5. Construction

The methods, resources, and timeframe for the construction of the Phase I Wind Turbine Development are described below. Construction of the Phase I Wind Turbine Development relies upon the infrastructure to be built for the Phase I Haul Road and Facilities, West Sinclair Rail Facility, and Road Rock Quarry.

5.1 Schedule

PCW anticipates construction of the Phase I Wind Turbine Development from 2016 through 2019, as shown in Table 5.2. Wind turbine construction will generally begin in the Sierra Madre WDA and finish in the Chokecherry WDA. Within the Sierra Madre WDA, wind turbine construction will begin in the Upper Miller Hill region, then move to Pine Grove and finish in McCarthy. In the Chokecherry WDA wind turbine construction will begin in the Smith Draw region and finish in Nevins Valley. A summary of the Phase I Wind Turbine Development elements to be completed during each year of construction is provided in Table 5.2 and displayed in Figure 5-1 and Figure 5-2.

PCW developed the Phase I Wind Turbine Development construction schedule in a manner that meets PCW's objectives and complies with the requirements of the ROD, as outlined in Appendix A. Specifically, PCW developed the Phase I Wind Turbine Development construction schedule to:

- Comply with applicable wildlife timing stipulations (Appendix A);
- Comply with mitigation measure GEN-1, i.e., "limit surface disturbance to areas where turbines would be constructed within 12 months with a goal to mitigate impacts from surface disturbances to wildlife, soils, water, and vegetation (e.g., weeds)."
- Construct the Phase I Wind Turbine Development efficiently and cost-effectively by performing similar activities at the same time within a sub-region; and
- Developing the highest wind energy potential areas first by prioritizing construction in the Sierra Madre WDA.

Based on these priorities, PCW developed a two-stage construction strategy for the Phase I Wind Turbine Development. Stage one consists of site establishment, i.e., initial construction in each sub-region that requires new ground disturbance, and stage two includes installation of equipment and facilities on the sites prepared during stage one. Typical stage one and stage two activities are shown in Table 5.1.

Table 5.1. Typical Construction Activities by Stage

Stage One (Construction)	Stage Two (Installation)
Roads and crane paths	Wind turbines
Wind turbine installation sites	Meteorological towers
Foundations	Underground electrical system cables
Substation pads	Overhead electrical system structures and lines
Overhead electrical system structure sites	Substations
Meteorological tower sites	
Laydown yards and crane assembly areas	

Based on the typical weather at the CCSM Project Site, PCW determined the practical construction season is between June and October of each year. In many years, weather conditions may allow construction activities as early as March or as late as December; however, PCW is unable to predict which years such construction would be feasible. Therefore, for planning purposes, PCW developed a construction schedule that mobilizes construction crews in May for work to begin in June and concludes work in October with demobilization in November. PCW will evaluate the conditions each season to determine if earlier mobilizations or later demobilizations would be effective.

In addition to weather restrictions, many wildlife timing restrictions were placed on the CCSM Project that affect the construction schedule. Stage one construction activities require new ground disturbance and as such they are subject to specific wildlife timing restrictions. For the Phase I Wind Turbine Development, the most restrictive wildlife stipulations prohibit new ground disturbance in some areas until as late as July 15 of each year. While PCW will evaluate these areas each year and may request exceptions where warranted, the Phase I Wind Turbine Development construction schedule assumes that these restrictions are in place. Due to the timing restrictions, PCW may attempt to complete stage one and stage two activities within a region in the same construction season, but recognizes that in most regions that is not achievable. Therefore, PCW's schedule includes separation between stage one and stage two activities within each region, with stage two activities generally done the year after stage one activities are completed for a region. Table 5.2 summarizes the regions and elements to be constructed each year.

Phase I Wind Turbine Development includes three buildings, a water system, construction trailer complex, and on-site accommodations which are not tied to a specific region. PCW will install these elements when their functionality is required for the Phase I Wind Turbine Development, as shown in Table 5.2. In the latter months of 2018 and 2019 when wind turbines are installed and the substations and transmission lines are completed and energized, PCW will commission the wind turbines as they are constructed and available. As such, portions of the Phase I Wind Turbine Development will reach operational status over a period of weeks in both 2018 and 2019.

Table 5.2 Construction Schedule Summary

Element	2016	2017	2018	2019
STAGE ONE (Construction)				
Site Preparation and Civil Construction		Upper Miller Hill Pine Grove	McCarthy Smith Draw	Nevins Valley
STAGE TWO (Installation)				
Wind Turbines Meteorological Towers Collection System			Upper Miller Hill Pine Grove	McCarthy Smith Draw Nevins Valley
Substations Transmission System			Overland Pine Grove McCarthy Trans. Line A	Smith Draw Nevins Valley Trans. Line B
Facilities	Water Source and Pipelines	North Yard Expansion Trailer Complex On-Site Accommodations	Operations Center Sierra Madre Maint. Bldg.	Chokecherry Maint. Bldg.
ANNUAL CONSTRUCTION TOTALS				
Wind Turbines			229 turbines	271 turbines
Roads		73 miles	81 miles	42 miles
Disturbance	Initial: 32 acres Long-Term: 2 acres Activity: 3 acres	Initial: 1,335 acres Long-Term: 212 acres Activity: 61 acres	Initial: 986 acres Long-Term: 170 acres Activity: 179 acres	Initial: 682 acres Long-Term: 101 acres Activity: 197 acres

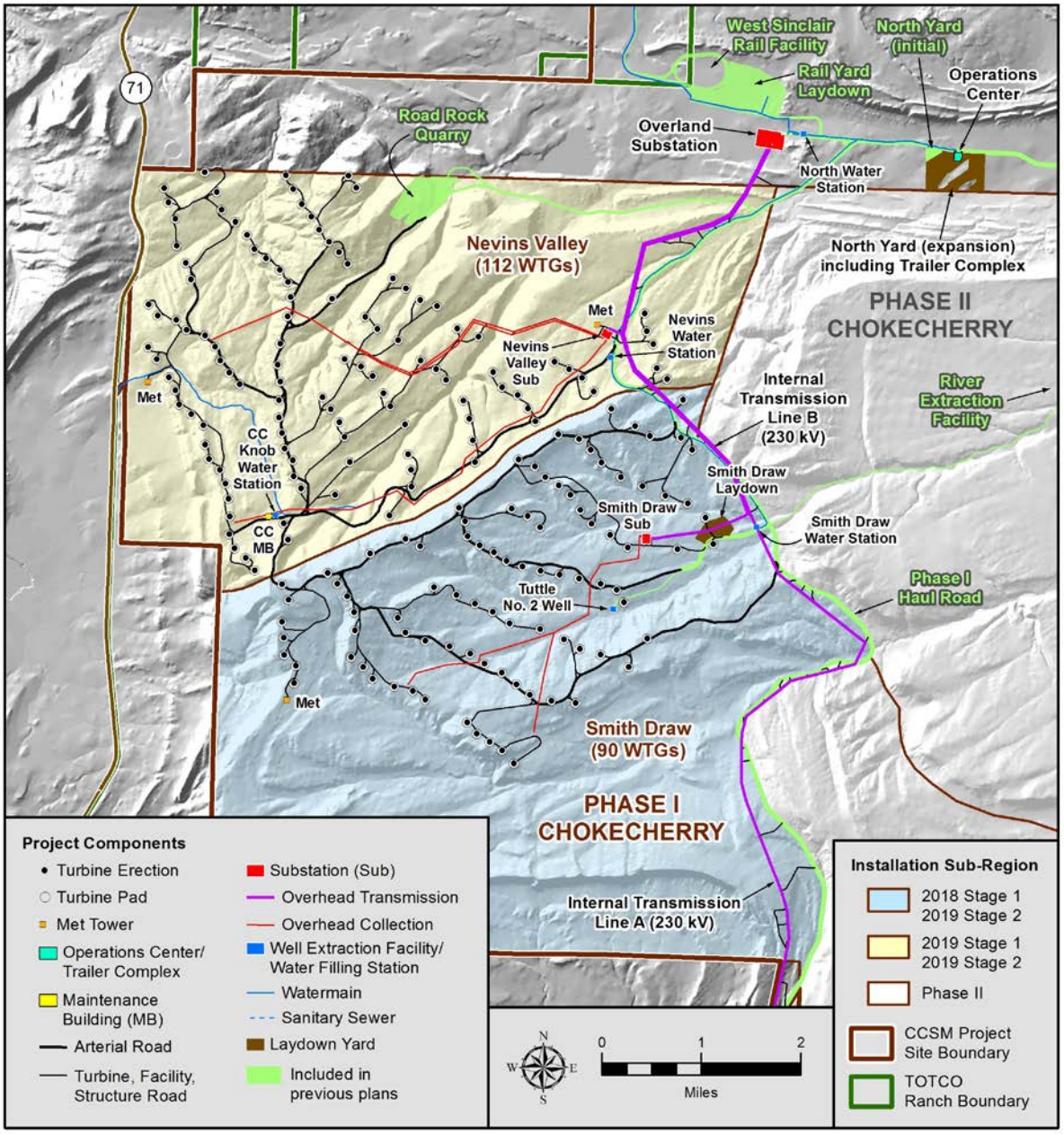

Figure 5-1. Chokecherry Construction Summary

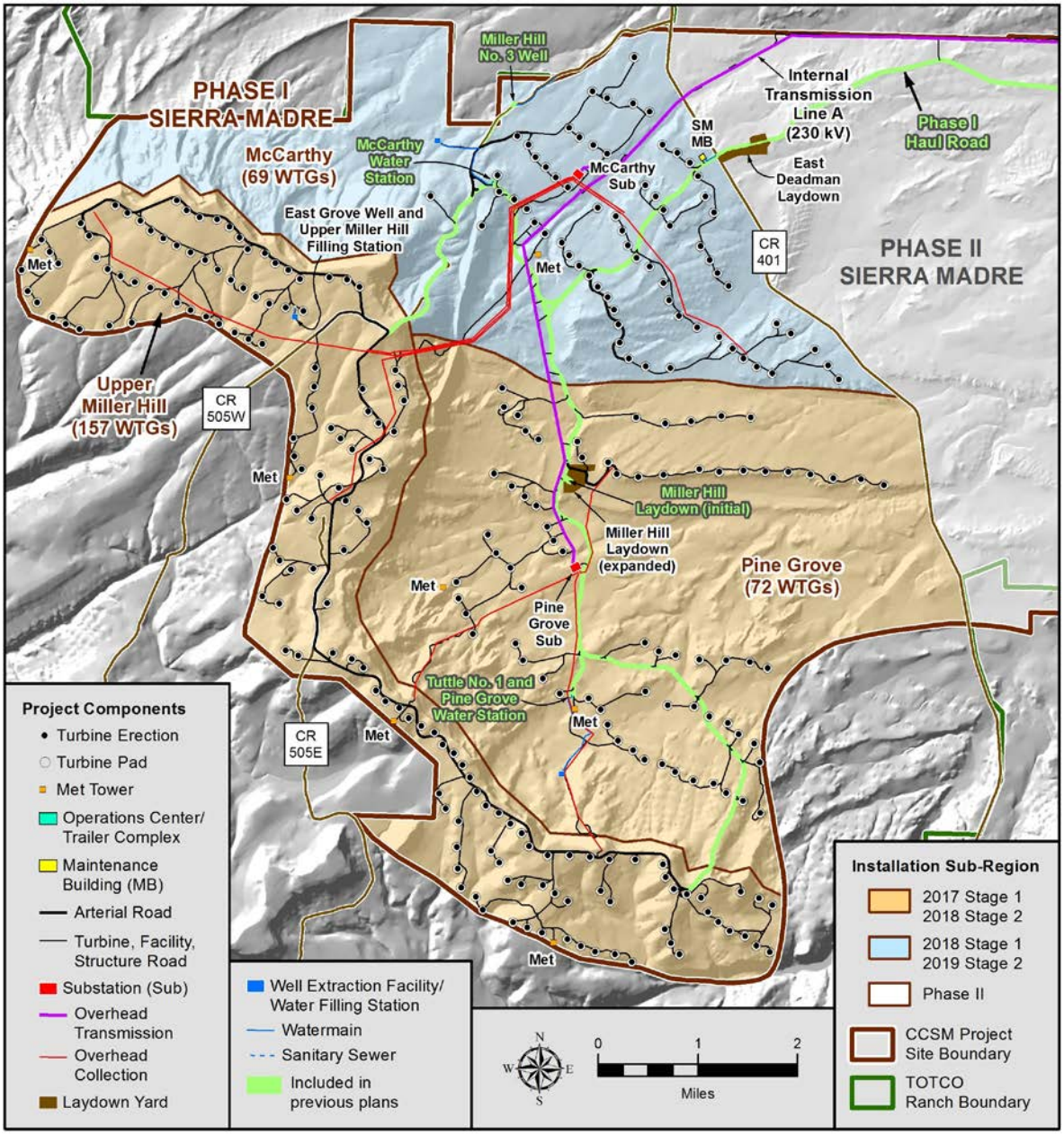

Figure 5-2. Sierra Madre Construction Summary

5.2 Workforce

Table 5.3 provides an estimate of the maximum workforce by month necessary to construct the Phase I Wind Turbine Development. The peak workforce for the construction of the Phase I Wind Turbine Development is 761 workers in July and August of 2018.

Table 5.3. Phase I Wind Turbine Development Construction Workforce Estimate

Month	Workforce			
	2016	***2017***	***2018***	***2019***
January	0	4	18	37
February	0	4	18	37
March	0	27	18	37
April	0	28	18	37
May	2	45	137	138
June	5	70	657	601
July	16	259	761	701
August	16	259	761	701
September	5	249	751	701
October	4	249	751	701
November	4	70	169	156
December	4	26	66	66

5.3 Access and Security

Vehicle access for construction of the Phase I Wind Turbine Development will be through two (2) entrances, the CCSM Project North Entrance and the CCSM Project South Entrance. The North Entrance is off of Interstate 80 at Exit 221, then south along CIG Road. The South Entrance is off Highway 71/Carbon County Road 401 (Sage Creek Road) approximately 17 miles south of Rawlins. A gate and guard shack will be located on private land at each CCSM Project entrance to secure the CCSM Project Site. The guard shack will be staffed whenever construction activities are being performed on-site. Outside working hours, the gates will be closed and locked. Signs will be posted with contact information for emergency access. In addition to the gates, security personnel will patrol the CCSM Project Site. Security will be adjusted based on the levels of activity and the value of the components in storage. Portions of the laydown yards will be fenced and have perimeter lighting. Security cameras may also be used.

The workforce supporting construction of the Phase I Wind Turbine Development will use the entrance closest to their place of work. Personnel will travel within the Phase I Wind Turbine Development Site only by company truck or van; all personal vehicles belonging to the workforce will be parked in parking lots near each entrance. Any deliveries for the Phase I Wind Turbine Development not arriving by rail will come through the North Entrance.

Additional information on the transportation of personnel, components, materials and equipment for the CCSM Project can be found in the Transportation Management Plan, Appendix D.

5.4 Equipment

The peak amount of equipment necessary to construct the Phase I Wind Turbine Development is listed in Table 5.4 for each year of construction. Not all equipment will be used simultaneously.

Table 5.4. Phase I Wind Turbine Development Peak Construction Equipment

Equipment	2016	2017	2018	2019
Heavy Vehicles and Equipment				
150 Ton Crawler Crane	0	0	8	8
300 Ton Crawler Crane	0	0	6	6
450 Ton Crawler Crane	0	0	6	6
Aggregate Hauling Trucks (Belly Dump)	0	20	20	20
Backhoe/Trackhoe	0	0	12	12
Bucket Truck	0	0	19	12
Compaction Equipment	0	7	12	12
Component Delivery Truck	0	8	44	44
Concrete Telebelt/Pump Truck	0	4	4	4
Concrete Truck	0	20	28	28
Drill Rig	2	10	16	13
Dozer	1	7	31	27
Excavator	1	5	5	4
Forklift	0	10	10	10
Front End Loader	0	2	5	5
Mini Excavator	0	0	16	8
Motor Grader	1	5	6	5
Reclaimer	1	2	1	0
Rough Terrain Crane	0	5	41	37
Scraper	0	4	4	4
Skidsteer	0	0	16	10

Equipment	2016	2017	2018	2019
Tensioner Rig	0	0	10	10
Tractor and Reel Trailer	0	0	14	15
Tractor with Disk	1	5	5	4
Trencher	0	0	6	6
Water Truck	1	6	6	4
Wheel Loader	0	4	4	4
HEAVY VEHICLES AND EQUIPMENT TOTAL	**8**	**124**	**355**	**318**
Light Vehicles				
Pick-Up Trucks	8	89	313	282
TOTAL VEHICLES AND EQUIPMENT	**16**	**213**	**668**	**600**

5.5 Materials and Components

A summary of the primary materials and components required for construction of the Phase I Wind Turbine Development is provided in Table 5.5. The material and component estimate summarized in Table 5.5 demonstrates that the anticipated materials and components for the Phase I Wind Turbine Development are within the estimate provided in Table 1 of the Transportation Management Plan (Appendix D).

Table 5.5. Construction Materials and Components Estimate

Material	2016	2017	2018	2019	TOTAL
Wind Turbine Components					
Nacelles	0	0	229	271	**500**
Hubs	0	0	229	271	**500**
Tower Sections	0	0	916	1,084	**2,000**
Blades	0	0	687	813	**1,500**
TOTAL COMPONENTS	**0**	**0**	**2,061**	**2,439**	**4,500**
Aggregate					
From Road Rock Quarry (cy)	0	442,000	273,000	152,000	**867,000**
From Outside Quarry (cy)	0	187,800	288,000	151,300	**627,100**
TOTAL AGGREGATE (cy)	**0**	**629,800**	**561,000**	**303,300**	**1,494,100**
Construction Components and Materials					
CMP Culverts	0	180	178	137	**495**
Rebar (tons)	0	9,420	13,860	6,720	**30,000**
Cable Reels	0	0	1,170	1,440	**2,610**
Overhead Collection Structures	0	0	285	243	**528**
Internal Transmission Structures	0	0	177	38	**215**
Notes: CMP = corrugated metal pipe					

5.6 Material and Component Deliveries

Traffic levels from material and component deliveries are detailed in Appendix D. All material and component deliveries in 2016 and 2017 will be by truck. Starting in 2018 the Rail Facility will be operational, at which time most deliveries will come to the CCSM Project Site by rail. Regardless of whether material and components arrive on site by truck or rail, or originate from the Road Rock Quarry, they will be delivered to their point of installation by truck using the CCSM Project's internal road network. Most large components will be loaded and unloaded from trucks using cranes. Large components such as wind turbine nacelles, blades, and towers, as well as large electrical components such as transformers will be loaded and unloaded using lattice cranes of sufficient capacity for the component's weight. Smaller components may be loaded and unloaded using rough terrain cranes or forklifts.

Because most deliveries to the CCSM Project Site will be by rail starting in 2018, PCW has more control to the timing of deliveries within the CCSM Project Site. PCW will be able to direct transporters to deliver components to wind turbine sites when needed rather than when they arrive via long-distance trucking, greatly improving overall efficiency. The following configurations are examples of the trucks that may be used for material and component deliveries within the CCSM Project Site.

5.6.1 Typical Component Deliveries

The Phase I Wind Turbine Development components that require special handling (due to weight or dimensions) will be delivered using trucks and flatbed trailers (Figure 5-3). These include turbine components such as the hub, nosecone, and containerized gear and tools. Electrical equipment such as switchgear, padmount transformers, overhead structure components, and cable spools will also arrive on flatbed trailers.

Figure 5-3. Typical Flatbed Trailer Configurations

5.6.2 Extra-Heavy Component Deliveries

Some components for the Phase I Wind Turbine Development have weights approaching 80 tons. To move these items, special delivery solutions will be used. Typically, “low-boy” trailers with several axles are used to distribute the per-axle loading and make the components easier to unload. Wind turbine nacelles and substation transformers commonly use truck/trailer combinations with between 13 and 19 axles, as shown in Figure 5-4. Low-boy trailers will also be used to deliver heavy construction equipment to the CCSM Project Site, as well as to reposition the equipment when the distance is further than is practical to drive the equipment.

Figure 5-4. Typical Nacelle and Transformer Trailer Configurations

5.6.3 Extra-Long Component Deliveries

Several components for the Phase I Wind Turbine Development have lengths exceeding the standard 53-foot semi-trailer length. Moving these components requires extra-long trailers. For wind turbine blades, the most common solution is a telescoping trailer. These trailers extend to support all or most of the length of the blade, then retract when unloaded for more efficient return trips. This configuration is shown in Figure 5-5. Similar telescoping trailers may be used for the longer, lighter top sections of the turbine towers.

Figure 5-5. Typical Wind Turbine Blade Trailer Configuration

For other wind turbine tower sections, the most common approach is to use the Schnabel trailer solution. This approach involves attaching wheeled sections to the front and back of the tower, and allowing the tower itself to act as its own trailer. An example Schnabel arrangement is shown in Figure 5-6.

Figure 5-6. Typical Schnabel Tower Trailer Configuration

5.6.4 Loose Dry Material Deliveries

For the placement of aggregate, fill dirt, and similar loose dry construction materials, PCW will use dump trucks for transportation across the CCSM Project Site. PCW will look to maximize the amount of material in each trip by using large belly-dump trucks where possible (Figure 5-7). Depending upon the material's weight and the distance, PCW may equip some belly-dump trucks with additional, smaller "pup" trailers.

Figure 5-7. Typical Belly Dump Trailer Configuration

5.6.5 Liquid Material Deliveries

Liquid material deliveries for the Phase I Wind Turbine Development primarily consist of fuel, water, and concrete. Water trucks will be filled at water stations located throughout the CCSM Project Site. These trucks will transport water, as well as apply water directly for dust control, road compaction, or revegetation. An example of a typical water truck is shown in Figure 5-8 (left). PCW will also operate concrete batch plants at laydown yards throughout the CCSM Project Site. Concrete will be delivered using concrete trucks (Figure 5-8 [right]). Fuel will be delivered within the CCSM Project Site using fuel tanker trucks, which will be clearly marked as carrying fuel.

Figure 5-8. Typical Water and Concrete Trucks

5.7 Communications

Personnel communications during construction will be maintained via hand-held radios and cellular phones per the CCSM Project Health and Safety Plan (Appendix R). If hand-held radio reception is inadequate, radio repeater stations will be installed within the limits of disturbance for the CCSM Project.

5.8 Construction Activities

5.8.1 Mobilization and Demobilization

The Phase I Wind Turbine Development construction team will mobilize a few weeks prior to commencement of construction each year. The construction team will bring construction trailers and management staff to the CCSM Project Site. The primary location for construction trailers will be in the North Laydown Yard where PCW anticipates up to four (4) double-wide and thirteen (13) single-wide trailers will be needed for 2018 and 2019 construction. The 2016 and 2017 construction team will use the same trailers as those set up for the Phase I Haul Road and Facilities construction. Additionally, up to six (6) single-wide trailers may be mobilized to the other laydown yards on a temporary basis as needed to support construction activities in those areas.

The construction trailers and construction equipment, such as bulldozers and graders, will arrive at the CCSM Project Site by truck. Upon arrival, the construction trailers will be placed on stands and the double-wide trailers will be connected. Electrical power for the construction trailers will be provided by portable generators, and PCW will place portable sanitation facilities adjacent to the trailer. Once the utility connections are completed in 2016, the North Laydown Yard trailers may be connected to electrical, water, and wastewater connections to eliminate the need for temporary solutions. Each trailer area will also have a parking lot for personal and company vehicles.

As construction of the Phase I Wind Turbine Development is completed and particular pieces of equipment are no longer required, equipment will be demobilized from the CCSM Project Site. Demobilization will be by the same transportation mode used for mobilization. At the conclusion of the Phase I Wind Turbine Development construction, the construction trailers will be removed along with any remaining construction equipment.

5.8.2 Site Preparation

Site preparation for the Phase I Wind Turbine Development will begin with topsoil removal. Bulldozers, scrapers, and motor graders will clear away existing vegetation and topsoil. Following topsoil removal, the site will be excavated, graded, and compacted per the design requirements (Appendix B). All soil handling will be in accordance with the requirements of the Reclamation Plan (Appendix L). Topsoil that is removed will be segregated and stockpiled for use during reclamation. Excavated subsoil will be stockpiled and used as fill throughout the CCSM Project Site when suitable. All soil will be handled in accordance with the requirements of the Storm Water Pollution Prevention Plan (SWPP Plan) (Appendix I) and the Reclamation Plan (Appendix L). Following site preparation, the necessary drainage structures and features will be installed and aggregate material will be placed.

The equipment used to conduct site preparation includes bulldozers (Figure 5-9 [right]), scrapers, motor graders (Figure 5-9 [left]), compaction equipment, aggregate hauling trucks, and water trucks. The bulldozers, scrapers, and motor graders will complete clearing and grading operations. The compaction equipment, typically vibratory rollers, will compact the graded earth to meet design requirements. It will also be necessary to occasionally use a water truck to condition the graded soils in order to meet the compaction requirements, as well as for dust control during construction.

Figure 5-9. Typical Clearing and Grading

5.8.3 Roads

Following the site preparation described in Section 5.8.2, the roads associated with Phase I Wind Turbine Development will be constructed as described in the following sections. The roads will be constructed to meet the requirements of the CCSM Project Road Design Manual (Appendix C).

5.8.3.1 Drainage Structure Installation

The roads associated with Phase I Wind Turbine Development cross drainages in a number of places. Following site preparation, PCW will install the necessary drainage structures. PCW will install circular corrugated metal pipe (CMP) culverts at a majority of the channel crossings (Figure 5-10 [left]). Locations for each CMP culvert will be excavated using excavators and bulldozers. Following excavation, bedding for the culvert will be placed using in-situ or nearby excavated soils. Culverts will then be placed with forklifts and excavators. Structural backfill will be placed around the culverts with dozers, front end loaders, excavators, and compactors, using soils excavated nearby wherever possible. While the Phase I Wind Turbine Development design does not currently include concrete box culverts, if any crossings are identified in the future where the hydrology favors the use of precast concrete box culverts, concrete box culverts will be installed in a manner similar to that of the CMP culverts, although typically a wider excavation and larger installation equipment are required (Figure 5-10 [right]).

Figure 5-10. Typical Culvert Installation

The Phase I Wind Turbine Development design identifies several locations where drainages will be crossed using at-grade crossings. While these crossings will be constructed in a manner and with equipment similar to the rest of the road, some additional site preparation will occur near drainages.

For at-grade crossings, topsoil and subsoil that is removed per the methods discussed in Section 5.8.2 will not be windrowed adjacent to the crossing, but rather moved and stored per the requirements of the SWPP Plan (Appendix I). Subgrade compaction (Section 5.8.3.2) may also require additional compaction, removal of unsuitable soil, and/or placing and compacting surge material (small clean rip rap). If deemed necessary by the design engineer, a geosynthetic fabric or geogrid may also be installed per Section 5.8.3.3 to stabilize the subgrade. The aggregate section (and crane travel shoulder, if applicable) for the at-grade crossing (installed per Section 5.8.3.4) will also have a thicker coarse graded aggregate subbase and a thinner surface aggregate than the typical road section.

5.8.3.2 Subgrade Soil Compaction

Following installation of drainage structures, the roadbed soil will be compacted. Water trucks will add moisture to the soil as needed and compaction equipment, typically vibratory rollers, will compact the subgrade soils to meet design requirements (Figure 5-11).

Figure 5-11. Road Subgrade Soil Compaction

5.8.3.3 Soil Stabilization

Geotechnical analysis performed to date on the Phase I Wind Turbine Development Site has not identified any known locations where PCW expects soil stabilization techniques to be required; however, should soil conditions be found during construction where design compaction of the subgrade cannot be achieved, PCW will enhance soil stability. Soil stability will be enhanced through the placement of additional aggregate, a geosynthetic material such as geotextile fabric, or geogrid. The process for determining when soil stabilization is required is described in the CCSM Project Road Design Manual (Appendix C). Aggregate placement is discussed in Section 5.8.3.4.

Where portions of the road require geotextile fabric or geogrid installation, PCW will install the material after road base compaction. To install the geotextile fabric or geogrid, the material is rolled out with a front end loader or a forklift while soil is placed along the edges with a motor grader to secure it into place (Figure 5-12). Once the material is placed, smoothed out, and secured on the edges, the road is ready for aggregate placement. Extra care is taken during the aggregate placement to keep the geotextile fabric or geogrid in its correct alignment (Figure 5-13).

Figure 5-12. Geotextile Fabric Installation

Figure 5-13. Geogrid Installation

5.8.3.4 Aggregate Placement

Following compaction and any necessary stabilization, PCW will place aggregate over the subgrade (Figure 5-14). As shown in the Road Section Detail of the Phase I Wind Turbine Development Issued for Permit Plans (Appendix B), different roads and portions of roads require aggregate layers of varying types and thicknesses. Aggregate requirements are based on soil properties, aggregate properties and anticipated traffic types and levels for each road. PCW will use the aggregate layering thicknesses to determine how many "lifts" of aggregate to place on each section of road. For each lift, a belly dump truck will dump the aggregate in the road section, bulldozers and motor graders will spread the material to the required thickness above the subgrade or above the previously-placed aggregate lift, and compaction rollers will compact the aggregate as needed. For thicker aggregate sections, multiple lifts of the same material may be required. If the observed soil conditions do not meet the design assumptions, the aggregate thicknesses may be field adjusted. During the placement of aggregate, water trucks will be used to apply water for compaction and dust suppression.

Figure 5-14. Aggregate Placement

5.8.3.5 Final Inspection and Testing

At the completion of road construction, PCW will test the roads to verify that they meet the design requirements. This testing will include proof-rolling or similar techniques for deflection verification. When roads pass the verification tests, PCW will distribute stockpiled topsoil along the road shoulders and ditches to support revegetation and reclamation in accordance with the Reclamation Plan (Appendix L).

5.8.4 Wind Turbine Sites

PCW will establish each wind turbine site in two steps; the first step occurs prior to foundation installation and the second step occurs prior to turbine installation. In conjunction with the construction of the turbine access road, construction crews will establish the grade necessary to install the wind turbine foundation (Section 5.8.2). Typically crews will only grade the area immediately adjacent to the foundation unless a wider area is necessary for site stability, steep grades, or drainage. Once the foundation area is graded, the wind turbine site is released for wind turbine foundation construction (Section 5.8.5.1). Following construction of the wind turbine foundation, the wind turbine site will be cleared and graded (Section 5.8.2) for wind turbine installation. The wind turbine site will then be compacted as needed using compaction rollers and water. If required for stabilization based on soil conditions, an aggregate surface will be placed across the wind turbine site using belly-dump trailers, bulldozers, and motor graders. Areas that are sufficiently flat and stable for wind turbine installation in their natural condition will not undergo the second step of site preparation work described above.

Each wind turbine site has a designated crane pad location for wind turbine installation. These pads, commonly 50 feet by 100 feet, are where the main turbine erection cranes will be placed for turbine assembly. Crane pads will be cleared by bulldozers and compacted using compaction rollers and water trucks as needed. Following compaction, wooden mats will be placed on each crane pad using rough terrain cranes. After the installation of the crane pad, the wind turbine installation site is ready for delivery of turbine components and is released for turbine construction (Section 5.8.6).

Figure 5-15. Example Wind Turbine Site Use During Construction

5.8.5 Foundations

The majority of the Phase I Wind Turbine Development elements require foundations. The type of foundation and construction technique varies depending on the element. Prior to the construction of each foundation, PCW will verify the soil conditions and conduct any necessary geotechnical testing. The appropriate level of geotechnical testing will be determined by the structural engineers.

5.8.5.1 Wind Turbine Foundations

The Phase I Wind Turbine Development design includes mat foundations for the wind turbines (Section 4.3.3.1). PCW has presented alternative foundation designs in Section 4.3.3.1.3 along with a description of the general construction techniques for each type of foundation. Alternative foundation designs are not currently anticipated for the Phase I Wind Turbine Development; thus, the construction process is not described again in this section.

Mat foundations consist of an anchor bolt cage in steel reinforced concrete. The foundation site is prepared as described in Section 5.8.4. The foundation site is then excavated to the design depth (typically 10 feet) using tracked excavators. Upon completion of the excavation, a thin (commonly two to three inches thick) and lighter duty (commonly 2,000 psi) concrete surface called a mudmat is poured. The mudmat provides a clean and level working surface from which to assemble the foundation. On the mudmat, workers begin assembling the bottom layer of the concrete reinforcing. An anchor bolt cage is then assembled and placed on the bottom layer of steel reinforcing. Workers then assemble a top layer of steel reinforcing intermeshed through the anchor bolt cage. Forms are then placed around the steel reinforcing and anchor bolt cage in preparation for pouring the base section of the foundation. The base section of the foundation is then poured using ready mixed concrete trucks discharging into a concrete telebelt or concrete pump truck to accommodate the size of the foundation.

Following placement of the base section of the foundation, workers place a circular form around the exposed anchor bolt cage to pour the foundation pedestal. Approximately one foot of the anchor bolts are left exposed above the pedestal forms for connection to the base tower flange. Additional steel reinforcing is placed within the pedestal forms, as well as polyvinyl chloride (PVC) conduit to allow connection of the turbine to the collection system upon turbine erection. After the reinforcing and conduit is installed, the concrete is poured for the pedestal.

After adequate concrete curing time (typically 3 days) the forms are stripped and the foundation is backfilled. The backfill operations are contingent upon the concrete reaching the required strength, as determined by cylinder break tests for each foundation. Backfill involves a bulldozer and vibratory roller compactor. The backfill is placed in incremental lifts per the design requirements and tested for compaction. All excavated material is commonly used in the backfill operation to achieve positive drainage from the turbine base. After completion of the backfill operations, the site is ready for the remaining turbine pad preparation. An example of the wind turbine foundation construction process is shown in Figure 5-16.

Figure 5-16. Example Wind Turbine Foundation Construction

5.8.5.2 Overhead Electrical Structure Foundations

While the overhead collection structures will be directly embedded into the ground and will not require foundations, the larger transmission structures will need the foundations described in Section 4.3.3.2. For overhead transmission structure foundations, each foundation site will be excavated to the design depth using tracked excavators. Workers will assemble the anchor-bolt cage with reinforcing steel adjacent to the excavation site and will then lower the assembly into the excavation site using a crawler crane (Figure 5-17). Once the cage is in place, concrete will be poured into the cage and excavation site using ready mixed concrete trucks discharging into a concrete telebelt or concrete pump truck. Overhead transmission structure foundations are typically installed 3 to 5 weeks ahead of the structure to allow the concrete sufficient time to reach design strength.

Figure 5-17. Example Transmission Line Structure Foundation Construction

5.8.5.3 Meteorological Tower Foundations

Each meteorological tower will require a foundation, as described in Section 4.3.3.3. The location for each of the foundation piers will be excavated by an auger truck. Once the holes are drilled, formwork will be installed. A rebar cage and anchor bolts will be lowered into the hole with a forklift or rough terrain crane and secured to the formwork. Concrete will then be placed using a concrete truck. Once cylinder testing verifies the concrete design strength has been reached, the final site grading and meteorological tower installation will be performed. An example of the meteorological tower foundation construction process is shown in Figure 5-18.

Figure 5-18. Example Meteorological Tower Foundation Construction

5.8.5.4 Electrical Device Foundations

Large electrical devices such as substation transformers require site-specific cast-in-place foundations (Figure 5-19). To install the cast-in-place foundations, the foundation site is excavated and frames are placed onto excavated soil or a mudmat (see Section 5.8.5.1). Steel reinforcement is added within the frame, and concrete is poured. Once the concrete has reached sufficient strength, the forms are removed and the area is backfilled.

The Phase I Wind Turbine Development will also include smaller electrical devices which, while requiring a stable installation surface, do not require site-specific cast-in-place foundations. The devices include turbine transformers (if required by turbine design), electrical boxes, and smaller substation elements. PCW will use either small precast concrete foundations, or fiberglass foundations depending on the equipment loading. Regardless of type, these foundations will be placed within areas already prepared for the construction of other project elements (such as wind turbine sites or road disturbance areas). The foundation site will be compacted using vibratory compactors and the pre-cast foundation will be placed using forklifts or rough-terrain cranes.

Figure 5-19. Example Cast-in-place Substation Transformer Foundation

5.8.5.5 Building Foundations

Once the site for each Phase I Wind Turbine Development building is prepared using the techniques described in Section 5.8.2, the building site will be excavated to the design depth using tracked excavators. Forms for the foundation footings will be placed along with the rebar necessary to join the footings with the foundation walls. Concrete is then poured into the footing forms via concrete trucks (and, if needed, concrete pump trucks). After sufficient curing time (typically less than 3 days), the footing forms are removed and required wall rebar is installed. The foundation wall forms will then be placed and the concrete for the walls will be poured. After sufficient curing time the wall forms will be removed and the foundation site backfilled. Figure 5-20 shows typical foundation footing and wall construction.

Figure 5-20. Example Building Foundation Construction

5.8.6 Wind Turbines

One of the primary construction activities for the Phase I Wind Turbine Development is the installation of the wind turbines. While there are slight variations between the methods used for different turbine vendors and models, the overall approach is generally the same and is described below.

5.8.6.1 Base Tower Section Placement

When a wind turbine's foundation is installed (Section 5.8.5.1) and the second stage of the wind turbine site preparation is complete (Section 5.8.4), the wind turbine's tower base section (the portion that connects directly onto the foundation) will be installed (Figure 5-21). The tower base section (or, for some turbine models, the lowest two sections) will be delivered to the wind turbine site using the equipment described in Section 5.6. The tower base section will be removed from the delivery trailer and placed onto the foundation using a crawler crane. Leveling nuts will be adjusted on the foundation to ensure the tower base is level within the tolerances of the turbine vendor. For those turbine designs that require the lowest two tower sections to be installed, the second tower section will also be lifted from its delivery trailer and staked on top of the base section. The tower sections will be secured together by internal tower bolts.

Once the tower base section is placed on the foundation, high-strength grout is placed between the tower base and foundation pedestal. Similar to concrete, forms are placed and the grout is poured into place. The forms are then removed once the grout has approximately 1 day to cure. The turbine will remain in this configuration until the foundation and grout have cured to their required design strength. While it is common for a foundation to achieve this strength within 14 days of the foundation pour and the grout to achieve design strength within a few days of the grout pour, the contractor will perform cylinder break tests on the concrete and grout cube break tests on the grout to verify strength before construction of the wind turbine proceeds.

Figure 5-21. Example Turbine Base and Grout Placement

5.8.6.2 Component Staging and Rotor Assembly

Prior to or while the turbine base grout is curing, the wind turbine components will be staged for assembly. Staging involves placing each wind turbine component around an installation site so that the assembly process can proceed quickly. Each wind turbine component will be delivered to the site and arranged per the site's staging design (see Figure 4-4 and Figure 5-22 for a typical arrangement). These components will be offloaded and arranged using rough terrain cranes, crawler cranes, and forklifts. For the larger components, forklifts will place dunnage at the staging location prior to offloading to keep components off the ground. The components to be staged include the following:

- Remaining tower sections (two or three);
- Blades;
- Hub;
- Nacelle;
- Two to four electrical devices (such as down-tower assemblies, padmounted transformers, or switchgear); and
- Two to four crates of bolts and other loose items.

For many turbine models, the rotor is first assembled on the ground and then installed as a single unit (Figure 5-23). Where these models are used, a crawler crane will position each turbine blade around the opening of the hub. The assembly crew will then bolt the blades to the hub and position dunnage under the blades for support. Once completed, crews will tie down the rotor to keep it stable until it is needed for turbine assembly.

As discussed in Section 5.8.4, PCW will use JIT delivery at some turbine sites. For those sites, the components will be offloaded from delivery vehicles and then used in the turbine assembly without staging the components on-site. The same equipment and procedures will be used to offload the delivery vehicles.

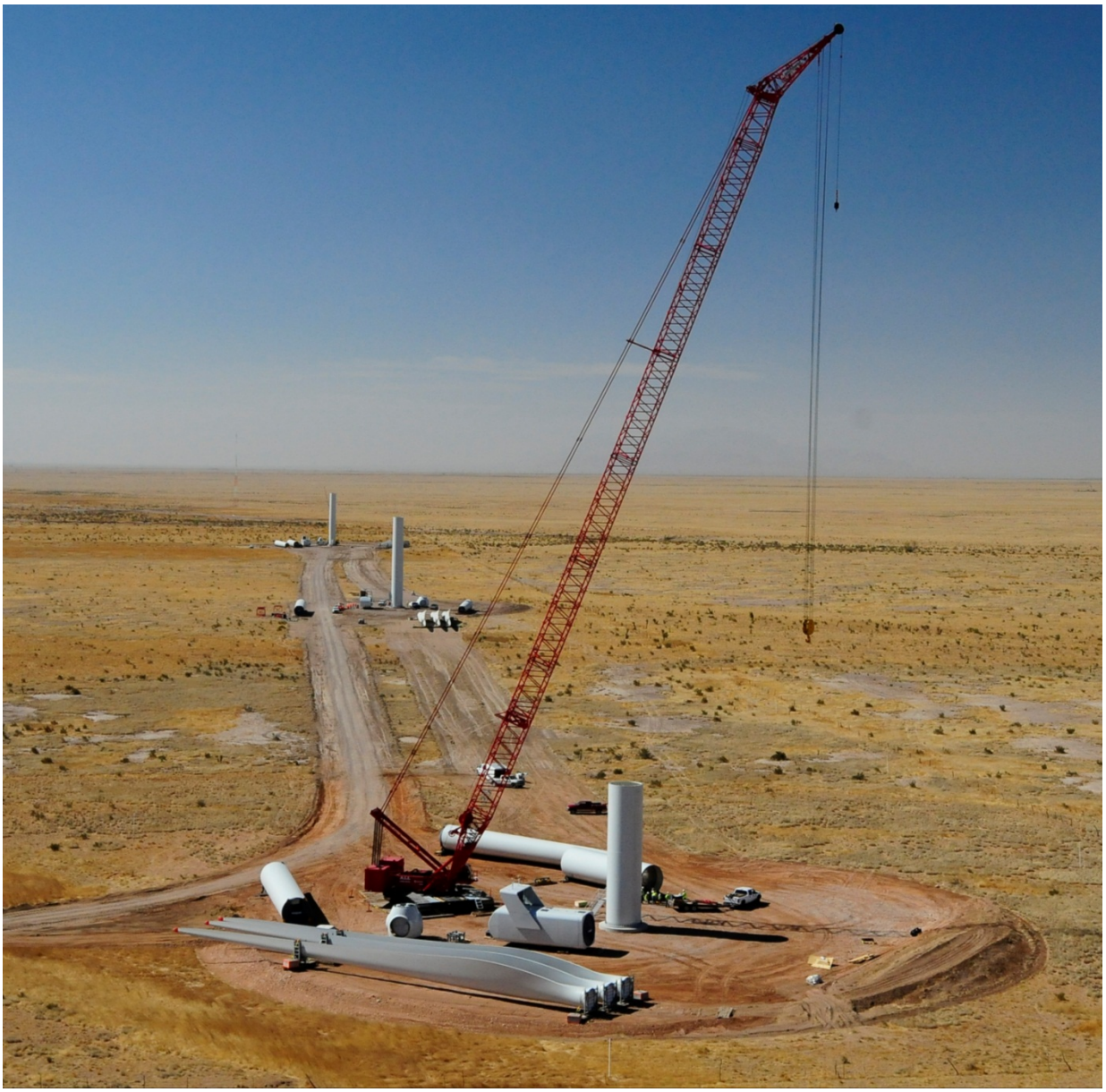

Figure 5-22. Example Staged Turbine Site

Figure 5-23. Example Turbine Rotor Ground Assembly

5.8.6.3 Wind Turbine Assembly

To begin wind turbine assembly, the main erection crane is positioned on the crane pad (see Section 5.8.4). This crane, with the assistance of a rough-terrain "helper" crane, will lift each of the remaining tower sections and place them on top of the previous tower section. Installation crews within the lower tower section will help guide the new section into position and attach the interior bolts (Figure 5-24). While the tower sections are being placed, forklifts are generally removing dunnage from the site.

Figure 5-24. Example Tower Assembly

Once the tower is completed, the next step in the turbine assembly is to install the turbine nacelle (Figure 5-25). To install the nacelle, the crane is rigged to the nacelle using spreader beams typically provided by the turbine vendor specifically for the model of turbine to be installed. The nacelle is guided into position by crews within the tower assisted by ground crews holding tag lines.

Figure 5-25. Example Nacelle Installation

Finally, the turbine rotor is installed. For models where the rotor is installed as a single unit (Figure 5-26), the crane will lift the rotor from the hub with a helper crane picking up the end of one of the blades. Once sufficiently off the ground, the main crane is held steady while the helper crane lowers its blade to get the rotor into a vertical alignment. The helper crane is then removed from the blade and the main crane lifts the rotor to the nacelle. Assisted by ground crews with tag lines, the rotor is positioned onto the low-speed shaft of the nacelle while installation crews bolt the rotor into place. Once the rotor is secured, the main crane is disconnected from the rotor, and the assembly of the turbine's major components is complete.

Figure 5-26. Example Rotor Installation

For turbine models where the rotor is not assembled as a single unit (Figure 5-27), the hub will be attached to the nacelle low-speed shaft before the nacelle is installed. The main crane will then pick up each blade one at a time in a horizontal configuration and align it (with support from ground crews with tag lines) with an open position on the hub. Turbine erection crews, positioned within the hub, will then bolt the blade into place and then leave the hub so it can be rotated to allow for the next blade's installation. Once all three blades are connected to the hub, the assembly of the turbine's major components is complete. Upon completion of the turbine assembly, the main erection crane and supporting equipment is moved to the next installation site.

Figure 5-27. Example Blade Installation

5.8.6.4 Mechanical Completion and Commissioning

Once the major components of the wind turbine are assembled, crews work internally to connect the generation equipment in the nacelle with drop cables in the tower and the control system in the base. All mechanical connections are secured and checked. When these activities are complete, the turbine has reached mechanical completion and is ready for commissioning.

Once wind turbine mechanical completion has been achieved by the contractor and verified by the turbine vendor, wind turbine commissioning will begin. If the collection system to the turbine is complete and backfeed power is available, then full commissioning can be completed. If mechanical completion is achieved before the collection system can provide backfeed power, pre-commissioning is performed. For pre-commissioning, temporary generators are connected to the turbine to power the control system, which allows the commissioning crews to verify the functionality of several turbine elements. Once complete, the turbine is locked into position until the backfeed power is available. When the collection system is complete, the remainder of the commissioning is completed.

To complete commissioning, numerous checks, verifications, and tests in regard to turbine assembly and functionality are performed. Once the initial checks are completed satisfactorily, the turbine is allowed to run under supervision to verify full functionality. When these activities are complete, the turbine manufacturer will present a commissioning completion certificate and transfer control of the turbine to PCW. At that time the turbine will be ready to operate.

5.8.7 Collection System

As discussed in Section 4.3.5, the collection system for Phase I Wind Turbine Development will include both underground and overhead elements. The construction methods for each are described below.

5.8.7.1 Underground

The placement of 34.5 kV collection cables into the ground can either be done with one-pass trenching machines or by laying the cables into excavated trenches which are then backfilled. If leveling for the trenching machine is necessary, leveling will occur within the limits of disturbance and disturbance will be minimized to the extent practicable. One-pass trenching generally requires soils free of significant rock content. Initial geotechnical information indicates that the depth of rock is very shallow on the Phase I Wind Turbine Development Site, making it unlikely that one-pass trenching machines would be successful (Fugro 2013; Terracon 2012). As such, the open trench method is assumed for the Phase I Wind Turbine Development (Figure 5-28). For open-trench collection system installation, a separate trench would be used for each collection circuit. Specific trench details are provided in Appendix B.

To install underground collection cables, trenches would be excavated with a trenching machine or backhoe. If competent rock is encountered within the depth of the trench such that the trenching equipment cannot break it, trenching crews will primarily use jackhammer attachments on trackhoes or skid steers to break up the rock so it can be removed. In the unlikely event that very competent bedrock is encountered, the rock may require drilling and blasting.

In areas where the native subsoil is too rocky to place the cables directly in the bottom of the trench, a bedding material will be placed at the bottom of the trench. The bedding material must have low rock content (individual debris less than 0.5 inch in diameter) so cables will not be damaged during compaction and must have sufficient thermal properties to effectively conduct heat away from the cables during high electrical loading. Where the subsoil can be used as bedding material if first screened of rocks, the subsoil will be run through a mobile screening machine and then placed into the trench. If the subsoil properties are insufficient to be used as a bedding material even if screened, PCW will import material with acceptable characteristics from either the Road Rock Quarry (if available), or from an off-site source. Where required, bedding material will be placed into trenches using a trackhoe, skid steer, wheel loader, or small bulldozer, and then compacted with a wheel compactor attached to a trackhoe.

Once the trench is excavated, and any necessary bedding prepared, the power and fiber optic cables will be placed into the trench. Cable and fiber optic spools are mounted on spool trailers that are pulled along the trench by a truck, tractor, or similar equipment. The power cables are fed from the spool trailer into the trench using a trenching machine, which places them in a trefoil configuration. Fiber optic cables are placed next to the power cables at the bottom of the trench, separated from the power cables as specified in Appendix B.

With the cables placed in the trench, select fill is placed to the depth specified in the design (Appendix B) (Figure 5-29). Select fill must generally meet the same requirements as the bedding material discussed above, and will most likely come from the same source. The material is placed typically in 2 to 3 lifts by a trackhoe, skid steer, wheel loader, or small bulldozer and is compacted to 85% to 95% depending upon soil characteristics. Soil compaction is typically done by a wheel compactor attachment on a trackhoe.

With the select fill in place, the remainder of the trench is backfilled. This is commonly done with native material if available as the thermal requirements are commonly less stringent. As the backfill will still need to be relatively free of rocks to avoid damage to the cables, the native material may require sifting. During the process of backfilling, a warning tape is placed approximately 18 inches below grade.

Where splice and junction boxes are necessary, they will be placed by a rough terrain crane or trackhoe on an aggregate pad. Cables are terminated into connecting lugs or T-bodies by specialized technicians. Depending upon weather conditions, the technicians may erect tents over the terminating operation as the terminations are sensitive to dust exposure.

Figure 5-28. Example Cable Trenching and Placement

Figure 5-29. Trench Select Fill and Trench Compaction

5.8.7.2 Overhead

As discussed in Section 4.3.5.3, overhead collection lines will consist of a series of steel (in some areas wooden) poles as specified in Appendix B with interconnecting overhead conductors. Construction and installation of overhead collection lines is described below.

Once the access routes and installation sites are prepared (Sections 5.8.2 and 5.8.3), the overhead structures are installed. In most locations, PCW expects the overhead structures to be direct embed designs, meaning that approximately 10 percent of the bottom of the structure will be placed into the ground without the use of an external foundation. The installation sites are therefore excavated using a vertical drilling rig or excavator. Once the design depth is reached, the structure is placed. If ground conditions or structure requirements lead to the use of a foundation for an overhead collection line structure, the structure foundation will be constructed per Section 5.8.5.2.

The components of the structures (poles, cross-arms, insulators, and hangers) are typically brought to the site and assembled on the ground so the structure can be raised as a complete unit. Structure assembly is generally aided by bucket trucks and skid steers. Once the structures are assembled, they are lifted into a vertical alignment and hoisted into place by a rough-terrain crane or boom truck. The structure is inspected for proper embedment depth, alignment and plumb. The structure is then held in place while the excavation is backfilled with the excavated subsoil, aggregate or concrete. The backfill is then mechanically vibrated or tamped in lifts to eliminate voids and assure proper bearing pressure. Once the design conditions are met, the structure is released.

Once the structure installation is complete, conductor stringing begins. Stringing involves the pulling of the conductors through the stringing dollies by means of ropes. The stringing dollies are attached to the insulators at the time of framing, and a rope line is looped down the structure to aid in the pulling of the stringing line. The line is pulled through the dollies from a tensioner to a dead end point on the line and attached to conductors located on a reel trailer. The tensioner then pulls the conductor though the dollies. Guard structures, which are typically temporary wood structures or nets that prevent the pulling lines or conductor from falling onto a roadway, will be used when crossing public roads or CCSM Project roads in active use.

When the desired span or reel length is reached, the reel end of the cable is placed into the dead end structures and the proper tension is applied using a mobile puller/tensioner machine. Once the proper tension and sag is obtained, the cable is clipped into place. This process involves the removal of the stringing dollies and the installation of the cable clamps to firmly hold the conductor. The clipping process will be performed by crews in bucket trucks. Testing of the line is then completed and the line is ready to be brought into service.

5.8.8 Substations

Once site preparation is completed for a substation (Section 5.8.2), structural footings and underground utilities, along with electrical conduit and a grounding grid are installed, followed by aboveground structures and equipment (Figure 5-30). A chain-link fence is constructed around the new substation for security and to restrict unauthorized persons, livestock, and wildlife from entering the substation. Snow fencing may be installed to help protect the site from drifting snow. The site is then graded and gravel surfaced, and reclamation is initiated outside the substation fence.

Substation control buildings will most likely be prefabricated off-site, and will be assembled or placed onto concrete slabs within the substations (Section 4.3.3.5). Major equipment to be installed inside the control buildings consists of relays, control panels, servers, communication equipment, power supplies, a battery bank for back-up power, and a heating/cooling system.

Outside the control building within the substation fence, steel structures are erected on concrete footings to support disconnect switches, electrical buswork, instrument transformers, lightning arrestors, and other equipment, as well as termination structures for incoming and outgoing collection and transmission lines. Equipment not set on tubular steel structures, such as circuit breakers and transformers, are typically secured on concrete slab foundations. Structures and major equipment are grounded by either thermally welding or bolting one or more ground wires to each structure and/or piece of equipment. These ground wires are then connected to the grounding grid. Major substation equipment will be set by crane and either bolted or welded to the foundations.

Oil spill containment basins will be installed around major oil-filled transformers and other equipment. Control cables are pulled from panels in the control building, through the underground conduits and concrete trench system, to the appropriate equipment. After the cables are connected, the relays and control equipment are set to the proper settings, and all equipment is tested before the substation is energized.

Figure 5-30. Example Collection Substations Under Construction

5.8.9 Internal Transmission Line

The installation process for the internal transmission line is similar to the process described for overhead collection lines (Section 5.8.7.2). However, due to the size of the transmission structure and conductors, the monopole steel structures used for the internal transmission lines cannot be directly embedded into the ground and they require foundations. The methods for constructing the structure foundation are described in Section 5.8.5.2. Following completion of the foundation, transmission structures will be brought to the installation sites for assembly, and will be erected as a complete unit. The remainder of the construction process for the internal transmission line is as described in Section 5.8.7.2. An example of transmission line structure construction is shown in Figure 5-31.

Figure 5-31. Example Transmission Structures Under Construction

5.8.10 Buildings

The Phase I Wind Turbine Development buildings will be pre-engineered metal buildings (Figure 5-32). As with all other Phase I Wind Turbine Development elements, construction will begin with site preparation as described in Section 5.8.2. The foundations for the buildings will then be construction as described in Section 4.3.3.5. After installation of the interior underground rough-in for the plumbing and electrical systems, the building floors will be installed. This installation will consist of installing a vapor barrier (typically a poly sheet), installing rebar, and then pouring concrete.

After the floor slabs have sufficiently cured, the buildings' steel structures will be erected. Steel columns, beams, girders, and metal stud framing will be assembled, along with a corrugated steel exterior shell. Workers will also install doors and windows to complete the buildings' exterior. The steel, doors, and windows will be erected with small cranes and forklifts. Workers will also use man-lifts in this process. Once the exterior is completed, interior work will commence. Wall rough-ins will be performed including the installation of plumbing lines, electrical work, and data services. Insulation and drywall will then be installed, and the remainder of the interior finishes completed. As the buildings near completion, the exterior finishing will be performed. Building drainage features will be installed and exterior wall painting performed per the requirements of the ROD. The buildings' parking areas will be completed and, where necessary, concrete bollards will be installed.

Figure 5-32. Example Site Buildings Under Construction

5.8.11 Meteorological Towers

Meteorological tower sites will be prepared in accordance with Section 5.8.2 and foundations will be installed as described in Section 5.8.5.3. Following foundation installation, the meteorological tower base will be placed onto the foundation pier anchor bolt leveling nut with either a forklift or rough terrain crane. The fasting nuts will then be secured and the base plate will be grouted.

Once the base is securely installed and the grout has reached strength, the balance of the tower sections will be installed. Many tower designs allow for the tower to be assembled on the ground in a horizontal configuration and then lifted by a crane and placed onto the tower base. If the tower design will not allow for this approach, the contractor will place each section of the tower individually. Upon completion of the tower assembly, the instrumentation will be installed. Data collection and communications gear will be installed and connected to the CCSM Project communications system. An example of meteorological tower installation is shown in Figure 5-33.

Figure 5-33. Example Meteorological Tower Construction

5.8.12 Utilities

5.8.12.1 Water

The water utilities for the Phase I Wind Turbine Development include groundwater wells, pipelines, and filling stations. The construction activities for each are described below.

5.8.12.1.1 Groundwater Wells

The site for each groundwater well includes the well, the well pump, and connections to the water pipeline. Additional space for the generator and vehicle parking is included. Site preparation for well sites will be performed as described in Section 5.8.2. Pumps and well connections will be installed to each well based on the conditions of the well at the time of construction (Section 4.3.10.1.1). Pump placement may require excavation and placement of pre-fabricated concrete structures (such as a wet well), or placement of a concrete slab foundation within a small pre-fabricated structure. Weather-resistant electrical control boxes will be placed on metal posts or unistrut adjacent to the pump and generator.

5.8.12.1.2 Water Pipelines

Water pipelines will be buried. The pipe sections needed to build the pipelines will arrive in sections (typically 50 ft in length) and will be welded together onsite. Where possible, the pipe welding will occur in a designated hot work location and the pipeline will be pulled into place; however, in some cases it may be necessary to weld the pipeline in place along the pipeline route. To install the pipeline, PCW will open a trench 72 inches deep using a trencher or excavator. The pipeline will then be placed in the trench using rough-terrain crane or similar equipment. Following placement of the pipeline, the trench will be backfilled and compacted by an excavator and vibratory compactor using suitable soil from stockpiles.

5.8.12.1.3 Water Filling Stations

Water filling station sites will be prepared in accordance with Section 5.8.2. Water tanks will be placed on level and compacted gravel surfaces using rough terrain cranes and forklifts. Pipelines to the water tanks will be installed in accordance with Section 5.8.12.1.2. Depending upon the final fuel tanks selected, fuel tanks will be placed either on a compacted gravel surface or a concrete slab foundation. Fuel tanks will be placed in secondary containment per the requirements of the SPCC Plan (Appendix Q).

5.8.12.2 Sewer

Septic tanks will be installed adjacent to the Operations Center and maintenance buildings. Excavators will excavate installation sites for each tank and trench septic lines between the tanks and buildings. Alternatively, should PCW enter into an agreement with the City of Rawlins for sewer service, sewer lines will be installed in a manner similar to the water pipelines described above (Section 5.8.12.2).

5.8.12.3 Power

The installation of power lines will be coordinated by Rocky Mountain Power and will most likely use overhead wooden poles. The procedure for the installation of the power utility lines will be the procedure for overhead collection lines described in Section 5.8.7.2.

5.8.13 Temporary Features

5.8.13.1 Laydown Yards

Laydown yards will be prepared using the methods described in Section 5.8.2. Drainage features will be installed in accordance with the requirements of the SWPP Plan (Appendix I) and as indicated on the Issued for Permit Plans (Appendix B). Procedures for installation of drainage features are set out in Section 5.8.3.1. Following drainage feature installation, a gravel surface will be added to each laydown yard to the depth prescribed in the Issued for Permit Plans (Appendix B). For laydown yards where higher activity levels are expected, PCW may use RAP along with aggregate for the yard surfacing. Aggregate and RAP would be mixed and spread on-site by motor graders.

In laydown yards where workforce parking is allowed, parking areas will be delineated using signs and rope guides or equivalent. Lighting will also be installed as needed for security and nighttime operations and fencing will be added for additional security as needed.

5.8.13.2 Crane Assembly Area

Crane assembly areas will be constructed in a manner similar to laydown yards (Section 5.8.13.1). Aggregate surfacing would be used only if required by the soil conditions or length of time the area was required.

5.8.13.3 Crane Path

Where a crane path follows a road, the shoulders of the roads will typically be leveled with a motor grader or bulldozer and compacted a vibratory compactor and water truck (for compaction and dust control). Where a crane path is required to be cross country, the path will be cleared, leveled where necessary, and compacted by a dozer, water truck, and vibratory compactor. If reduction of ground pressure is deemed necessary by the design engineer due to soil conditions, timber mats will be placed in-front of the walking crane by forklifts. As soon as the crane passes, the timber mats will be removed. If culverts are necessary where crane paths cross drainages, the culverts will be installed per the procedure discussed in Section 5.8.3.1.

5.8.13.4 On-Site Accommodations

If on-site accommodations, i.e., the construction camp and RV park, are necessary for the construction workforce, they will be located within the North laydown yard. The construction of the North laydown yard, including site preparation, is described in Section 5.8.13.1. The construction camp housing units will be prefabricated units that are trucked onto the site. Housing units will then be positioned by their delivery vehicles into their installation locations and anchored. Following installation, utility connections will be made and exterior and site finishes completed. For the on-site RV park, the area will be divided into slots, each supporting one RV and an associated vehicle. Utilities will be run to each RV slot in the manner described in Section 5.8.12.

6. Operations and Maintenance

Operations and maintenance of the Phase I Wind Turbine Development are integral to the efficiency of the CCSM Project. Key elements of the CCSM Project's operations and maintenance, specifically as they apply to the Phase I Wind Turbine Development, are described below.

6.1 Workforce

The operations and maintenance workforce for the CCSM Project, including the Phase I Wind Turbine Development, will mobilize in 2018 following installation of the first wind turbines. By the end of 2018, PCW anticipates an operations workforce of 40 workers that will expand to 64 workers by the end of 2019. The CCSM Project operations workforce will consist of wind turbine technicians, electrical and site maintenance technicians, and administrative support personnel as summarized in Table 6.1. There may be periods during the CCSM Project's operations when additional technicians are brought to the site temporarily for limited periods to perform specialized maintenance activities.

Table 6.1. Phase I Wind Turbine Development Operations Workforce Estimate

Job Function	End 2018	End 2019
Project Management	2	2
Administration	2	3
Operations	4	4
Wind Turbine Maintenance	26	47
High Voltage Maintenance	2	2
Civil Maintenance	2	2
Environmental Monitoring	2	4
TOTAL	**40**	**64**

6.2 Access and Security

Workforce access for operation and maintenance of the Phase I Wind Turbine Development will be through two entrances, the CCSM Project North Entrance and the CCSM Project South Entrance. The Operations Center at the CCSM Project North Entrance will be the base of operations and material deliveries for operations and maintenance will be primarily through the North Entrance. Access through the CCSM Project South Entrance will be for access directly to the Sierra Madre WDA as needed. During winter months, access to the CCSM Project Site will be maintained per the Winter Access Plan for the CCSM Project (Appendix E). Additional information on the transportation of personnel, components, materials, and equipment for the CCSM Project can be found in the Transportation Management Plan, Appendix D.

The CCSM Project North Entrance and South Entrance are located on private land and will be equipped with lockable gates for safety and security purposes. During business hours, visitors will have access to the Operations Center through the CCSM Project North Entrance. Outside business hours the gate at the North Entrance will be closed and locked. The gates along Chokecherry Road near the CCSM Project South Entrance will be closed and locked at all times, and only opened as operations personnel are actively traveling through them. PCW will use security cameras around buildings, entrances, and other areas as necessary.

6.3 Nighttime Operations and Maintenance

The majority of the Phase I Wind Turbine Development operations and maintenance activities will occur during daylight hours. Nighttime activities outside of buildings and substations will be rare. Temporary lighting will be used during instances where nighttime activities are required away from substations and buildings. When safety considerations allow, these lights will be equipped with downward shields.

For nighttime operations and maintenance activities in close proximity to buildings and substations, PCW will use a combined switch and motion-detection system for exterior lights. A master control switch for exterior lights will be placed at the gate or inside the building entrance so that lights can be activated prior to personnel entering (as required for safety). These lights will remain on when movement is detected within the substation, and for a “safety time period” (likely 30 to 60 minutes) after motion has been detected. A few minutes prior to the end of the safety time period, the lights will flash to warn personnel that the lights are about to turn off. If motion is still not detected, the lights will then turn off at the end of the safety time period. The lights will turn back on whenever motion is detected until the master switch at the substation gate is turned off.

While nighttime activities will be rare, this approach will minimize the time the lights are on to avoid attracting wildlife, but provide adequate safety for personnel. This approach will also minimize the instances of false motion detection needlessly activating exterior lights.

6.4 Communications

CCSM Project personnel performing operations and maintenance activities on the Phase I Wind Turbine Development will have radios with access to the CCSM Project operations and maintenance channels, as well as access to the CCSM Project's safety radio channel. Access to internet and telephone service will be at the Operations Center and maintenance buildings.

6.5 Wind Turbines

Wind turbines operate autonomously, based on sensors that detect the conditions of the wind, power grid, and the turbine itself. When the electric grid is available to accept generation and there is sufficient wind, the wind turbines will operate and generate power in an automatic mode. CCSM Project operators will monitor turbine conditions from the Operations Center.

Maintenance activities for wind turbines fall into two categories; scheduled and unscheduled, as described below. Scheduled maintenance will be planned by CCSM Project management and performed by the maintenance teams. If a turbine's sensors detect an issue with the turbine or grid, the turbine will shut down and send a notification to the Operations Center through the Project's SCADA system as to the nature of the issue. Operators will then inform the maintenance teams that an unscheduled maintenance check on the turbine is required.

6.5.1 Scheduled Turbine Maintenance

PCW will conduct scheduled (routine) turbine maintenance to maintain turbine reliability and efficiency. PCW will develop maintenance protocols based on the wind turbine manufacturer's recommendations. The recommended frequency of scheduled maintenance is typically between six months and one year. The requirements for scheduled maintenance vary by turbine vendor, but generally address the following:

- Inspect visually and audibly all major turbine components
- Check torque on tower and component bolts
- Level and leak check lubrication systems
- Lubricate appropriate seals and bearings
- Level, leak check, and sample of gearbox oil
- Replace gearbox oil filters
- Inspect brake system
- Test control and emergency systems
- Inspect aviation warning lights

Scheduled wind turbine maintenance varies widely based on scope and inspection results, but can require crews of two to four technicians over a period of up to three days. PCW will prioritize the performance of scheduled maintenance during the summer months for areas of the CCSM Project where winter winds are particularly high and when site access is more challenging. For the Phase I Wind Turbine Development, that is primarily the turbines in Upper Miller Hill.

6.5.2 Unscheduled Turbine Maintenance

While PCW will develop a comprehensive and effective scheduled maintenance program based on the wind turbine manufacturer's recommendations, some turbines will still require unscheduled maintenance and repairs. When maintenance and repair needs cause the wind turbine to go off-line, PCW will perform the unscheduled maintenance work as soon as practical to return the turbine to service. The majority of unscheduled maintenance involves relatively minor repairs internal to the wind turbine and can be completed at any time. If an unscheduled maintenance activity requires work outside the turbine (e.g., blade cleaning or repair, or when tools or components must be winched on the outside of the tower), then PCW will perform repair work as soon as weather conditions allow.

In some instances, a major turbine component (such as gearbox, generator, or blade) may require replacement. In such an instance, an external crane would be necessary and PCW would re-establish a crane pad at the turbine site 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. Where necessary, the crane pad would be reclaimed per the reclamation plan (Appendix L) upon completion of the maintenance activity.

6.6 Electrical System

The electrical system does not have significant maintenance requirements. While significant maintenance is not anticipated, CCSM Project technicians will routinely inspect electric lines and substations and will perform vegetation management and maintenance as needed.

6.6.1 Overhead Electrical System

Overhead electrical lines will be inspected visually on a regular basis, commonly at least once per quarter and after any strong storm events. CCSM Project technicians will generally perform visual inspections from the ground using existing roads. If visual inspections indicate issues with the electrical line, additional inspections and maintenance will be performed on the line. These activities may require de-energizing portions of the line for close inspection using utility boom trucks.

Following inspections, CCSM Project technicians will perform necessary vegetation management and maintenance. Generally, vegetation management consists of technicians limiting growth to no more than 3 feet above ground level, and removing tree branches within about 50 feet of the overhead electrical system structures for the internal transmission lines and 25 feet for the overhead collection lines. Maintenance involves replacement of structures or sections of overhead line. If a section of overhead line needs to be replaced, it will be done in a manner similar to the original installation (Section 5.8.7.2).

6.6.2 Underground Electrical System

While infrequent, maintenance issues may occur on underground electrical lines. Maintenance issues on underground electrical lines primarily occur at junction points or splices which are located in above-ground boxes where they are easily accessible. While unlikely, if an issue occurs with a section of underground cable away from a junction box, technicians will first perform testing to determine the location of the fault. Once the location is known, a small portion of the cable would be excavated and repaired. The excavation disturbance would then be reclaimed as required by the reclamation plan (Appendix L).

6.6.3 Substations

PCW will complete preventative maintenance at substations based on the equipment manufacturer's recommendations. Preventative maintenance for substation equipment is generally performed on an annual basis, commonly requiring a brief (less than 1 day) de-energization. The CCSM Project will have high-voltage technicians on-staff to perform and supervise such maintenance, and perform any unplanned maintenance that may be required. Virtually all substation maintenance can be performed within the substation fence, and without using large equipment. Such work is often performed at ground level, or using utility boom trucks.

6.7 Roads

During operation and maintenance of the Phase I Wind Turbine Development, PCW will control dust from the roads as described in the CCSM Project Dust Control Plan (Appendix G). During the winter months, PCW will perform snow removal per the Winter Access Plan (Appendix E).

Periodic maintenance of the roads associated with the Phase I Wind Turbine Development will be required. Roads will be bladed and maintained to allow for safe access and to minimize dust generation. Weather and traffic may cause long-term road base degradation. If the road base becomes degraded to the point where the function of the road is reduced, PCW will undertake road repairs such as recompaction or the addition of aggregate, as needed.

All drainage structures and erosion control measures will be inspected periodically and maintained as needed. PCW will inspect drainage features and erosion control measures as described in the SWPP Plan (Appendix I) and the Erosion Control Plan (Appendix H). Drainage structures and erosion control measures will be cleaned, repaired or replaced as needed.

6.8 Other Features and Facilities

PCW will maintain all CCSM Project elements, including buildings, meteorological towers, and water facilities in good working order in accordance with accepted maintenance practices. PCW will conduct routine maintenance on buildings such as painting and landscape maintenance and will perform repairs as needed and all meteorological towers will receive annual and as-needed maintenance to replace sensors and check structure conditions. Aviation warning lights will be equipped with sensors to notify maintenance personnel if any issues arise that require service.

In addition, PCW will operate and maintain the CCSM Project water facilities as needed to supply water to the CCSM Project, including the Phase I Wind Turbine Development. The water supply facilities will be operated remotely from each water filling station to maintain adequate storage for CCSM Project operation. PCW will also inspect the water facilities on a regular basis to identify any maintenance needs and will follow the preventative maintenance guidelines for the equipment associated with the water facilities, including schedules for lubrication, oil changes, and bearing and belt inspections. PCW will evaluate the local availability of spare parts for the water facilities and will keep the necessary equipment and components onsite to allow for timely repair of the water facilities. The water demand for the CCSM Project is expected to drop substantially during the winter months; as such, PCW will temporarily deactivate water facilities that are not required for the CCSM Project. Pumps will be deactivated and, if necessary, removed. Pipelines and tanks will be drained.

7. Decommissioning

This chapter describes the methods and means to decommission the Phase I Wind Turbine Development at the end of the CCSM Project. PCW anticipates the decommissioning of the CCSM Project, including the Phase I Wind Turbine Development, will take three (3) years to complete.

7.1 Pre-Decommissioning

Pre-decommissioning activities will occur prior to mobilization of the decommissioning contractor. In general, pre-decommissioning activities for the CCSM Project include coordination and outreach meetings with stakeholders. It is anticipated that a stakeholder workshop will be held to determine the scope and requirements for decommissioning and to insure that current decommissioning standards are met. PCW will use the stakeholder workshop to solicit input from TOTCO, affected landowners and businesses, as well as appropriate federal, state, and local agencies. Input from the stakeholder meeting will be used to help define the decommissioning scope of work, e.g., roads that will remain in place, recycling and reuse options, and identification of landfill facilities.

Following the stakeholder meeting, PCW will create the final scope of work for decommissioning and a work plan to implement it. PCW will also obtain all permits necessary to complete decommissioning.

7.2 Workforce

During decommissioning of the CCSM Project, including the Phase I Wind Turbine Development, PCW anticipates a workforce of up to 398 people working 12 hours per day, 6 days per week.

7.3 Equipment

Decommissioning equipment is expected to include the same equipment used for the construction of the Phase I Wind Turbine Development, as listed in Section 5.4. The demolition contractor will determine the exact numbers of each piece of equipment needed prior to decommissioning.

7.4 Materials and Components

The materials and components required for construction of the Phase I Wind Turbine Development are the same as the materials and components removed during decommissioning, with the exception of roads that will be left for use by the Ranch, and buried cables and underground foundation mats that will be left in place. The methods and procedures for removing materials and components from the Phase I Wind Turbine Development Site will be similar to those used during construction to receive materials and components (Section 5.6). Materials and components removed from the Phase I Wind Turbine Development Site will be stockpiled within the laydown yards and disturbance areas and then transported to the Rail Facility where they will be sorted and transported for disposal in accordance with CCSM Project Waste Management Plan (Appendix P).

7.5 Communications

Personnel communications during decommissioning will be maintained via hand-held radios and cellular phones.

7.6 Decommissioning Activities

Decommissioning activities expected for the Phase I Wind Turbine Development are described in the following subsections and are expected to include the following:

- Removal of wind turbines
- Removal of wind turbine pedestals
- Removal of electrical equipment
- Demolition of buildings
- Removal of meteorological towers
- Removal of aggregate
- Decompaction of subbase
- Removal of drainage structures (i.e., culverts)
- Removal of laydown yard aggregate
- Removal of temporary facilities
- Final earthwork to reshape and re-contour the land
- Placement of any topsoil remaining in storage
- Revegetation

Demolition of the Phase I Wind Turbine Development is not anticipated to require blasting activities.

7.6.1 Mobilization and Demobilization

The PCW decommissioning team will mobilize a few weeks prior to decommissioning and will bring temporary construction trailers and management staff to the CCSM Project Site. The decommissioning team will have dedicated equipment and material that will be delivered to the CCSM Project Site by truck. Demolition equipment will consist of excavators, bulldozers, front end loaders, motor graders, water trucks, forklifts, lattice crawler and rough terrain cranes, and similar equipment (Section 7.3). As demolition progresses and equipment is no longer required, it will be removed from the CCSM Project Site by truck. At the conclusion of the decommissioning, all temporary facilities will be removed along with any remaining equipment.

7.6.2 Wind Turbines

Turbine decommissioning consists of tower wiring removal and wind turbine dismantling. To facilitate wind turbine removal, it may be necessary to restore portions of the turbine sites, similar to conditions during construction. Specifically, crane pads will be necessary to remove the turbine components and will be established as described in Section 5.8.5.1. Additionally, some areas around the pads may need to be compacted to allow turbine components to be stored on the ground until they can be removed from the site.

Prior to a crane arriving at the turbine site, turbine wiring removal will be done with turbine wiring demolition crews. Once the crane pad is complete, a main erection crane will be deployed to the turbine site. A main erection crane will remove the wind turbine piece by piece in roughly the reverse order and process of the original turbine installation (Section 5.8.6). Main erection cranes will be assisted by rough terrain cranes and forklifts. A main erection crane will walk onto the crane pad and mats to perform the following decommissioning activities:

1. Remove the turbine rotor
2. Remove the turbine nacelle
3. Remove the turbine tower sections

Once the turbine parts are on the ground the next step is to disassemble the rotor. The rotor disassembly will be done with a crawler crane or rough terrain cranes and a forklift. Upon completion of rotor disassembly all turbine parts will be loaded onto trucks for transport back to the Rail Facility. Once the wind turbine components have been removed, any above-ground electrical elements (such as padmount transformers) will be removed along with associated conduits and grounding to a depth of about 3 feet.

7.6.3 Electrical System

PCW will decommission the CCSM Project electrical transmission and collection system, consisting of both overhead and underground elements, as described in the following sections.

7.6.3.1 Substations

All substations internal to the CCSM Project are expected to be removed at the end of the CCSM Project; however, decommissioning of the Overland Substation may not be feasible. If at some future time, other permitted transmission lines or generation facilities interconnect into the Overland Substation such that decommissioning and removal of the substation would lead to instability of the transmission grid, then the Overland Substation would remain and continue under the operation and maintenance of PCW or a regional transmission operator such as Rocky Mountain Power or Western Area Power Administration until such time as decommissioning and removal is feasible.

The CCSM Project substations will be decommissioned by first removing the substation fencing to allow for equipment access. Following removal of the fence, the electrical equipment will be removed using rough terrain cranes and trucks. Once all equipment is removed, the structural steel and buildings will be removed using rough terrain cranes. Foundations will then be removed using the procedure discussed in Section 7.6.4.

7.6.3.2 Underground Electrical System Decommissioning

The underground electrical system consists of buried cable with above-ground junction and splice boxes (Section 4.3.5.2). Backhoes and bulldozers will be used to remove all above ground boxes along with cabling tails to a depth of about 2 feet below grade. To minimize new disturbance in previously reclaimed areas, cabling buried deeper than 2 feet will remain in place.

7.6.3.3 Overhead Electrical System Decommissioning

The overhead electrical system will be removed in its entirety using bucket trucks, backhoes, front end loaders, and bulldozers. Conductors will be removed using boom trucks and cable reeling machines. Poles will then be disassembled in roughly the reverse order of construction using crawler or rough-terrain cranes. Foundations will then be removed per Section 7.6.4.

7.6.4 Foundations

Once an element supported by a foundation (e.g., wind turbine, transmission structure or building) has been decommissioned, the foundation will be removed up to four feet deep, except in the case of wind turbine foundations. Foundation removal for wind turbines will be limited to the pedestal portion of the foundation, i.e., the underground mat foundation will be left in place. In many instances removing the pedestal will result in removal of the foundation up to four feet deep, but this will not always be the case. By leaving the significantly wider mat portion of the turbine foundation in place, PCW will minimize disturbance of previously reclaimed areas during decommissioning.

Foundations will be removed using a backhoe with ram, bucket with thumb, and processor as needed. The foundation material removed will be separated into concrete and steel and hauled to the Rail Facility. The foundation removal equipment will then be relocated to the next turbine site.

7.6.5 Roads

To complete decommissioning of the CCSM Project it may be necessary to return some roads to the conditions present during construction. This will allow for efficient crane access to the turbine sites and facilitate removal of the wind turbine components by truck. In addition, as required by the ROD, PCW will remove existing roads on the Ranch that PCW and TOTCO find to be redundant during CCSM Project construction. Due to this requirement, some CCSM Project roads must remain to operate the Ranch after CCSM Project decommissioning. PCW and TOTCO will determine which roads will remain in place prior to decommissioning.

Once roads are no longer needed for CCSM Project decommissioning activities, they will be removed, with the exception of the roads designated to be left in place during stakeholder meetings or for Ranch operations. Decommissioning of roads will consist of removing the aggregate with a combination of motor grader, scraper, and front end loader. Once the aggregate has been removed, the subbase will be decompacted with a bulldozer equipped with a ripper and/or a pull-type disk similar to those used in agricultural operations. With the subbase decompacted, the drainage structures will be removed with an excavator, front end loader, and forklift. The area will then be recontoured and revegetated in accordance with the Reclamation Plan (Appendix L).

7.6.6 Temporary Facilities

PCW will use the CCSM Project operations and maintenance facilities during decommissioning to the maximum extent possible. However, some temporary features such as laydown yards, crane assembly areas, and crane paths are expected to be necessary for the decommissioning of the Phase I Wind Turbine Development. PCW will establish these temporary features as needed in a manner consistent with Section 5.8.13, and in the locations specified in the Issued for Permit Plans (Appendix B). At the conclusion of decommissioning, the temporary features will be removed.

7.6.7 Other Features and Facilities

PCW will decommission other CCSM Project features and facilities such as buildings, meteorological towers, and utilities using standard demolition techniques, including those described above. Generally each feature or facility will be removed in the reverse order in which it was constructed, as described in Section 5.0 and using the equipment listed in Section 5.4. Elements to be left in place include those required for the operation of the Ranch or as agreed to in the stakeholder meetings. All other elements will be removed, including underground cables and pipelines located two feet or less below the surface. Underground cable and pipelines located more than two feet below the surface will be drained, when applicable, and abandoned in place to avoid disturbing areas that have already been reclaimed.

8. Environmental Resources

PCW has planned and will implement all aspects of the Phase I Wind Turbine Development to minimize effects to environmental resources, consistent with the ROD and to the extent practicable. The CCSM Project has been thoroughly reviewed and analyzed in the EIS and ROD. Measures will be applied to avoid, minimize, or mitigate potential effects to environmental resources from construction, operation, maintenance, and decommissioning of the CCSM Project as described in Appendix A and this site-specific plan of development. The following sections provide site-specific information on the environmental resources within the Phase I Wind Turbine Development and the potential effects of the Phase I Wind Turbine Development.

8.1 Land Use

The Phase I Wind Turbine Development is located within the CCSM Project Site primarily in an ownership region known as the "checkerboard," in which land ownership alternates between private lands and federal lands (section 2.1). The vast majority of the private lands are owned by TOTCO, and the federal lands are administered by BLM RFO. A small percentage of the land within the Ranch is owned by the State of Wyoming and is administered by the State Board of Land Commissioners. Finally, Anadarko Land Corporation owns some sections located on the periphery of the northwest boundary of the Ranch. Table 8.1 summarizes the Phase I Wind Turbine Development disturbance by land ownership.

The Phase I Wind Turbine Development Site is largely agricultural range land managed by TOTCO. The communities of Rawlins and Sinclair are in the vicinity of the northern extent of the Phase I Wind Turbine Development Site. TOTCO maintains the grazing leases on the federal property and operates the Phase I Wind Turbine Development Site as part of its ranching operation. There are no year-round residences within the Phase I Wind Turbine Development Site.

The Phase I Wind Turbine Development is compatible with the current land uses on the Ranch and the land use in the vicinity of the CCSM Project Site. PCW and TOTCO value preserving the agricultural operations on the Ranch. TOTCO's ranching operations will continue without material change during construction, operation, maintenance, and decommissioning of the Phase I Wind Turbine Development. The Phase I Wind Turbine Development and CCSM Project will not materially impair or diminish current uses or any other future agricultural use on the Ranch. The EIS found that construction, operation, and decommissioning of the CCSM Project are not expected to affect land uses, federal land use designations and current land use authorizations (BLM 2012a).

Table 8.1. Phase I Wind Turbine Development Disturbance

Region	Initial Disturbance (acres)				Long-term Disturbance (acres)				Activity Area (acres)			
	Private	Federal	State	Total	Private	Federal	State	Total	Private	Federal	State	Total
Chokecherry WDA												
Nevins Valley	357	278	36	**671**	56	47	5	**108**	64	38	8	**110**
Smith Draw	328	259	4	**591**	53	41	<1	**95**	37	28	2	**68**
Chokecherry TOTAL	***685***	***537***	***40***	***1,262***	***109***	***88***	***6***	***203***	***101***	***67***	***10***	***178***
Sierra Madre WDA												
McCarthy	255	137	0	**392**	42	24	0	**66**	86	27	0	**113**
Pine Grove	196	204	33	**433**	29	26	5	**60**	34	19	7	**60**
Upper Miller Hill	229	450	46	**725**	37	71	7	**115**	34	36	2	**72**
Sierra Madre TOTAL	***680***	***791***	***79***	***1,550***	***108***	***121***	***12***	***241***	***154***	***82***	***9***	***245***
Infrastructure Areas												
Northern	180	3	0	**183**	37	1	0	**38**	3	0	0	**3**
Basin	22	16	2	**40**	2	1	<1	**3**	6	5	4	**15**
Infrastructure Area TOTAL	***202***	***19***	***2***	***223***	***39***	***2***	***<1***	***41***	***9***	***5***	***4***	***18***
GRAND TOTAL	**1,567**	**1,347**	**121**	**3,035**	**256**	**211**	**18**	**485**	**264**	**153**	**23**	**440**

8.2 Air Quality

PCW will comply with all federal, state, and local emissions standards for air quality. PCW has incorporated the measures from the ROD, as detailed in Appendix A, to minimize impacts to air quality. Air pollutants emitted during construction, operation, maintenance, and decommissioning of the Phase I Wind Turbine Development include particulates (fugitive dust) from vehicle traffic and construction activities, as well as nitrogen dioxide (NO_2), carbon monoxide (CO), and sulfur dioxide (SO_2) from engines powering construction equipment and other mobile sources. Emissions of fugitive volatile organic compounds (VOCs) will be very small compared to other local sources including refineries, power plants, oil and gas development, interstate traffic, and other area sources.

Air emissions from the Phase I Wind Turbine Development were considered in the EIS. Taking into account the emissions estimated for the entire CCSM Project and air quality impacts of other projects in the area, BLM concluded that increases in concentrations of CO, NO_X, SO_2, PM_{10}, and $PM_{2.5}$ in the vicinity of CCSM Project will be unlikely to exceed federal or state ambient air quality standards (BLM 2012a). Emissions generated during construction, operation, maintenance and decommissioning of the Phase I Wind Turbine Development will be consistent with those evaluated in the EIS for the CCSM Project (BLM 2012a). The equipment inventory for the construction, operation, maintenance, and decommissioning of the Phase I Wind Turbine Development is shown in section 5.4. The equipment inventory analyzed in the EIS is shown in section 3.3.

Maximum pollutant emissions associated with the Phase I Wind Turbine Development will be temporary and associated with construction. Air emissions from the construction of each wind turbine would occur in isolation and would not significantly interact with construction of adjacent wind turbines (BLM 2012a). Construction and decommissioning involve the use of trucks, semi-tractor trailers, cranes and earth-moving equipment, including loaders, scrapers, bulldozers, shovels, and backhoes. Installation of wind turbines also requires construction of concrete batch plants with associated annual point source emissions (BLM 2012a); however emission levels are expected to be minimal. Air emissions during operations and maintenance include emissions and fugitive dust from trucks delivering materials and personnel to turbine sites (BLM 2012a). Since pollutant emissions from the CCSM Project would be temporary, and would not be from major stationary sources, Prevention of Significant Deterioration (PSD) regulations including increments would not be applicable.

Although the Phase I Wind Turbine Development will emit low levels of pollutants principally from mobile sources during construction and decommissioning, the net effect of the CCSM Project will be to improve atmospheric conditions since it will be in support of generation of electricity from wind turbines that will reduce the need for electricity generated in fossil fuel-fired power plants (BLM 2012a).

8.3 Soils

The Phase I Wind Turbine Development Site is located in an arid environment that contains potentially erosive soils. Surface-disturbing activities may result in exposed soils, accelerated soil erosion, and reduced soil productivity. To minimize effects of the Phase I Wind Turbine Development on soil resources and watersheds, PCW will implement the measures detailed in Appendix A, as well as the Phase I Wind Turbine Development Reclamation Plan (Appendix L), Erosion Control Plan (Appendix H) and SWPP Plan (Appendix I). These plans include erosion control measures and soil handling protocols to avoid, minimize, or mitigate effects from surface-disturbing activities. The measures control surface runoff and erosion and ensure biophysical conditions are maintained for reclamation. Erosion control measures and structures are specified in Appendix B, the Phase I Wind Turbine Development Issued for Permit Plans; these structures will be inspected and maintained as outlined in the SWPP Plan.

The physiography of the Phase I Wind Turbine Development Site is characterized by alluvial fans, piedmont plains, and pediments originating from the surrounding mountains that form broad intermountain basins. The topography ranges from nearly level to steep and slopes are commonly dissected. Soils have developed from a wide variety of parent material primarily derived from sedimentary origins, which include alluvium and residuum of limestone, sandstone, and shale(NRCS 2011).

A variety of soils occur across the Phase I Wind Turbine Development Site. Soil variability stems primarily from a variety of parent materials as influenced by topography, aspect, elevation, vegetation, and differential rates of mineral weathering. Soils within the Phase I Wind Turbine Development Site are primarily derived from sedimentary formations and are predominantly Orthents; soils that are shallow to very deep and medium to fine textured and have a frigid temperature regime, an aridic moisture regime, and mixed or bentonitic mineralogy.

8.3.1 Chokecherry Wind Development Area

Soils within the Chokecherry WDA are derived from shale, sandstone, and weathered remnants (i.e., residual soils) of the Mesaverde Group and Steele Shale (Fugro Consultants, Inc. [Fugro] 2013). Within this area, the Upper Cretaceous Aged Mesaverde Group and Steel Shale are interbedded throughout the Chokecherry WDA, which is easily seen within the side hills and bluffs throughout the WDA. These geologic units are composed of slightly to moderately weathered shale and slightly to completely weathered sandstone. The weathering of these units reduces as depth below existing grade increases. Additionally, previous geologic mapping indicates these geologic formations may contain seams, layers, and pockets of anthracite. The remaining weathered remnants are typically lean clays, low plasticity silts, and clayey and silty sands. These materials generally exhibit little to no swell potential. Residual soils extended to the termination depth of test borings (5.5 to 20 ft.) and was generally described as medium dense to very dense or soft to hard with occasional sub-rounded to sub-angular gravel, slight ferrous staining, intermittent sandstone seams and layers, and few sandstone fragments.

The most commonly encountered soils in the Chokecherry WDA include the Rentsac, Blazon, and Diamondville series (BLM 2012a). The Rentsac series occurs on mountains, escarpments, bedrock-floored plains, and hills. Slopes range from 10 to 70 percent. Rentsac soils are shallow to calcareous sandstone with loamy-skeletal textures. Water erosion potential is high and wind erosion potential is moderate. Topsoil suitability is poor due to large stones. The Blazon series is shallow to shale bedrock and occurs on pediments, hill slopes, plateaus, and ridges. Slopes range from 6 to 40 percent. The Blazon series is calcareous and is also compaction prone when moist or saturated. Water erosion potential is high and wind erosion potential is moderate. Topsoil suitability is good. The Diamondville series consists of moderately deep, well-drained soils that formed in alluvium and residuum weathered from calcareous loamstone and sandstone. Diamondville soils are on fan remnants, plateaus, hills, and ridges of cold intermountain basins. Slopes range from 3 to 70 percent. Water erosion potential is severe and wind erosion potential is slight. Topsoil suitability is fair due to high clay content.

8.3.2 Sierra Madre Wind Development Area

Soils between the Chokecherry and Sierra Madre WDAs and soils within the Sierra Madre WDA east of Highway 71/County Road 401 are composed of alluvium underlain by Upper Cretaceous Aged Steele Shale (Fugro 2013). The alluvial soils are generally compromised of unconsolidated lean clays, low plasticity silts, and clayey and silty sands. There are also areas of gravel and cobble likely deposited by historic floods of the North Platte River. The alluvium extended to the completion depth of test borings (5.5 to 20 ft.) and was generally described as soft to hard with occasional sub-rounded to sub-angular gravel and slight ferrous staining.

Soils within the McCarthy and Pine Grove turbine development regions in the Lower Miller Hill portion of the Phase I Wind Turbine Development Site are generally composed of alluvium while the slopes of Miller Hill are composed of highly to slightly weathered sandstone of the Niobrara Formation, shale of the Frontier, Mowry, and Thermopolis Shale, and interbedded sandstone and shale of the Browns Park Formation (Fugro 2013). The alluvium is from the Quaternary period and is typically composed of unconsolidated gravel, sand, silt and clay. Several areas of lower Miller Hill contain large gravel and cobble deposited by rain events, historic flooding of the North Platte River, and material displaced by slope failures along Miller Hill.

The most commonly encountered soils in the Sierra Madre WDA include the Wellsville, Echemoor, and Lupinto series (BLM 2012a). The Wellsville series formed in thick, calcareous, gravelly, locally transported materials derived from limestone and other sedimentary rocks. Wellsville soils are deep and occur on alluvial fans and valley side slopes. Slopes range from 2 to 20 percent. Topsoil suitability is fair due to large stones. The Echemoor series has a dark thick surface layer rich in organic matter overlaying channery subsoil. A channery soil has more than 15% by volume thin, flat fragments of sandstone, shale, slate, limestone, or schist (less than 6 inches in length). The soil is moderately deep to paralithic bedrock and formed in residuum and colluvial materials derived from sedimentary rock. Echemoor soils are on mountain slopes and hill slopes contiguous to mountain fronts. Slopes range from 3 to 10 percent. Water erosion potential is severe and wind erosion potential is slight. Topsoil suitability is fair due to high clay content. The Lupinto series consists of deep, well-drained soils on relict fan aprons, terraces, and valley fill positions. These soils formed in calcareous gravelly alluvium from mixed sources. Slopes range from 6 to 20 percent. Water erosion potential is severe and wind erosion potential is slight. Topsoil suitability is fair due to large stones and high clay content.

8.3.3 Steep Slopes

The Phase I Wind Turbine Development incorporates the measures in Appendix A to avoid and minimize impacts to soil; however, PCW is requesting an exception and/or waiver from BLM of the prohibition on surface disturbance for wind turbine staging areas on slopes greater than 25 percent for a total of 6.0 acres of initial disturbance based on the Phase I Wind Turbine Development design presented in Appendix B.

No wind turbines are located on slopes over 25 percent; however, the initial disturbance areas for some wind turbine sites affect slopes greater than 25 percent in a limited manner due to cut and fill requirements necessary to establish appropriate slopes on the site that intersect the existing terrain. Generally this disturbance consists of leveling features or placing fill on steep slopes to establish the design grade for the staging area.

PCW will apply the appropriate measures in the Erosion Control Plan, Stormwater Pollution Prevention Plan, and Reclamation Plan to stabilize all locations on slopes greater than 25 percent and minimize erosion. In addition, PCW has proposed site-specific erosion control measures for all wind turbine sites that disturb more than 0.16 acres of slopes greater than 25 percent, as well as sites with slopes greater than 25 percent located within 200 feet of an ephemeral or perennial channel. The erosion control measures for these 12 sites are included as detail drawings in Appendix B.

8.4 Vegetation

The Phase I Wind Turbine Development Site is characterized by areas of rolling sagebrush steppe, salt desert shrub basins, and foothills shrubland. Vegetation surveys were conducted throughout the Phase I Wind Turbine Development Site during 2009, 2012 and 2013. State of Wyoming and Carbon County listed noxious and invasive species in the Phase I Wind Turbine Development Site are identified in the Weed Survey Report (Appendix J). Wetland delineation data were collected in 2012, 2013 and 2014 to characterize the wetland plant communities within the Phase I Wind Turbine Development Site, as further discussed in section 8.6.2 and Appendix K of this site-specific plan of development. Table 8.2 includes a summary of the vegetation communities within the Phase I Wind Turbine Development Site. Nearly 85% of the vegetation within the initial disturbance will be reclaimed following construction activities resulting in 485 acres of long-term disturbance in the Phase I Wind Turbine Development Site.

Table 8.2. Summary of the Vegetation Communities within the Phase I Wind Turbine Development Site

Vegetation Community	Initial (Acres)	Long-Term (Acres)	Activity (Acres)
Wyoming Big Sagebrush Communities	716	130	84
Mountain Big Sagebrush Communities	669	99	110
Black Sagebrush Communities	467	76	42
Shadscale Saltbush Communities	419	66	77
Upland Grassland Communities	328	50	43
Gardner's Saltbush Communities	196	19	28
Disturbed and Developed Areas	110	26	19
Greasewood Communities	61	10	22
Riparian/ Mesic Lowland Communities	36	4	7
Aspen Woodland Communities	16	2	2
Basin Big Sagebrush Communities	8	1	4
Barren Slopes	4	1	<1
Mixed Mountain Shrub Communities	4	<1	2
Birdfoot Sagebrush Communities	1	<1	<1
Total*	**3,035**	**485**	**440**

*Values may not sum to total due to rounding

8.4.1 Sagebrush Communities

Sagebrush communities are dominated by one of several species of sagebrush (*Artemisia* sp.). Big sagebrush (*Artemisia tridentata* Nutt.) and black sagebrush (*Artemisia nova*) communities are the dominant vegetation communities throughout much of the CCSM Project Site.

8.4.1.1 Wyoming Big Sagebrush Communities

Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is a variety of big sagebrush and is closely related to mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Wyoming big sagebrush overlaps in range and elevation with basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). Plants are considerably smaller than those of basin big sagebrush, usually less than 0.9 m tall, and have main stems branching from the ground. Flowering stems are not as widely branching as those of the basin variety, but otherwise closely resemble that subspecies. Leaves are typically shorter, from 1 to 1.5 cm long, and flabelliform. The range of mountain big sagebrush and Wyoming big sagebrush overlap and the species are known to hybridize.

Wyoming big sagebrush steppe communities are prevalent in the West (NatureServe 2014). The species is a native long-lived shrub, generally 45-80 cm tall with rounded uneven crowns. The species typically occurs on foothills, undulating terraces, slopes and plateaus, but also occurs in basins and valley bottoms. It is most commonly found on frigid, mesic, and xeric soils of silty, clayey, skeletal and mixed textures. Soil pH varies from moderately acidic to moderately basic. Species diversity is relatively low in Wyoming big sagebrush communities; common associates may include fringed sagebrush (*Artemisia frigida*), broom snakeweed (*Gutierrezia sarothrae*), western wheatgrass (*Pascopyrum smithii)*, Sandberg bluegrass (*Poa secunda)*, bluebunch wheatgrass (*Pseudoroegneria spicata*), bottlebrush squirreltail (*Elymus elymoides*), Idaho fescue (*Festuca idahoensis*), and needle-and-thread grass (*Hesperostipa comata*). Unique Wyoming big sagebrush assemblages within the Phase I Wind Turbine Development Site include: Wyoming big sagebrush communities; Wyoming big sagebrush/greasewood; Wyoming big sagebrush/rabbitbrush; Wyoming big sagebrush/black sagebrush; Wyoming big sagebrush/birdfoot sagebrush; and, Wyoming big sagebrush/threadleaf sedge.

8.4.1.2 Mountain Big Sagebrush Communities

Mountain big sagebrush is currently recognized as a subspecies of big sagebrush. This shrub is generally smaller in stature than basin big sagebrush with an average height of less than 1 meter. Mountain big sagebrush inhabits an elevational range from 2,600 to approximately 10,000 feet. Mountain big sagebrush occurs as a dominant or codominant over a range of habitats. The community usually occurs in cool, wet (10-14 inch, 15-19 inch, and 20+ inch precipitation zones), upper elevation ranges in montane valleys and on foothills, slopes and high ridges. Soils are moderately deep, well drained, slightly acid to slightly alkaline. It favors soils with more organic matter, nutrients, and microbial biomass. Mountain big sagebrush is commonly found in association with Wyoming big sagebrush, basin big sagebrush, antelope bitterbrush (*Purshia tridentata*), and black sagebrush. Common understory species include Idaho fescue, bluegrass (*Poa* sp.), needle-and-thread grass, bluebunch wheatgrass, slender wheatgrass (*Elymus trachycaulus*), buckwheat (*Eriogonum* spp.) and various other perennial and annual herbaceous species. Unique mountain big sagebrush assemblages within the Phase I Wind Turbine Development Site include: mountain big sagebrush communities; mountain big sagebrush/rabbitbrush communities; mountain big sagebrush/Wyoming big sagebrush communities; mountain big sagebrush/mixed mountain shrub communities; mountain big sagebrush/antelope bitterbrush communities; mountain big sagebrush/Utah serviceberry communities; and, mountain big sagebrush/mixed grassland communities.

8.4.1.3 Black Sagebrush Communities

Black sagebrush communities are commonly associated with sandy or coarse textured soils at middle to upper elevation dry sites on mountain and hillslopes, ridges, mesa tops, alluvial fans and bluffs. Sites are nearly level to steeply sloping with variable aspects. Soils are shallow (often <30 cm deep), well-drained, and coarse-textured with high cover of gravel and cobble. Soil texture ranges from gravelly loam to sandy clay loam. The vegetation is characterized by an open to moderately dense (12-40% cover) dwarf-shrub layer (<0.5 m tall) that is dominated or co-dominated by black sagebrush. Generally, black sagebrush occurs on drier surfaces with co-dominant shrubs located in more mesic positions. Commonly associated species include antelope bitterbrush, buckwheat, shadscale saltbush (*Atriplex. confertifolia*), spiny horsebrush (*Tetradymia spinosa*), and other species of *Artemisia*. Diagnostic of this community include a sparse herbaceous understory with only scattered grasses and forbs. Common grasses may include Idaho fescue, prairie junegrass *(Koeleria macrantha),* bluebunch wheatgrass, mutton grass (*Poa fendleriana*), needle-and-thread grass, and Sandberg bluegrass. Forbs such as stemless mock goldenweed (*Stenotus acaulis)*, and *Phlox* spp. may also be present. Unique black sagebrush assemblages within the Phase I Wind Turbine Development Site include: black sagebrush/low sagebrush, black sagebrush/mountain big sagebrush, and black sagebrush/mixed grassland.

8.4.1.4 Basin Big Sagebrush Communities

Basin big sagebrush is a widespread erect, rounded, or somewhat spreading evergreen shrub which normally grows 1 to 3 m in height, maximum stature being reached on deep, well-drained soils in sheltered areas. The species is found in mesic habitats, in valley bottoms, lower foothills, or adjacent to drainages; it frequently coincides with high water tables or deep water accumulations. Basin big sagebrush is most commonly found on stratified sandy loam soils and is generally considered intolerant of alkaline conditions though some ecotypes may be found in association with salt tolerant species such as shadscale, black greasewood (*Sarcobatus vermiculatus*), and saltgrass (*Distichlis spicata*). Common shrub associates include broom snakeweed and yellow rabbitbrush *(Chrysothamnus viscidiflorus).* The community commonly grows in association with bluebunch wheatgrass, needle-and-thread grass (*Hesperostipa comata*), Idaho fescue, and Sandberg bluegrass. Unique basin big sagebrush assemblages within the Phase I Wind Turbine Development Site include: basin big sagebrush, basin big sagebrush/basin wildrye, and basin big sagebrush/shadscale saltbush.

8.4.1.5 Birdfoot Sagebrush Communities

Birdfoot sagebrush (*Artemisia pedatifida*) is a native, dwarf mat-forming perennial sub-shrub that grows from 5 to 15 cm in height. The community typically grows in small isolated stands on dry hills, mesas, ridges, high plains and foothills where soils are often shallow clays or clay loams derived from marine shales, with a high percentage of bare ground and gravel at the surface. Vegetation cover is generally sparse, not exceeding 35%. The sparse herbaceous layer (<25% cover) may include Sandburg bluegrass*,* bluebunch wheatgrass, and western wheatgrass. Common forbs include textile onion (*Allium textile),* spiny phlox (*Phlox hoodii),* basindaisy *(Platyschkuhria integrifolia)*, and occasionally denser cover of American vetch (*Vicia americana)* and plains pricklypear (*Opuntia polyacantha)*.

8.4.2 Saltbush Communities

The saltbush (*Atriplex* spp.) cover type is dominated by Gardner's saltbush (*A. gardneri*) and shadscale. Gardner's saltbush is a subshrub, which is woody at its base and seldom grows higher than 16 inches. It grows on alkaline soils of barren plains and hills. Shadscale is a relatively compact spiny shrub, also tending to grow in alkaline soils on plains and hills. Shadscale generally grows in dense clumps less than 1 m in height (Simonin 2001).

8.4.2.1 Shadscale Saltbush Communities

These open to sparse shrublands are dominated by shadscale saltbush but lack other diagnostic species (NatureServe 2014). Shadscale saltbush communities are widespread across western and central Wyoming. In general, these communities occur on hills, ridges, and toeslopes, where soils are often shallow clays or clay loams derived from marine shales, with a high percentage of bare ground and gravel at the surface. Vegetation cover is generally sparse, not exceeding 35%. The short-shrub canopy is dominated by shadscale saltbush with other associated species, including buckwheat, Gardner's saltbush, yellow rabbitbrush, and spiny horsebrush. The herbaceous layer varies from sparse to relatively dense, and may comprise Indian ricegrass (*Achnatherum hymenoides*), bluebunch wheatgrass, and Sandberg bluegrass. Unique shadscale saltbush assemblages within the Phase I Wind Turbine Development Site include: shadscale saltbush/Wyoming big sagebrush communities; shadscale saltbush/spiny horsebrush communities; shadscale saltbush communities; and, shadscale saltbush/black sagebrush communities.

8.4.2.2 Gardner's Saltbush Communities

Gardner's saltbush is most commonly found on saline, poorly developed, or clayey soils with a pH ranging from 7.8 to 8.6 (NatureServe 2014). Soils are typically low in available phosphorous, nitrogen and potassium. Gardner's saltbush also grows on sodic, silty soils, usually on harsh and arid sites (generally 7-9 and 10-14 inch precipitation zones), with widely fluctuating temperatures and high winds. Gardner's saltbush is a spreading, low growing, evergreen, perennial member of the goosefoot family (*Chenopodiaceae*). It is often called a sub-shrub because it is often woody at the base. It grows from 8-20 inches in height and has alternate, gray-green leaves up to 2 inches long. The plant has a highly branched deep root system, with lateral spread up to 7 feet. The species tolerates poor site conditions and is used to stabilize soils and to reclaim areas. Unique Gardner's saltbush assemblages within the Phase I Wind Turbine Development Site include: Gardner's saltbush communities; Gardner's saltbush/stemless mock goldenweed communities; Gardner's saltbush/birdfoot sagebrush communities; Gardner's saltbush/greasewood communities; Gardner's saltbush/shadscale saltbush communities; and, Gardner's saltbush/Wyoming big sagebrush communities.

8.4.3 Upland Grassland Communities

Upland grassland communities typically occur between 6,500 to 8,400 feet in elevation and occur on a variety of ecological sites. The vegetation is characterized as mixed-grass prairie on gentle to moderate slopes (0–20%), growing on drainage terraces, draws, alluvial flats and plains, escarpments, gulches, hillslopes, knobs, knolls, bluffs, and plateaus. Upland grasslands form a matrix with the surrounding sagebrush steppe, creating a mosaic landscape of rolling grasslands interspersed throughout sagebrush communities. Surface soil textures range from silty clays to sand in poor to well-developed soils that are shallow to very deep. Erosion potential is low to high, and is predominantly a function of vegetation cover. Exposed surfaces, fine-textured soils, sandy soils, slope, and depth to bedrock determine the extent of erosive forces such as surface runoff and rills.

Upland grasslands are defined by a dominant cover of bunchgrasses and rhizomatous grasses including bluebunch wheatgrass, western wheatgrass, bluegrass, Indian ricegrass, and needle-and-thread grass among other species. The distribution of both bunchgrasses and rhizomatous grasses are negatively related and as one functional group increases in cover, the other functional group will decrease. Bunchgrasses dominate the vertical structure of these communities with heights ranging between 15 and 50 cm, while rhizomatous grass height ranges from 8 to 30 cm. Exposed soil accounts for up to 60% of the surface, while the remainder consists of native forbs (0.7–5.3%) and an open shrub canopy (0.1–16.3%). Sagebrush canopy increases near transitions between upland grassland and sagebrush steppe. Unique upland grassland assemblages within the Phase I Wind Turbine Development Site include: bluebunch wheatgrass/Wyoming big sagebrush communities; bluebunch wheatgrass communities; bluebunch wheatgrass/mountain big sagebrush communities; bluebunch wheatgrass/black sagebrush communities; and threadleaf sedge communities.

8.4.4 Greasewood Communities

Black greasewood is a native flowering perennial with an erect to low spreading growth form reaching 3 m tall and 1 to 3 m across (NatureServe 2014). On saline sites, greasewood may grow in nearly pure stands or in association with saltbushes (*Atriplex* spp.). Greasewood typically occurs in areas receiving 7-14 inches of annual precipitation and is often confined to alkali-sodic soils in alluvial areas, floodplains, dry washes, and gullies where soil moisture is high. Soil pH typically ranges from 6.2 to 9.8 and surface soils are typically rich in sodium and other cations. Greasewood tolerates mildly to strongly sodic soil as well as non-saline to strongly saline soils. It is found predominantly in soils that are fine-textured and saline and/or sodic. This community usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or co-dominated by greasewood. Other shrubs that may be present or codominant in some occurrences include shadscale saltbush, Gardner's saltbush, Wyoming big sagebrush, basin big sagebrush, silver sagebrush (*Artemisia cana* ssp. *cana)*, or winterfat (*Krascheninnikovia lanata*). Occurrences are often adjacent to mixed salt desert scrub or big sagebrush shrublands. Graminoids dominate the herbaceous layer, when present; common species include alkali sacaton (*Sporobolus airoides),* western wheatgrass, saltgrass, bluegrass, alkaligrass *(Puccinellia* sp.*)*, or common spikerush (*Eleocharis palustris)*. Unique greasewood assemblages within the Phase I Wind Turbine Development Site include: greasewood/saltbush/basin big sagebrush communities; greasewood/basin wildrye communities; greasewood communities; greasewood/inland saltgrass communities; greasewood/mountain big sagebrush; greasewood/Wyoming big sagebrush; and, greasewood/basin big sagebrush communities.

8.4.5 Riparian/Lowland Communities

Riparian/lowland communities grow along streambeds and open water and can be found on all aspects of drainage terraces, washes, draws, alluvial flats, alluvial plains, floodplains, and hillslopes (NatureServe 2014). The dominant trees and shrubs include sandbar willow (*Salix exigua)*, narrowleaf cottonwood (*Populus angustifolia)*, plains cottonwood (*Populus deltoides)*, and birch (*Betula* spp.). Typical shrubs found in association with these systems include basin big sagebrush, silver sagebrush, antelope bitterbrush, snowberry (*Symphoricarpos* spp.*)*, and chokecherry (*Prunus virginiana*). Grass cover generally consists of dense mats of sedges (*Carex* sp.), rushes (*Juncus* sp.), timothy (*Phleum pratense*), redtop (*Agrostis gigantea*), meadow foxtail (*Alopecurus pratensis*) and basin wildrye (*Leymus cinereus)*. Forbs are commonly present within these systems and typically distributed throughout open areas, and include lupine (*Lupinus* sp.*)*, common yarrow (*Achillea millefolium)*, pussytoes (*Antennaria* spp.*)*, phlox (*Phlox* spp.), aster (*Aster* spp.), and flax (*Linum* spp.). Unique riparian/lowland assemblages within the Phase I Wind Turbine Development Site include: meadow foxtail communities; basin big sagebrush; basin big sagebrush/basin wildrye communities; willow/herbaceous wetland communities; willow; wet fresh meadow communities; and, basin wildrye communities.

8.4.6 Mesic Lowland Communities

Four mesic lowland vegetation assemblages occur in the Phase I Wind Turbine Development Site. These communities require mesic sites that generally are adjacent to riparian zones and moist mountain meadows. Species diversity and community production is often high in these systems with vegetation cover indicative of perennially or ephemerally wet conditions. . The dominant trees and shrubs generally include willow (*Salix* spp.) and aspen. Typical shrubs found in association with these systems include silver sagebrush, antelope bitterbrush*,* snowberry, and chokecherry. Other shrubs are scattered throughout and occur in higher concentration along transition areas, and include mountain and Wyoming big sagebrush and yellow rabbitbrush. Common grasses include mountain rush *(Juncus balticus),* mountain (Arctic) rush (*Juncus arcticus),* common spikerush*,* Kentucky bluegrass (*Poa pratensis),* Idaho fescue*,* slender wheatgrass, Sandburg bluegrass, several species of *Carex,* timothy, redtop, and basin wildrye. Forbs are commonly present and typically distributed throughout open areas, and include buckwheat, lupine, common yarrow, pussytoes (*Antennaria* sp.*)*, phlox, aster, flax, slender cinquefoil (*Potentilla gracilis),* western valerian *(Valeriana occidentalis),* and Virginia strawberry (*Fragaria virginiana)*. Unique mesic lowland communities within the Phase I Wind Turbine Development Site include: mountain big sagebrush/silver sagebrush, wet fresh meadow, wet fresh meadow/silver sagebrush, and willow/wet fresh meadow.

8.4.7 Aspen Woodland Communities

Quaking aspen (*Populus tremuloides*) is a widely distributed pioneer tree species that grows at elevations ranging between 6,000 and 11,000 feet. Aspens grow on rich, moist, loamy soil, but may occupy sites that are substantially wetter or even dry and gravelly (Howard 1996). Aspens form dense, pure stands with trees averaging 20 to 50 feet in height. Aspen reproduces vegetatively by way of horizontal rhizomes. Aspen is found in mixed conifer woodland and mixed mountain shrub communities.

This plant community is moisture-dependent and found in areas with mesic conditions. The community occurs at higher elevations of variable slope and throughout transitional foothills and mesas along hillslopes, knobs, and gulches. Surface soils range from fine-textured silty clay loams to coarse-textured sands in well-developed soils that are moderately deep to deep. Soils are typically wet throughout the year and maintain some level of increased soil moisture. This plant community is generally characterized by an open-canopy of quaking aspen interspersed with a dense and highly diverse understory of montane shrubs and herbaceous vegetation. Understory vegetation is dominated by herbaceous cover (40.6–55.4% cover) primarily composed of bunchgrasses (8.5% cover), rhizomatous grasses (10.8 % cover), and native forbs (5.6% cover), while very little of the soil surface is left unoccupied (3.6–14.0% cover). In addition to aspen, dominant trees include limber pine (*Pinus flexilis*), lodgepole pine (*Pinus contorta*), and Douglas-fir (*Pseudotsuga menziesii*). Common forbs and grasses include lupine, cowparsnip (*Heracleum maximum*), common yarrow, pussytoes, Sandberg bluegrass, bottlebrush squirreltail, smooth brome (*Bromus inermis*), dropseed (*Sporobolus* spp.), and sedges (*Carex* sp.). Low-growing deciduous shrubs and conifers are common throughout this woodland community, and include snowberry, creeping barberry (*Mahonia repens*), and currant (*Ribes* spp.). Various larger shrubs are intermixed within more open areas and along edges of these woodland-forest complexes, and are primarily composed of serviceberry, alderleaf mountain mahogany (*Cercocarpus montanus*), and mountain big sagebrush. Unique aspen woodland assemblages within the Phase I Wind Turbine Development Site include: aspen/mixed conifer woodland, aspen/mixed grassland, and aspen/mixed mountain shrub.

8.4.8 Barren Slopes

Barren slopes have relatively low vegetation cover primarily due to topography that expose surfaces to harsh climatic conditions or underlying soil conditions that limit vegetation growth. Sites can be found on all aspects and include drainage terraces, alluvial flats, alluvial plains, bluffs, hillslopes, knobs, knolls, and plateaus. Surface soils range from silty clay loams to sandy soils with a wide range of depths from very shallow to deeper, poorly developed soils. Erosion potential ranges from low to severe and are typically highly susceptible to water and wind erosion due to exposed soil surfaces, shallow depth to bedrock, soil texture, and steep slopes, resulting in increased surface runoff, gullying, rills, and topsoil loss.

Barren soil ranges from 43.0% to 71.3% cover, with herbaceous vegetation cover ranging between 12.3% and 36.9%. Native forbs are the most abundant herbaceous species group in sparsely vegetated communities (1.1–12.1% cover), while bunchgrasses (0.1–6.3% cover) and rhizomatous grasses (0.2–3.0% cover) provide very little cover. Although shrubs are a frequent component of this system, they are widely distributed in an open-canopy and percent shrub cover rarely exceeds 6%. Big sagebrush does occur in these communities; however, it is typically not a substantial vegetative component. Vegetation is characterized by a patchy distribution of cushion plants and mat-forming forbs composed of stemless mock goldenweed and one or more phlox species such as spiny phlox, prickly phlox (*Phlox pungens*), and granite prickly phlox (*Linanthus pungens*). Various buckwheat species and pricklypear often codominate these barren landscapes, but cover is minimal. Open-canopied shrubs occur sporadically and include one or more *Atriplex* species such as Gardner's saltbush, shadscale, and fourwing saltbush (*Atriplex canescens*). Other shrubs present may include big sagebrush, black sagebrush, rabbitbrush, black greasewood, winterfat, birdfoot sagebrush, and horsebrush. The herbaceous layer is sparse and typically not a contributing component of this vegetation class. Unique barren slope assemblages within the Phase I Wind Turbine Development Site include: sparsely vegetated and barren slopes.

8.4.9 Mixed Mountain Shrub Communities

The mixed mountain shrub community occurs at elevations ranging between 7,200 to 8,100 feet. Mixed mountain shrub is typically associated with dry, exposed sites that limit tree growth, being generally restricted to exposed hillsides and dry conditions, throughout foothills and mesas along hillslopes and valley sides. Surface soil textures range from fine-textured silt loams to coarse-textured sands in well-developed soils that are moderately deep to deep. Erosion potential ranges from low to high, with more susceptible soils located on steeper slopes with fine-textured soils. Montane shrublands create a relatively open canopy dominated by a wide variety of shrubs. Overall shrub cover ranges from 4.2% to 27.2%, while big sagebrush canopy cover ranges from 3.7% to 7.3%. Understory vegetation is dominated by herbaceous cover (37.8–47.2% cover) primarily composed of bunchgrasses (13.2% cover), rhizomatous grasses (8.9% cover), and native forbs (8.1% cover), while the soil surface may be left exposed (2.3–41.7% cover). In addition, a litter layer is typically present on the soil surface (8.8–29.8% cover). Inclusions of sagebrush steppe or grassland often occur, but the vegetation is typically dominated by a variety of shrubs including serviceberry, mountain mahogany, common juniper, currant, snowberry, creeping barberry, antelope bitterbrush, rose (*Rosa* spp.), and skunkbush sumac (*Rhus trilobata*). Grasses are represented as species of bluegrass, dropseed (*Sporobolus* spp.), and wheatgrass/wildrye, while forbs are represented as species of lupine and phlox.

8.5 Noxious and Invasive Weed Species

BLM has recorded occurrences of several noxious and invasive weed species within the CCSM Project Site, including the Phase I Wind Turbine Development Site (BLM 2012). Additional locations were also identified as part of site-specific survey efforts completed in 2013 (Table 8.3). Areas most susceptible to noxious and invasive weed infestations or occurrences include recently disturbed soils, roadsides, pipeline rights-of-way, drainages, and agricultural improvements. Noxious and invasive weed species surveys have been conducted throughout the Phase I Wind Turbine Development Site (Appendix J) and the treatment and control of known occurrences will follow the Weed Management Plan (Appendix H) for all weed occurrences within the Phase I Wind Turbine Development Site.

Table 8.3 summarizes the known weed occurrences throughout the Phase I Wind Turbine Development Site. Cheatgrass (*Bromus tectorum*) has been identified along roadsides and in recently disturbed areas. Perennial pepperweed (*Lepidium latifolium*) occurs in many of the wet drainages in the Phase I Wind Turbine Development Site. Whitetop (hoary cress) (*Cardaria draba*) occurs in ephemerally-wet areas, including Hugus and Smith Draws. Roadsides and areas of recent pipeline development in the northern portion of the Phase I Wind Turbine Development Site contain Russian thistle (*Salsola kali*) and halogeton (*Halogeton glomeratus*); however, these species are common along most roadsides intersecting saline environments. Canada thistle (*Cirsium arvense*) occurs in Sage Creek and is primarily found in agricultural improvements, along ditches and surrounding impoundments.

Table 8.3. CCSM Project Site Known Weed Occurrences

Common Name	Scientific Name	Occurrence
Alyssum	*Alyssum* spp.	Sandy soils in Chokecherry WDA
Canada thistle	*Cirsium arvense*	Along North Platte River; throughout Sierra Madre WDA in existing roadsides, drainages, and agricultural use areas.
Cheatgrass	*Bromus tectorum*	Roadsides throughout CCSM Project Site, sandier soils
Halogeton	*Halogeton glomeratus*	Roadsides, pipeline rights-of-way throughout CCSM Project Site
Whitetop (hoary cress)	*Cardaria draba and C. pubescens*	Adjacent to North Platte River, Little Sage Creek, Rasmussen Creek, and Hugus Draw drainages
Musk Thistle	*Carduus nutans*	Little Sage Creek drainage, Sierra Madre WDA roadsides, drainages, and agricultural use areas
Russian knapweed	*Centaurea repens*	Little Sage Creek, Sage Creek, North Platte River, Pass Creek, Iron Spring Draw drainages; roadsides and agricultural use areas in Sierra Madre and Chokecherry WDAs
Russian thistle	*Salsola kali*	Road and pipeline rights-of-way north of Chokecherry WDA, Little Sage Creek drainage
Perennial pepperweed	*Lepidium latifolium*	Little Sage Creek and Sugar Creek drainages
Tumble mustard	*Sisymbrium altissimum*	Sandy soils of Chokecherry WDA
Sow thistle	*Sonchus oleraceus*	North Platte River corridor
Leafy spurge	*Euphorbia esula*	North Platte River corridor
Russian olive	*Elaeagnus angustifolia*	North Platte River corridor(south of I-80)
Saltcedar	*Tamarix* spp.	North Platte River corridor (south of I-80), Rasmussen Reservoir

8.6 Water Resources

The Phase I Wind Turbine Development Site is located within Division 1 of the Wyoming State Engineer's Office and includes waters in the North Platte River and Yampa-White River basins. The Phase I Wind Turbine Development has the potential to impact water resources through water use, as well as through erosion and sedimentation from construction, operations, maintenance, and decommissioning activities. PCW will implement the measures described in Appendix A to minimize impacts to water resources from the Phase I Wind Turbine Development. PCW has developed a SWPP Plan (Appendix I) and Erosion Control Plan (Appendix H) to further minimize impacts to water resources. In addition, PCW is implementing the Watershed Monitoring Plan (ROD, Appendix B) for the CCSM Project to detect impacts to watersheds from the CCSM Project for early identification and management. Erosion control is discussed further in Appendix H and Appendix I of this site-specific plan of development.

PCW will use a combination of surface water, groundwater and municipal water resources to meet the water demands of the Phase I Wind Turbine Development during construction, operations, maintenance and decommissioning. TOTCO owns numerous water rights within the Ranch far in excess of the amounts required to construct, operate, maintain, and decommission the Phase I Wind Turbine Development. These rights are generally approved for irrigation, domestic, and stock watering uses. The temporary or permanent change of these existing water rights for use on the CCSM Project has been negotiated with TOTCO. Additional options to meet long term water supply needs include purchasing bulk water and negotiating a water supply agreement with the City of Rawlins and/or Town of Sinclair.

The water supply for the Phase I Wind Turbine Development takes into consideration environmental concerns along with water resource availability and infrastructure needs. Where possible, PCW will make use of existing water resources and infrastructure by using existing water rights as well as taking advantage of municipal supplies when available. Throughout construction, operation, maintenance and decommissioning, PCW will work to minimize water demand and make the most efficient use of the water resources available.

8.6.1 Watershed

The Phase I Wind Turbine Development Site is located within Division 1 of the Wyoming State Engineer's Office and includes waters in the North Platte River and Yampa-White River basins. Named surface waters within the Phase I Wind Turbine Development Site include Smith Draw, Hugus Draw, Little Sage Creek, Deadman Creek, La Marsh Creek, McKinney Creek, Grove Creek, Miller Creek, Rasmussen Creek, Sage Creek, Stoney Creek, and Lone Tree Creek. Multiple unnamed ephemeral drainages that are tributary to these creeks are also present. The estimated initial and long-term disturbance associated with the Phase I Wind Turbine Development is broken down by watershed in Table 8.4 for comparison to the analysis contained in the EIS.

Table 8.4 Phase I Wind Turbine Development Disturbance by Sub-Watershed

Sub-watershed Name	Sub-watershed Total Area (acres)	Initial Disturbance		Long-term Disturbance		Activity Areas		Stream Crossings in sub-watershed
		acres	percent	acres	percent	acres	percent	
NORTH PLATTE BASIN								
North Platte River-First Cottonwood Draw	46,942	--	--	--	--	--	--	--
Little Jack Creek	35,771	--	--	--	--	--	--	--
Upper Sage Creek-North Platte River	40,935	223	0.5%	32	0.1%	11	<0.1%	5
Rasmussen Creek	23,488	529	2.3%	76	0.3%	76	0.3%	95
Lower Sage Creek-Upper North Platte River	20,079	--	--	--	--	--	--	--
Miller Creek	28,571	365	1.3%	62	0.2%	108	0.4%	59
Upper Little Sage Creek	30,732	2	0.01%	<1	<0.1%--	<1	<0.1%	--
Lower Little Sage Creek	16,898	45	0.3%	5	<0.1%--	13	0.1%	5
North Platte River-Coal Mine Draw	34,326	--	--	--	--	--	--	--
North Platte River-Lost Springs Draw	47,020	--	--	--	--	--	--	--
Iron Springs Draw	18,853	--	--	--	--	--	--	--
Hugus Draw	35,341	536	1.5%	85	0.2%	60	0.2%	43
Grenville Dome	22,059	246	1.1%	32	0.1%	47	0.2%	32
Pass Creek-Stage Station Springs	34,785	--	--	--	--	--	--	--
Middle Sugar Creek	24,897	252	1.0%	35	0.1%	18	0.1%	19

Sub-watershed Name	Sub-watershed Total Area (acres)	Initial Disturbance		Long-term Disturbance		Activity Areas		Stream Crossings in sub-watershed
		acres	percent	acres	percent	acres	percent	
Lower Sugar Creek	42,909	1	<0.01%	--	--	--	--	--
101800021304 (Sugar Creek)	11,042	401	3.6%	87	0.8%	50	0.5%	21
North Platte Basin Subtotals*	***514,648***	***2,599***	***0.5%***	***414***	***0.1%***	**384**	**0.1%**	***279***
WHITE-YAMPA BASIN								
North Fork Savery Creek	30,812	--	--	--	--	--	--	--
Little Savery Creek	30,995	--	--	--	--	--	--	--
Muddy Creek-Littlefield Creek	32,259	--	--	--	--	--	--	--
McKinney Creek	30,433	436	1.4%	71	0.2%	55	0.2%	20
White-Yampa Basin Subtotals*	***124,499***	***436***	***0.4%***	***71***	***0.1%***	***56***	***<0.1***	***20***
TOTAL	**639,147**	**3,035**	**0.5%**	**485**	**0.1%**	**440**	**0.1%**	**299**

*Values may not sum to total due to rounding

8.6.2 Wetlands

Waters of the U.S. (WUS) and wetland delineations were completed for the Phase I Wind Turbine Development Site in 2013 and 2014. A total of 6.7 acres of wetlands consisting of riverine palustrine emergent or scrub-shrub wetlands and 0.25 acres of non-wetland WUS were mapped in the Phase I Wind Turbine Development Site.[13] Of this, 5.07 acres of wetland WUS and 0.13 acre of non-wetland WUS occur within the initial disturbance area, the remainder are within activity areas and will not be disturbed. Major drainages to be crossed by the Phase I Wind Turbine Development Site include Smith Draw, Hugus Draw, Deadman Creek, La Marsh Creek, Rasmussen Creek, Lone Tree Creek, McKinney Creek, Grove Creek, and Stoney Creek, along with a number of ephemeral or intermittent unnamed drainages.

The locations, types, and acres of wetland and non-wetland WUS encountered during surveys are documented in the Aquatic Resource Inventory Report for the Phase I Wind Turbine Development (Appendix K). PCW will work with the U.S. Army Corps of Engineers to permit any disturbances within WUS. The measures described in Appendix A will be used to minimize potential impacts to wetlands and other water bodies.

8.6.3 Water Usage

PCW estimates it will use approximately 193 ac-ft of water for construction of the Phase I Wind Turbine Development. Water use for the Phase I Wind Turbine Development will primarily be for dust suppression, with some water used for compaction and concrete batching during construction. PCW is requesting that BLM approve the use of magnesium chloride for dust suppression to minimize water demands and the vehicular traffic associated with dust suppression activities; the Rawlins Resource Management Plan (RMP) allows the use of magnesium chloride (BLM 2008).[14] Using magnesium chloride for dust suppression may reduce water demands by as much as 30 percent, reducing water consumption for the Phase I Wind Turbine Development to 135 ac-ft during construction.

8.6.4 Water Supply

A combination of water sources will be used to supply water to the Phase I Wind Turbine Development for construction, operations, maintenance and decommissioning. Water resources will be used in compliance with all applicable Wyoming State Engineer's Office rules and regulations. PCW will not withdraw surface water from within the Colorado River Basin to supply the CCSM Project.

---

[13] Note that Appendix K, the Phase I Wind Turbine Development Aquatic Resources Inventory mapped 41.67 acres of wetlands and 2.07 acres of non-wetland WUS in the larger Study Area. The Study Area is inclusive of the 6.82 acres of wetlands and 0.25 acres of non-wetland WUS mapped within the Phase I Wind Turbine Development Site.
[14] In accordance with current BLM policy, PCW will not apply chloride compounds or lignin derivatives within 500 feet of a perennial stream on federal lands.

Water for the construction, operation, maintenance and decommissioning of the Phase I Wind Turbine Development will be obtained from the CCSM Project water facilities. The long-term water supply for the CCSM Project involves extracting water from the North Platte River and using existing groundwater sources on the Ranch opportunistically to supplement the surface water supply. As an alternative to using surface water rights to meet the temporary and permanent water demands of the CCSM Project, PCW is in discussions with the City of Rawlins to provide a supply of both raw and treated water to the CCSM Project, subject to approval by the Rawlins City Council and the Wyoming State Engineer's Office. Table 8.5 details the water rights that will be used to supply the Phase I Wind Turbine Development.

Table 8.5. Phase I Wind Turbine Development Water Supply Sources

Water Right Name	Type/Source	Permit Number	Maximum Annual Use for Phase I Wind Turbine Development (acre-feet)
Savage No. 1	Direct Flow North Platte River	7883	54
Savage No. 2	Direct Flow North Platte River	7884	54
Tuttle No. 1	Groundwater Non-Tributary	29550	10
Tuttle No. 2	Groundwater Non-Tributary	32966	30
McCarthy No. 1	Groundwater Non-Tributary	339	10
Miller Hill No. 3	Groundwater Non-Tributary	106432	15
East Grove 1701	Groundwater Non-Tributary	103525	8
City of Rawlins	Municipal	N/A	*[1]
Town of Sinclair	Municipal	N/A	*[2]
Other TOTCO Wells	Groundwater Non-Tributary	N/A	*[3]

Notes: [1]As a potential alternative to the surface and groundwater sources listed above, PCW is discussing options for the City of Rawlins to provide raw or treated water.
[2]As a potential alternative to the surface and groundwater sources listed above, PCW is discussing options for the Town of Sinclair to provide raw or treated water.
[3]Other potential TOTCO well connections are shown in Appendix B and are potential alternatives to the surface and groundwater sources listed above.

The U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) for the CCSM Project (BLM 2012b) evaluated the potential impacts of water depletions for the CCSM Project. The BO concluded that because the CCSM Project is using existing water rights, it is already accounted for as an existing system depletion. The BO further stated that the CCSM Project is not likely to jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon, or the federally threatened northern Great Plains population of the piping plover, or western prairie fringed orchid, in the central and lower Platte River. Additionally, the BO concluded that the CCSM Project is not likely to destroy or adversely modify designated critical habitat for the whooping crane. No surface water will be withdrawn from within the Colorado River Basin and no impacts to downstream listed fish species will occur.

8.7 Range Resources

The Phase I Wind Turbine Development Site is currently used for grazing by livestock, primarily cattle. Private, state, and public lands are administered as grazing allotments and the Phase I Wind Turbine Development Site is included in the Pine Grove/Bolten, Sage Creek, and Emigrant allotments. Grazing by big game wildlife species (elk, mule deer, and pronghorn) also occurs within the Phase I Wind Turbine Development Site. The allotment acreage, designated animal unit months, and long-term disturbance per allotment for the Phase I Wind Turbine Development are shown in Table 8.6 (BLM 2014). The long-term disturbance associated with the Phase I Wind Turbine Development Site will impact approximately 0.2 percent of the Pine Grove/Bolten Allotment acreage and 0.1 percent of the Sage Creek Allotment acreage. There will be no long term impacts in the Emigrant allotment.

Table 8.6. Grazing Allotments and AUMs

Allotment	Allotment Acreage[1]	Allotment AUMs[1]	Initial Disturbance	Long-term Disturbance
Pine Grove/ Bolten	277,369	18,006	2,860	461
Sage Creek	29,433	10,703	174	24
Emigrant	5,583	755	0.3	0
TOTAL	350,476	36,179	3,035	485

Notes: 1. BLM 2014

Range improvements have taken place throughout the Pine Grove/Bolten and Sage Creek allotments to minimize the impacts of grazing and maintain proper functioning conditions (PFCs). Range improvements include fences, wells, developed springs, and sagebrush treatments (BLM 2012b). The allotments are currently managed within an intensive rotation system with adjacent allotments in which grazing is rotated during the growing season among several pastures within each allotment to provide complete growing season rest during

alternate years. Range improvements have resulted in increased soil stabilization and infiltration, decreased runoff, and enhanced riparian vegetation health (BLM 2012b, 2014a). In 2013, the BLM assessed proper functioning conditions (PFCs) for healthy rangeland management for the Pine Grove/Bolten and Sage Creek allotments, and concluded that the allotments have improved conditions and meet BLM Rangeland Health Standards (BLM 2014a).

8.8 Reclamation

A Reclamation Plan has been developed for the Phase I Wind Turbine Development (Appendix L) to document the site-specific methodologies, monitoring, and reporting requirements for reclaiming disturbed areas on federal lands. The Reclamation Plan identifies the Ecological Sites that occur in the Phase I Wind Turbine Development Site and documents the reclamation standards, site and soil characteristics, and Ecological Site-specific conditions and revegetation methods that will be implemented. While the preference is to implement these measures on private lands and state lands, specific measures on private lands and state lands may vary and will be developed in coordination with private landowners, WYDEQ-LQD, Wyoming Industrial Siting Council, the State Land Board and the Wyoming Game and Fish Commission, as appropriate.

Limited reclamation potential areas occur in portions of the Phase I Wind Turbine Development. These include areas of slopes greater than 25 percent and southerly aspects, sandy and clayey soils, shallow soils, and areas with saline conditions. Areas of slopes greater than 25 percent and southerly aspects will be avoided to the extent possible. Shallow ecological sites generally have limited reclamation potential due to poor topsoil quality, increased rock fragment content, and shallow depth to bedrock or a restrictive layer. Saline ecological sites contain soil conditions that are difficult to reclaim due to low strength and high erosive potential and seed sources for suitable plant species in these saline environments are often limited. Limited recreation potential areas with the greatest limitations are in areas of strongly saline and or seleniferous soils (Saline Upland and Saline Lowland ecological types). Plant species within these ecological sites (saltbush [*Atriplex* spp.], greasewood [*Sarcobatus vermiculatus*], grooved milkvetch [*Astragalus bisulcatus],* and woodyaster [*Xylorhiza glabriuscula*]) indicate high salt and or selenium content. These soils are generally more difficult to reclaim due to poor topsoil suitability and seed source for suitable plant species are limited. The Phase I Wind Turbine Development has been sited to minimize impacts to soils with the greatest reclamation limitations.

8.9 Wildlife

The Phase I Wind Turbine Development Site is used by a number of wildlife species. In developing the CCSM Project, PCW has worked in close cooperation with the Wyoming Game and Fish Department (WGFD), BLM, and USFWS to develop survey protocols and avoidance, minimization and mitigation measures for wildlife species. Baseline wildlife occurrence information has been collected since 2010 throughout the CCSM Project Area. Additionally, BLM has collected wildlife data for the CCSM Project Site for several decades. Site-specific

surveys for the Phase I Wind Turbine Development Site were completed in 2013 and are documented in the Phase I Wind Turbine Development Wildlife Survey Report (Appendix N) and the Phase I Wind Turbine Development Avian Resource Report (Appendix M).

8.9.1 Big Game

Big game species that may be present within the Phase I Wind Turbine Development Site include mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), and pronghorn (*Antilocapra americana*) (WGFD 2013). Big game seasonal ranges were identified for the Phase I Wind Turbine Development Site using the big game seasonal ranges designated by the WGFD (EIS p. 3.14-3, 3.14-4, and 3.14-6).

8.9.1.1 Mule Deer

The Phase I Wind Turbine Development Site overlaps with two Mule Deer Herd Units, the Platte Valley (Unit #541) and the Baggs (Unit #427). Highway 71 divides the Herd Units with the Platte Valley Unit east of Hwy 71 and the Baggs Unit west of Hwy 71. Spring-summer-fall range occurs throughout portions of the Sierra Madre WDA, with a small portion of winter-yearlong range along the easternmost extent of the Sierra Madre WDA. Winter-yearlong range occurs in portions of the Chokecherry WDA and along the I-80 corridor. The northern portion of the Phase I Wind Turbine Development Site in the Chokecherry WDA is identified as crucial winter-yearlong range. One seasonal migration route occurs at the southern end of the Chokecherry WDA.

8.9.1.2 Elk

The Phase I Wind Turbine Development Site overlaps with the Snowy Range (#533) and Sierra Madre (#425) Elk Herd Units. The Chokecherry WDA contains no defined habitat areas or migration routes for elk. Spring-summer-fall range for elk is identified in the southern portion of the Sierra Madre WDA, and elk are considered a priority wildlife species for the Upper Muddy Creek Watershed/Grizzly WHMA, which overlaps with the western portion of the Sierra Madre WDA (BLM 2008). Elk use winter and year round range throughout the Grizzly WHMA but primarily on the south-west facing slopes. Winter/Yearling habitat occurs along much of the face of Miller Hill. No crucial elk habitat is identified within the Phase I Wind Turbine Development Site.

8.9.1.3 Pronghorn

The Chokecherry portion of the Phase I Wind Turbine Development Site overlaps with the Iron Springs (#630) Pronghorn Herd Unit, which provide winter/yearlong seasonal range and spring/summer/fall range at higher elevations. The Sierra Madre portion of the Phase I Wind Turbine Development Site overlaps with the Iron Springs (#630) Herd Unit. The Sierra Madre portion of the Phase I Wind Turbine Development Site contains spring/summer/fall range. Two mapped migration routes cross the Phase I Wind Turbine Development Site; one at the base of the Hugus cut-off road that extends north into the Chokecherry WDA and another crosses the Sierra Madre WDA from the base of Miller Hill to Miller Creek.

8.9.2 Small Game and Furbearers

Small game species in Wyoming include cottontail rabbits (*Sylvilagus* spp.), snowshoe hare (*Lepus americanus*), and the red squirrel (*Tamiasciurus hudsonicus*). Desert and mountain (Nuttall's) cottontails (*S. audubonii* and *S. nuttallii*, respectively) are likely to inhabit the Phase I Wind Turbine Development Site. Snowshoe hares and red squirrel occur within Wyoming mountain ranges, but would not likely occur within the Phase I Wind Turbine Development Site. Additional small game species and furbearers include badger (*Taxidea taxus*), bobcat (*Lynx rufus*), marten (*Martes americana*), weasel (*Mustela* sp.), coyote (*Canis latrans*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), beaver (*Castor canadensis*), mink (*Mustela vison*), and muskrat (*Ondatra zibethicus*). Mink, beaver, and muskrat may occur in some drainages (e.g., Sage Creek and Miller Creek) impacted by the Phase I Wind Turbine Development. Badger, bobcat, long-tailed weasel, coyote, red fox, and striped skunk all have distributions that include the Phase I Wind Turbine Development Site.

8.9.3 Migratory and Breeding Bird Species

The Phase I Wind Turbine Development Site is used by a number of avian species. Avian species use is informed by survey crew observations as well as data collection in similar habitats across the CCSM Project Site. Data collection in the CCSM Project Site for migratory birds and raptors include a combination of a DeTect Avian Radar System (radar), long-watch raptor surveys, raptor nest surveys, migratory bird point count surveys, waterbird surveys, and breeding bird grid density surveys.

A total of 295 migratory bird surveys were performed from April 4, 2011 through March 27, 2012 throughout the CCSM Project Site. Point count locations were each surveyed 16 to 23 times, with the variation in number of surveys due to accessibility issues and inclement weather postponing or cancelling surveys. Breeding bird density surveys were completed at 15 locations across the CCSM Project Site. Grid surveys were conducted following the survey protocols published by the Rocky Mountain Bird Observatory (Hanni et al. 2010).

Horned lark (*Eremophila alpestris*) dominated the number of observations, accounting for 62 percent of all individuals observed. Horned lark was also the most frequently encountered species on surveys, with the species recorded for 100 percent of grid surveys. The next most abundant species observed were Brewer's sparrow (*Spizella breweri*) and vesper sparrow (*Pooecetes gramineus*).

The Phase I Wind Turbine Development Site includes all major habitats found throughout the CCSM Project Site. Based on habitat characteristics of the Phase I Wind Turbine Development Site and survey crew observations, species occurrence of migratory and breeding birds within the Phase I Wind Turbine Development Site is expected to be similar to that seen across the entire CCSSM Project Site.

8.9.4 Fisheries

Fish habitats in the Phase I Wind Turbine Development Site include perennial and intermittent streams, springs, lakes and reservoirs. The Phase I Wind Turbine Development Site includes drainages within the North Platte River Basin and the White-Yampa River Basin. Fish habitat is related to the hydrologic conditions of the riparian area and uplands associated with, or contributing to stream channel characteristics. The Phase I Wind Turbine Development Site is located in the headwaters of stream habitat for many native and non-native fish species. A portion of the Phase I Wind Turbine Development is within the Upper Muddy Creek Watershed/Grizzly WHMA, which is managed to maintain, restore, and enhance habitat for Colorado River fish species unique to the Muddy Creek Watershed (BLM 2008). The Upper Muddy Creek Watershed provides habitat for game coldwater fish including Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) and non-game coldwater fish including mountain sucker (*Catostomus platyrhynchus*) and speckled dace (*Rhinichthys osculus*). The lower, warm water reach of the Upper Muddy Creek supports the only viable assemblage of bluehead sucker (*Catostomus discobolus*), roundtail chub (*Gila robusta*), and flannelmouth sucker (*Catostomus latipinnis*) known to still exist in Wyoming (WGFD 2008) and are considered BLM sensitive species.

8.10 Special Status Species

Special status species (SSS) include wildlife species under the jurisdiction of WGFD, species designated as *Wyoming's Species of Greatest Conservation Need* (WGFD 2010), designated BLM sensitive species, and those federally protected under the Endangered Species Act (ESA) (BLM 2012a). These species include both terrestrial and aquatic animals, and plants. As part of the consultation process with the USFWS completed for the EIS, a Biological Assessment (BA) was prepared and submitted to the USFWS, and a corresponding BO was included with the ROD issued in October 2012 (BLM 2012b).

SSS are listed as BLM Sensitive Species in the RFO (BLM 2010) due to their dependence on specialized habitats located on BLM-administrated lands. The wildlife species for which specific field reviews will be applied for the Phase I Wind Turbine Development Site were developed based on management agency input and public concern identified during the NEPA review process (BLM 2012a; BLM 2012b). These species may occur within the Phase I Wind Turbine Development Site as a result of the presence of potentially suitable habitat.

SWCA conducted SSS surveys for the Phase I Wind Turbine Development Site in accordance with the Wildlife Monitoring and Protection Plan for the CCSM Project (Appendix G in BLM 2012b). Survey results are presented in the Phase I Wind Turbine Development Wildlife Survey Report (Appendix N) and Rare Plant Report (Appendix O). Surveys focused on the potential occurrence of SSS and habitat assessments for species identified in the wildlife monitoring and protection plan.

8.10.1 Avian Species

PCW has collected detailed data on avian use of the CCSM Project Site, including the Phase I Wind Turbine Development Site, through diurnal point count surveys and other monitoring protocols (Appendix M). PCW has also collected data relating to the use of the CCSM Project Area by greater sage-grouse since 2009.

8.10.1.1 Sagebrush obligates

Sagebrush habitats occur throughout much of the Phase I Wind Turbine Development Site. These habitats provide suitable nesting and foraging locations for sagebrush obligates (sage thrasher, sage sparrow, and Brewer's sparrow).

8.10.1.2 Mountain Plover

Potential mountain plover habitat occurs in the Phase I Wind Turbine Development Site. Potential mountain plover habitat was also observed in the Sage Creek Basin in areas of reduced vegetation cover and increased white-tailed prairie dog activity. While no mountain plover were identified within the Phase I Wind Turbine Development Site, mountain plover were observed in habitats adjacent to the site.

8.10.1.3 Burrowing owl

One observation of western burrowing owl was recorded adjacent to the survey corridor for the Phase I Wind Turbine Development. It was observed within an inactive prairie dog colony in Sierra Madre WDA. Other potential habitat (i.e., white-tailed prairie dog colonies) was observed during surveys, but no additional burrowing owls or signs were observed.

8.10.1.4 Greater sage-grouse

PCW has been conducting greater sage-grouse population monitoring within the CCSM Project Site, the Ranch, and surrounding areas since spring 2010. Surveys completed as part of the greater sage-grouse monitoring program from 2010-2014 include outfitting 50 female greater sage-grouse with GPS Platform Terminal Transmitters, lek counts, nest monitoring, and brood surveys. The study design for greater sage-grouse monitoring follows a before-after control-impact (BACI) design (Smith 2002). This allows for a stronger inference regarding the success of proposed conservation measures, particularly due to those measures that seek to reduce greater sage-grouse mortality and improve productivity by enhancing nesting and brood-rearing habitat. A discussion of the proposed conservation measures and a detailed greater sage-grouse monitoring report is included as part of the Sage-grouse Conservation Plan for the CCSM Project Plan of Development (BLM 2012b). The CCSM Project, including the Phase I Wind Turbine Development, is located outside of greater sage-grouse Core Areas (Core Area) as defined by Wyoming Executive Order 2011-5 (version 3 map).

Greater sage-grouse habitat occurs throughout much of the Phase I Wind Turbine Development Site. Year-round greater sage-grouse use observed in the survey area occurs across the Chokecherry and Sierra Madre WDAs although greater sage-grouse do not use the Upper Miller

Hill region during winter months (November – March) and use in the Lower Miller Hill region during the same period is very low.

8.10.1.5 Exceptions, Waivers and Authorizations

8.10.1.5.1 High-profile Structure Authorization

As provided for in the ROD, PCW is requesting authorization from BLM for high-profile structures in the Phase I Wind Turbine Development located within 1 mile of the following greater sage-grouse leks:

- Chokecherry
- Chokecherry Bench
- Deadman Creek
- Deadman Creek South
- Miller Creek
- Rawlins Reservoir
- Sage Creek Ranch
- Upper Hugus
- Wild Horse Canyon

BLM's analysis of potential impacts to greater sage-grouse in the Final EIS for the CCSM Project determined that 19 greater sage-grouse leks would be located within 1.0 mile of wind turbine locations. PCW has reduced these anticipated impacts for the Phase I Wind Turbine Development to the extent practicable. Of the 19 leks identified as being within 1.0 mile of potential wind turbine locations, only 8 are now within 1.0 mile of Phase I Wind Turbine Development turbine and transmission structure locations. The Phase I Wind Turbine Development siting efforts combined with PCW's monitoring, conservation, and mitigation commitments insure that authorization of high-profile structures within 1.0 mile of greater sage-grouse leks for the Phase I Wind Turbine Development is appropriate and will not result in impacts to greater sage-grouse beyond those considered in the Final EIS.

In accordance with the ROD and EO 2011-5, no wind turbine generators or transmission structures will be located within 0.25 miles of any lek. The preferred alternative of the BLM's Draft Land Use Plan Amendment and Draft Environmental Impact Statement for sage-grouse (BLM 2013) provides consistency with Wyoming Executive Order 2011-5 (EO 2011-5) by identifying that outside of designated core areas (EO 2011-5 version 3 map), wind turbines should not be placed within 0.25 miles of lek locations. If adopted, this 0.25 mile avoidance would amend the Rawlins RMP requirement for case-by-case authorization of high-profile structures within 1.0 miles of greater sage-grouse leks.

Nevertheless, consistent with the requirements of the Rawlins RMP, the Final EIS (BLM 2012a) analyzed the impacts of authorizing wind energy within the CCSM Project Area, including those areas within 1 mile of a greater sage-grouse lek. BLM determined in the ROD (BLM 2012b) that over 200,000 acres of the CCSM Project Area are suitable for wind energy development; this area includes areas within 1.0 mile of a greater sage-grouse lek, but excludes greater sage-grouse core areas (Core Area) as defined by Wyoming Executive Order 2011-5 (version 3 map). In compliance with the ROD, the Phase I Wind Turbine Development is located outside of greater sage-grouse Core Area. PCW has been conducting greater sage-grouse population monitoring within the CCSM Project Site, the Ranch, and surrounding areas since spring 2010. While greater sage-grouse habitat occurs throughout much of the Phase I Wind Turbine Development Site, PCW's monitoring data confirms that sage-grouse core areas adjacent to the CCSM Project contain the highest quality lekking, nesting, brood-rearing/summer use, and winter habitat. Using the data collected as part of PCW's sage-grouse monitoring efforts, PCW has sited the Phase I Wind Turbine Development in a manner that is compliant with the measures contained in EO 2011-5 and Appendix D of the CCSM Project ROD. This includes placement of high-profile structures, including turbines and transmission structures, outside of the 0.25 mile buffer around known sage-grouse lek locations as well as using natural project-specific topography to shield the lek locations and seasonal habitats from the Phase I turbines to the extent practicable.

In addition, PCW, WGFD, and BLM have developed and implemented numerous conservation measures and a detailed Sage-grouse Conservation Plan is included in the CCSM Project Plan of Development (BLM 2012b). PCW's commitment to locate the CCSM Project outside of core area habitats and to add further protections within Core Area through the establishment of approximately 27,500 acres of conservation easements in the highest quality nesting, brood-rearing, and wintering habitats, will mitigate impacts to sage-grouse and will conserve and enhance greater sage-grouse populations. As a result, as identified in the CCSM Project ROD, the avoidance, minimization, and mitigation efforts associated with the CCSM Project are expected to reduce impacts below significance thresholds. In sum, PCW's request for this authorization was anticipated and analyzed in the Final EIS and will not result in new or increased impacts to greater sage-grouse. Moreover, the requirement for case-by-case authorization of tall structures may soon be superseded if the preferred alternative of the BLM's Draft Land Use Plan Amendment and Draft Environmental Impact Statement for sage-grouse is adopted (BLM 2013).

8.10.1.5.2Deadman Creek South Lek

The Phase I Wind Turbine Development incorporates the measures in Appendix A to avoid and minimize impacts to greater sage-grouse; however, the Phase I Wind Turbine Development design includes improvement of an existing ranch road in one location (Appendix A, Table1). In 2014, PCW discovered a new greater sage-grouse lek in the Sierra Madre WDA. This lek, the Deadman Creek South lek, is located in Section 25, Township 18N, Range 88W. When discovered, PCW had two wind turbines, LMH-D-11 and LMH-D-12, and associated infrastructure located within 0.25 miles of the lek. Since then, PCW has worked with WGFD to avoid and minimize impacts to this lek. PCW has adjusted the locations of the turbines to move them at least 0.25 miles away and has also re-designed the electrical collection system so that no structures or overhead lines will be located within 0.25 miles of the lek. However, PCW was unable to relocate the turbine road between LMH-D-11 and LMH-D-12 due to topography and resource constraints. The turbine road is in the location of an existing road and the terrain in the area will not allow the road to be moved; however, this road is a turbine class road that dead ends at LMH-D-20 and it will not see significant use or traffic following construction of the turbines. Further, the road is already 0.23 miles away and as it is an existing road, the disturbance is not anticipated to adversely affect the lek.

While adverse effects to the Deadman Creek South lek are not anticipated, PCW commits to the following additional measures to further minimize potential impacts to the Deadman Creek South lek:

- DCS-01: PCW will conduct all construction activities within 0.25 mile of the Deadman Creek South lek before March 1st or after May 20th.

- DCS-02: PCW will conduct all non-critical operation and maintenance activities within 0.25 mile of the Deadman Creek South lek before March 1st or after May 20th. Critical operation and maintenance activities may include but are not limited to road, culvert, and erosion control repair; disabled vehicle repair or removal; and application of dust suppression.

- DCS-03: PCW will conduct all non-critical construction, operation and maintenance activities that require use of the road located within 0.25 mile of the Deadman Creek South lek before March 1st or after May 20th. Critical construction, operation and maintenance activities may include but are not limited to unscheduled maintenance of wind turbines and electrical components; road, culvert, and erosion control repair; disabled vehicle repair or removal; and application of dust suppression.

- DCS-04: During the period from March 1st to May 20th, PCW will conduct all critical, non-emergency, construction, operation and maintenance activities located within 0.25 mile of the Deadman Creek South lek or that require use of the road located within 0.25 mile of the Deadman Creek South lek between the hours of 9:00 am and 6:00 pm. Critical construction, operation and maintenance activities may include but are not limited to unscheduled maintenance of wind turbines and electrical components; road, culvert, and erosion control repair; disabled vehicle repair or removal; and application of dust suppression.

The above avoidance and minimization measures for the Deadman Creek South lek have been incorporated into Appendix A as Table 6.

8.10.2 Raptors

Between August 20, 2012 to August 30, 2013 raptor count surveys, 748 individual raptor point count surveys were conducted within the Phase I Wind Turbine Development Site for a total of 53,704 minutes (895 hours). During spring, summer, and fall months, red-tailed hawk (*Buteo jamaicensis*), prairie falcon (*Falco mexicanus*), golden eagle (*Aquila chrysaetos*) and American kestrel (*Falco sparverius*) were the most commonly observed raptor species (Appendix M). During winter months, golden eagle and rough-legged hawk (*Buteo lagopus*) were the only raptor species observed.

The Phase I Wind Turbine Development is designed to avoid known raptor nests and areas with higher eagle and raptor use to the extent practicable; however, in some locations, the Phase I Wind Turbine Development will be constructed in proximity to nests (Appendix M). Table 8.7 lists the species and location for nests that fall within 825 feet (1,200 feet for ferruginous hawks) of the Phase I Wind Turbine Development Site (Appendix A). Habitat exists that could potentially support other, unknown accipiter or buteo nests. The portion of the transmission corridor on the southern edge of the Chokecherry WDA will be constructed adjacent to cliff habitats that might support nesting raptors. Additionally, areas in and adjacent to aspen habitats in the southern portion of the Phase I Wind Turbine Development Site near the Miller Hill climb could support tree nesting buteos and accipiters.

Table 8.7. Raptor Nests Within 825 Feet (1,200 Feet for Ferruginous Hawks) of the Phase I Wind Turbine Development Site

Common Name	Scientific Name	BLM Nest ID	Northing (UTM NAD 83)	Easting (UTM NAD 83)	Project Location	Distance to Site (ft)	Years Monitored	Years Active
American Kestrel	*Falco sparverius*	--	4592178	312889	Lower Miller Hill Turbine Road	11	2013	2013
Ferruginous Hawk	*Buteo regalis*	FH20881301	4620081	312604	Nevins Ridge Water Main	360	2011, 2012, 2013, 2014	None
Golden Eagle	*Aquila chrysaetos*	GE20873601	4614839	321561	Lower Miller Hill Transmission Structure	334	2011, 2012, 2013, 2014	2014
Red-Tailed Hawk	*Buteo jamaicensis*	--	4594862	305478	Upper Miller Hill Arterial Road	765	2008, 2014	2008 (Common raven active in this nest in 2014)
Great Horned Owl (previously unknown raptor)	*Bubo virginianus*	--	4593306	310021	Lower Miller Hill Crane Path	0	2013, 2014	2014
Great Horned Owl	*Bubo virginianus*	GH18881801	4600683	303369	Lower Miller Hill Electrical Collection Structure	795	2011, 2013, 2014	Red-tailed hawk active in this nest in 2011
Unknown Raptor	--	--	4589471	312801	Upper Miller Hill Turbine Tag Line	702	2011, 2013, 2014	None
Unknown Raptor	--	--	4590889	312401	Upper Miller Hill Turbine Road	459	2012, 2013, 2014	None

Common Name	Scientific Name	BLM Nest ID	Northing (UTM NAD 83)	Easting (UTM NAD 83)	Project Location	Distance to Site (ft)	Years Monitored	Years Active
Unknown Raptor	--	--	4591367	311116	Upper Miller Hill Arterial Road	331	2014	None
Unknown Raptor	--	--	4595634	304688	Upper Miller Hill Turbine Road	668	2014	None
Unknown Raptor	--	--	4617630	312967	Nevins Ridge Turbine Pad	510	2012, 2013, 2014	None
Unknown Raptor	--	--	4619206	316104	Nevins Ridge Turbine Pad	455	2011, 2012, 2013, 2014	None
Unknown Raptor	--	--	4622655	320341	Pine Grove Transmission Structure	751	2011, 2012, 2013, 2014	None
Unknown Raptor	--	--	4614047	317122	Nevins Ridge Turbine Pad	757	2014	Common raven active in this nest in 2014
Unknown Raptor	--	--	4620575	320048	Nevins Ridge Turbine Road	88	2011, 2012, 2013, 2014	None

8.10.3 Small Game and Furbearers

8.10.3.1 White-tailed Prairie Dog

During surveys of the Phase I Wind Turbine Development Site, 234 white-tailed prairie dog colonies (140 active, 94 inactive) totaling 3,483 acres were delineated (Appendix N). Of those, 62 colonies (44 active, 18 inactive) totaling 139 acres (4% of the total area of all colonies identified) are within the Phase I Wind Turbine Development Site and will be disturbed. PCW has avoided the remainder of the colonies. At the inactive sites, mound conditions were old and weather worn, and the majority of burrows were collapsed and or shut-in. No signs of white-tailed prairie dog activity (e.g., scraping, scat, etc.) were present near or surrounding mounds and burrows in inactive sites. Active sites had burrow counts ranging from less than 5 to over 100 burrows.

8.10.3.2 Pygmy Rabbit

Thirty-five pygmy rabbit occurrences were recorded within 0.25 mile of the Phase I Wind Turbine Development Site, 21 active and 14 historic. Active areas provide suitable pygmy rabbit habitat of dense big sagebrush in deep loamy soils. No pygmy rabbit locations occur within the long-term disturbance area for the Phase I Wind Turbine Development. Four locations (2 active and 2 inactive) occur within the Phase I Wind Turbine Development Site. The remaining 31 locations occur outside the Phase I Wind Turbine Development Site.

8.10.3.3 Wyoming Pocket Gopher

During wildlife surveys for the Phase I Wind Turbine Development, 273 pocket gopher mounds and mound complexes were located within 75 meters of the initial and long term disturbance areas. (Appendix N). Following the Griscom and Keinath (2010) model, 24 mound/mound complexes (approximately 8 percent of all pocket gopher activity) were predicted as Wyoming pocket gopher, 171 mound/mound complexes (approximately 65 percent of all pocket gopher activity) were predicted as northern pocket gopher, and 78 mound/mound complexes (approximately 27 percent of all pocket gopher activity) were predicted as unknown. An additional 17 northern pocket gopher locations were identified within 75 meters of the activity areas associated with the Phase I Wind Turbine Development.

Overall, predicted Wyoming pocket gopher mounds occurred in relatively flat areas with dominant Gardner's saltbush cover, bare soil, and very little sagebrush cover. Predicted Northern pocket gopher activity occurred in rolling terrain with dominant big sagebrush cover, increased perennial cover, and less saltbush.

8.10.4 Fisheries

No BLM sensitive species occur within the Phase I Wind Turbine Development Site. The lower, warm water reaches of the Upper Muddy Creek watershed supports the only viable assemblage of bluehead sucker (*Catostomus discobolus*), roundtail chub (*Gila robusta*), and flannelmouth sucker (*Catostomus latipinnis*) known to still exist in Wyoming (WGFD 2008). This area of the Upper Muddy Creek watershed is more than 8 miles downstream from the Phase I Wind Turbine Development Site and will not be impacted by the CCSM Project.

8.10.5 Amphibians and Reptiles

Amphibian and reptile monitoring in the Phase I Wind Turbine Development Site was accomplished through opportunistic wildlife observations while performing wildlife surveys since in 2009 as well as the 2013 site-specific surveys for the Phase I Wind Turbine Development. Neither northern leopard frog nor Great Basin spadefoot toad have been found in the Phase I Wind Turbine Development Site (Appendix N).

8.10.6 Rare Plants

8.10.6.1 ESA Listed Plants

Carbon County does not contain critical habitat for any ESA plant species (USFWS 2013); however, the Phase I Wind Turbine Development Site may potentially provide habitat for two federally listed threatened plant species, the Ute ladies'-tresses orchid (*Spiranthes diluvialis*) and Colorado butterfly plant (*Gaura neomexicana* spp. *coloradensis*).

Efforts to locate these two plant species within the CCSM Project Site were conducted during 2008 (WEST 2008a, 2008b) and no occurrences or suitable habitat were identified. Additional survey efforts were completed during 2012 and 2013 site-specific surveys of the Phase I Wind Turbine Development Site. No ESA-listed plants or their suitable habitat were located during the site-specific surveys (Appendix K, Appendix O).

8.10.6.2 BLM Sensitive Species

Surveys for sensitive species plants were completed throughout the Phase I Wind Turbine Development Site in 2013 and 2014. No BLM sensitive species plants were located (Appendix O). A review of BLM and WYNDD plant records identify that only persistent sepal yellowcress (*Rorippa calycina*) has been documented within the immediate vicinity of the CCSM Project Area.

8.11 Cultural Resources

A Class I file search and a Class III cultural resource inventory were completed for the Phase I Wind Turbine Development in 2013 and 2014. The intent of these efforts was to identify and assess the cultural resources that occur within the Phase I Wind Turbine Development Site.

The Class I review, which was conducted through the Wyoming Cultural Resources Office and BLM RFO, identified all previously conducted cultural resources investigations and previously recorded cultural resources the Phase I Wind Turbine Development Site. A total of 141 cultural resources investigations have been previously conducted in the files search analysis area (Kromarek et al. 2014). Previous cultural resource investigations identified a total of 431 cultural sites in the search area. Of these resources, 94 sites are located within the Phase I Wind Turbine Development Class III cultural resource inventory area. Of those 94 sites,57 fall within the Phase I Wind Turbine Development Site; 50 were not eligible for inclusion on the National Register of Historic Places (NRHP), seven (7) were eligible for NRHP nomination, including three (3) non-contributing portions. The 57 sites that were previously recorded within the Phase I Wind Turbine Development Site include:

- 13 prehistoric sites,
- 20 historic sites, and
- 24 multicomponent sites consisting of both prehistoric and historic components.

The Class III inventory of the Phase I Wind Turbine Development Site was completed in 2013 and 2014. Results of the Phase I Wind Turbine Development Class III inventory have been documented in one technical report that is pending submittal to BLM and Wyoming State Historic Preservation Office (SHPO) for review and concurrence (Kromarek et al. 2014). During the Class III inventory SWCA revisited 94 previously recorded sites and newly recorded 189 sites and 224 isolated resources. A total of 126 of those previously (n=57) and newly recorded sites (n=69) lie in the Phase I Wind Turbine Development Site. Of these sites, eight (8) sites (48CR932_193, 48CR2181, 48CR4009, 48CR9097, 48CR9163, 48CR9180, 48CR10089, and 48CR10321) are recommended eligible for NRHP nomination. The 126 sites within the Phase I Wind Turbine Development Site include intersections with multiple areas:

- 42 intersections in the activity areas
- 114 intersections in the initial disturbance areas
- 88 intersections in the long-term disturbance areas

As disclosed in the EIS, the Phase I Wind Development will result in adverse effects to historic properties. Avoidance and minimization measures for cultural resources have been incorporated into the CCSM Project as described in Appendix A. Where avoidance is not possible, sites will be mitigated in accordance with the CCSM Project Programmatic Agreement for cultural resources (BLM 2012b). Unexpected discoveries of cultural resources during construction will be handled in accordance with the CCSM Project PA.

8.12 Paleontological Resources

Paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) in which they are located. The probability of finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. The potential fossil yield classification (PFYC) system is a method of classifying geologic units based on the relative abundance of vertebrate fossils or scientifically important fossils (plants and invertebrates) and their sensitivity to adverse impacts (BLM 2009a). Geologic mapping in conjunction with the PFYC system can be used for assessing the potential for the occurrence of paleontological resources.

Geology maps indicate that the geologic units underlying the Phase I Wind Turbine Development Site include Quaternary alluvium (PFYC of 3), mixed Steele Shale/Niobrara formations (PFYC of 3 and 5, respectively), Mesa Verde Group (PFYC of 3), Steele Shale and a small parcel of Frontier, Mowry and Thermopolis Shales (PFYC of 3). Geotechnical testing was conducted at locations throughout the Phase I Wind Turbine Development Site. Results of the borings indicate that the majority of the Phase I Wind Turbine Development Site is underlain by silty, sandy, or clayey soils with a depth of 5.5-20 ft.

A pedestrian paleontological assessment of Class 5 and associated Class 3 formations on federal lands in the Phase I Wind Turbine Development Site was completed in 2013. The majority of fossils identified were evaluated as non-significant marine invertebrate fossil locations in the Niobrara formation in the Lower Miller Hill portion of the Sierra Madre WDA. One location in the Mowry and Thermopolis Shales in the Lower Miller Hill portion of the Sierra Madre WDA contained marine vertebrate and invertebrate fossils and may meet BLM's standards for significant paleontological resources set forth in IM 2009-011.

8.13 Visual Resources

Visual resources on federal lands within the Phase I Wind Turbine Development Site are managed as Visual Resource Management (VRM) Class IV; which provides for management activities that may result in major modifications to the existing character of the landscape with a high level of change. The Phase I Wind Turbine Development includes construction and operation of aboveground, at-grade, and belowground facilities including wind turbine generators; aboveground and buried electrical transmission and collection lines; electrical substations; access roads; and associated infrastructure. The EIS identified that VRM Class IV management objectives are achieved during and following construction of the CCSM Project. Construction and operation of the 500 turbines in the Phase I Wind Turbine Development would result in impacts less than those described in the BLM EIS for all 1,000 turbines.

The Phase I Wind Turbine Development incorporates the measures described in Appendix A to minimize impacts to visual resources; however, PCW is requesting an exception and/or waiver for mitigation measure VR-5 for the Phase I Wind Turbine Development only as to fencing. Mitigation measure VR-5 requires that fencing be painted Shadow Gray or a similar dark grey color. Fencing for the Phase I Wind Turbine Development is generally located far from public views; therefore, painting chain-link fencing is likely to be of little benefit to visual resources. Painting fences will also require near constant maintenance in the conditions found on-site. In addition, painting fences may cause other unanticipated adverse effects, e.g. housekeeping issues.

8.14 Waste

Waste from the construction, operations, maintenance and decommissioning of the Phase I Wind Turbine Development will be handled in accordance with the CCSM Project Waste Management Plan (Appendix P). The Phase I Wind Turbine Development is expected to generate up to 903 tons of waste during construction and negligible amounts during operations and maintenance. Waste estimates for decommissioning of the Phase I Wind Turbine Development will be developed in the decommissioning plan when recycling options are identified. Waste materials generated by the Phase I Wind Turbine Development will include municipal solid waste (trash or general supervision waste), construction debris (e.g., soil, concrete, pallets, packaging, etc.) and sanitary waste. Small amounts of used oil, waste oil, oil-contaminated materials, and hazardous waste may also be generated. Used oil, waste oil, and oil-contaminated materials will be handled in accordance with the requirements of the SPCC Plan (Appendix Q). Hazardous materials will be managed in accordance with the requirements of the hazardous material management portion of the Health and Safety Plan (section 9 and Appendix R). All sanitary waste will be handled by a licensed sanitary waste vendor.

Materials will be reused or recycled when feasible. For material that cannot be reused or recycled, PCW will store the waste at designated locations in accordance with the Waste Management Plan, SPCC Plan (as applicable), Health and Safety Plan (as applicable), and all other applicable rules and regulations until it is collected for transport to an approved disposal facility by a licensed hauler. Wastes will be segregated by type and materials that will be recycled will be stored separately.

All materials and debris associated with the Phase I Wind Turbine Development will be removed and properly recycled or disposed of at offsite facilities; waste will not be disposed of onsite.

9. Health and Safety

PCW will implement a health and safety program for the CCSM Project in accordance with the Health and Safety Plan (Appendix R) and all applicable rules and regulations. The Health and Safety Plan developed by PCW applies to all stages of the CCSM Project, including the development, construction, operations, maintenance, and decommissioning, and applies to all PCW employees working on the CCSM Project Site.

PCW also requires that the general contractor or operating entity for the CCSM Project provide a site safety policy and site health and safety plan that will be applicable to all work on the CCSM Project Site. All personnel on the CCSM Project Site (general contractor, subcontractor, vendor, PCW, and BLM) must adhere to the site health and safety plan. The site health and safety plan will, at a minimum, address the following topics:

- Site evaluation and pre-work planning
- Blasting
- Electrical safety (including lock out/tag out)
- Fire prevention
- Public access control and interaction (including work in areas with public access)
- Drug and alcohol policy and testing
- Weapons policy and hunting restrictions
- Onsite speed limits
- Fall protection
- Suspended loads
- Wildlife and livestock interactions
- Emergency response plan
- Security
- Required levels of Personal Protective Equipment (PPE)
- Severe weather
- Work permits and notifications
- Night work
- Safety briefing requirements
- Hazardous materials
- Training

In addition to adhering to the site health and safety plan, all contractors and entities working on the CCSM Project are responsible for developing a health and safety plan that is specific to their particular scope of work and that meets all applicable legal and regulatory requirements.

PCW has also prepared for the possibility of fuel and oil spills from the Phase I Wind Turbine Development with a SPCC Plan (Appendix Q). The SPCC Plan includes measures that will be implemented to avoid, minimize, and mitigate potential oil spills. This plan establishes emergency response procedures, lines of communications, and responsibilities. Although hazardous spills are not anticipated during project activities, the SPCC Plan provides the protocols and control measures that will be adhered to in the event of a spill.

10. References

Bureau of Land Management (BLM). 2008. Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management Rawlins Field Office, Rawlins, Wyoming. Prepared by the U.S. Department of the Interior, Bureau of Land Management Rawlins Field Office. Internet website: http://www.blm.gov/rmp/wy/rawlins/documents.html. Accessed December 8, 2008.

Bureau of Land Management (BLM). 2008a. Wind Energy Development Policy. Instruction Memorandum No 2009-043. United States Department of the Interior, Bureau of Land Management, Washington, D.C. December 19, 2008.

Bureau of Land Management (BLM). 2009. Wyoming Reclamation Policy. Cheyenne, Wyoming: U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office. Instruction Memorandum No. WY-2009-022. Available online at http://www.blm.gov/pgdata/etc/medialib/blm/wy/resources/efoia/IMs/2009.Par.54664.File.dat/wy2009-22.pdf. Accessed September 2011.

Bureau of Land Management (BLM). 2009a. Potential fossil Yield Classification System - Update to Handbook H-8270-1 General Procedural Guidance for Paleontological Resource Management, IM 2008-2009. United States Department of the Interior, Bureau of Land Management.

Bureau of Land Management (BLM). 2010. BLM Wyoming Sensitive Species Policy and List. March 31, 2010.

Bureau of Land Management (BLM). 2012a. Chokecherry and Sierra Madre Wind Energy Project Final Environmental Impact Statement (Volume II). Rawlins Field Office, Carbon County, Wyoming. June 2012.

Bureau of Land Management (BLM). 2012b. Record of Decision for the Chokecherry and Sierra Madre Wind Energy Project and Approved Visual Resource Management Plan Amendment on Public Lands Administered by the Bureau of Land Management Rawlins Field Office, Carbon County, Wyoming. October 2012.

Bureau of Land Management (BLM). 2013. Draft Land Use Plan Amendment and Draft Environmental Impact Statement for the Casper, Kemmerer, Newcastle, Pinedale, Rawlins, and Rock Springs Field Offices and Bridger-Teton and Medicine Bow National Forests and Thunder Basin National Grassland for Public Lands Administered by the Bureau of Land Management Wyoming State Office and National Forest System Lands Administered by the Medicine Bow and Bridger-Teton National Forests and Thunder Basin National Grassland. December 2013. BLM/WY/PL-14/006+1110.

Bureau of Land Management (BLM). 2014. Rangeland Administration System. Bureau of Land Management. Available at: http://www.blm.gov/ras/. Accessed November 2014.

Bureau of Land Management (BLM). 2014a. Letter of recognition to Aaron Bricker, Overland Trail Cattle Company, from Dennis Carpenter, BLM Rawlins Field Office Manager. Letter 4000 (WYD03), February 2014.

Fugro Consultants, Inc. (FUGRO). 2013. Geotechnical Data Report 2012 Phase I Haul Road Geotechnical Investigation CCSM Wind Energy Project. Carbon County, Wyoming. Report Number 04.30121094-1. Fugro Consultants Incorporated. 2013.

Griscom, H.R., and D.A. Keinath. 2010. Wyoming pocket gopher habitat and radio telemetry: final project report. Report prepared for the U.S. Department of the Interior Bureau of Land Management by the Wyoming Natural Diversity Database – University of Wyoming, Laramie, Wyoming.

Hanni, D. J., C. M. White, J. A. Blakesley, G. J. Levandoski, and J. J. Birek. 2010. Field protocol for spatially-balanced sampling of landbird populations. Unpublished report. Rocky Mountain Bird Observatory, Brighton, CO. 28 pp. http://www.rmbo.org/public/monitoring/.

Howard, J.L. 1996. Populus tremuloides in Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at http://www.feis-crs.org/beta/. Accessed February 2014.

Kromarek V., Baer S., Zietz V., Burkard J., Witt T., Driver C., Burnett P., Phillips S., Retter M., Kennedy J., Crumbley N. 2014. Class III Cultural Resource Inventory of the Chokecherry and Sierra Madre Wind Energy Project, Site-Specific Plan of Development 4: Phase I Wind Turbine Development, Carbon County, Wyoming. Prepared for the Power Company of Wyoming, by SWCA Environmental Consultants, Broomfield, Colorado.

NatureServe. 2014. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available online at http://www.natureserve.org/explorer. Accessed December 2013.

Power Company of Wyoming (PCW). 2012. Plan of Development for the Chokecherry and Sierra Madre Wind Energy Project, as amended August 30, 2012. August 2012.

Power Company of Wyoming (PCW). 2014a. Site-Specific Plan of Development for the Phase I Wind Turbine Development. March 2014.

Power Company of Wyoming (PCW). 2014b. Site-Specific Plan of Development for the West Sinclair Rail Facility. March 2014.

Power Company of Wyoming (PCW). 2014c. Site-Specific Plan of Development for the Road Rock Quarry. March 2014.

Simonin, K.A. 2001. Atriplex confertifolia. in Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at http://www.feis-crs.org/beta/. Accessed February 2014.

Terracon Consultants, Inc. 2012. Geotechnical Engineering Report, Chokecherry & Sierra Madre Wind Energy Project, Various Locations, Carbon County, Wyoming. May 2, 2012.

U.S. Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. Department of the Interior, U.S. Fish and Wildlife Service, Washington D.C.

U.S. Fish and Wildlife Service (USFWS). 2013. U.S. Fish and Wildlife Service Critical Habitat Portal. Internet website: http://ecos.fws.gov/crithab/. Accessed July 3, 2013.

U.S. Fish and Wildlife Service (USFWS). 2013a. Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy, Version 2. Department of the Interior, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Washington D.C.

Western EcoSystems Technology, Inc. (WEST). 2008a. Rare Plant Surveys for Chokecherry and Sierra Madre Wind Resource Areas. Carbon County, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2008b. Threatened and Endangered Species Issues for the Chokecherry and Sierra Madre Wind Resource Areas. Carbon County, Wyoming.

Wyoming Game and Fish Department (WGFD). 2008. Stream Lake Database data request results prepared for Western EcoSystems Technologies, Inc. January 8, 2009.

Wyoming Game and Fish Department (WGFD). 2010. Wyoming State Wildlife Action Plan. Wyoming Game and Fish Department, Cheyenne, WY.

Wyoming Game and Fish Department (WGFD). 2013. Wyoming Interagency Spatial Database & Online Management System (WISDOM), version 1.0. Available online at: http://wisdom.wygisc.org/. Accessed June 2013.

Wyoming Natural Diversity Database (WYNDD). 2014. Available online at http://www.uwyo.edu/wyndd.