing underground electrical and communications cables in trenches and backfilling;
- Constructing overhead electric collection lines;
- Constructing transmission lines and substations;
- Electrically connecting transformers and WTGs;
- Testing and commissioning;
- Final road grading, controlling erosion, and site cleanup;
- Interim reclamation; and
- Reclamation success monitoring.

A.3.1.1 Construction Schedule and Phasing

PCW has modified their construction schedule and approach in the revised draft POD to reflect Draft EIS Mitigation Measure GEN-1 (PCW 2012a) that would limit surface disturbance to areas where turbines would be constructed within 12 months with a goal to mitigate impacts from surface disturbance to wildlife, soils, water, and vegetation (e.g., weeds). Interim reclamation will begin in accordance with the BLM-approved master reclamation plan (**Appendix D**) once wind turbine installation and associated construction activities are completed. For each year of construction, construction activities would occur within practical and allowable construction seasons. Each construction season will include the late spring, summer, and fall months (generally April through October) as allowed by weather conditions and environmental timing stipulations (**Appendix C**). Seasonal timing stipulations as set forth in the ROD will be incorporated into each site-specific POD.

The proposed project would require 5 years to construct. The GEN-1 Phased Construction Sequence would result in a minimum of four ROW grants issued for the project: 1) internal haul road, water extraction site, and RDF; 2) transmission line between the two sites; 3) Sierra Madre development; and 4) Chokecherry development. A breakdown of components built in each construction year is shown in **Table A.3-1**.

Table A.3-1 Facility Development Associated with Phased Construction Sequence Mitigation

Facility	Construction					Post-construction
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1
Support						
Laydown Areas	Northern Trailer Complex	SM-West	SM-East CC-West	CC-East	--	--
Substations	--	Site Prep: SM-West & Int	Complete: SM-West & Int Site Prep: SM-East & CC-West	Complete: SM-East & CC-West Site Prep: CC-East	Complete CC-East	--
O&M Buildings	--	--	Ops Center SM-Maint.	CC-Maint.	--	--
RDF	Complete	--	--	--	--	--

Table A.3-1 Facility Development Associated with Phased Construction Sequence Mitigation

Facility	Construction					Post-construction
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1
Water Extraction Site	Complete	--	--	--	--	--
Transportation Network						
Internal Haul Road	Complete	--	--	--	--	--
Resource Roads	--	SM-West	SM-East CC-West	CC-East	--	--
WTG						
WTG Pads	--	SM-West	SM-West SM-East CC-West	CC-East	--	--
WTG Foundations	--	SM-West	SM-West SM-East CC-West	CC-West CC-East	CC-East	--
WTG Installation	--	--	SM-West	SM-East CC-West	CC-East	--
Transmission						
Collection System	--	SM-West	SM-East CC-West	CC-East	--	--
Transmission between two sites	--	--	SM-West to Int.	SM-East to SM-West CC-West to Int.	CC-East to Int.	--
Reclamation	--	Year 1 Completed Activity	Year 2 Completed Activity	Year 3 Completed Activity	Year 4 Completed Activity	Year 5 Completed Activity

Notes: SM = Sierra Madre; CC = Chokecherry; Int. = Interconnection; Ops Center = Operations Center; Maint. = Maintenance Building.

A.3.1.2 Construction Work Force

The work force required to build the project would be made up of a wide array of skill sets, including heavy civil work, iron work, concrete batching and placement, large mechanical assembly, crane work, electricians, and more. Some skill sets may be available regionally, and PCW would seek to hire those local skilled workers available. However, much of the work force would be “travelers,” many of whom are experienced in wind energy project construction and build projects throughout the country.

The work force would most likely work a single shift of 10 hours per day, 6 days per week (Monday through Saturday). If schedule or weather constraints require, the work force could be split into multiple shifts for limited periods of time. Most often this involves the erection of wind turbines being done when the winds are lowest, which may occur at night. The scheduling of these shifts can be dynamic and based on week-ahead and day-ahead forecasting. Alternative shifts would be done within the peak work force levels specified in the permit issued by the Wyoming Industrial Siting Council.

Estimated total work force expected during each year of construction is displayed in **Table A.3-2**.

Table A.3-2 Estimated Total Workers per Month in Each Construction Year

	Year 1	Year 2	Year 3	Year 4	Year 5
May	Up to 100	Up to 50	Up to 50	Up to 50	Up to 50
June	Up to 100	Up to 50	200 – 400	200 – 400	200 – 400
July	150 – 300	300 – 400	900 – 1,200	900 – 1,200	700 – 1,000
Aug	150 – 300	300 – 400	900 – 1,200	900 – 1,200	700 – 1,000
Sep	150 – 300	300 – 400	900 – 1,200	900 – 1,200	700 – 1,000
Oct	100 – 200	200 – 300	600 – 900	600 – 900	600 – 900
Nov	Up to 100	Up to 100	Up to 200	Up to 200	Up to 200

A.3.1.3 Site Fencing and Access

Fencing currently exists throughout the Application Area, and there are no modifications proposed to the current location of fencing, other than those that may be proposed as part of mitigation measures. Permanent fencing would be installed and maintained around electrical substations, and turbine tower access doors would be locked to limit public access during operations. Temporary fencing would be installed around laydown areas and storage yards during construction to limit public access. Public access to open excavations would be limited by either installation of locked gates at public access points, or use of other approved means of limiting public access. Public access in the Application Area would remain unchanged; however, some areas may be restricted to protect public safety and for security during construction and decommissioning.

A.3.1.4 Clearing and Grading

Before construction activities commence, areas would need to be cleared of trees and shrubs using a standard bulldozer, grader, brush hog, or other similar earth-moving equipment to allow for movement of construction traffic, operation of construction machinery, and placement of excavated materials during construction. Brush hogging would be used whenever reasonably feasible, as this method generally leaves the root mass of vegetation intact and can help to maintain soil stability within the work area. Trees, brush, other woody material, and rocks would be placed in a designated area for later use in reclamation. Grading would require that topsoil be locally stockpiled in accordance with the BLM-approved master reclamation plan and that affected areas be reseeded after construction is complete. Topsoil storage areas would generally be located within laydown areas and alongside roadways during construction. Every effort will be made to separate the topsoil from any subgrade material during this operation, so that the topsoil can be effectively used during reclamation. The clearing and grading of any vegetated areas also will include the use and stockpiling of waste vegetation for reclamation as defined in the BLM-approved master reclamation plan (**Appendix D**).

Clearing, grading, and other disturbance of soil and vegetation would be limited to the minimum area required for construction. In most areas, clearing or grading of the transmission line corridors would be significantly less than the proposed temporary work area limits to reduce the potential impacts to existing resources. In addition, efforts would be made to overlap ROW disturbance with previous disturbance areas to the extent possible.

A.3.1.5 Laydown Areas

Laydown areas are storage yards into which components and material are delivered. The laydown yards are primarily used to store construction material (aggregate, steel, cement, and other items) in areas close to construction sites. These items will remain in the yard until they are needed for construction. Some items are stored uncovered, while others may be stored in cargo containers or crates. Laydown areas are commonly graded and graveled, surrounded by fencing, and may include night lighting and security. Laydown and storage areas would be located throughout the Application Area during construction. All laydown areas would be located on private property. All laydown areas are commonly graded and graveled, surrounded by fencing, and may include night lighting and security. The size of laydown areas would vary depending on the intended use of the area, but would typically vary from 5 to 40 acres.

Within a typical laydown area, a small area would be allocated for construction trailers and employee parking. The remaining area would be used for additional vehicle and equipment parking and storage of construction materials.

A.3.1.6 Concrete Batch Plants and Construction Materials

Temporary concrete batch plants will be used for preparing and mixing the concrete used for wind turbine foundations, the footings and the pads at the substations, the operations and maintenance buildings foundations, and other necessary project facilities. It is anticipated that two batch plants would be operated simultaneously each year when foundations are being built (currently scheduled for Years 2 through 4). The batch plants would be located within laydown yards close to the sites where foundations are being poured, which would be located on private property and no additional surface disturbance would be required. The batch plants would be relocated as needed to maintain an efficient operation. The batch plants would be constructed on a concrete pad that would be 20 feet wide by 20 feet long by 1 foot deep. However, the entire concrete mixing and batch plant operations would use an area of approximately 5 acres.

The batch plant complexes consist of a mixing plant, areas for sand and aggregate stockpiles, an access road, and truck load-out and turnaround areas. The batch plants themselves consist of cement storage silos, water and mixture tanks, aggregate hoppers, and conveyors to deliver different materials.

Concrete consists of sand, aggregate, water, and cement. The sand, aggregate, and cement would be obtained from a permitted off-site commercial source, and would arrive into the RDF, be transloaded and then trucked to the site and stored separately. Material estimates of aggregate, concrete, and water would vary by alternative based on anticipated miles of roads, acres of facility footprints, and number of foundations for structures. Water requirements are discussed in the next section.

Table A.3-3 displays an estimate of the amount of construction equipment, including trucks, bulldozers, graders, and cranes, required to construct the roadways, erect turbines, and install transmission lines. The vast majority of this equipment would be transported to the project at the beginning of the construction season in which it is needed, remain within the site during its use, and would be removed at the end of each season. Most of this equipment would be brought to and removed from the site by trucks or rail cars. The revised draft POD (PCW 2012a) presents additional detail of the equipment that would likely be used during construction of the project.

A.3.1.7 Water Requirements

The Application Area east of the Continental Divide is within the North Platte River watershed, and the portion west of the Divide is within the Little Snake River watershed. PCW expects to obtain 90 to 100 percent of all construction water from sources within the North Platte River watershed. The amount of water sourced from the Little Snake River watershed is not expected to exceed 10 percent of the overall construction water.

Table A.3-3 Estimated Total Construction Equipment in Each Construction Year

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
General Pick-Up Trucks	200	350	850	900	750
Other Equipment	200	200	400	450	300
Total	**400**	**550**	**1,250**	**1,350**	**1,050**

There are three major uses for water in conjunction with the construction of the project: concrete batching, dust control, and road construction (compaction). Potable water for use by the work force would be brought in from an off-site commercial source, in either 5-gallon containers or smaller bottles, and stored in laydown areas.PCW would contract with The Overland Trail Cattle Company LLC (TOTCO) to supply non-potable water for construction, dust control, and other uses. TOTCO owns numerous direct flow, storage, and groundwater rights in the vicinity of the Application Area, both in the North Platte River Watershed and the Little Snake River Watershed, in excess of the amounts required to build, operate, and decommission the project. These rights are currently approved and adjudicated for irrigation, domestic, and stock watering uses. The rights vary from senior territorial rights in Lake Creek and the North Platte River, to more junior ground water rights scattered throughout the Application Area. The right to temporarily or permanently change the location and type of use of these existing water rights may be negotiated with TOTCO. Additional options to meet long term water supply needs may include negotiation of a water supply agreement with the City of Rawlins or Town of Sinclair. The specific water rights that will supply each sequence of the project will be identified in the site-specific PODs.

During operation of the project, water use would consist of potable water for the operations and maintenance building and dust control. For potable water for permanent office facilities, PCW intends to contract with either the Town of Rawlins or the Town of Sinclair. Up to 30 acre-feet of water annually would be required for dust control and road maintenance; however, use of other dust control measures would reduce this water requirement. Operations and maintenance water sources would be the same as anticipated for construction – approximately 90 to 100 percent from the North Platte watershed and up to 10 percent from the Little Snake River watershed. PCW also may enter into contracts with Rawlins or Sinclair for non-potable water for construction, dust control, and other uses if water is available, subject to mutually acceptable agreements. The source of water for the cities of Rawlins and Sinclair also is the North Platte River Watershed.

PCW has estimated the amount of water to be used would be between 500 and 600 acre-feet over the 5-year construction period. The amount of water used depends upon the final configuration of the project, most specifically the length of roads required, and the dust control methods used.

Currently, PCW is considering obtaining the construction water necessary for the Sierra Madre site via groundwater wells. TOTCO has irrigation wells just east of Miller Hill with sufficient permitted capacity to supply this phase of the project. TOTCO would use existing irrigation wells or drill a new temporary well. These waters are tributary to the North Platte River. Where possible, existing water diversion structures will be used, although improvements may be necessary due to the age of the existing structures and equipment. All pump intakes will be properly designed and screened to reduce impingement and entrainment.

For the Chokecherry site, PCW is evaluating the possibility of obtaining water service from Rawlins or Sinclair. If this is not possible and water is supplied by TOTCO, TOTCO would most likely establish a new temporary point of diversion from the North Platte River within Section 3 of T20N, R85W. Other options might include diversion off Sage Creek or wells within the Chokecherry area, which would be tributary to the North Platte River.

If water were diverted from the North Platte River, an access point would be located along the proposed access road adjacent to the North Platte River in T20N, Range 85 West Section 3. Water may then be trucked to its final place of use or may be transported via pipeline within the road ROW. If trucked, a 20-foot-wide loop road approximately 350 feet in length (approximately 0.2 acre of surface disturbance) would be constructed between the proposed access road and the river to allow several water trucks to pull off the access road, fill on-vehicle tanks, and return to the access road without disrupting other traffic. This loop road would have the same design characteristics as the post-construction operations and maintenance roads described in Section A.3.4. Two raised water storage tanks would be located adjacent to the river with a pump inlet located in the river. A cage would be placed over the inlet to reduce sediment drawn into the tanks and to prevent entrapment of fish. Water would be pumped from the river into the tanks, and then drawn from the tanks into water trucks by gravity. This arrangement would allow water trucks to drive under the tanks to refill and then drive away from the water filling station with minimal disturbance to the river shoreline.

TOTCO has obtained from the WSEO a Temporary Use Agreement in TOTCO's agricultural water rights as provided under W.S. 41-3-25 110 through 112. Through this Temporary Use Agreement of its agricultural water rights, the quantity of water transferred shall not exceed the amount of water historically diverted under the existing use. Furthermore, the historic rate of diversion and the amount consumed will not exceed that under the existing use, and historic return flows will be maintained and returned within the same reach of the North Platte River as has historically occurred. Re-timing of return flows is not anticipated at this time as water would be diverted and used during the historic irrigation season (April to October). The applicant has committed to these measures; therefore, there would be no additional depletions to the North Platte and Little Snake river watersheds as a result of the Temporary Use Agreement. Also, as this would not be a new demand, there should be no potential for injury to other appropriators. PCW and TOTCO entered into a WSEO Temporary Water Use Agreement on March 2, 2012.

Daily consumption in a given year would likely be relatively constant during the period of use, with perhaps a slight reduction in the final month of construction as activities begin to curtail. Daily consumption patterns would depend upon the water source. For those sources capable of supporting larger flow rates, consumption would occur during the work day. For sources with restricted flow rates, consumption may occur continuously to charge temporary storage tanks that would then be depleted during the work day.

If the options for obtaining construction water from TOCO-permitted wells or from the Cities of Rawlins or Sinclair are not practical, then some or all of the construction water necessary for the project would be obtained from the direct flow rights in the North Platte River. Withdraw of direct flow rights from the North Platte River would not exceed historic quantities under TOTCO's water rights.

A.3.1.8 Sanitation System

PCW would rent portable toilets from a local sanitation company. Portable toilets would be located in laydown areas and throughout the Application Area where active construction is occurring and would be relocated when required. A typical portable toilet can serve up to 10 workers for a 1-week work period. As many as 122 toilets may be required on-site during the first year of construction. During maintenance phases, a portable toilet would be located at each electric substation site and serviced as necessary. The portable toilets would be replaced and serviced according to manufacturer's recommendations.

Based on the currently planned location of the operations and maintenance building, PCW expects to connect the building to the sewer systems of Sinclair. If such connections are not feasible or are cost prohibitive, a septic system for the building may be installed.

A.3.2 Operations and Maintenance Facilities

Most wind energy projects have a single operations and maintenance (O&M) building that includes all offices, services, parts storage, and employee facilities. Given the size and scale of the project, it is possible that a separate dedicated operations center and multiple maintenance buildings may be required rather than the traditional single combined building. These buildings would be pre-engineered buildings assembled and finished on-site.

The Operations Center will be the facility that will monitor the output and status of all turbines and maintain communications between the project, transmission providers, and off-take utilities. Operations and maintenance would be accomplished through a Supervisory Control and Data Acquisition (SCADA) system from an operations and maintenance building. It is anticipated that the Operations Center would be single floor (total roof peak height of about 14 feet) pre-engineered building with approximately 7,500 square feet of office and storage space.

While a final location has not yet been chosen, it is likely the Operations Center will be located in the northern part of the Application Area along the haul road. Two sites are being considered for the operations center. The first (currently preferred) location would be within the RDF site, which would be located either Township 21 N, Range 86 W, Section 33 or T21N, R86W, Sections 22 and 23 depending on the alternative selected. The alternate location for the operations center would be within a 40-acre site located in T21N, R86W, Section 25 (**Figure A-2**). The operations and maintenance building would be 40 feet wide by 75 feet long by 16 feet in height next to a graveled staging/storage area approximately 5 acres in size.

Maintenance facilities would be used for component, part, and vehicle storage, and include repair shops and additional restrooms. Maintenance facilities would be single-story and be no more than 1,600 square feet. The number and location of the maintenance facilities would depend upon the final project layout and locations of various turbine models. Current expectations are for two maintenance facilities, one likely in the center of the Chokecherry Site (perhaps adjacent to one of the substations) and one in the Sierra Madre Site near CR401 (Sage Creek Road).

Project buildings, larger substation components (such as substation transformers), and permanent met towers will utilize cast-in-place foundations designed for the Application Area soil and climate conditions.

A.3.3 Met Towers

PCW currently operates a fleet of temporary met towers across the Application Area to record wind conditions. When the project is constructed, a smaller number of permanent met towers would be installed that also track wind conditions and allow operators to compare those conditions to wind turbine performance. PCW would install some or all permanent met towers a number of months before nearby temporary towers are removed so that overlapping data collection can occur, allowing for a site calibration of the new towers to the existing data set to be done. Once site calibrations are performed, all temporary met towers would be removed.

The permanent met towers would have heights at least to the wind turbine hub height. PCW has not yet selected a design for the met towers, but anticipates the towers to be steel monopole, or lattice. PCW would explore the potential of using non-guyed towers; however, site conditions may require guyed structures. The guyed lattice design is what PCW currently has deployed as the Chokecherry 8 and Sierra Madre 5 met towers.

A.3.4 Transportation Network

The following sections are based on information from the January 2012 POD (PCW 2012a) and the Preliminary Transportation Management Plan (PCW 2012b) for the revised Applicant Proposed Alternative.

A.3.4.1 Rail Distribution Facility

To reduce effects on local roadways that may occur given the amount of equipment, components, and material necessary to build the project, as many of these items as practical would be delivered to the Application Area by rail. As some components have dimensions beyond those of certain rail bridges, tunnels, and curves, PCW is working with turbine vendors and the Union Pacific Railroad to determine any issues with the transport of the turbine components from the vendor fabrication centers to the Application Area. Early indications are that these issues can be resolved and that rail transport would be feasible and cost effective.

An evaluation of the existing rail centers in Rawlins and Sinclair by Union Pacific have indicated those centers are not capable of accepting the loads required; therefore, PCW plans to build a rail transload/distribution facility as part of the project. Existing rail centers would not be used for this project.

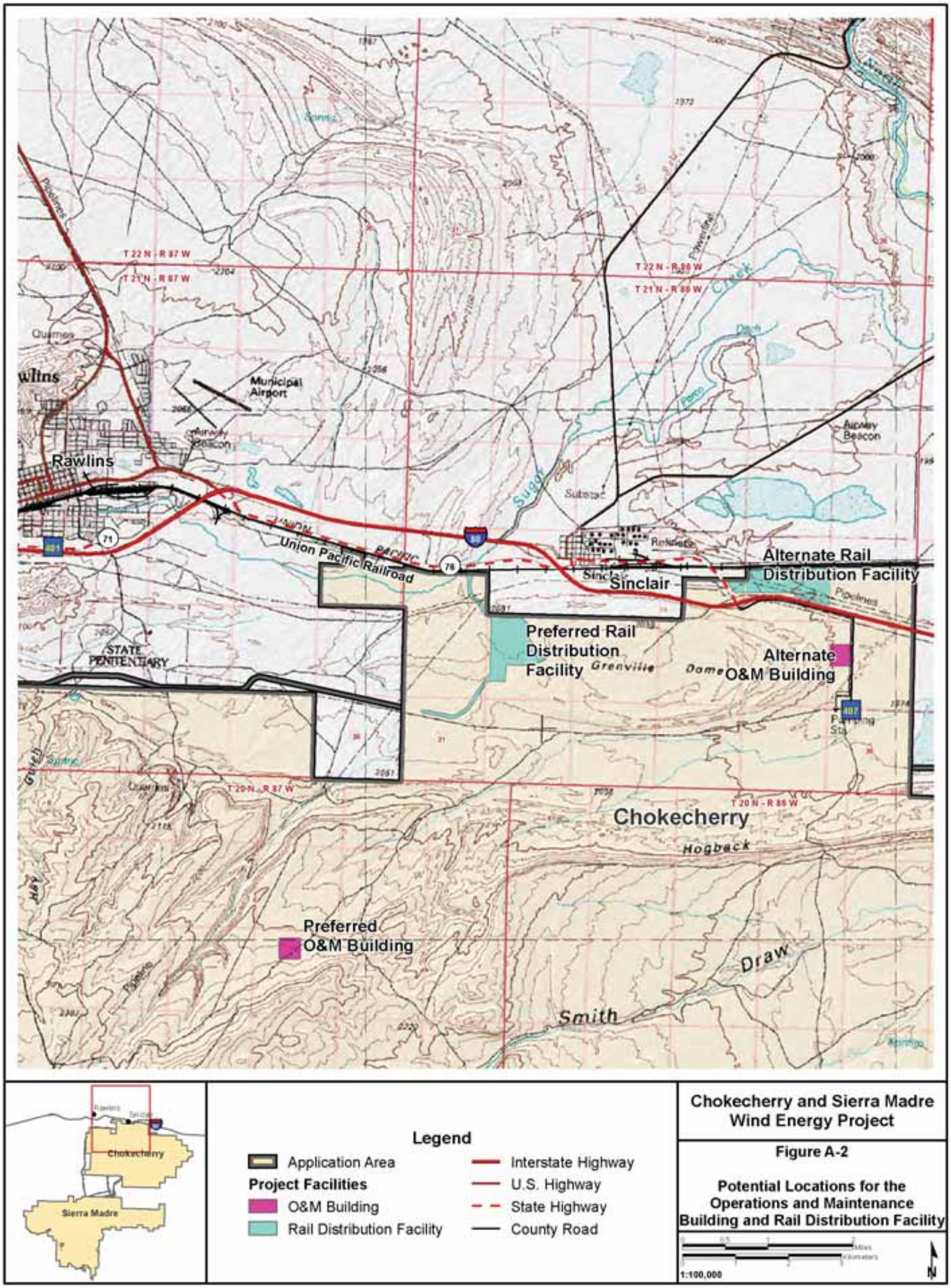
The rail facility would be adjacent to the Union Pacific main line that exists along the northern boundary of the Application Area. It is assumed that the rail facility would have a disturbance area of approximately 250 acres. Two possible locations for the rail facility, one site north of I-80 and the other site south of I-80, are being evaluated as part of the project alternatives (shown in **Figure A-2**).

Construction of the rail facility would occur in two stages: site preparation and track construction. Site preparation would begin with topsoil removal, which will be stockpiled and stored per the guidelines in the BLM-approved master reclamation plan. The site would then be excavated, graded, and compacted and the necessary drainage structures and features would be installed. Once the site preparation is completed, the track materials (rail, cross ties, and fasteners) would be assembled to form the running track and turnouts. Near the completion of the facility, Union Pacific would install the switches and crossings necessary to connect the facility to the main line. Upon completion, all track components would be inspected and tested as needed to verify they meet railroad requirements.

Permanent access to the rail facility would be via the haul road. However, it is possible the rail facility would be built before or at the same time as the haul road. In such an instance, PCW would prioritize the construction of the haul road to the rail facility site to provide construction access. PCW may explore alternatives, such as temporary road access to the rail site using existing roads, in the site-specific PODs.

Almost all components and material would be delivered to the Application Area via rail; however, certain components and materials may be delivered by truck as it may not be feasible to deliver these items by rail. This may include a few final turbine components where there are not enough to make dispatching a unit train economical. This also may include material needed in smaller quantities where rail transport is not economically practical, such as small tools, bottled water, office goods, and miscellaneous deliveries. It also is possible that, if construction of the rail facility is delayed, some initial truck deliveries of material may be required. Project materials needed while the rail facility is under construction would be trucked to the Application Area.

The rail facility would be designed to accommodate the project's deliveries and anticipated construction schedule. Wind turbine components would most likely arrive on unit trains of similar components (such as all blades, tower sections, or nacelles). The wind turbine component trains are assumed to be up to 7,000 feet long consisting of between 45 and 70 cars per train depending upon component type (car lengths vary by component type). Some components are commonly transported on typical 80-foot flatbed cars using specialized cribbing, while others may arrive on specially fabricated railcars. Construction material trains (for aggregate and similar materials) are assumed to be 3,500 feet long and consisting of far fewer cars due to the increased weight per car. Union Pacific operating requirements for this main line corridor mandate that the entire unit train pull completely off the main track in a continuous move and placed onto facility off-loading tracks as needed. This operating scenario would use a total length of 13,700 feet of running track off the main line.



Chokecherry and Sierra Madre Wind Energy Project

Figure A-2

Potential Locations for the Operations and Maintenance Building and Rail Distribution Facility

To transport the components for the 1,000 WTGs proposed, a total of 175 trains would be required. It is estimated that approximately 329 trains would be required to transport the estimated construction material. To maintain a more steady labor force and limit the potential for project construction effects due to transport disruptions, deliveries to the delivery staging area would begin starting in May of each year of construction. At the rail facility, cranes would be required to unload the deliveries from trains onto trucks, semi-tractors, and trailers for transport to the Application Area via the haul road.

Components would be unloaded from the trains onto a main staging area adjacent to the rail facility. Within this area, components would be organized by type and kept until they are needed on the site.

A.3.4.2 Access Roads

The purpose of the proposed access roads is to provide access to the CCSM sites from major roadways. Internal resource roads, discussed in the next section, would provide access to the WTGs and ancillary features (e.g., overhead electric transmission lines and substations) within the Application Area. The proposed access and internal resource roads allow the materials and equipment required for the construction of the project to be delivered to the site. These access, haul, and internal resource roads also would be needed to provide ongoing access to the sites for routine maintenance and repairs upon completion of construction and during decommissioning.

Most construction materials are anticipated to be transported by rail to the RDF. If materials are not transported by rail, they would likely be transported to the access route using I-80. The very few vehicles anticipated to arrive from the north would be transported through Rawlins using US 287 bypass and travel I-80 east to the project access route at Sinclair. All heavy vehicles would be routed from the RDF, across the I-80 overpass in the Town of Sinclair, to County Road 407 CIG Road (CR 407 [CIG Road]) where they would connect to the internal haul road. All WTG components would be hauled along internal haul road and access roads to their final locations.

Materials destined for the Sierra Madre site would be transported along the project's internal haul road and would cross WY 71 to reach the western portion of the site. Flaggers or a temporary traffic signal would be needed at the crossing with WY 71 to reduce potential conflicts with traffic using WY 71.

New access locations that have direct access to WY 71 would follow WYDOT procedures for obtaining an access permit. The existing roads that are proposed as access locations may need to obtain a revised access permit due to the increase in the number of trips on the roadway. WYDOT requires that a Traffic Impact Study accompany all requests for access to a project that would generate more than 50 trips a day. A Traffic Impact Study would be completed for the project once the site plan and trip estimates have been finalized.

The approval of new or revised access permits by WYDOT would require that the access locations meet safety standards. Detailed analysis of each new or revised access permit would be conducted in conjunction with the WYDOT permitting process.

After the site access locations and proposed roadways have been finalized as part of the final project design, a Traffic Management Plan would be developed in coordination with WYDOT for traffic both on- and off-site. Through the WYDOT and Carbon County permitting processes, any required construction traffic mitigation to accommodate increased construction traffic, overweight loads, and oversized loads would be addressed. Such mitigation could include use of flaggers, relocating signs, and placing temporary paving. If excessive wear is evident during project construction, these road surfaces would be restored to their original condition upon completion of construction. Any roadway damage due to the transport of the heavy equipment would need to be repaired on the public roadways when the construction of the project is complete.

A.3.4.3 Internal Road Network

The internal road network would be designed in compliance with the design criteria according to wind turbine industry standards and as specified in the BLM Gold Book (BLM 2007) and BLM Manual 9113: Roads (1985). While design criteria would remain consistent throughout the project, changing site conditions may require alternate design and construction approaches. For instance, aggregate width and thickness would depend upon the bearing capacity of the native soils as much as the design requirements of the road. Soil conditions in some portions of the Application Area also might require the use of geosynthetic materials (such as woven fabric or geogrids) to provide necessary bearing capacity as well as durability enhancement. PCW would identify all such design requirements in the site-specific PODs; however, some site condition challenges may not be identified until construction is underway. In such instances, PCW would work with the BLM to identify and utilize appropriate solutions.

Storm water management includes the design and construction of roadside ditches that would parallel many of the proposed internal resource roads. These ditches divert storm water and snowmelt runoff safely away from the roads and back into the natural swales and streams throughout the project. Some resource roads would be constructed along the crest of the hills and ridge tops, providing positive drainage away from the road in both directions and eliminate the need for ditches. Many roads would be constructed perpendicular to drainage ways requiring the need to capture and collect the runoff.

Road surfacing methods other than gravel (such as chip seal, asphalt, or concrete) would not be used due to the very high construction cost and the limited life of other surfacing methods due to the expected volume of construction traffic. The large number of heavy loads to be transported along project roads would cause these surfaces to break down quickly, requiring frequent repairs and may lead to the rapid development of unsafe conditions. Road maintenance and longevity is more cost effectively served by gravel roads, which is why they are exclusively used on wind energy projects except in a very few and specialized circumstances.

Drainage facilities would meet BLM design criteria and would be designed to provide the required level of protection for the WTG pads and roads during precipitation events.

The construction of the project roads would begin with clearing and grading operations. The topsoil that is cleared and graded would be stockpiled or placed in a berm along the outer edge of the road disturbance area. Every effort would be made to separate the topsoil from any subgrade material during this operation, so that the topsoil can be effectively used during reclamation of the road ROW. Erosion control measures would be employed to preserve the stockpiles of topsoil throughout the project life (PCW 2012a, Appendix G). The clearing and grading of any vegetated areas also will include the use and stockpiling of waste vegetation for reclamation as defined in the BLM-approved master reclamation plan (**Appendix D**).

A.3.4.3.1 Haul Road

The haul road would facilitate the movement of all project components, material, and work force throughout the site while minimizing the effects and potential safety conflicts on local roads and residents. This road would be the primary connection between the Application Area’s main access from I-80 (via Exit 221 and CR407/CIG Road), northern facilities (rail, laydown areas, and operations center), and the wind energy development areas. The haul road would provide access to the major project facilities including the substations, operation and maintenance facilities, and the project laydown areas.

The haul road would be designed to allow for two-way semi-truck traffic. The road would be constructed to a design width that accommodates the construction traffic volumes with a high level of safety. The road would be designed to a higher speed however it would likely be posted and operated at a lower speed. Following construction, it is anticipated that the haul road would remain at its full design width. Since this haul road would accommodate all of the project traffic, the structural section would be the largest of all project roads and designed to account for the heavy and frequent loads and high performance standard. Anticipated haul road width would be 120-feet during construction and 40-feet during operations.

Construction of the haul road would require wider corridors of disturbance and grading in places than the other road classifications. The alignment of the haul road would be designed while keeping the natural lay of the land in mind, and balancing efforts to reduce the grading required while adhering to the design standards required for functionality and safety. New and improved stream crossings may be required, but shall be minimized to the extent possible.

A.3.4.3.2 Internal Resource Roads

Internal resource roads would be located within the Application Area boundaries and would provide access to each WTG and ancillary features (e.g., overhead electric transmission line and substations) during construction, operation, and maintenance.

A significant design element unique for wind energy projects is the necessity for the movement of large cranes. As crane breakdown and assembly between each turbine site is impractical, wind energy project roads commonly have compacted shoulders wide enough for tracked cranes to “walk” between turbine sites. Crane movement also drives other road design elements (such as slopes). The other most significant element driving wind project road design is the transport limitations of trucks delivering wind turbine components. Given the large overall dimensions and significant weight of some of these components, road design elements such as curve radii and road deflection would be kept within tolerances to be specified in detail in the site-specific PODs.

Construction traffic, turbine deliveries, and crane travel on these roads would still be significant on many roads, however these roads would be designed and constructed to standards that allow for more flexibility to traverse more complex terrain and land use constraints. Internal resource roads may be located in areas of the project that contain increasingly steeper slopes, narrow and winding ridges and valleys, and waterways. Biological, cultural, and other environmental and land based constraints and setbacks also would be considered in determining the roads best and final locations.

Internal resource roads may require an increased level of maintenance during and after construction due the steeper slopes, reduced structural sections, and reduced hydraulic design standards. These design considerations are often necessary to construct roads in difficult terrain while maintaining an environmentally responsible design.

During construction some internal resource roads may be constructed as wide as the haul road to facilitate two-way traffic and crane travel. Following construction, the width of these roads would be reduced to the permanent design width, and the disturbed area no longer needed restored in accordance with the BLM-approved master reclamation plan. Roads that receive less construction traffic and crane travel would be designed for one-way traffic with wide shoulders. Following construction, the wide shoulders would be reduced and the disturbed land reclaimed per the BLM-approved master reclamation plan. Other roads where access will be brief and infrequent would be designed to minimize the level of disturbance. For instances where structures are near other project roads and the soil conditions allow, corridors where “drive and crush” access is allowed would be designated. Drive and crush is a standard industry practice involving overland travel without mechanical clearing (such as blading) of vegetation. If soil conditions do not allow for drive and crush access, access spur roads may be built to the structures. Such spur roads would involve the minimum amount of improvement necessary to allow for structure construction and maintenance access. The average width of internal resource roads would be 80 feet during construction and 17 feet during operations.

Internal resource roads would require crossing natural drainage channels and streams on the site. Some of these crossings would consist of improving existing ranch road crossings, while others would be in new locations. The final road network would be designed to minimize the number of crossing required even if somewhat longer road lengths are required; however some water crossings would be unavoidable to access all project areas, turbine locations, and facilities. Low water crossings would be used across the site to provide a balance between the project's road design requirements and the sensitivity of the environmental constraints. For each low water crossing required, the road design requirements, stream flow characteristics, and geometry of the existing channel would be evaluated to determine the optimum design. A more detailed selection methodology, along with the low water crossing design to be used for each specific crossing, would be provided in the site-specific PODs.

A.3.4.4 Construction Traffic

The majority (between 60 and 80 percent of the total construction traffic) of daily traffic to the project would be personal vehicles of the work force. The effect of these vehicles on the local traffic conditions is evaluated in the preliminary Transportation Management Plan (PCW 2012b). Prior to the start of construction each year, PCW expects to meet with the Wyoming Department of Transportation, Carbon County, City of Rawlins, and Town of Sinclair officials to discuss the expected traffic patterns for the project. PCW expects to provide local officials with monthly updates on project construction, including any expected changes to the planned traffic patterns.

The transportation of equipment and materials from the rail facility to where they are required on-site would be accomplished with various types of trucks and trailers. The materials used for the foundations, collection systems, and a majority of substation components would be transported to the designated areas by flatbed semi-trucks. The cement would be transported to the batch plants using dry bulk trailers. The aggregate would be transported from the rail facility to areas throughout the site using belly dump and side dump semi-trucks. The turbine components would be loaded onto specially designed transport trailers pulled by a semi-tractor. The oversize and overweight components for the substation (such as the 230/34.5 kV transformers) would be hauled on lowboy/flatbed trailers that are specifically designed for those weights. All liquids on site would be transported in tanker trucks. The main liquid items that would require transport will be water and fuel. The transportation of earth moving equipment and erection equipment on-site would be accomplished by using lowboy trailers and flatbed trailers.

The major source of transportation for moving the work force on site would be through the use of pick-up trucks. The trucks would be staged at the construction trailer complex where workers would gather each day and use the pick-up trucks to mobilize to their work areas. The workers would return to the trailer complex at the end of their shift and park the pick-up trucks and exit the project in their personal vehicles.

Parking would be in designated areas that are located within laydown areas. Within a typical 40-acre laydown area, approximately one acre would be allocated for construction trailers and employee parking. The remaining acreage would be used for additional vehicle and equipment parking and storage of construction materials.

Construction traffic volumes would vary throughout the project duration. The volume and mix of vehicles would depend on the amount and type of work occurring at any given time. **Table A.3-4** and **Table A.3-5** present the estimated number of construction traffic that could occur during the project.

Table A.3-4 Total Truckloads of Project Construction Material (One-way Trips per day[1])

Items	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Imported from Off-site[1]						
Wind Turbine Components	0	0	5,220	4,680	5,100	15,000
Aggregate	43,122	19,246	25,309	24,022	1,572	113,270
Cement/Sand/Ash	18	4,312	8,010	7,504	2,003	21,846

Table A.3-4 Total Truckloads of Project Construction Material (One-way Trips per day[1])

Items	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Foundation Steel	0	950	1,710	1,663	428	4,750
Collection System Cables/Structures	0	186	119	199	0	504
Transmission Line Cables/Structures	0	0	644	584	622	1,850
Substation Components	0	0	20	40	40	100
Buildings/Trailers	25	25	100	50	50	250
Other Materials	2,000	2,000	2,000	2,000	2,000	10,000
Equipment Deliveries	466	580	1,944	1,952	1,696	6,638
Personnel Off-site Trips	852	329	627	378	0	2,187
Total Imported	**46,482**	**27,628**	**45,702**	**43,072**	**13,510**	**176,394**
On-site Only						
Concrete	50	12,320	22,885	21,440	5,724	62,418
Water	2,248	4,073	4,986	6,191	424	17,922
Total On-site	**2,298**	**16,393**	**27,871**	**27,631**	**6,147**	**80,340**

[1] Each delivery to the site from the RDF or other off-site location.

Table A.3-5 Total Labor Force Commuting to Site During Construction[1,2,3]

Month	Year 1	Year 2	Year 3	Year 4	Year 5
May	100	50	50	50	50
June	100	50	400	400	400
July	300	400	1,200	1,200	1,000
August	300	400	1,200	1,200	1,000
September	300	400	1,200	1,200	1,000
October	200	300	900	900	900
November	100	100	200	200	200

[1] Workers will be commuting from off-site housing with an assumed distribution of: 65 percent from Rawlins, 10 percent from East of Rawlins (Laramie area), 15 percent from west of Rawlins (Rock Springs and Wamsutter area), and 10 percent from south of Rawlins (Saratoga area).

[2] Assumes one trip to and one trip from the Application Area per day.

[3] Workers outside the Rawlins area would be assumed to carpool at 1.5 workers per vehicle.

A.3.5 Electrical System

The project includes the construction of collector systems, double circuit overhead electric transmission lines, and electric substations to collect and interconnect the generated power from the project to a 500 kilovolt (kV) interconnection substation.

A.3.5.1 Collector System

Given the nameplate rating range for wind turbines and that they are spread over a large area, it is most efficient to use medium voltages (34.5 kV being the most common) for the collection system, since low voltage would have large losses and require many more connections, and high voltage is expensive and difficult to use. Multiple turbines are grouped together onto a single collection circuit and “daisy-chained.” This method is repeated with several circuits to connect all turbines in a given area to the nearby collection substation.

The collection system would use a combination of underground and overhead systems to connect the wind turbines to the collection substation. The final combination of underground and overhead systems would be a function of the wind turbine and substation locations, and would take into consideration a wide range of technical, environmental, and economic factors. It is estimated that almost 20 percent of the total length of the circuits would be overhead, mostly in areas of long homeruns and where circuits go through steep terrain (such as from the top of Miller Hill to the base). Of the underground portion, it is estimated that less than 5 percent may be routed in trenches separate from the internal resource roads.

Underground segments are used for connection between adjacent wind turbines. Once the number of turbines connected to a circuit reaches the design limit, that circuit is connected back to a collection substation via a dedicated connection (often called “home runs”). In general, shorter home runs would be made with underground cables, and longer home runs would be made with overhead lines, although technical, topographic, or environmental issues would affect which solution is used (for example, multiple circuits can be accommodated on an overhead line).

Underground Collection

The underground portions of the collection system would consist of the power cable (three single-conductor cables), trench ground conductor, and fiber optic cable buried in a trench. The power cable would be a 35-kV-class cable suitable for direct burial.

Due to the size of the project, there will be areas where multiple underground circuits may be run in parallel. In these cases, each circuit would have a dedicated trench, and would be separated by a minimum of 12 feet in order to avoid de-rating the cables due to effects of mutual heating. Wherever practical, the trenches would follow the project access roads, although PCW does expect there to be instances where the trenches need to deviate from access roads for technical or environmental reasons. In instances where underground collection lines are routed away from roads and may need to cross ephemeral or perennial streams, PCW would explore the feasibility of using methods other than open trenching for cable placement.

Overhead Collection

Overhead collection would be used in combination with the underground sections in order minimize overall disturbance, collection system lengths, and electrical losses. One or more underground collection segments can connect to a single overhead collection line, allowing for more wind turbines to be connected to a given circuit, which also reduces the overall number of circuits needed for the project and space in the substations. Typically, the overhead lines would be used as the homerun of a circuit. Overhead lines also can be used as a favorable solution through difficult terrain when the alternative is to route around the difficult terrain, increasing the overall disturbance and equipment needed.

Wood poles are proposed for the overhead collection system wherever possible. Turning structures, wider spans, or steep terrain could require the use of light duty steel poles in some areas of the project. Steel poles would either be fabricated with "weathering" steel or other finishes that meet BLM requirements. Other material options (such as modular fiberglass poles finished to appropriate BLM-mandated colors) also could be used if specific needs for such structure types arise. PCW will determine which structure type will be used where in the site-specific PODs.

A given circuit may have multiple riser poles to allow multiple segments to feed into the overhead homerun. The overhead segments will be a combination of single circuit and double circuit structures.

Wherever practical, two overhead electrical circuits would be installed on a single set of structures in a double circuit formation. This approach allows for further minimizing of disturbance due to collection system installation and also reduces the amount of equipment needed. To the extent practical, the overhead collection system routing would follow terrain features such as valleys or the base of ridgelines in order to reduce the visual effect of the overhead lines.

Wooden poles used in single-pole or H-frame structures are most commonly directly embedded into the ground without the use of a concrete foundation. Holes just larger than the pole diameter are augured into the ground to a common depth of up to 10 feet for distribution lines and 15 feet for transmission lines. After the poles are placed into the holes and aligned, the holes are backfilled with native material, aggregate or a small amount of concrete.

Steel monopole structures such as those that may be used for the internal transmission lines are each secured to a foundation. Typically monopole transmission structure foundations are drilled piers ranging 4 to 12 feet in diameter and approximately 15 to 60 feet deep.

Steel lattice structures also are secured to foundations, one under each of the towers "feet." These foundations are commonly small pier or block designs, and can be pre-fabricated or cast in place.

A.3.5.2 Padmount Transformers

The electrical system would be composed of low-voltage and medium-voltage subsystems. The low-voltage subsystem (approximately 690 volts) would consist of three-phase conductors that connect individual WTGs via underground cables to a padmount transformer and switchgear. Depending on the specific WTG configuration, the padmount transformer and switchgear may sit adjacent to the WTG tower or be enclosed inside the WTG tower. Transformer capacity would be 2,500- to 3,000-kilovolt amperes (kva) depending on the specific WTG.

If the transformer/switchgear equipment is not located inside the WTG tower, the equipment would be placed on a portion of the WTG pad and would be installed on a foundation set on structural fill. The type of foundation would depend on the requirements of the transformer/switchgear associated with the selected turbine and the soil conditions at each site. These concrete foundations could either be precast (i.e., manufactured off-site) or cast on-site. Where concrete foundations are cast on-site, the amount of concrete required would be one cubic yard or less, which is within the estimates for turbine foundations and truck trips. Transformer pad dimensions would be approximately 5 feet by 5 feet.

A.3.5.3 Substations

The collector substations convert the 34.5-kV collector voltage to 230 kV for transmission to the 500-kV interconnection substation. All substations would be sited within the short-term construction and laydown area footprints. However, final design, transportation, and safety considerations may require substations to be located separately from laydown areas. If so, an additional 120 acres (40 acres for each of the three collector substations) of initial surface disturbance may be incurred. For analysis purposes, it is assumed that substations would be located separately from laydown areas.

The collection substations are used to “collect” generation from groups of wind turbines within the project and transfer it to the project’s 230-kV internal transmission network. The collection substations are strategically located for accessibility, constructability, and sited in order to minimize the overall collection system lengths.

Due to the uneven distribution of turbines and difference in terrain across the Application Area, the final design may use different size substations. For example, a large cluster of turbines may connect to a larger three-transformer substation, where a smaller cluster of turbines would connect to a smaller single-transformer substation. However, in order to minimize overall disturbance due to the collection system and also provide for a more efficient electrical design, PCW may elect to build multiple medium-sized substations as opposed to a single large substation in each area. The final substation sizes, dimensions, and equipment used would be determined in site-specific PODs.

Near the northern boundary of the Application Area, the internal transmission network would interconnect the project with existing and planned regional transmission lines so that the wind generation could be transmitted to the energy off-takers. This interconnection would occur in a substation that connects each of the project’s internal transmission lines with these external transmission lines. PCW expects this station would operate entirely at 230 kV.

A chain-link fence is constructed around the new substation for security and to restrict unauthorized persons, livestock, and wildlife from entering the substation. The site is then finish graded and gravel surfaced, and reclamation is initiated outside the substation fence.

A.3.5.4 Internal Transmission

A double-circuit 230-kV alternating current (AC) overhead transmission line would run from each collector substation to the 500-kV interconnect substation. The project’s 230-kV transmission network would transfer the electrical generation from the collection substations throughout the site to an interconnection substation along the project’s northern boundary. PCW intends to construct the network using wooden H-frame structures wherever practical and efficient. In locations of steep or narrow terrain, or if the demands of the double-circuit portions of the line exceed the design of the wooden H-frames, either steel lattice or steel monopole structures may be used. The location of structure types would be specified in the site-specific PODs.

Monopole structures would either be fabricated using “weathering” steel (such as core-ten) materials, or fabricated with other finishes that meet BLM requirements (PCW does not intend to paint towers due to the associated high long-term maintenance requirements). PCW would explore feasible options for “duller” finishes for lattice structures; however, the design of these structures already makes them less visible than the monopole design. The structures would likely use vertical or delta configuration to minimize the required distance between parallel circuits.

PCW expects that 230 kV is the ideal voltage for the internal transmission network as lower voltages would require more transmission lines, and higher voltages are much more expensive and not in use in this region of Wyoming.

Minimum horizontal and vertical clearances would be calculated using National Electric Safety Code (NESC) or similar requirements. Where practical, the transmission line corridor would follow the haul road or other project roads, negating the need for an independent transmission line construction road. In areas where the transmission line deviates from the project roads, “spur” roads would be necessary for construction and maintenance activities. PCW would strive to minimize such deviations where possible, however terrain and proximity to wind turbines would likely necessitate some deviations. In addition to the access to each transmission structure, temporary effects would occur along the centerline of each transmission line for wire stringing.

The transmission line design would use appropriate best practices as identified by the Avian Power Line Interaction Committee.

Transmission Line Assembly and Construction Access

The construction ROW width for the overhead electric transmission line would be 300 feet, although not all of this area would be disturbed during construction. The 300-foot ROW is required for interim disturbance during construction, but long-term disturbance would consist of the transmission line and access road to allow for periodic maintenance and repair. The width of the transmission line access road would be 20 feet and would be constructed using the same design as for other project access roads.

Work areas would be required at each transmission line structure site to facilitate assembly of the structure and the safe operation of equipment and other construction activities. Transmission line structures would be located adjacent to the transmission line operations and maintenance road, and spur roads would be used where structures cannot be sited adjacent to the existing operations and maintenance road. A temporary 283-foot-long loop road, 20 feet wide, would be constructed around each structure site to provide equipment access to the structures. The work area would be cleared of vegetation only to the extent that it is necessary. Grading may be required to accommodate some structure sites in steep or rough terrain. The temporary construction areas would be located within the 300-foot transmission line ROW. At each structure site, a level spot would be needed for the crane to erect the structure. Excavations for the tower foundations would be made with a vehicle mounted power auger or backhoe, where the soil permits. In rocky areas, the foundation holes may be excavated by drilling, or special rock anchors may be installed. Spoils material would be spread on the ground or may be used in other portions of the Application Area if it meets reclamation standards. Concrete and anchor bolt foundations would be used for the transmission structures at angles. At each structure site, cast-in-place footings would be installed by placing reinforcing steel and anchor bolt clusters into the foundation hole, positioning the anchor bolt cluster, and encasing it in concrete. Spoil material would be used for fill, where suitable.

Once construction of the structures is complete, the temporary loop road would be removed and the temporary construction area would be reclaimed in accordance with the BLM-approved master reclamation plan. The only remaining disturbance would be the tower footings.

After the transmission line structures are erected, transmission line pulling and tensioning would occur. Transmission line pulling and tensioning areas would be spaced approximately 2 miles apart along the transmission line route. These areas would be used as part of conductor installation. Mid-span pulling and tensioning sites would vary in size but would typically be 175 feet by 300 feet. Dead-end pulling/tensioning structure sites would be about 300 feet by 1,275 feet.

A.3.6 Wind Turbine Generators

Multiple turbine models are being considered for potential use in the project—Clipper C89, Fuhrlander FL2500, Gamesa G80, GE (1.5SLE, 1.5XLE, 2.5XL), RePower MM82, Siemens (SWT-2.3-93, SWT-2.3-101), and Vestas (V80, V90 [1.8 MW, 3.0 MW], V112). These turbine models were chosen based on the following criteria:

- A nameplate capacity of 1.5 to 3.0 MW;
- Meet requirements for construction in areas with Wind Resource Class 6 and higher; and
- Ability to withstand the expected temperature extremes and wind speeds.

Turbine models being considered for this project range from approximately 262 feet at the hub height to approximately 328 feet, and maximum rotor diameters would be 394 feet. These dimensions represent a composite of the largest on-shore turbine components currently available. If technological improvements or design changes to turbines result in substantive changes to the above turbine attributes which may be inconsistent with BLM's ROD, then PCW will consult with BLM before submission of the site-specific PODs incorporating such technological improvements or design changes.

Given the varying wind conditions across the large Application Area, the project may be constructed using a combination of turbine models and heights. PCW would define the sites where each model would be installed in the site-specific PODs. For the purposes of the analysis, it is assumed that all turbine model sizes would be approximately 328 feet within the project alternative footprint. The final decision on the turbine model used would be based on the availability of turbine models and suitability for the wind regimes across the Application Area. Dimensions of a representative WTG model is provided in **Table A.3-6**.

Table A.3-6 Representative Wind Turbine Specifications

Turbine Specifications	Unit	Dimensions
Rated Power	MW	2.5
Rotor Diameter	ft	328.1
Standard Tower Height	ft	328.1
Tower Type		Tubular Steel
Standard Tower Color		5% Gray
Power Regulation		Pitch
Fixed/Variable Speed		Variable
Cut-In Wind Speed	ft/sec	11.5
Nominal Wind Speed	ft/sec	44.3
Cut-Out Wind Speed	ft/sec	82.0
Rotor Speed (min)	RPM	5.0
Rotor Speed (max)	RPM	14.0
Generator Type		PSM
Generator Voltage (60 Hz)	V	690
Generator Speed (min)	RPM	N/A
Generator Speed (max)	RPM	N/A
IEC Class		2A
Design 50-yr 10-min avg min	ft/sec	123.0
Design 50-yr 10-min avg max	ft/sec	139.4
Tip Speed (min)	mph	58.5
Tip Speed (max)	mph	163.9

The WTGs would be equipped with both aerodynamic and manual braking systems designed to shut down the blades during high wind conditions or in case of electric power failure. When not operating, the blades would be rotated so that the edges would face the wind, which would keep them from rotating independently and prevent damage to the units.

A.3.6.1 WTG Foundation Construction

Wind turbine foundation design will rely on evaluating existing geological site conditions and determining the option most technically and economically appropriate for the site. The foundation design will be based on the site-specific geotechnical design parameters, wind turbine manufacturer design requirements, site climate conditions, and wind turbine industry standards. The design of the foundations will generally consider the following:

- Turbine manufacturer loading and design requirements.
- Global stability calculations of the turbine/foundation system to ensure proper resistance to overturning and sliding.
- Concrete reinforcement.
- Net allowable bearing stresses, foundation stiffness calculations, and overall and differential settlements for the foundation system.
- Backfill density over the foundation and grading above and around the foundation.

PCW would use a single foundation design (most likely a mat foundation) for as many turbine locations as practical. Where necessary due to site conditions or design requirements, alternate designs also may be used. Unfavorable site conditions that would warrant considering alternative foundation designs may include the discovery of soft or non-compactable subsurface materials, karst deposits, collapsible soils, compressible soils, friable or weathered bedrock, or the presence of soil types that cannot support the bearing capacities required.

The foundations would be located within the wind turbine pads; therefore, the surface disturbance associated with foundations is accounted for in the disturbance area of the wind turbine pads.

A.3.6.2 Tower and Turbine Assembly and Erection

Upon completion of the turbine assembly, the site would be reclaimed per the requirements of the BLM-approved master reclamation plan (**Appendix D**). Remaining above ground facilities would be the turbine itself, road access to the turbine, and a maintenance circle or “beauty ring” of aggregate around the turbine base of sufficient width to allow for operations and maintenance activities. PCW would remove the crane pads at the conclusion of construction. If cranes are required during operations and maintenance activities, PCW would re-establish temporary crane pads as needed (although alternative equipment may be available during such maintenance activities to limit the crane pad requirements).

Areas for wind turbine component laydown are prepared within slope requirements set by the pad design and wind turbine manufacturers, and any necessary compaction is performed. Upon completion of the turbine erection, the wind turbine pads would be reclaimed to the long-term pad design in accordance with the BLM-approved master reclamation plan.

Tower and turbine locations would be flagged and staked. Approximately 1.5 acres around each WTG location would be brush-hogged to remove vegetation and debris from the laydown areas that would interfere with the storage, assembly, and installation of WTGs, electric transmission line towers, or substations. **Figures A-3** and **A-4** display a typical wind farm construction site. **Figures A-5** and **A-6** display a typical WTG pad site during and post construction.

With the wind turbine pad and foundation complete, the site is ready for off-loading of the turbine components. Each turbine component would be delivered to the turbine pad on a semitractor and trailer configured to accommodate the length and weight of the component. The typical equipment used to off-load these components consists of rough terrain cranes, forklifts and a crawler crane. All of the

Figure A-3 Typical Wind Farm Construction

Figure A-4 Typical WTG Assembly

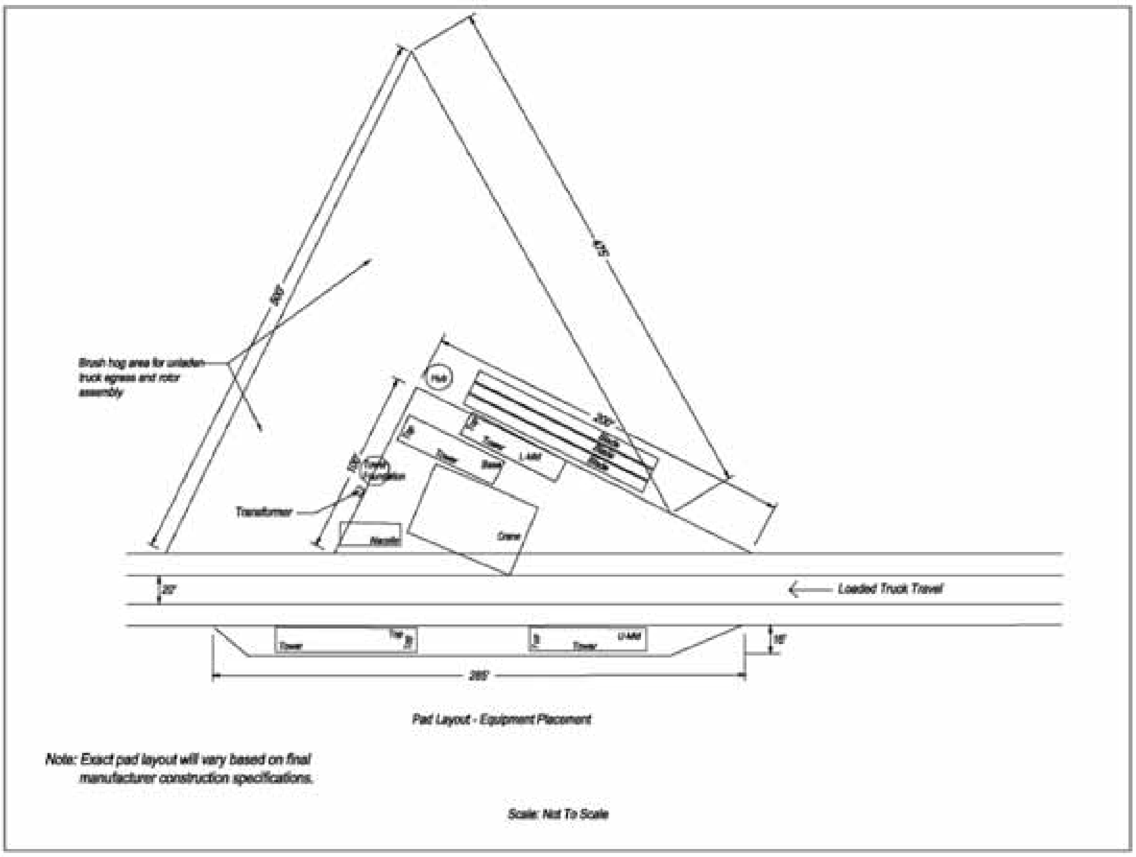


Figure A-5 Typical WTG Pad Layout during Construction

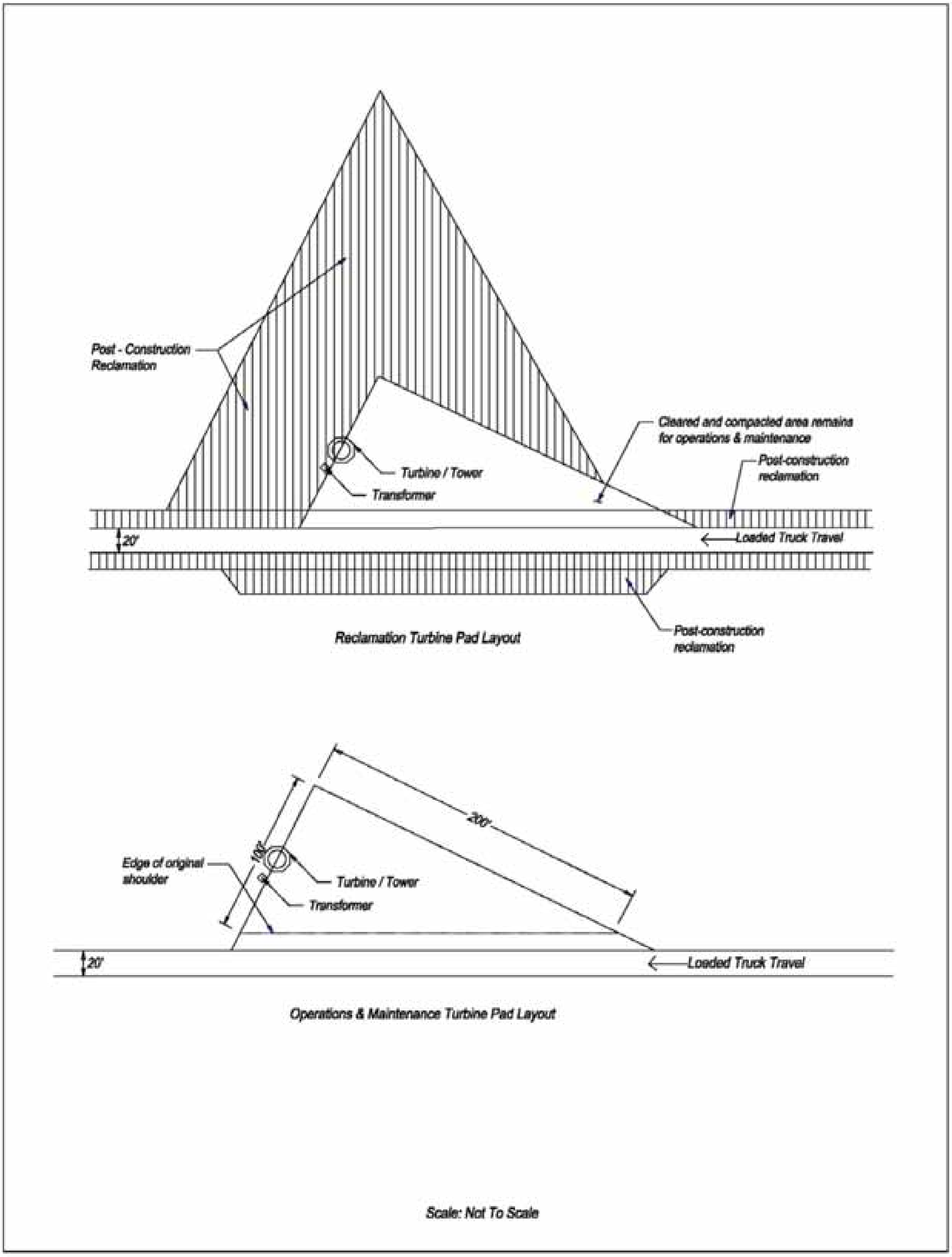


Figure A-6 Typical WTG Pad Post Construction

components are placed within the turbine pad adjacent to the crane pad such that they are within the picking radius of the various cranes that would be used to erect that component. After all the turbine components have been off-loaded, the tower sections are erected using a 100- to 200-, 200- to 300-, and 400- to 600-ton crawler cranes dependant on the component being installed.

Towers, blades, and nacelles would be delivered by truck, rail, or a combination of both, transported on-site with trucks, semi-tractors, and trailers and unloaded within each WTG pad using various size cranes. Other components would be stored in laydown areas. The four-piece tubular tower sections would be assembled onto the foundation using various crane sizes. The nacelle would then be installed on top of the tower. The blades would be mounted onto the rotor hub on the ground before the rotor assembly is mounted onto the nacelle. Each WTG would require the use of 7 to 8 large cranes to erect. However, due to the rate of part delivery and construction phasing, no site pad would require more than two cranes at any given time. The large cranes would then proceed to the next WTG site.

The FAA regulations require that the administrator be notified of any “construction or alteration of more than 200 feet in height above the ground level at its site” (14 CFR § 77.13[a][1]). Notice is required at least 30 days before the earliest of: 1) the date the proposed construction is to begin; or 2) the date an application for a construction permit is to be filed (Id. at § 77.17[1] & [2]). PCW would comply with these notification requirements and notify the FAA by completing a Notice of Proposed Construction or Alteration Form (FAA Form 7460-1) and submitting it to the Obstruction Evaluation Service (OES).

A.3.6.3 WTG Painting and Coating

Turbine towers, nacelles, and rotors would be painted RAL 7035 (a roughly 5 percent gray color, the manufacturer’s standard color) to comply with FAA requirements. Each of these components would be painted or coated prior to transportation to the site. WTG models that are being considered for use in this project would not require recoating for the life of the project. The padmount transformers and other ancillary structures would be painted a color that blends with the surroundings.

A.3.6.4 Wind Turbine Lighting

As wind turbines are more than 200 feet in height, aviation warning lights would be required. According to the Federal Aviation Administration (FAA) Technical Note (FAA 2005) and subsequent Advisory Circular update (FAA 2007), the FAA recommends:

- The selection of turbines with aviation warning lights should be such that, when the lights strobe, pilots get a clear indication of the extent of the wind energy project.
- When arranged in clusters, the turbines on the outside edge and the end of rows should be equipped with lights.
- There should be a gap of no more than 0.5-mile between lighted turbines.
- The most effective lighting choice is medium-intensity red L-864 flashing lights.
- Light flashing should be synchronized.

Based upon the above recommendations, PCW will install synchronized red lights on roughly 35 percent of the project wind turbines. The lights will be installed in such a manner as to limit their visibility from the ground while maintaining the appropriate visibility to pilots.

PCW has evaluated the feasibility of using radar-controlled aviation warning systems that only activate the lights when aircraft is determined to be nearby. PCW has found this technology to be evolving and has not yet reached full acceptance by the FAA or wind industry. The first North American installation of such a system for a wind energy project was in mid-2011, and on a relatively small wind energy project (less than 5 percent the number of turbines as the CCSM project). An initial review of the CCSM project determined that over 50 radar units would be required, and that all units would need to be operating for the system to work (if a single radar goes off-line, it would be necessary to activate the lights). Because PCW determined this technology has not yet reached commercial maturity, it is not integrated into the project design. PCW will continue to monitor the progress of the technology, and may elect to propose adding it to the project design when commercial maturity is reached.

A.3.7 Interim Reclamation and Long-term Disturbance

Interim reclamation involves reclamation of all areas remaining after construction is complete. Final reclamation (discussed in Section A.5.5) would occur after the life of the project. In consultation with the BLM, PCW would implement a project-specific reclamation plan developed in accordance with BLM policy concurrent with the Final EIS. This project would comply with the Wyoming Reclamation Policy (IM WY-2009-022), the 2008 Rawlins RMP and Final EIS reclamation plan (BLM 2008, Appendix 36), the *Record of Decision for Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments* (BLM 2005), and various other applicable planning and management guidelines, policies, documents, and regulations.

Once construction of the facilities is complete, the cleared shoulders and drainage ditches on either side of the roads would be revegetated from an average 80-foot width to an average 17-foot driving width, but the shoulders would not be recontoured. The internal haul road would be reclaimed from the 120-foot width to a 40-foot width. WTG pads would be reclaimed and restored from a 1.5-acre area to a 0.25-acre cleared area around each WTG for future access during routine maintenance and repair activities. The construction area for the transmission lines and substations also would be reclaimed in accordance with the BLM-approved master reclamation plan. During maintenance requiring a crane (estimated at 12 occurrences per year on average), wind turbine access roads may need to be temporarily re-disturbed to allow for crane transport. This would result in approximately 2.4 acres per mile of widened roadway. In addition, wind turbine pad locations would be temporarily expanded from the 0.25 acre of long-term disturbance to up to 1.5 acres (an increase of 1.25 acres) for the crane and support equipment to perform the repairs. Disturbance associated with extraordinary maintenance (roads and pads) would be re-vegetated at the completion of the maintenance activity.

A.4 Operations and Maintenance

Once the project is fully functioning, on-site personnel would operate and maintain the wind energy facilities. Operation of the project would require up to 114 full-time employees to maintain roads, service turbines, and maintain the transmission lines. The operations and maintenance personnel would be hired from the local labor pool to the maximum extent practicable. The majority of the employees would be full-time over the calendar year and throughout the anticipated life of the project.

Permitted land uses such as grazing would still occur in the Application Area. Operations and maintenance practices would continue to adhere to the applicant-committed BMPs as outlined in **Appendix C**.

It is anticipated that the majority of traffic to and from the project would involve daily trips between on-site operations and the operations and maintenance facility currently expected to be located south of CR 407 (CIG Road) in T21N, R86W, Section 31. The majority of the trips would include traveling to the operations and maintenance facility during the morning peak, where it is anticipated that the majority of the maintenance equipment for the workers would be staged. Once the workers reach the laydown area, most of the trips would be on-site for the remainder of the workday until the evening peak, when the workers would be leaving the site. As an estimate, it was assumed that each employee would make three external trips per day to and from the site. Assuming 114 employees per day, this would result in approximately 340 trips per day to and from the site, with the majority of the trips occurring in the peak morning and evening periods.

A.4.1 Turbine Commissioning

Once wind turbine mechanical completion has been achieved and the collection system is available to receive generation, control of the turbine would then be transferred to the turbine manufacturer for commencement of commissioning activities. It also is important to note that backfeed power is required to be available from the grid in order to commence full commissioning. If backfeed power is not available, pre-commissioning would be required. In order to perform pre-commissioning, temporary generators would be used to provide the WTG with the required power to perform full commissioning. Wind turbine commissioning would be performed individually for each turbine.

A.4.2 Project Maintenance

Maintenance would occur as necessary or as specified by the equipment manufacturer, when climatic conditions permit. Inspections of the facilities would occur as necessary to fulfill federal, state, and local policies. When access is required for maintenance and repairs, the same precautions identified for the construction of the project would be followed. Crews would be instructed to protect livestock, vegetation, wildlife, and other resources of significance. Maintenance of the project facilities would consist of routine maintenance, non-routine maintenance, and exceptional maintenance, each of which is described in the following subsections.

PCW would develop a winter access plan for the project. This plan would include when and how snow clearing would be performed, and when alternative equipment (such as snow cats) would be used. PCW would stage such alternative equipment where it would likely be needed (such as the base of Miller Hill) during the winter months to give technicians easy access to the equipment.

A.4.2.1 Routine Maintenance

Routine maintenance of the WTGs would be necessary to optimize performance and to detect potential malfunctions. Routine maintenance would consist of WTG oil changes, lubrication, rotor blade washing, and other scheduled activities that are required to keep the turbines in operating condition. The amount of oil for each WTG is scaled according to the size of the WTG. Typical types and quantities of turbine fluids that need field replacement include:

- Gearbox Oil – 200-300 gallons;
- Coolant – 50 -150 gallons; and
- Hydraulic Oil – 10 - 60 gallons.

The exact schedule of routine maintenance would depend on the WTG model selected, but is expected to occur approximately every 6 months, which would be scheduled during summer months. Based on the lubricating oil requirements of a 3-MW WTG, routine maintenance of the WTGs would generate an estimated 240,000 gallons of used oil on an annual basis. In addition, the used oil would have to be replaced with new oil, which would require the storage of bulk oil (new) at the operations and maintenance facility. There would be four 11,875-gallon aboveground storage tanks at the operations and maintenance facility used for storage of both new and used lubrication oil. Used oil would be disposed of at an authorized facility in accordance with applicable legal requirements.

The transmission lines would be inspected two times per year by ground or aerial patrols, and maintenance would be performed as necessary. Substation maintenance activities would include routine, scheduled equipment maintenance and grounds keeping.

<u>Road Maintenance</u>

As part of the routine maintenance activities, the internal resource roads would be maintained in a condition that allows for continued access to the WTGs. Road maintenance activities would incorporate existing BLM standards regarding road maintenance consistent with those described in the BLM

Manual 9113: Roads (BLM 1985) and the Surface Operating Standards of Oil and Gas Exploration and Development (BLM 2007) (i.e., the Gold Book). All roads would be maintained in a safe and environmentally responsible manner.

Project operation would require the use of the new roads for equipment and personnel to reach the WTGs. In addition, an access road that runs adjacent to each WTG site and the project substations would be used. The access roads would provide vehicular access to the following facilities:

- Each WTG;
- Meteorological towers;
- Substations;
- Operations and maintenance building; and
- Transmission line structures.

Most road maintenance would be performed on an as-needed basis. The frequency and type of maintenance that is required would be determined by routine inspections. The inspections would be performed on a regular basis and following snowmelt or heavy or prolonged rainfall. Inspections would identify maintenance needs for reduction of ruts and holes, maintenance of crowns and outslopes to keep water off the road, replacement of surfacing materials, clearing of sediment blocking ditches and culverts, maintenance of interim reclamation, and noxious weed and invasive plant species control. The maintenance program would ensure that maintenance operators have proper training and understand the road maintenance objectives and requirements.

To mitigate fugitive dust, road surfaces would be watered or otherwise treated with BLM-accepted dust control measures. These treatments would occur on an as-needed basis, depending on weather conditions and the amount of traffic on the road.

Snow plowing would take place on an as-needed basis in accordance with BLM approval. The following standard stipulations are typically included as a part of ROW grants:

- When snow removal from the road is undertaken, equipment used for snow removal operations shall be equipped with 6-inch shoes to keep the blade six-inches off the road surface. Holder shall take special precautions where the surface of the ground is uneven and at drainage crossings to ensure that equipment blades do not destroy vegetation.
- No new surface disturbance, which includes blading or plowing of the soil, will be allowed. If surface disturbance does occur during the snow removal process, Company must notify the BLM RFO. With any and all surface disturbance, a Class III cultural survey of the disturbed area will be required.
- No new surface disturbance, which includes blading or plowing of the soil, will be allowed to occur during the snow removal process. However, if disturbance does occur reclamation of this area will be required.

A.4.2.2 Non-routine Maintenance

Non-routine maintenance would consist of any unscheduled repair activities where the use of large cranes is not required. Non-routine maintenance may consist of WTG heater replacement, WTG fan replacement, rotor blade patching, brake repairs, yaw system repairs, or belt replacement. Any emergency maintenance would involve prompt movement of crews to repair or replace any damaged equipment.

A.4.2.3 Exceptional Maintenance

Exceptional maintenance may include rotor assembly replacement, single blade replacement, drivetrain replacement, generator replacement, or nacelle gearbox replacement. Exceptional maintenance may take place during adequate weather conditions year round.

Exceptional maintenance activities would be any repair that requires large equipment (i.e., 600-ton cranes). To accommodate large cranes, a crane pad at the turbine site would be re-established, possibly using an existing access road or adjacent area. The crane would be trucked to the site and assembled on the crane pad. Once the component replacement was complete, the crane would be disassembled and trucked from the turbine site, allowing the turbine to return to service. The crane pad would be reclaimed per the BLM-approved master reclamation plan upon completion of the maintenance activity.

It is unlikely that turbines requiring unscheduled maintenance at the same time would be close enough together to make walking cranes between them viable. However, if such a situation did occur and walking the crane between sites was deemed appropriate, PCW would re-establish the compacted road shoulders as was done during the project construction. Once the crane had moved and the unscheduled maintenance was completed, PCW would restore the road shoulders per the BLM-approved master reclamation plan.

A.4.2.4 Maintenance Frequency and Equipment

Routine maintenance activities would be regularly scheduled. Non-routine maintenance and exceptional maintenance would be conducted as the need arises. **Table A.4-1** presents the anticipated frequency that maintenance activities would occur and the number of man-hours required for each type of repair. It is estimated that 10,553 equipment operating hours would be needed for operations and maintenance activities in the summer months and 7,469 equipment operating hours would be needed in the winter months.

Table A.4-1 Anticipated Frequency of Repairs and Required Repair Hours

Component	Anticipated Number of Failures per Year	Crane Required	Crane Hours per Event	Manhours per Event
Blade Patching	50	No	0	70
Blade Replacement	3	Yes	120	39
Drivetrain	3	Yes	120	123
Gearbox	3	Yes	120	93
Generator	3	Yes	120	20
Brakes	5	No	0	8
Yaw System	3	No	0	8
Switch Gear Cabinet	4	No	0	8
Transformer	1	No	0	8

A.5 Decommissioning

The requested ROW grant is for a term of 30 years with the option to renew the ROW grant and upgrade the wind facility, as necessary. The major components of WTGs are modular, and thus, can be removed, replaced, or upgraded as necessary without extensive cost. However, at such time that decommissioning becomes necessary, all facilities (e.g., towers/turbines, electrical network, and upper 2 feet of foundations) would be removed and recycled, to the extent practicable. Unsalvageable materials would be disposed of in an approved disposal facility. Ground disturbance associated with complete decommissioning of the project would be similar to the ground disturbance associated with construction of the project.

In the event the project requires decommissioning, the following sequence would be used for removal of the components:

- Remove WTGs and meteorological towers;
- Partially remove WTG foundations;
- Remove aboveground electrical network;
- Remove electric substations;
- Remove operations and maintenance building; and
- Reclaim access roads (unless requested otherwise).

Decommissioning of the project facilities is expected to take three years, primarily during April to October, and would have similar equipment and work force requirements to construction of the project. The estimated amount of total work force is provided in **Table A.5-1** and total equipment operating hours required is provided in **Table A.5-2**.

Construction traffic volumes would vary throughout the decommissioning of the project. The majority of the trips generated would be due to hauling the large turbine components off-site. Daily commuting traffic is expected to make up over 90 percent of the peak hour project decommissioning traffic. **Table A.5-3** displays the estimated roundtrip traffic volume during the peak month of decommissioning. **Table A.5-4** provides the estimated labor force commuting to the site during decommissioning. Any roadway damage due to the transport of the heavy equipment would need to be repaired on the public roadways when the decommissioning of the project is complete.

A.5.1 Tower and Turbine Removal

Removal of the towers and WTGs would involve a process that is similar to construction. Equipment and personnel needs would be comparable to construction, as would disturbance areas. Approximately 1.5 acres per turbine pad location would be necessary, and access roads would need to be rewidened to construction widths. Dismantling would occur in reverse order of construction, and materials would be salvaged or recycled to the maximum extent practical. Control cabinets, electronic components, and internal cables would be removed.

The rotor, nacelle, and tower sections would be lowered to the ground where they may be transported for reconditioning and reuse, or disassembled/cut into more easily transportable sections as salvageable, recyclable, or disposable components. Those parts that cannot be refurbished and reused, or recycled, would be disposed of in an approved disposal facility after all fluids have been removed. The WTG tower and nacelle would yield approximately 80 percent salvageable materials that can either be reused or recycled. The blades are made primarily of fiberglass, so if they cannot be reused elsewhere they would be disposed of in the proper facilities. All meteorological towers also would be removed and reused or recycled.

Table A.5-1 Estimated Total Workers per Month in Each Decommissioning Year[1]

	Year 1	Year 2	Year 3
April	Less than 200	Less than 200	200 – 300
May	300 – 400	300 – 400	300 – 400
June	300 – 400	300 – 400	300 – 400
July	300 – 400	300 – 400	300 – 400
Aug	300 – 400	300 – 400	300 – 400
Sep	200 – 300	200 – 300	300 – 400
Oct	200 – 300	200 – 300	300 – 400

[1] Estimate based on an average of 60 hours/week/worker.

Table A.5-2 Estimated Total Construction Equipment Operating Hours per Month in Each Decommissioning Year

	Year 1	Year 2	Year 3
General Pick-Up Trucks	350	350	350
Other Equipment	150	150	150
Total	**500**	**500**	**500**

Table A.5-3 Total Truckloads of Project Decommissioning Material (One-way Trips per day[1])

Items	Year 1	Year 2	Year 3	Total
Removed from Off-site[1]				
Wind Turbine Components	5,220	5,220	4,560	15,000
Aggregate	19,038	29,041	40,822	88,900
Concrete Removal	2,231	2,148	1,862	6,242
Collection System Cables/Structures	81	82	71	233
Transmission Line Cables/Structures	644	647	559	1,850
Substation Components	20	54	36	110
Buildings/Trailers	30	20	30	80
Other Materials	3,719	2,960	3,321	10,000
Equipment Deliveries	1,180	1,180	1,180	3,540
Personnel Off-Site Trips	439	329	47	815
Total Removed	**32,601**	**41,680**	**52,489**	**126,770**
On-site Only				
Water	8	16	8	33

[1] Each truckload from the site to the RDF or other off-site location.

Table A.5-4 Total Labor Force Commuting to Site During Decommissioning[1,2,3]

Month	Year 1	Year 2	Year 3
April	200	200	300
May	400	400	400
June	400	400	400
July	400	400	400
August	400	400	400
September	300	300	300
October	300	300	300

[1] Workers will be commuting from off-site housing with an assumed distribution of: 65 percent from Rawlins, 10 percent from East of Rawlins (Laramie area), 15 percent from west of Rawlins (Rock Springs and Wamsutter area), and 10 percent from south of Rawlins (Saratoga area).

[2] Assumes one trip to and one trip from the Application Area per day.

[3] Workers outside the Rawlins area would be assumed to carpool at 1.5 workers per vehicle.

A.5.2 Foundation Removal

Foundations would not be completely removed upon decommissioning of the project; rather, they would be removed to just below the surrounding ground surface (approximately 2 feet or per current industry standard) and backfilled. To completely remove the foundations would require additional surface disturbance, off-site disposal or recycling of the foundation materials, and import of fill for the resultant holes.

Removal of the top portion of the foundations would involve equipment and personnel to break and excavate concrete, then backfill and re-grade the surface to approximate pre-disturbance contours. Concrete would be broken up and recycled for use as material for roads, to the maximum extent practicable, or disposed of in an approved disposal facility. Upon completion of foundation removal, all disturbed areas would be backfilled using local soil/topsoil and reclaimed in accordance with the BLM-approved master reclamation plan.

A.5.3 Electrical Network Removal

Assuming that the transmission lines would not be used for other potential developments, all transmission line components would be removed. Removal of the electrical network (e.g., transformers, electric collection system, substations, and overhead transmission lines) would involve a similar process as construction, with similar equipment and personnel needs. Disturbance areas equal to those needed during construction would be required to remove the electrical network. Components of the electrical network would be dismantled in reverse order of construction, and materials would be salvaged or recycled to the maximum extent practicable or disposed of in an approved disposal facility. Any underground electrical cables would be left in place. Following dismantlement, all storage facilities and substations would have an inspection for the presence of industrial contamination from minor spills or leaks. If any are found, decontamination would be done in full compliance with applicable regulations in place at that time.

A.5.4 Access Roads Removal

To perform the decommissioning activities, it may be necessary to return some roads to their construction stage conditions. This would allow for efficient crane access to the turbine sites and facilitate removal of the wind turbine components by truck.

Once all materials have been removed from the site, the access roads would be reclaimed in accordance with the BLM-approved master reclamation plan, unless the BLM and/or the landowner prefer they stay in place. Previously existing roads would be reclaimed to the original widths and new roads would be removed and reclaimed. All gravel would be removed and either reused or disposed of in the proper facilities.

Reclamation would include regrading (including de-compacting soils), spreading topsoil, and revegetating all disturbed areas. Once the roads have been removed, or the width has been reduced, the area would be reclaimed according to the BLM-approved master reclamation plan.

A.5.5 Final Reclamation and Abandonment

Final reclamation would occur upon decommissioning of the project, which may be 30 years or more after completion of construction. Interim reclamation of all areas remaining after construction is complete is discussed in Section A.3.7. All reclamation (interim and final) would conform to the requirements outlined in a project-specific reclamation plan developed in accordance with BLM policy concurrent with the Final EIS.

At the end of the project's useful life, the owner/operator would obtain the necessary authorizations from the appropriate regulatory agencies to decommission the facilities. Upon decommissioning, all facilities would be removed and recycled, as detailed in the above sections. Unsalvageable materials would be disposed of in an approved disposal facility. Reclamation procedures would be based on site-specific requirements and techniques commonly employed at the time the area is to be reclaimed and would include re-grading (including de-compacting soils), spreading topsoil, and re-vegetating all disturbed areas. Detailed final reclamation procedures would be developed by the operator using appropriate techniques consistent with industry standards at the time.

Final reclamation equipment and personnel requirements are expected to be similar to the requirements for construction reclamation. Initial reclamation would follow the 3-year decommissioning by 1 year. It is anticipated that successful reclamation can take up to 5 years.