APPENDIX C

Biological Assessment

Report

Appendix C to the COB Energy Facility EIS

Biological Assessment for the COB Energy Facility

Prepared for

U.S. Fish and Wildlife Service

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Acronyms

AC	alternating current
BA	biological assessment
BFD	bird flight diverter
bgs	below the ground surface
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
Btu/kWh	British thermal units per kilowatt-hour
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COPEC	chemicals of potential ecological concern
CTG	combustion turbine generator
dBA	decibel (A-weighted)
EFSC	Energy Facility Siting Council
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ESA	Endangered Species Act
FCRTS	Federal Columbia River Transmission System
GE	General Electric
gpm	gallons per minute
HDPE	high-density polyethylene
HHV	high heating value
HRSG	heat recovery steam generator
kV	kilovolt
MG	million gallon
mg/L	milligrams per liter
MW	megawatt

NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
NWPPC	Northwest Power Planning Council
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
PERC	Peoples Energy Resource Corporation
PVC	polyvinyl chloride
RO	reverse osmosis
ROW	right-of-way
SCA	site certificate application
STG	steam turbine generator
TDS	total dissolved solids
USFWS	U.S. Fish and Wildlife Service
WECC	Western Electricity Coordinating Council
WPCF	water pollution control facility
WWTP	wastewater treatment plant

SECTION 1

Introduction

This section provides an overview of the biological assessment (BA) prepared for the proposed COB Energy Facility. The purpose of the BA is reviewed; terminology used throughout this document is defined; species list are identified; critical habitat is discussed; a list of consultations held to date is provided; and the current federal and state management direction for the proposed project is summarized.

1.1 Purpose

The purpose of this BA is to determine to what extent the proposed COB Energy Facility may affect any of the threatened, endangered, proposed, or sensitive species listed in Section 1.2. This BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 (c)), and follows the standards established in the National Environmental Policy Act (NEPA). Information necessary to initiate formal consultation as required by 50 Code of Federal Regulations (CFR) 402.14(c) is provided.

This BA provides the best available scientific and commercial data for threatened, endangered, proposed, or sensitive species and critical habitat listed in Sections 1.2 and 1.3. The Bonneville Power Administration (BPA) is the lead agency to conduct an environmental analysis pursuant to NEPA and the Bureau of Land Management (BLM) is a cooperating agency.

The following terms are used in this BA:

- The power generation equipment and other onsite facilities are referred to collectively as the proposed Energy Facility or proposed project.
- Development of the proposed Energy Facility is referred to as the proposed action.
- The physical location of the Energy Facility is referred to as the proposed Energy Facility site.
- The Energy Facility site and related or supporting facilities (e.g., electric transmission line, water supply well system, water supply pipeline, and natural gas pipeline) are referred to as the Facility.
- The site certification applicant, COB Energy Facility, LLC, is referred to as the project proponent. The project proponent is a subsidiary of Peoples Energy Resource Corporation (PERC).

1.2 List of Threatened, Endangered, and Candidate Species Potentially Affected by the Proposed Project

Federally listed species considered in this BA include:

- Applegate's milk-vetch (*Astragalus applegatei*) E
- Bald eagle (*Haliaeetus leucocephalus*) T
- Shortnose sucker (*Chasmistes brevirostris*) E
- Lost River sucker (*Deltistes luxatus*) E

Any special-status species whose habitat(s) or known distribution is present within the COB Energy Facility project area was evaluated for potential impacts from construction, operation, and maintenance activities. The following describes the occurrence of these species in the project area:

- There are no reported occurrences or historical records of Applegate's milk-vetch in the vicinity of the project area, no plants were identified during biological surveys, and the Facility would have no effect on Applegate's milk-vetch.
- The bald eagle is known to occur in the project area and suitable nesting habitat was identified within the isolated stand of ponderosa pine habitat along the southern portion of the electric transmission line easement; however, no nests were observed.
- The Energy Facility would be designed to be low discharge. Therefore, no process wastewater would be discharged to surface water or irrigation canals. No cumulative affects are expected to occur to the shortnose and Lost River suckers as a result of construction and operation of the Facility.

State-listed species, Species of Concern (state and federal), and other special-status species that were included on the United States Fish and Wildlife Service (USFWS), the Oregon Department of Fish and Wildlife (ODFW), BLM, and the Oregon Natural Heritage Program (ONHP) lists are addressed in a site certificate application submitted to the Oregon Energy Facility Siting Council (EFSC) on September 5, 2002, and are not evaluated further in this BA.

1.3 Critical Habitat

No critical habitat has been designated for any of the listed species evaluated in this document. Therefore, no critical habitat would be affected by the project. Critical habitat was proposed by USFWS for the shortnose sucker and the Lost River sucker on December 1, 1994 (Federal Register Vol. 59, No. 230). The proposed units near the project area include Gerber Reservoir, located approximately 10 miles to the east, and Tule Lake, located approximately 18 miles to the south, as well as Upper Klamath Lake and the Sprague River, which are located approximately 22 miles west and 20 miles north of the proposed project area, respectively.

1.4 Consultation to Date

Exchanges in communication that have occurred since the fall of 2001 are as follows:

- October 23, 2001—A preliminary (informal) list of threatened, endangered, proposed, and candidate species that may occur in Klamath County, Oregon, was obtained from the Endangered Species division of USFWS.
- December 4, 2001—A formal list of threatened, endangered, proposed, and candidate species that may occur in Klamath County, Oregon, was obtained from the Endangered Species division of the U.S. Fish and Wildlife Service.
- April 5, 2002—Information on rare, threatened, and endangered plant and animal records in the vicinity of the proposed project were obtained from the ONHP.
- April 22, 2002—Mr. Robert Wooley, botanist with the Fremont National Forest, was consulted regarding special-status plants potentially occurring in the project area.
- April 30, 2002—A list of special-status plant species was obtained from BLM's Klamath Falls Resource Area.
- June 5, 2002—Ms. Gail McEwen of ODFW was consulted regarding ODFW habitat classifications and winter mule deer habitat in the project area.
- July 26, 2002—A meeting was held with the Oregon Department of Energy (ODOE) at the Klamath County Planning Department. Representatives from state and federal resources agencies present at this meeting included Leonard LeCaptain (USFWS), Chris Carey (ODFW), and Tom Collom (ODFW). At this meeting the project was introduced to USFWS and ODFW to initiate informal consultation and identify preliminary issues related to wildlife and vegetation.
- August 1, 2002—A site visit was conducted with Leonard LeCaptain (USFWS) and Chris Carey (ODFW) to provide an overview of the project area and a discussion of potential habitat and wildlife issues. Concerns expressed at this meeting were focused on minimizing adverse affects to bald eagles and the ponderosa pine habitat. No formal resolution was reached regarding Bald Eagles. Mr. LeCaptain said that USFWS would need to be further consulted on this issue under Section 7 of the Endangered Species Act. If an evaporation pond is the selected alternative for process wastewater disposal, the agencies recommended covering the evaporation pond with netting to exclude wildlife.
- August 1, 2002—Copies of the COB Energy Facility Notice of Intent (dated December 3, 2001) and an Addendum to the Notice of Intent (dated May 10, 2002) were provided to Leonard LeCaptain (USFWS).
- August 6, 2002—Mr. Gale Sitter from the Bureau of Land Management's Klamath Falls Resource District was contacted regarding habitat mitigation and revegetation plantings in Klamath County, Oregon.
- August 8, 2002—Copies of water quality data obtained from the Babson well in January 2002, were provided to Leonard LeCaptain (USFWS).

- September 18, 2002—Richard Crowe (CH2M HILL) contacted Leonard LeCaptain (USFWS) and Chris Carey (ODFW) regarding the observation of fish in the irrigation canal that was receiving water from the Babson well pump test.
- September 24, 2002—Leonard LeCaptain (USFWS) met with Greg White, a fisheries biologist with CH2M HILL, to investigate fish observed in the irrigation canal receiving discharge from the pump test and observe the shutdown of the pump test. The fish were determined to be red side shiners, a species in the minnow family.
- December 3, 2002—Additional information on the distribution and potential for occurrence of special-status fish species was provided by Leonard LeCaptain (USFWS) and Stewart Reid (USFWS).
- January 15, 2003—Russell Huddleston (CH2M HILL) conducted a site visit with Tom Collom (ODFW), Gale Sitter (BLM), and Rob Roninger (BLM). The purpose of the site visit was to provide an overview of the project area, as well as the habitats and potential wildlife issues. Concerns expressed at this meeting were focused on habitat mitigation for listed species.
- March 5, 2003—Robert A. Trotta (PERC) provided Leonard LeCaptain (USFWS) with a letter prepared by Phil Brown and Ken Trotman of CH2M HILL dated March 5, 2003, and titled *Impacts of Babson Well Deep Aquifer Pumping on Surface Water*. The purpose of the CH2M HILL letter was to provide comments and clarification regarding a December 23, 2002, letter from Marshall Gannett of the U.S. Geological Survey (USGS) to Ron Larson (USFWS). The CH2M HILL letter states that no data gathered from the monitoring well network indicate that the deep aquifer withdrawals would impact groundwater levels in the shallow aquifer, or flows at Bonanza Big Springs and the Lost River.
- May 9, 2003—A draft BA for the COB Energy Facility was submitted to Leonard LeCaptain (USFWS) for review and comment.
- May 29, 2003—Leonard LeCaptain (USFWS) provided written comments on the draft BA.
- June 11, 2003—Robert A. Trotta (PERC) and Mark Bricker (CH2M HILL) met with Leonard LeCaptain (USFWS) to discuss comments on the draft BA. In addition Robert A. Trotta (PERC) informed Leonard LeCaptain (USFWS) that the Energy Facility would switch to air cooling from wet cooling, reducing water requirements by 97 percent.

1.5 Current Management Direction

1.5.1 Bonneville Power Administration

NEPA requires federal agencies to consider environmental values in planning and decision making processes. BPA works closely with other agencies to develop comprehensive and coordinated approaches to protect and rebuild species populations that have been listed under the ESA. BPA is committed to working towards regional solutions based on sound biology and currently provides funding for more than 500 fish and wildlife projects a year that range from improvements to rearing and spawning habitats to study of fish diseases.

BPA also has specific duties regarding fish and wildlife under the ESA:

- BPA must avoid jeopardizing listed species.
- BPA must comply with incidental take statements.
- BPA must use its authorities to conserve listed species.

Electricity generated by the proposed Energy Facility would enter the regional grid at BPA's Captain Jack Substation. Providing this connection triggers the requirement for BPA to conduct an environmental analysis pursuant to NEPA. BPA is the lead agency for NEPA compliance review.

1.5.2 Bureau of Land Management

BLM has established a management plan for fish and wildlife which includes proactive management of special-status plant and animal species (BLM, 2000). BLM works closely with other federal and state agencies to achieve conservation goals for listed endangered, threatened, proposed, candidate and other special-status species. In addition, BLM may establish a list of "Bureau Sensitive" species which would be managed similarly to other designated sensitive species. BLM has a responsibility to protect, manage, and conserve any sensitive species and their habitats such that any BLM action would not significantly affect a species status.

The interconnection from the proposed Energy Facility to the Captain Jack Substation requires a 7.2-mile electric transmission line. The line would cross some federal lands. BLM must decide whether to grant the necessary rights-of-way for the electric transmission line. This action triggers NEPA requirements for BLM. BLM is a cooperating agency for the NEPA compliance review.

1.5.3 Oregon Department of Fish and Wildlife

The mission of ODFW is to protect and enhance Oregon's fish and wildlife and their habitats under the ESA. ODFW has established a habitat classification system that ranks habitats according to six categories based on their relative distribution, importance to fish and wildlife, and mitigation potential. Each ODFW habitat category is associated with specific mitigation goals and standards.

SECTION 2

Description of Proposed Action

This section provides a detailed description of the proposed action.

2.1 History

Recent national and regional forecasts project increasing consumption of electrical energy to continue into the foreseeable future. This increased consumption requires development of new generation facilities to satisfy the increasing demand, as documented in the following citations:

- The Energy Information Administration, a statistical agency of the U.S. Department of Energy, states in the *Annual Energy Outlook 2003 with Projections to 2025* (January 2003), that total electricity demand is projected to grow by 1.9 percent per year from 2001 through 2020 and 1.8 percent per year from 2001 to 2025.
- The Western Electricity Coordinating Council (WECC) forecasts electricity demand in the western United States. In the *10-Year Coordinated Plan Summary 2002-2011* (September 2002), the WECC states that from 2001 through 2011, Northwest Power Pool Area peak demand and annual energy requirements are projected to grow at respective annual compound rates of 2.5 percent and 1.9 percent.
- The Northwest Power Planning Council (NWPPC) in the *Draft Forecast of Electricity Demand for the 5th Pacific Northwest Conservation and Electric Power Plan* (August 2002) states, "Total consumption of electricity is forecast to grow from 20,080 average megawatts in 2000 to 25,423 average megawatts by 2025, an average yearly rate of growth of less than one percent per year."

Generation resources require interconnection with a high-voltage electrical transmission system for delivery to purchasing retail utilities. BPA owns and operates the Federal Columbia River Transmission System (FCRTS), comprising more than three-fourths of the high-voltage transmission grid in the Pacific Northwest, including extra-regional transmission facilities. BPA operates the FCRTS, in part, to integrate and transmit electric power from existing and new federal or nonfederal generating units.

An environmental impact statement (EIS) is currently being prepared to provide BPA and BLM with the environmental information they need to determine whether to allow construction of an electric transmission line on public land and a connection of the Energy Facility to the regional power grid at BPA's Captain Jack Substation. There are no other issues to be resolved. In Oregon, the environmental review is conducted through the state's energy facility siting procedures. The project proponent prepared and submitted a site certificate application for the proposed project on September 5, 2002. The site certificate application was determined completed by EFSC on April 30, 2003. Amendment No. 1 to the site certification application was filed on July 25, 2003, to switch the Energy Facility to air cooling from wet cooling. The focus of this BA is specifically on listed threatened and endangered species that may be affected by the proposed project.

2.2 Facility Description

The project proponent proposes to construct a natural gas-fired, combined-cycle electric generating plant near Bonanza, Oregon (Figure 2-1). The Energy Facility would have a nominal generation capacity of 1,160 megawatts (MW). Electric power from the plant would enter the regional grid at BPA's Captain Jack Substation, located approximately 7.2 miles south of the Energy Facility Site (Figure 2-2). Related or supporting facilities include a 4.1-mile natural gas pipeline, a 2.8-mile water supply pipeline, a 7.2-mile electric transmission line, and a water supply well system that would consist of one existing, reconstructed well and two additional water supply wells.

2.2.1 Process Wastewater Management

Process wastewater from the Energy Facility would be managed by one of three alternatives:

- Beneficial use of the water for irrigated pasture
- Evaporation in an onsite, lined evaporation pond
- Storage and hauling to a wastewater treatment plant (WWTP) for offsite disposal

2.2.2 One- or Two-Phase Combined-Cycle Operation

The project description assumes that the Energy Facility would be constructed in one phase. However, based on conditions of the electric power market after EFSC's approval of the site certificate application (SCA), the project proponent may decide to construct the Energy Facility in two phases. One- and two-phase descriptions are as follows:

- One Phase: If the Energy Facility is constructed in one phase, it would consist of two blocks of a two-on-one configuration in combined-cycle operation as described in the original SCA. A block would consist of two General Electric (GE) model 7 FA (or equivalent) combustion turbine generators (CTGs), two heat recovery steam generators (HRSGs), and one steam turbine generator (STG). The nominal generating capacity at average annual conditions would be approximately 1,160 MW. The heat rate on a higher heating value basis (HHV) would be approximately 7,391 British thermal units per kilowatt-hour (Btu/kWh) when supplemental duct firing is used and 6,842 Btu/kWh without supplemental duct firing.

- Two Phases: If the Energy Facility is constructed in two phases, each phase would be a combined-cycle operation consisting of a single block of a two-on-one configuration. Each phase would have a nominal generating capacity of 580 MW at average annual conditions. The base load capacity would be approximately 450 MW and supplemental duct firing would add up to 130 MW at average annual conditions for each 580-MW phase. For the first 580-MW phase, the heat rate on an HHV would be approximately 7,391 British Btu/kWh when supplemental duct firing is used and 6,842 Btu/kWh without supplemental duct firing.

Unless otherwise noted, references to acres and values represent construction of the entire 1,160-MW Energy Facility.

2.2.3 Facility Location

The proposed Energy Facility site is located 20 miles east of Klamath Falls, Oregon, and 3 miles south of Bonanza, Oregon, on the east side of West Langell Valley Road No. 520 in Klamath County. Access to the site would be from Langell Valley Road No. 520 (see Figures 2-1 and 2-2). The Energy Facility site is located in Sections 23, 25, and 26 of Township 39 South, Range 11 East and would be constructed primarily in fallow agricultural land. Of the approximately 2,700 acres the project proponent has under option, approximately 200 acres are for easement purposes, and approximately 2,500 acres constitute land that would be purchased in fee title. The Energy Facility site itself would permanently disturb 108.7 acres during the 30-year operating life of the Energy Facility , and if the evaporation pond is selected as the wastewater management alternative, the Energy Facility site would permanently disturb 128.7 acres.

The Lost River is located approximately 2 miles north of the Energy Facility site and approximately 0.4 mile east of the water supply well system. Bryant Mountain is located approximately 1 mile south of the Energy Facility site and approximately 1 mile east of the new electric transmission line route.

2.2.4 Permanent Facility Components

The principal components of the proposed action are listed here with more detailed descriptions in Section 2.2.7:

- A new 1,160-MW air-cooled, natural gas-fired combined-cycle electric power generation plant on 50.6 acres of land
- A 31-acre irrigated pasture area
- A designated process wastewater management alternative
  - If a lined evaporation pond is the selected process wastewater management alternative, it would permanently impact 20 acres.
  - If the selected wastewater disposal alternative is either trucking offsite or land application, two 5-million-gallon (MG) wastewater tanks would be constructed on the Energy Facility site.
- A 3.0-MG raw water storage tank on the Energy Facility site
- A new 7.2-mile, 500-kilovolt (kV) electric transmission line to deliver electricity from the proposed Energy Facility to the Captain Jack Substation; the transmission towers and access roads would disturb 57.3 acres of land
- A 0.3-acre area for a water supply well system that would consist of a reconstructed well and two additional water supply wells
- A 1.5-acre stormwater pond and a 4.7-acre stormwater infiltration basin

Table 2-1 summarizes the acreage of habitats permanently affected by feature during the 30-year operating life of the Energy Facility.

2.2.5 Temporary Facility Components

In addition to the habitats permanently affected by feature during the 30-year operating life of the Energy Facility, the following habitats would be temporarily affected during construction:

- A 71.0-acre area for temporary construction parking and laydown (does not include a 6.2-acre laydown and storage area located with the Energy Facility)
- A 1.0-acre area for temporary construction parking and laydown for the water supply well system
- A 2.8-mile water supply pipeline to deliver water from the water supply well system to the raw water storage tank (3.0 MG) on the Energy Facility site; the temporary construction easement would be 19.4 acres
- A new 4.1-mile natural gas pipeline to deliver natural gas to the proposed Energy Facility; the temporary construction easement would be 43.8 acres
- A series of temporary staging areas totaling 7.6 acres that would be used for construction of the electric transmission line

2.2.6 Protection and Mitigation Measures

Protection and mitigation measures include:

- Creation and enhancement of an approximately 236-acre mitigation area that would be enclosed with wildlife-friendly fencing and include water troughs for wildlife
- Installation of bird flight diverters (BFDs) on the new 500-kV electric transmission line to reduce collisions
- Predisturbance surveys for nesting birds and other special-status species, salvage and relocation by biological monitor of individual wildlife in construction impact areas, worker environmental awareness training, and onsite biological monitoring in sensitive areas
- Preservation or creation of snags at several locations along the route of the new electric transmission line to provide habitat for cavity nesting species
- Restoration and enhancement of natural habitats in temporarily disturbed areas in accordance with a Habitat Mitigation and Natural Area Revegetation Plan (Appendix A, a modified version of Attachment P-1 to Exhibit P of the EFSC site certificate application), developed in consultation with USFWS, ODFW, and BLM

This Habitat Mitigation and Natural Area Revegetation Plan offsets the permanent disturbance during the operating life of the Energy Facility and also provides wildlife habitat enhancements. At Facility retirement, the project proponent would implement a Facility Retirement and Site Restoration Plan (Exhibit W in the EFSC site certificate application) to ensure that soil in and around the Energy Facility site is returned to conditions suitable for agricultural use. The electric transmission line would be removed (i.e., the transmission towers, conductors and groundwires, and insulators) and the transmission tower footings would be removed to a depth of 5 feet. The natural gas and water supply pipelines would be capped and left in place.

2.2.7 Energy Facility Site

Each major component of the Energy Facility, including the related wastewater disposal options, are described below.

Energy Facility

Construction of the proposed Energy Facility would result in the permanent habitat disturbance of 45.9 acres during the 30-year operating life of the Energy Facility. The Energy Facility would be constructed entirely on fallow agriculture land.

Mechanics. The Energy Facility is proposed to consist of four GE model 7FA (or equivalent) CTGs with some shared balance of plant services. The CTGs would be outdoor units with thermal insulation and acoustical attenuation. Combined-cycle operation would consist of two blocks of a two-on-one configuration. The exhaust of each CTG would be coupled with a three-pressure HRSG. There would be up to four CTGs and four HRSGs. Steam from two HRSGs would expand through a single condensing steam turbine that drives a STG. Therefore, there would be two STGs. To increase steam-generating capacity, a duct burner system would be included in each HRSG.

Electrical output would be stepped up to 500 kV through generator step-up transformers. The step-up transformers would be located in an onsite switchyard.

A make-up demineralizer system would supply the demineralized water required for steam cycle make-up, CTG compressor water wash, and other high-purity water uses. The make-up demineralizer system would be designed to receive and treat raw water and the recycled or reused water. The make-up demineralizer system would consist of a reverse osmosis (RO) unit followed by a polishing demineralizer. Both systems are discussed in Exhibit O of the site certificate application.

Additional Facilities and Equipment. Other facilities include an administration/control room building, warehouse/maintenance building, parking area water treatment building, raw water and demineralized water storage tanks, stormwater pond, switchyard, septic tank/leach field, gas metering and regulation station, and air-cooled condensers.

Equipment used during construction would include light and heavy trucks, foundation piling equipment, backhoes, bulldozers, graders, cranes, air compressors, welding machines, and power hand tools. The grading plan for the Energy Facility would be a balance cut/fill; therefore, no excess material would be generated. Recyclable materials would be separated from the solid waste stream. Solid waste that cannot be recycled would be trucked to an approved disposal site.

Wastewater Management

Table 2-2 shows the constituents of the process wastewater generated by the air-cooled Energy Facility. The Energy Facility would not discharge any process wastewater directly to surface waters or irrigation canals.

The total dissolved solids (TDS) for the process wastewater would be approximately 1,203 milligrams per liter (mg/L). The principal constituents would be sulfate, silica, and sodium. The estimated process wastewater quality was based on groundwater samples from the deep aquifer (Babson well, KLAM 51920). Process water flows and process recycle rate were determined using the power cycle design water balances. The groundwater would be mixed with recycled process water in the raw water storage tank, and the combined flow would serve as the water source for the process water for the plant. The process water would be cycled through an RO filtration system and a portion would be reused. The remaining fraction would be land applied under the process wastewater management alternative by beneficial use of the water for irrigated pasture.

The constituents in the projected land application water were calculated on the basis of the parameters of the RO system operation and the chemicals added to the process water streams. Sanitary and stormwater waste streams are completely separate from the process water cycle.

For the onsite evaporation pond alternative, two types of chemicals—phosphonates (organo phosphorus) and polyacrylate polymers—would be added to the system for water treatment purposes. Phosphonate is a scale-inhibitor and polyacrylate is a dispersant. The phosphonate scale inhibitor prevents marginally soluble constituents from precipitating by increasing the solubility of these constituents. In the instance that some of the constituents do precipitate out of solution, the polyacrylate dispersant keeps the small particles of the precipitates in suspension, thereby preventing them from forming scales or fouling the RO membrane surfaces.

Process wastewater from the Energy Facility would be managed by one of three alternatives:

- Beneficial use of the water for irrigated pasture
- Evaporation in an onsite in a lined evaporation pond
- Storage and hauling to a WWTP for offsite disposal

Irrigated Pasture Beneficial Use. Process wastewater from the Energy Facility would be managed to provide beneficial use by irrigating 31 acres of pasture (approximate dimensions would be 711 feet wide by 1,900 feet long). Process wastewater would be stored in two 5-MG tanks (one 5-MG tank for each 580-MW power block) prior to pumping over to and irrigating the pasture area. The pasture area would be reduced in half if one 580-MW power block is constructed and later expanded to 31 acres if the second 580-power block is constructed.

During the winter months, the process wastewater would be stored in the tanks and applied by an irrigation system to the pasture area during the summer months. Positive irrigation demands occur from April through September. Irrigation is planned only for those months.

From October through March, precipitation more than satisfies the evapotranspiration (ET) of the pasture grasses.

Process wastewater would be supplied to the irrigation system from the 5-MG process wastewater storage tanks via a booster pump station and a buried irrigation pipeline. The booster pump station would be located adjacent to the process wastewater storage tanks within the Energy Facility footprint and would consist of a 25-horsepower (hp) centrifugal pump on a concrete pad with a starter panel and electrical service, discharge valving, and a flowmeter.

The irrigation pipeline would consist of approximately 3,770 feet of 6-inch polyvinyl chloride (PVC) pipeline buried with 3 feet of cover. The 31-acre rectangular pasture area would be irrigated using a side-roll irrigation system. The 1,900-foot-long side-roll unit would have wheels 4 to 6 feet in diameter around a 5-inch aluminum irrigation supply line. Sprinklers would be located every 40 feet along the supply line. Every 60 feet along the buried irrigation pipeline on the southern edge of the pasture area, a riser valve would be provided for hose connection to the side-roll sprinkler line. Each riser consists of a 5-inch irrigation riser valve extending 12 inches above ground with an 18-inch-by-18-inch concrete pad around the riser. A total of 11 riser valves would be located along the 711-foot southern edge of the past area, requiring 11 irrigation sets to cover the pasture area. During the peak irrigation month of July, approximately two 7-hour irrigation sets would be run each day for 5 days of the week, plus one additional set on the weekend.

The side-roll unit would be stationary during irrigation. However, after an irrigation set at each riser, the side-roll piping would be automatically drained and the system manually moved to the next riser before the next irrigation set begins. When the side-roll is moved, the drive engine must be manually started to move the irrigation line 60 feet to the next set location. Once the side-roll is advanced to the end of the field, the side-roll is then moved back to its original position to begin the cycle again.

A livestock fence would be used around the pasture area to prevent livestock in the pasture area from traveling out across the rest of the wildlife enhancement areas on the property (immediately north and west of the pasture area). A wildlife-friendly fence would be used to allow mule deer and antelope to safely enter and exit the pasture area. An approximately 100-gallon temporary watering trough would also be provided in the pasture area for livestock watering. This would be served by a 1-inch buried water line tapped off of the water supply system at the Energy Facility and would be routed and buried in the same trench as the buried irrigation pipeline.

Evaporation Pond. In the unlikely event that process wastewater management by irrigated pasture beneficial use does not function as designed, an optional backup of a 20-acre evaporation pond sized to store approximately 7 MG and lined to protect groundwater would be used to manage process wastewater. The evaporation pond alternative is a contingency only and it would not be built until such time as it is determined that process wastewater management by irrigated pasture beneficial use does not function as designed. If the need for the evaporation pond occurs, the water treatment system at the Energy Facility would be changed to incorporate a RO system to increase the cycling of the water and to reduce the quantity of wastewater to be discharged to the evaporation pond.

The evaporation pond would be designed to operate passively. A wastewater pipeline would directly route wastewater from the Energy Facility to the evaporation pond. The evaporation pond would be designed and sized to contain total suspend solids from the wastewater for the life of the Energy Facility with minimal, if any, requirement for sediment removal.

The evaporation pond would be designed to include a composite liner system for containment of the wastewater and suspend solids. Bentonite would be added to the soil at the base of the evaporation pond, mixed to a depth of approximately 12 inches, and then compacted to achieve a permeability of greater than or equal to $1x10^{-6}$ centimeters per second (cm/sec). An alternative to the bentonite-treated soil would be to use a bentomat geotextile system. The bentomat geotextile system is available with a permeability as low as $5x10^{-9}$ cm/sec. A 60-mil high-density polyethylene (HDPE) liner would be placed over the bentonite-treated soil or the bentomat geotextile system, to form the top layer of the composite liner system. The evaporation pond would be netted to prevent access by birds and surrounded by a chain-link fence to prevent wildlife access. A spray enhancement system may be used to increase evaporation.

Storing and Hauling to Wastewater Treatment Plant. If this alternative were to be selected, process wastewater would be managed by storing and hauling to a WWTP for disposal. The project proponent has contacted the two municipal WWTPs in Klamath Falls—the South Suburban Sanitary District and the City of Klamath Falls Sanitary District. The ability of these two WWTPs to accept wastewater from testing and commissioning of the Energy Facility and the wastewater from operation of the Energy Facility is presently being evaluated. According to managers at both facilities, each would be required to evaluate whether they can meet the U.S. Environmental Protection Agency (EPA) categorical standard to accept industrial waste or whether local ordinances provide for acceptance of truck-hauled wastewater. During the life of the Energy Facility, other WWTPs may be constructed or considered for management of wastewater generated at the Energy Facility. The project proponent would arrange with a trucking company to routinely haul the wastewater stored in the wastewater storage tanks at the Energy Facility to the WWTP.

Sanitary Wastewater

During operations, sanitary wastewater from restroom and shower facilities would be routed to an onsite septic tank, which would discharge to a leach field**.** Approximate flows of up to 1,500 gallons per day or about 1 gallons per minute (gpm) are expected. A permit from either Klamath County or the Oregon Department of Environmental Quality (ODEQ) would be required. The permit process requires a site evaluation to be conducted to determine whether the location of the septic field is appropriate for sewage disposal. During construction, portable toilets would be provided for onsite sewage handling and they would be pumped and cleaned regularly by a licensed contractor.

Stormwater Management

While stormwater is not considered wastewater, stormwater would be managed at the Energy Facility by a 4.7-acre infiltration basin and therefore would be covered under a Water Pollution Control Facility (WPCF) permit. Under the preferred alternative, there would be no discharge of stormwater from the Energy Facility into surface waters, stormwater drainage ditches, or irrigation canals.

Stormwater would be managed through three separate systems, including the plant drainage system, the storm sewer system, and the stormwater run-on diversion system. Figure 2-3 shows a schematic of the three separate and segregated systems designed to handle stormwater during Facility operations. The figure shows individual drainage systems as well as a breakdown of the drains connected to each system. The individual drainage systems are described in more detail below.

Plant Drains System. A dedicated plant drains system would be designed and constructed at the Energy Facility to segregate stormwater that comes in direct contact with plant components from the storm sewer system, thus preventing runoff in the plant drains system from reaching the stormwater pond or the infiltration basin. This design would be accomplished by separating the runoff from drains with the potential to come in contact with pollutants from the remainder of the storm drainage system. Drains in areas with the potential for contact with pollutants from materials used or stored at the Energy Facility would be routed to the segregated plant drains system, which would discharge to an oil/water separator. This system includes drains inside buildings and enclosures and drains from the interior of spill containment berms. The resulting oil/water separator discharge water would be routed to a wastewater collection basin and then pumped back to the raw water tank for use as process water. No stormwater collected by the segregated plant drains system would be routed to the stormwater pond or infiltration basin.

The wastewater collection basin would be a concrete sump located in an accessible location so it can be inspected without interfering with Facility operations. It would hold approximately 5,000 to 10,000 gallons.

The oil from the oil/water (O/W) separator would be contained in the oil/water separator itself. The O/W separator would include a level indicator with an alarm that would alert the operations staff when it needs to be emptied. At that point, a licensed contractor would pump the oil out and haul it offsite for proper disposal.

The dedicated plant drains system would include the following:

- Combustion turbine enclosure floor drains
- Steam turbine area foundation and floor drains
- HRSG foundation and stack floor drains
- Warehouse/maintenance building floor drains
- Administration building floor drains

Stormwater Sewer System. Stormwater that falls inside the fence line of the Energy Facility that is not routed to the plant drains system described above, would be collected in the storm sewer system. The collection of rainfall runoff in this system is limited to parking lots, roof drains, graveled areas and vegetated areas. This storm sewer system would consist of ditches, culverts, and piping as required that is routed to the stormwater pond. From the stormwater pond there are two alternatives for discharge of the stormwater. The preferred alternative is to discharge the stormwater into a 4.7-acre infiltration basin. The second alternative is to discharge the stormwater through a ditch adjacent to the Energy Facility access road and into the West Langell Valley Roadside ditch where it would eventually enter the High Line Levee Ditch and then into the Lost River. These alternatives are described in more detail below.

Stormwater Pond. The captured runoff from the Energy Facility in the storm sewer system would be conveyed to a 1.5-acre, 750,000-gallon stormwater pond, located in the southeast corner of the Energy Facility (see Figure 2-4). This stormwater pond would serve two purposes: 1) provide pretreatment of the runoff before it enters the infiltration basin, and 2) provide temporary storage should unwanted material make its way into the stormwater.

The stormwater pond would provide a wide spot in the stormwater flow path. This wide spot would reduce the flow velocity of the stormwater, allowing suspended sediment to settle out. The operating life of the infiltration basin would be increased by removing the sediment.

A ditch would be constructed from the toe of the fill for the Energy Facility over to the infiltration basin to convey stormwater in the stormwater pond to the infiltration basin. An 18-inch-diameter discharge pipe would be installed through the southern end of the dyke of the stormwater pond. The outlet would discharge into the ditch. The pipe would include a manually operated valve that would normally be closed. The 18-inch-diameter discharge pipe would drain the 2.3 acre-foot stormwater pond if it were full in approximately 5 hours.

The stormwater pond is not designed to detain a 100-year, 24-hour storm. It is able to detain only approximately 34 percent (2.3 acre-feet divided by 6.7 acre-feet). The spillway would be sized to handle the peak flow from the 100-year, 24-hour storm, which is approximately 112 cubic feet per second (cfs). The dyke of the stormwater pond would include a 2-foot-deep, concrete-lined flume directly above the discharge pipe. This flume would act as an emergency spillway for storms greater than the volume of the stormwater pond. The spillway routes stormwater overflow to the ditch that directs water into the infiltration basin. The 112-cfs peak flow occurs for less than 15 minutes and is not representative of the average flow for a 100-year storm.

Infiltration Basin Alternative (Preferred). Though not accounted for in the preliminary basin sizing, evaporation of the collected stormwater would occur during the summer months. Vegetation would be planted in the bottom of the infiltration basin to help to improve the infiltration functions and protect these surfaces from rain and wind erosion. There are three primary reasons to vegetate the basin with native grasses or other suitable vegetation:

- The #1 cause of soil erosion in Klamath County is wind on barren soil.
- The infiltration basin would be a collection basin for wind blown soil and noxious weed seeds. Although the soil may become resuspended by the wind, some seeds would germinate and overtime the basin would be vegetated by noxious weeds and require greater maintenance to remove weeds.
- Vegetation would help uptake any nutrients or potential pollutants that may be in the stormwater.

A chain-link fence would be installed around the infiltration basin to prevent debris, such as wind-blown vegetation or litter, from entering and settling on the basin bottom. The fence would also serve to prevent unauthorized personnel or wildlife from entering the basin. A gate would be installed in the fence to allow access for maintenance personnel and equipment. An access road would be constructed from the access road to the Energy Facility over to the infiltration basin (see Figure 2-4).

Runoff calculations were performed using the TR-20 hydrologic model. This model was developed by the Soil Conservation Service and the U.S. Department of Agriculture. The 100-year, 24-hour storm event was used to size the infiltration basin. This return event is consistent for the design of stormwater retention systems. The probability of a 100-year storm event to occur in any one year is one percent.

The infiltration basin would be located adjacent to the Energy Facility on Claimus series loam soil. The NRCS (Natural Resources Conservation Service) Soil Survey for Klamath County lists the saturated infiltration rate for this soil as 0.6 inch per hour (in/hr) to 2.0 in/hr. The infiltration basin was sized using the lower value of 0.6 in/hr. Using this lower infiltration value provides a conservative infiltration basin size. Table E-1.1 summarizes the preliminary infiltration basin sizing.

The primary controlling factor in sizing the infiltration basin is the surface area of the basin bottom, the depth of water storage, and one foot of freeboard. One foot of freeboard is a typical design standard for stormwater ponds. Over designing the infiltration basin reduces the chances of the water over-topping the infiltration basin should a storm, larger than the 100-year event occur or if back-to-back smaller storm events occur. Based on the over-design of the basin configuration for this project, the additional one foot of free board provides approximately 40 percent additional storage volume that could be filled by stormwater before overtopping would occur. A 48-hour drawdown period of the 100-year stormwater volume was used for sizing the infiltration basin and is consistent with the design requirements of similar functioning ponds, such as an extended dry detention pond. This draw-down period reduces the risk of stormwater overtopping the infiltration basin should back to back storm events occur. Drawdown duration would be less than 48 hours for the more frequent return storm events.

Offsite Stormwater Diversion System. Stormwater diversion ditches would be installed on the north and west sides of the Energy Facility to divert stormwater form undisturbed areas adjacent to the Energy Facility from flowing onto the Energy Facility. These diversion ditches would direct water into existing natural drainage system or into the drainage ditch along West Langell Valley Road. Runoff to the south and east of the Energy Facility would naturally drain away from the Energy Facility.

2.2.8 Related or Supporting Facilities

Related or supporting facilities include the water supply system (wells and pipeline), natural gas pipeline, electric transmission line, and temporary construction and parking laydown areas.

Water Supply System

Water would be needed by the proposed Energy Facility to generate steam for the combined-cycle operation. The water supply system would consist of water supply wells and a 2.8-mile water supply pipeline that would connect to two 1.1-MG raw water storage tanks at the Energy Facility.

Water Supply Wells. The water supply wells would consist of an existing well and two additional water supply wells located along East Langell Valley Road (Figure 2-2). The existing well, known as the Babson well, was originally drilled to depths exceeding 5,000 feet for oil and gas exploration in the 1920s and is currently open to a depth of 2,050 feet. The two additional water supply wells would also be constructed to withdraw water from this deep aquifer, which is isolated from the shallow zone aquifer and from surface water. Construction would result in temporary disturbance to 1.0 acre of pasture for parking and laydown. An additional 0.3 acre of pasture would be permanently disturbed during the 30-year operating life of the Energy Facility.

An aquifer test was performed in the summer of 2002 (CH2M HILL, 2002). The Babson well was pumped at an average rate of 6,800 gpm for approximately 30 days. An expanded observation well network (31 different locations) was used that included both shallow wells and deeper irrigation wells in Langell Valley, Yonna Valley, Swan Lake Valley, Malin, and Klamath Falls. There was a hydraulic response in two nearby wells in the observation well network attributable to a leaking well packer. This aside, the data do not indicate that the deep system is in hydraulic connection to a shallow aquifer system. A reconstructed well should eliminate the minor response observed. No hydraulic response was observed at Bonanza Big Springs.

Deep aquifer response suggests extremely high aquifer transmissivity and supply: at the end of the 30-day pumping period, water levels had recovered to the pretest static level within 5 minutes. These observations show that the roughly 294 MG withdrawn for this test were insignificant relative to the rate and volume of water available to the Babson well.

Water requirements for the Energy Facility, under annual average conditions with supplemental duct firing, would be approximately 36 gpm for one 580-MW block or 72 gpm for the 1,160-MW arrangement from the Babson well. Under maximum consumption conditions with supplemental duct firing, that rate increases to 104 gpm for one 580-MW block or 210 gpm for the 1,160-MW arrangement.

Two additional water supply wells would be installed near the Babson well. One would be located up to 50 feet northwest and the other up to 500 feet southeast of the existing Babson well. These maximum distances for well locations were included in the OWRD water right application as additional points of diversion. Each of the three wells (the Babson well and the two additional water supply wells) would be designed to produce the maximum, instantaneous rate of 210 gpm. Flexibility to pump 100 percent of the required maximum, instantaneous rate is necessary in the event that two wells are offline simultaneously because of malfunction or scheduled maintenance.

Water Supply Pipelines. Water from the well system would be pumped through a 2.8-mile, 6-inch-diameter water supply pipeline to a 1.1-MG raw water supply tank at the Energy Facility site.

The 2.8-mile water supply pipeline would be constructed within a temporary, 60-foot-wide easement on land under ownership options by the project proponent, except for portions of the route that cross Klamath County roads. The route of the water supply pipeline would cross two Klamath County roads: East Langell Valley Road and Teare County Road 1161. In addition, the water supply pipeline would cross an irrigation canal operated by the Langell

Valley Irrigation District in three locations. The crossings would be conventionally bored underneath the public roads and irrigation canal. The rest of the water supply pipeline would be constructed by open trench methods. The pipeline would be installed in a 36-inch-wide trench at a depth of about 4 feet.

Construction. In the areas where conventional bores would occur, additional temporary work space would be required on both sides of the road or irrigation canal. Excavations would be larger than in the open trench sections to provide room for workers to safely work down in the excavations. The excavations would be approximately 15 feet deep. The additional work space would be necessary to excavate a safe ditch and store the excavated soil.

Construction would result in temporary disturbance to 10.2 acres of juniper-sage scrub, 1.4 acres of agricultural fields, 6.3 acres of pasture, 0.8 acre of fallow field, and 0.7 acre of ruderal habitat for a total of 19.4 acres. There would be no permanent disturbance for the water supply pipelines because the construction easement would be restored and revegetated.

Figure 2-5 shows a typical construction configuration of the water supply pipelines. The trench would be backfilled with pipe zone material and then with native soil up to the original grade. Equipment used would include cranes, excavators, supply trucks, boom trucks, and line trucks.

Natural Gas Pipeline

A new 4.1-mile, 20-inch-diameter pipeline would be required to supply natural gas to the Energy Facility. The pipeline would connect to an existing PG&E Gas Transmission Northwest (GTN) gas transmission system at the Bonanza Compressor Station. The proposed alignment would be located along the right-of-way (ROW) of existing Klamath County roads (Figure 2-2). The project proponent would be responsible for constructing a gas measurement station to be located either at the Energy Facility site or at the PG&E GTN Bonanza Compressor Station. PG&E GTN would be responsible for the final gas interconnection (side tap installation) with its existing pipelines.

Easement options have been obtained along the pipeline alignment for a temporary 80-foot-wide construction easement needed for equipment staging and material laydown along the pipeline alignment. The easement would be immediately adjacent to and along the Klamath County ROW for Harpold County Road No. 1097 and West Langell Valley Road No. 520. The alignment of the natural gas pipeline would cross the public roads in three places. These crossings would be conventionally bored underneath the public roads. The rest of the natural gas pipeline would be constructed by open trench methods. The natural gas pipeline would be installed in a 36-inch-wide trench at a depth of about 4 feet. Additional temporary work space of 40 feet (for a total of 120 feet) would be required along the north side of West Langell Valley Road near the Energy Facility site, where the natural gas pipeline route goes through an approximate 2,200-foot section of steep topography. The extra width would be needed for soil storage when leveling the easement to create a safe working platform for workers and equipment. Construction of the natural gas pipeline would result in temporary impacts to 9.0 acres of juniper-sage scrub, 23.9 acres of agricultural field, 0.8 acre of pasture, 3.5 acres of fallow field, 3.0 acres of ruderal habitat, and 3.6 acres of developed land for a total of 43.8 acres that would be restored after construction.

Figure 2-6 shows a typical configuration of the natural gas supply pipeline construction. The trench would be backfilled with pipe zone material and then with native soil up to the original grade. Equipment used along the pipeline alignment would include light and heavy trucks, excavators, bulldozers, graders, cranes, air compressors, welding machines, and power hand tools. Some specialized boring equipment would be used to do the conventional bores under the existing roads and the irrigation canal.

Electric Transmission Line

The proposed Energy Facility would include construction of a new 7.2-mile-long, 500-kV, alternating current (AC) electric transmission line running south from the Energy Facility to an interconnection at BPA's Captain Jack Substation (Figure 2-2). The final route and configuration of the new transmission line (for example, exact number of transmission towers, transmission tower heights, and location of transmission towers) would depend on final design and engineering, geotechnical, and environmental considerations.

Transmission Towers. Approximately 38 transmission towers would be required. The transmission towers would consist of steel lattice structures assembled in sections near the transmission tower site (Figure 2-7). Typical transmission towers would range in height from 100 to 165 feet, with most towers in the 105- to 110-foot range. On average, the towers would be spaced approximately 990 feet apart, with a range from 380 to 1,500 feet to span sensitive areas. Transmission towers would rest on four concrete footings, each about 4 feet in diameter. Allowing room for access and maintenance workspace around the footings would result in a permanent footprint disturbance of approximately 60 feet by 60 feet at each transmission tower.

At nine transmission tower locations, approximately 100 feet by 150 feet of additional, permanent space would be required to ensure safety for vehicles and equipment. Footings would be placed in holes that are excavated, augured, or blasted. The design of the footings would vary based on soil properties, bedrock depth, and the soundness of the bedrock at each transmission tower site. Construction of the transmission towers would result in permanent loss during the 30-year operating life of the Energy Facility of 3.5 acres of juniper-sage scrub, 0.6 acre of sagebrush-steppe, 0.8 acre of ponderosa pine, 0.1 acre of unimproved pasture, and 0.5 acre of fallow field for a total of 5.5 acres.

Conductors and BFDs. Typically, 500-kV AC transmission lines require three sets of wires (or "conductors"). Each set is referred to as a phase, and typically consists of a pair of bundled aluminum cables. One or two "shield wires" are placed near the top of the transmission structure, above the conductors, to shield the towers from lightning strikes. To prevent electrocutions, conductor wires would be spaced further apart than the wing span of a large birds (24 feet on the vertical and 25 feet on the diagonal) (APLIC, 1996). The top groundwire would be fitted with BFDs to visually enhance the wire and subsequently deflect birds from colliding with hard to see wires. Annual monitoring of the lines would be conducted to determine if the lines are a significant impact to waterfowl and special-status birds that forage or nest in the area.

Access Roads. A permanent access road would be required for construction and to access the new electric transmission line for maintenance during operation. The access road would be designed for use by cranes, excavators, supply trucks, boom trucks, and line trucks. The access road would be surfaced with gravel. Approximately 6.6 miles of new access road would be required. The access road would be approximately 15 feet wide, and grades would be less than 15 percent. To minimize clearing, the access road would remain within the electric transmission line ROW where possible. Construction of the electric transmission line access roads would result in permanent conversion of 28.1 acres of juniper-sage scrub, 9.8 acres of sagebrush-steppe, 11.6 acres of ponderosa pine, 2.0 acres of unimproved pasture, and 0.3 acre of fallow field for a total of 51.8 acres. Where temporary roads are used, any disturbed ground would be repaired and the area would be revegetated with the appropriate native species to minimize erosion.

Vegetation Management. To minimize fire hazards for safe and uninterrupted operation of the electric transmission line, vegetation more than 10 feet tall would be cleared or trimmed within the 154-foot easement. The easement would consist of 79.5 acres of juniper-sage scrub, 22.3 acres of sagebrush-steppe, 23.7 acres of ponderosa pine, 2.1 acres of unimproved pasture, and 6.4 acres of fallow field for a total of 134.0 acres. Removal of juniper trees would provide an overall benefit to the habitat by improving understory growth of grasses and shrubs.

Clearing may include removal of vegetation or managing vegetation so that it does not grow above 10 feet in height. Considerations that influence the amount and type of clearing include vegetation species, height and growth rates, ground slope, wind and snow patterns, conductor elevation above ground, and clearance distance required between the conductors and other objects. Some form of selective vegetation removal may be required at the edge of the 154-foot easement. Leaning or diseased trees that could fall into the electric transmission line or pose a threat to reliable operation would be removed as necessary. At transmission tower sites, trees, brush, stumps, and snags would be removed, including root systems. After construction, vegetation management would be necessary, and would include controlling noxious weeds and managing growing vegetation in and adjacent to the easement. Vegetation management would consist of manual, mechanical, biological, and chemical methods.

Construction Parking and Laydown Areas

During construction, temporary parking and laydown areas would be required as follows:

- At the Energy Facility site there would be four areas for construction parking and laydown totaling 71.0 acres.
- In the water supply well area, the construction parking and laydown area would total 1.0 acre.
- Along the electric transmission line, there would be 7.6 acres of staging and construction areas.

2.2.9 Construction Schedule

Based on conditions of the electric power market after approval of the site certificate application, the project proponent may decide to construct the Facility in one phase or two phases. If the Facility is constructed in two phases, construction of the second phase may start up to 2 years after the first phase starts commercial operation.

If the Facility is constructed in one phase, construction would be expected to take 23 months. If the Facility is constructed in two phases, the first phase of construction would be expected to take approximately 18 months.

Because the conditions of the power market fluctuate and are volatile, the project proponent may choose not to start construction of the Facility until 3 years after the site certificate application is approved.

TABLE 2-1
Permanent and Temporary Disturbance by Habitat Type

Feature	Total	Juniper-Sage	Sage-Steppe	Pine	Ag Field	Pasture	Unimproved Pasture	Fallow	Ruderal	Developed	Sensitive Biological Resources Affected
Permanent Effects to Habitat During the 30-Year Operating Life of the Energy Facility Site											
Energy Facility Site	50.6							50.6			Loss of marginal upland bald eagle foraging habitat during the 30-year operating life of the Energy Facility and from temporary disturbance during construction activities. After site restoration activities, the Energy Facility would be revegetated and restored to conditions suitable for agricultural use.
Permanent Effects to Habitat for the Related or Supporting Facilities During the 30-Year Operating Life of the Energy Facility											
Alternative wastewater evaporation pond	20.0							20.0			Potential toxicity to wildlife. The evaporation pond would be netted with a 1-inch square-knotted polypropylene netting to prevent bird access. Also, the evaporation pond would be enclosed with a chain-link fence to prohibit wildlife access.
Water supply well system	0.3					0.3					Loss of marginal upland bald eagle foraging habitat during the 30-year operating life of the Energy Facility and from temporary disturbance during construction activities.
Electric transmission line towers and access roads	57.3	31.6	10.4	12.4			2.1	0.8			Potential for bald eagle collisions with new electric transmission line and loss of upland bald eagle foraging habitat. Potential for increased road kill that increases carrion forage for bald eagle. Bird flight diverters would be installed on top groundwires of new electric transmission line. Awareness training would be provided to employees responsible for using the access roads to perform maintenance and inspection.
Access road to irrigated pasture *	0.5							0.5			
Subtotal—Related or supporting facilities without evaporation pond	58.1	31.6	10.4	12.4	0.0	0.3	2.1	1.3	0.0	0.0	
Subtotal—Related or supporting facilities with evaporation pond	77.6	31.6	10.4	12.4	0.0	0.3	2.1	21.3	0.0	0.0	
Project Total—without evaporation pond	108.7	31.6	10.4	12.4	0.0	0.3	2.1	51.9	0.0	0.0	
Project Total—with evaporation pond	128.7	31.6	10.4	12.4	0.0	0.3	2.1	71.9	0.0	0.0	
Temporary Effects to Habitat Not Included in the Permanent Effects											
Temporary construction parking and laydown areas	71.0	5.4							65.6		Temporary disturbance during construction to marginal upland bald eagle foraging habitat.
Water supply well system construction parking and laydown area	1.0					1.0					Temporary disturbance during construction to marginal upland bald eagle foraging habitat.
Water supply pipeline construction easement	19.4	10.2			1.4	6.3		0.8	0.7		Temporary disturbance during construction to marginal upland bald eagle foraging habitat.
Natural gas pipeline construction easement	43.8	9.0			23.9	0.8		3.5	3.0	3.6	Temporary disturbance during construction to marginal upland bald eagle foraging habitat.
Irrigation pipeline	5.2							5.2			
Electric transmission line (additional construction and storage areas at each transmission tower)	7.6	3.6	1.8	1.6			0.3	0.3			Potential temporary disturbance to bald eagle nesting and foraging on Bryant Mountain during construction.
Total: Temporary—without evaporation pond	148.0	28.2	1.8	1.6	25.3	8.1	0.3	9.8	69.3	3.6	
Total: Temporary—with evaporation pond	148.0	28.2	1.8	1.6	25.3	8.1	0.3	9.8	69.3	3.6	
Project Total—with evaporation pond	256.7	59.8	12.2	14.0	25.3	8.4	2.4	61.7	69.3	3.6	
Project Total—without evaporation pond	276.7	59.8	12.2	14.0	25.3	8.4	2.4	81.7	69.3	3.6	
Habitat Areas Modified for Related or Supporting Facilities During the 30-Year Operating Life of the Energy Facility											
Clearing within the 154-foot electric transmission line easement (includes the transmission towers and access roads inside the easement)	134.0	79.5	22.3	23.7			2.1	6.4			Modification of upland habitat would occur when vegetation above 10 feet in height within the 154-foot easement would be cleared. Removal of juniper trees would provide an overall benefit to the habitat by improving understory growth of grasses and shrubs.

* If the evaporation pond is the selected alternative, the access road to the irrigated pasture would not be constructed.

TABLE 2-2
Process Wastewater Characteristics

Parameter	Land Application Case	Evaporation Pond Case	Units
PH	7.5-9.0	7.5-9.0	Standard units
Iron	0.14	0.68	mg/L
Copper	0.00	0.032	mg/L
Manganese	0.02	0.044	mg/L
Calcium	28.92	65.6	mg/L
Magnesium	11.74	26.6	mg/L
Sodium	20.12	52.0	mg/L
Potassium	4.22	9.57	mg/L
Boron	0.54	1.22	mg/L
Silica	71.12	183.0	mg/L
Chloride	4.14	15.7	mg/L
Nitrate as N	0.84	1.9	mg/L
Nitrite as N	0.02	0.044	mg/L
Ammonia as N	0.00	0.35	mg/L
Sulfate	6.29	269.8	mg/L
Total Alkalinity	164.12	250.0	mg/L as $CaCO_3$
Fluoride	0.20	0.44	mg/L
Phosphorous	0.05	20	mg/L
Orthophosphate as P	0.05	20	mg/L
Sulfite	1.00	25.0	mg/L
Oil and Grease	0.30	10.7	mg/L
Total Organic Content (TOC)	1.50	69.6	mg/L
TDS [1]	203	1,077	mg/L
TSS	1.00	1.0	mg/L
Phosphonates [2]	0.00	30.0	mg/L
Polyacrylate [2]	0.00	20.0	mg/L
Free Chlorine [2]	0.00	0.20	mg/L

[1] Includes treatment chemicals identified in [2].
[2] Added as treatment chemical.
mg/L = milligrams per liter.

Insert Figures 2-1 through 2-7:

2-1 Site Map

2-2 Facility Map

2-3 Stormwater Drainage Flow Schematic

2-4 Energy Facility Site Layout

2-5 Typical Water Supply Pipeline Configuration

2-6 Typical Natural Gas Pipeline Configuration

2-7 Typical Transmission Tower Structure

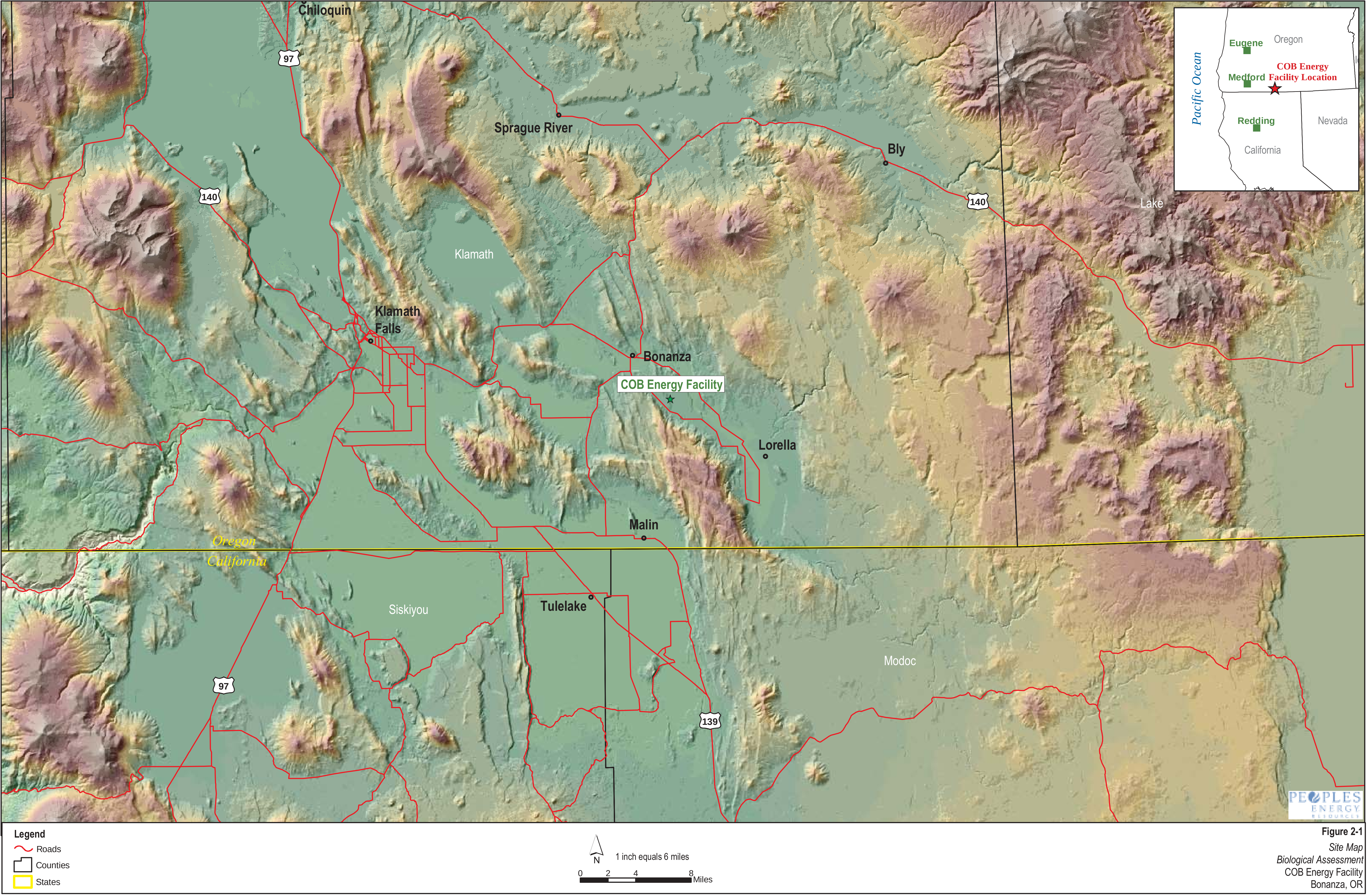

Figure 2-1
Site Map
Biological Assessment
COB Energy Facility
Bonanza, OR

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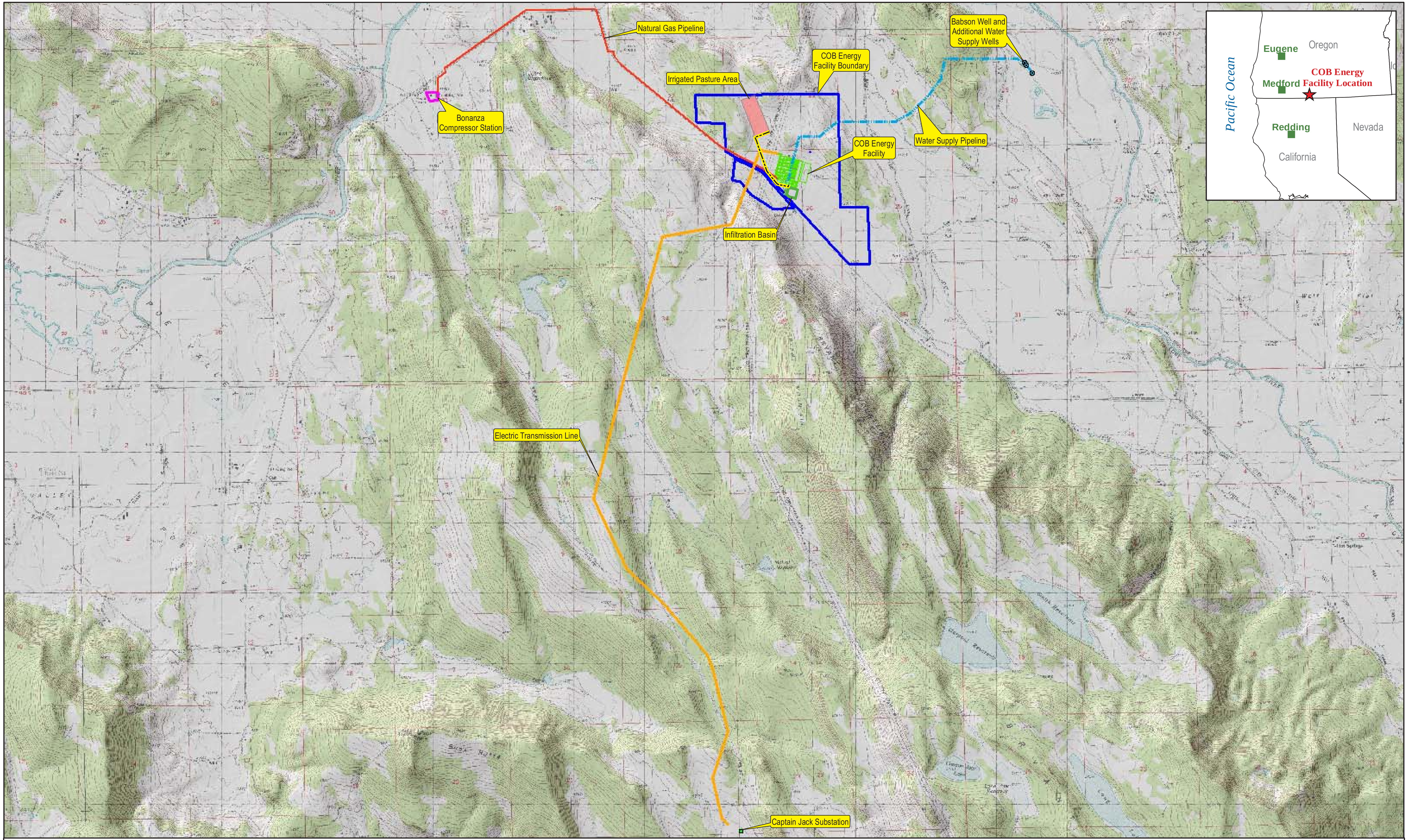

Legend

- Captain Jack Substation
- Babson Well and Additional Water Supply Wells
- COB Energy Facility Boundary
- Bonanza Compressor Station
- COB Energy Facility
- Electric Transmission Line
- Natural Gas Pipeline
- Water Supply Pipeline
- Irrigation Pipeline
- Infiltration Basin
- Irrigated Pasture Area

N

1 inch equals 4,000 feet

0 2,000 4,000 8,000 Feet

Figure 2-2
Facility Map
Biological Assessment
COB Energy Facility
Bonanza, OR

PEOPLES ENERGY

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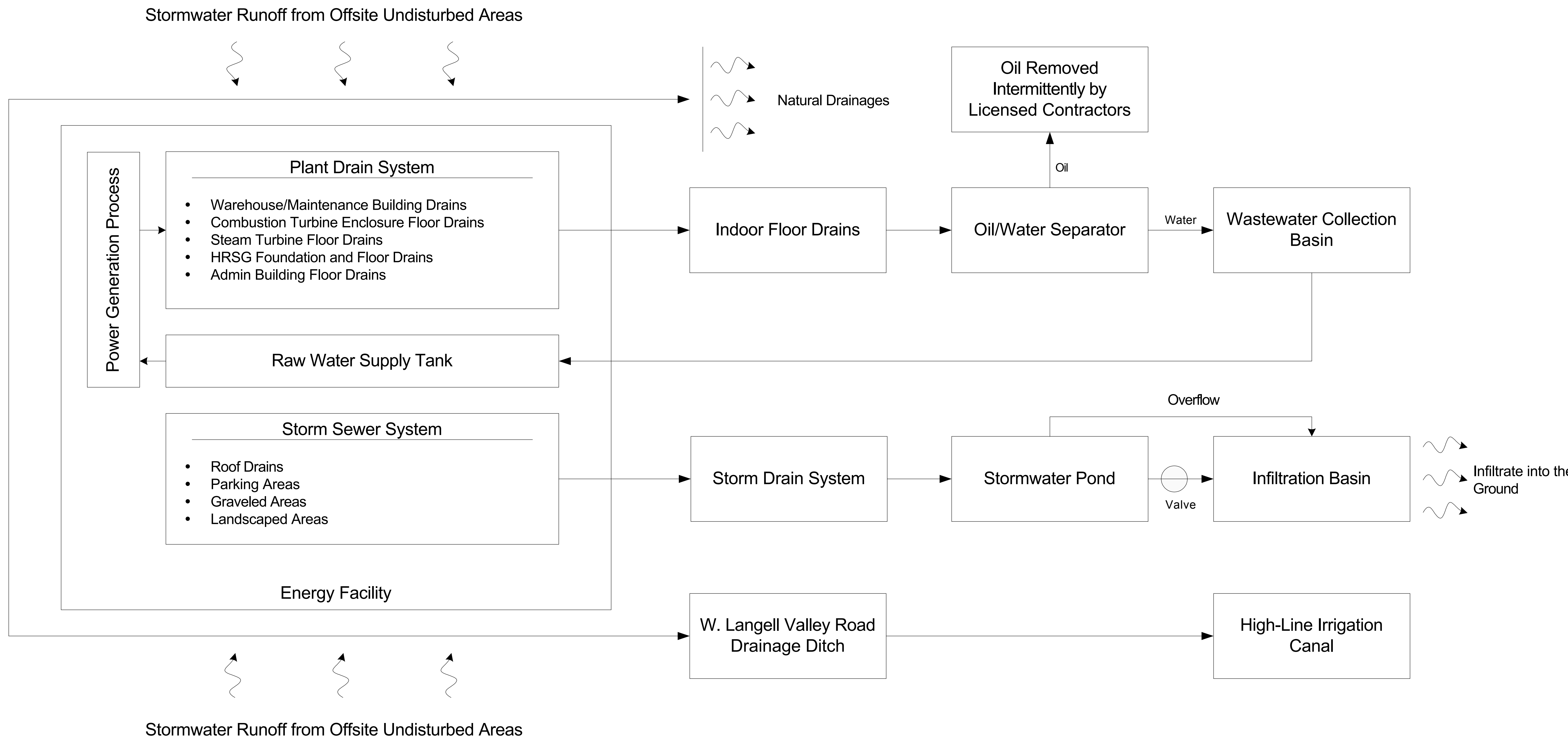

FIGURE 2-3
Stormwater Drainage Flow Schematic
Biological Assessment
COB Energy Facility
Bonanza, OR

PEOPLES ENERGY Resources

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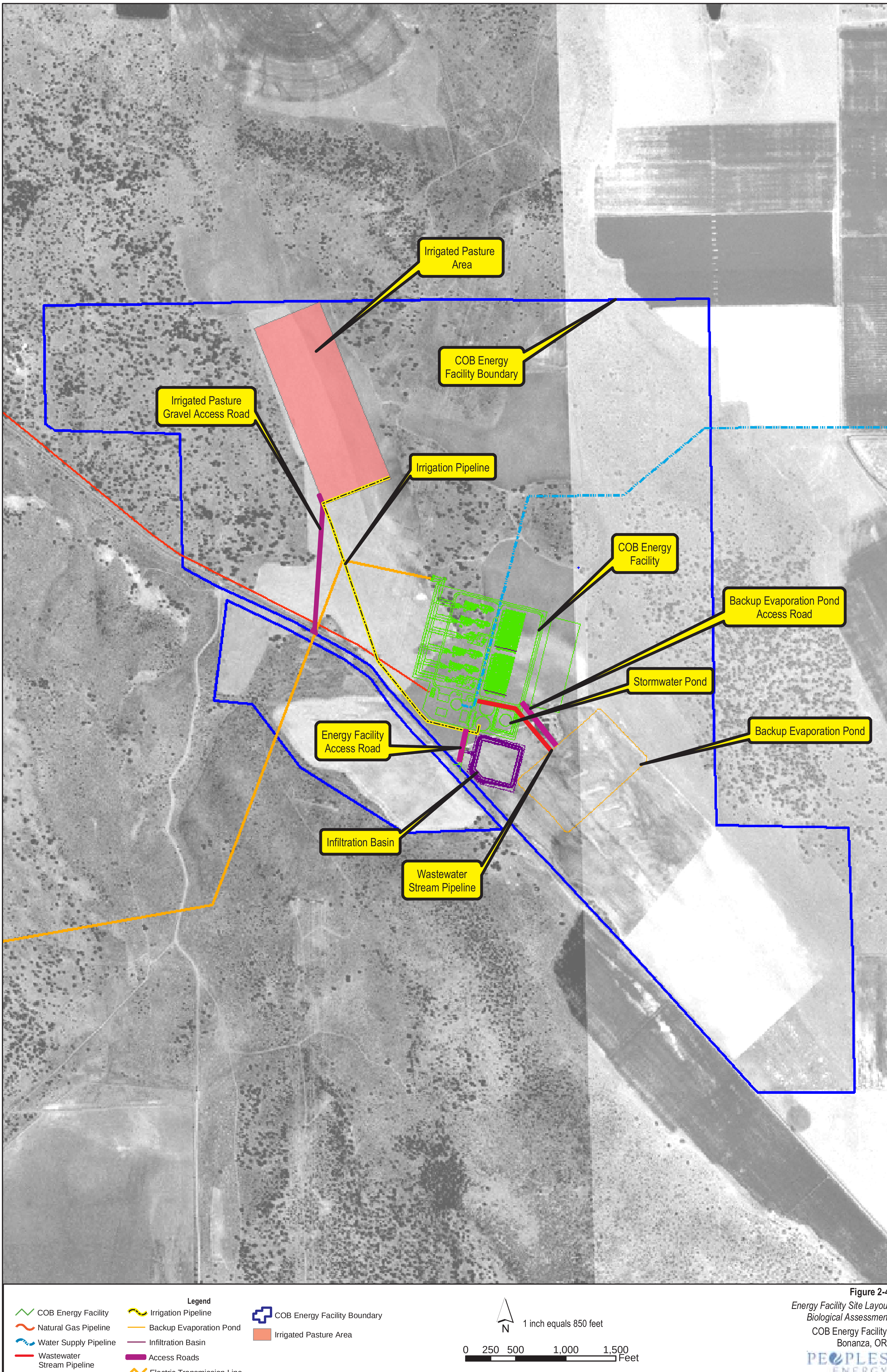


Figure 2-4
Energy Facility Site Layout
Biological Assessment
COB Energy Facility
Bonanza, OR

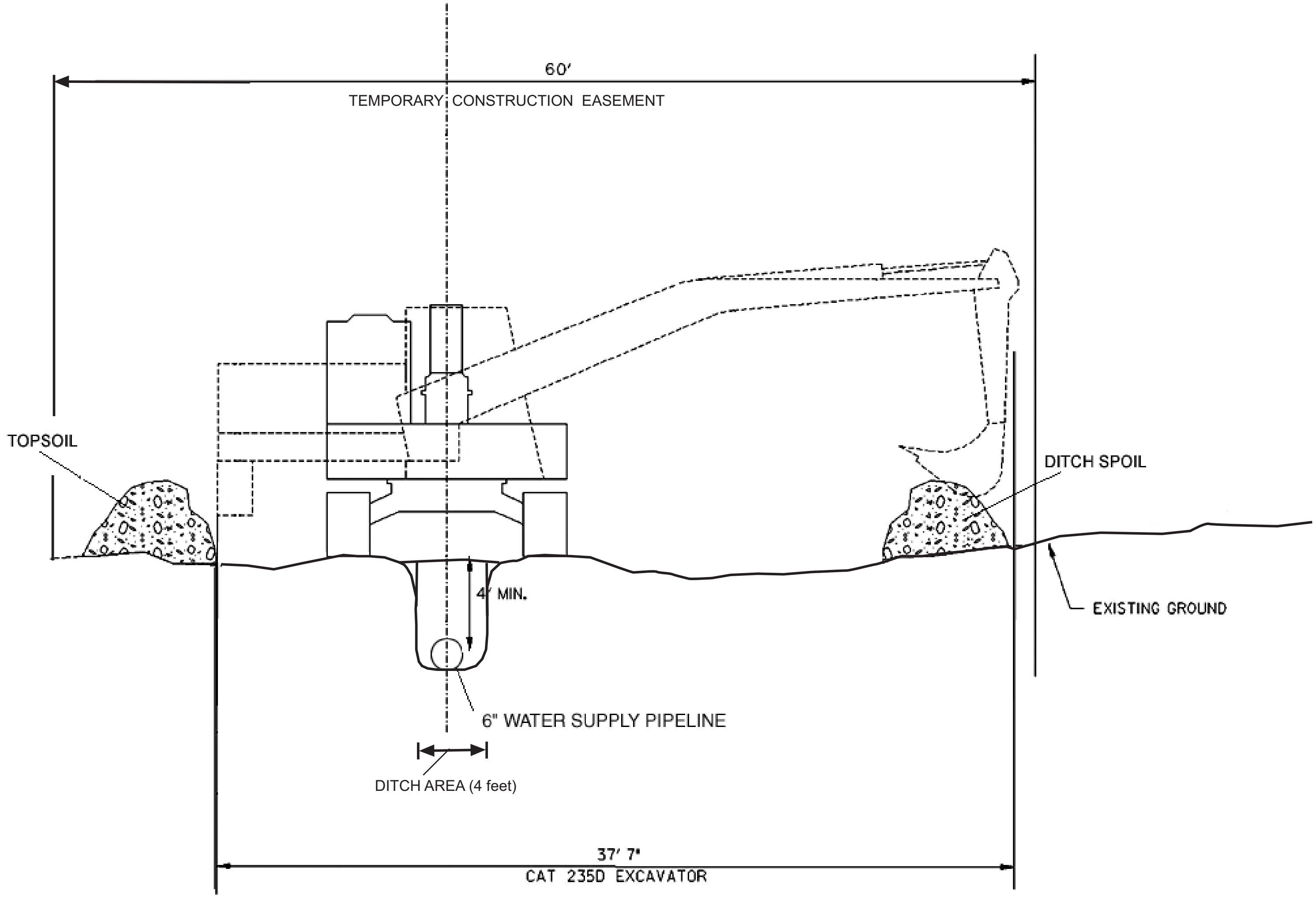
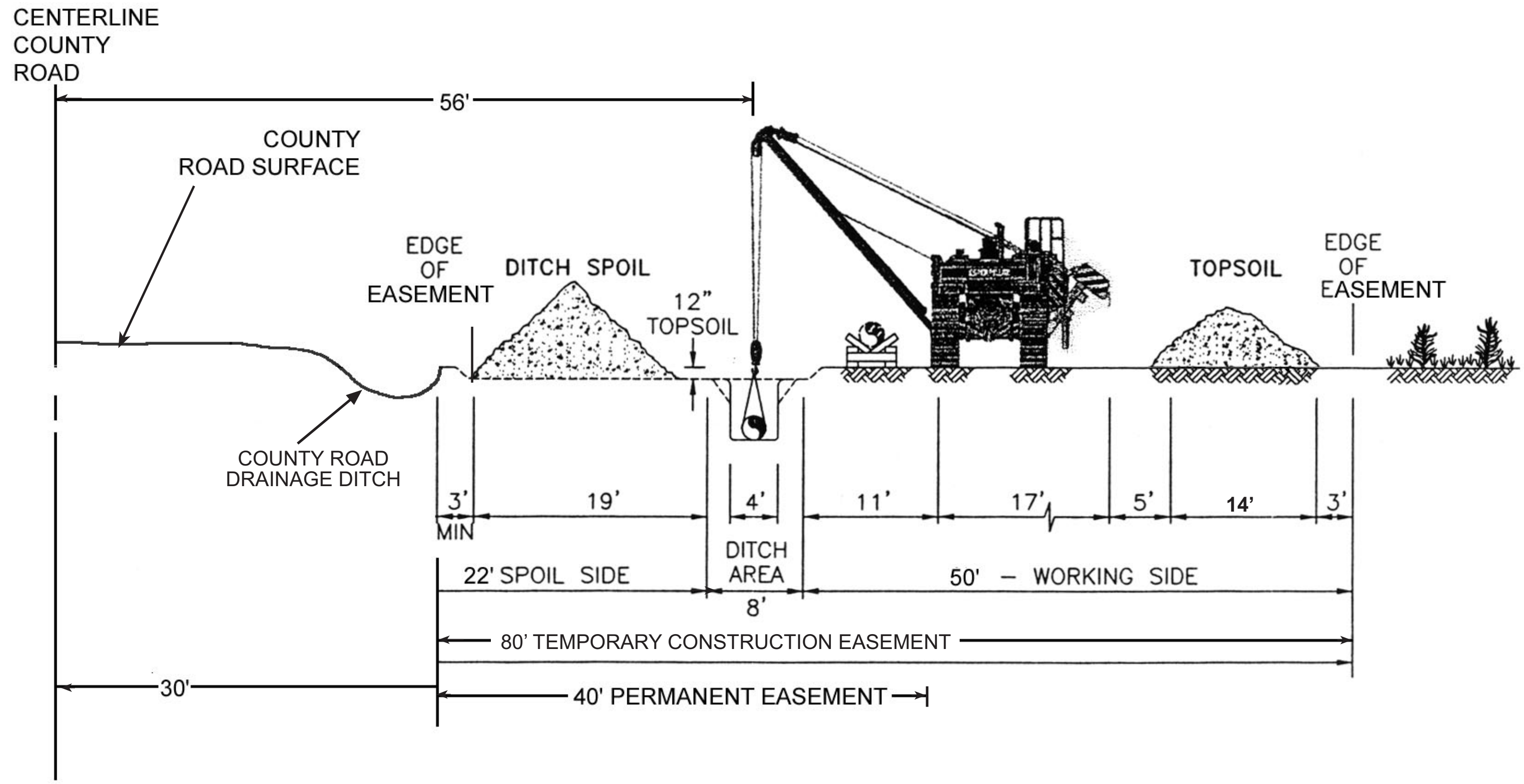


Figure 2-5
Typical Water Supply Pipeline Configuration
Biological Assessment
COB Energy Facility
Bonanza, OR

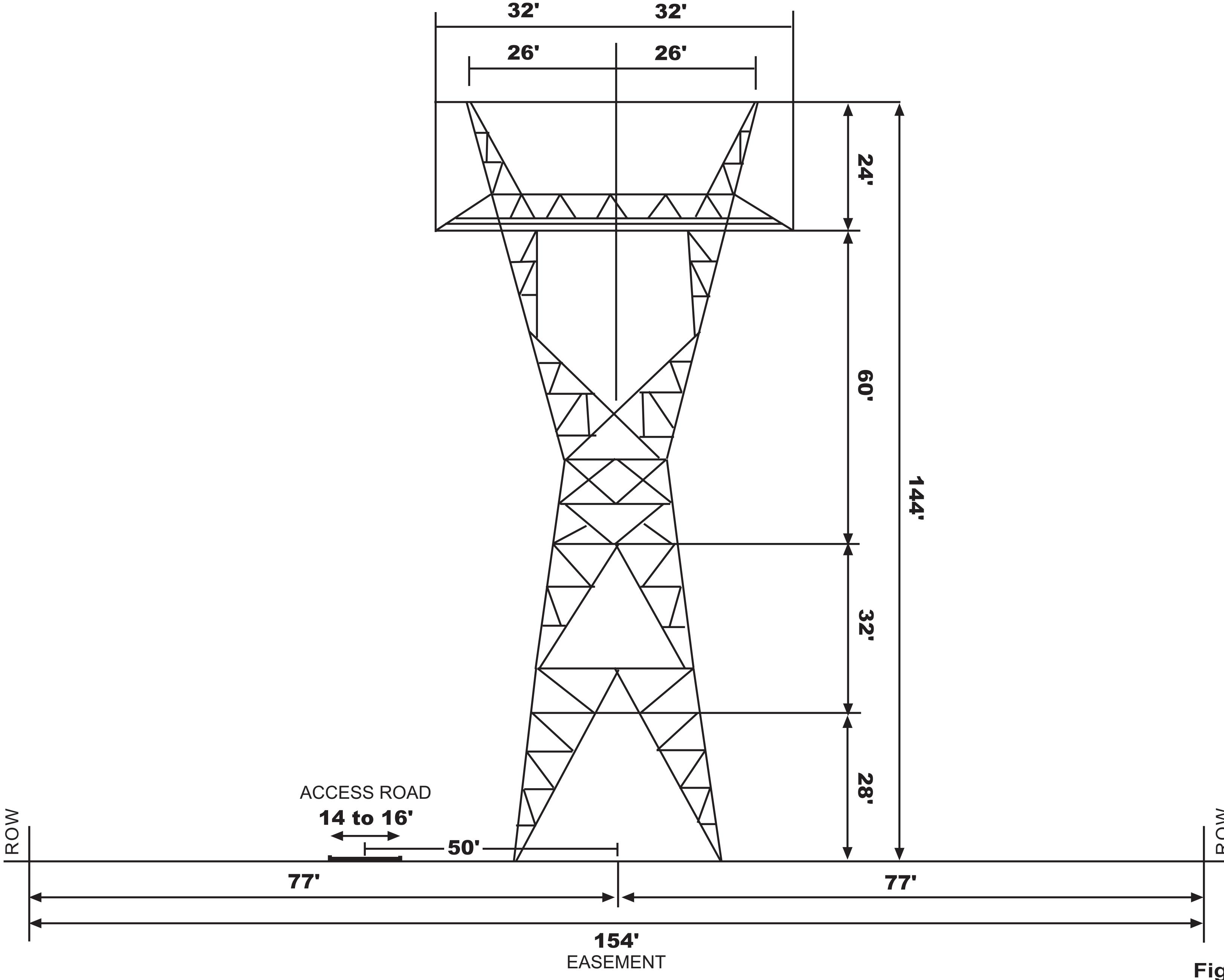
CH2MHILL

PEOPLES ENERGY Resources



Source: (Adapted from *Temporary Right-of-Way With Requirements for Pipeline Construction.* Prepared for The INGAA Foundation, Inc., by Gulf Interstate Engineering. 1999.)

Figure 2-6
Typical Natural Gas Pipeline Configuration
Biological Assessment
COB Energy Facility
Bonanza, OR



NOTES:
1. TRANSMISSION TOWER IS LATTICE.
2. CONDUCTORS COULD BE HORIZONTAL OR VERTICAL.
3. ACCESS ROAD MAXIMUM GRADE IS LESS THAN 15 PERCENT.

Figure 2-7
Typical Transmission Tower Structure
Biological Assessment
COB Energy Facility
Bonanza, OR

CH2MHILL

PEOPLES ENERGY Resources

SECTION 3

Study Methods

This section describes the study methods used to develop the BA.

3.1 Data Review

Before conducting field surveys, several natural resource agencies were consulted and a literature review was conducted to obtain information about sensitive biological resources known to occur or that potentially could occur within the project area. As part of the literature review process, USFWS was consulted regarding special-status species that could occur within Klamath County, and a search was conducted of the ONHP database to provide information on reported occurrences of special-status plant and wildlife species in the project area. Because the route of the electric transmission line crosses land owned and managed by BLM (Figure 2-2), BLM was contacted to obtain a list of sensitive and special interest wildlife and plants. The list was provided on April 30, 2002.

Resource agency biologists at ODFW and the U.S. Forest Service were also contacted regarding site-specific special-status wildlife species with the potential to occur in the project area. Lists of special-status species potentially occurring in the project area that were provided by the natural resource agencies and the project impact analysis for those species are presented in Exhibit P of the site certification application.

Federally listed species with habitat or known distribution in the project area are evaluated for potential impacts from construction, operation, and maintenance activities in the BA.

3.2 Onsite Field Surveys

Reconnaissance-level surveys for the Energy Facility site, the water supply pipelines, and the natural gas pipeline were conducted on October 10 and 11, 2001, to evaluate potential effects of the preliminary project design on sensitive biological resources. Detailed habitat assessment and field surveys for sensitive plants and wildlife potentially occurring in the project area were conducted by the following CH2M HILL staff: Marjorie Eisert (Senior Biologist), Russell Huddleston (Biologist), Debra Crowe (Senior Biologist), Heather Johnson (Mammalian Biologist), and Richard Crowe (Senior Environmental Technician). Surveys of the proposed Energy Facility site and the proposed natural gas, water supply, and electric transmission line alignments were conducted from May 6 to May 10, 2002. Additional rare plant and breeding bird surveys were conducted from June 17 to 20, 2002, and on July 9 and 10, 2002.

Prior to conducting the 2002 biological surveys, the centerlines of the water supply pipeline, natural gas pipeline, and electric transmission line were flagged by surveyors. Habitat surveys were conducted for areas within ¼ mile of the Energy Facility site and the water supply pipeline, natural gas pipeline, and electric transmission line. Aerial photography, topographic maps, visual identification, and field verification at specific locations were used to categorize habitat types. Methodology of detailed field surveys for special-status wildlife and plants within each project feature are discussed below. Plant and wildlife species observed during the surveys are presented in Appendix B.

3.2.1 Energy Facility Site and Process Wastewater Application Areas

The majority of the Energy Facility site lies within unirrigated fallow agricultural fields and was surveyed by driving or walking transects. Areas with natural vegetation, relatively little disturbance, or potential habitat for special-status species (e.g., old farm buildings) were inspected on foot. Selected areas of the fallow barley field, where there was a potential for additional wildlife observations, were also surveyed on foot. Wildlife and identifiable plant species observed on the Energy Facility Site were noted. Trail Master photo stations were established at several locations containing wildlife signs (e.g., scat latrines on rock escarpments, woodrat structures, and near burrow systems in the fallow field) to monitor for cryptic and/or nocturnal species.

3.2.2 Electric Transmission Line

The electric transmission line route was surveyed by walking six meandering transects along the entire length of the alignment. These transects covered approximately 300 feet on either side of the centerline, for a total survey width of approximately 600 feet. Wildlife and plant species observed within the survey corridor were noted. Habitat types were mapped based on the characteristic trees, shrubs, and herbaceous vegetation. Visual estimation and field verification at specific locations was used to categorize habitat types beyond the survey corridor. Aerial photos and topographic maps were used in the field to help identify adjacent habitat areas within ¼ mile of the survey area. These areas were further investigated for potential sensitive wildlife and plant species that potentially could be indirectly affected by the proposed project.

3.2.3 Water Supply Pipeline and Natural Gas Pipeline

The proposed water supply pipeline and natural gas pipeline routes were surveyed by walking meandering transects covering approximately 100 feet to either side of the centerline for a total width of 200 feet. Wildlife and identifiable plant species observed within the survey corridor were noted. Habitat types were mapped based on the characteristic trees, shrubs, and herbaceous vegetation. Visual estimation was used to categorize habitat types beyond the survey corridor. As with the electric transmission line, aerial photos and topographic maps were used in the field to help identify areas that may have been overlooked during the meandering transects. Each of these areas was investigated in the field for potential sensitive species. Active cultivated crops and developed areas along the natural gas supply pipeline were not included in the surveyed area.

SECTION 4

Environmental Setting

This section describes current land use, habitat types, and hydrologic resources in the proposed project area.

4.1 Geological Setting

The proposed project is located in the Klamath Ecological Province (East Cascades Ecoregion) on the eastern side of the Cascade Mountains. This region is characterized by large basins surrounded by ancient lake terraces and basaltic fault block mountains. Elevations range generally range from around 4,000 to 6,500 feet. Regionally the project is located within the Klamath River Basin, which extends from the Williamson River in southern Oregon to the Trinity River in northern California and covers approximately 10.5 million acres. The watersheds included in the Klamath Basin provide habitat for genetically distinct anadromous fishes as well as endemic freshwater species. Approximately 75,000 acres of shallow lakes and fresh water wetlands also provide habitat for numerous species, including the largest wintering population of bald eagles in the lower 48 states. Approximately 80 percent of the migratory birds in the pacific flyway use habitats within the Klamath Basin.

4.2 Current Land Use

The majority of the lowland areas in the Langell Valley have been converted to agricultural use, including cultivated crops and irrigated pastures. The Energy Facility site is unirrigated. The few developed areas included scattered residential, agricultural, and industrial sites, such as farm homes, dairies, the PG&E GTN compressor station, and the Captain Jack Substation. The hills and terraces around the valleys are characterized by juniper woodlands with an understory of low sagebrush, rabbitbrush, native perennial bunchgrasses, and forbs, and are used primarily as open rangeland managed by Federal and private landowners. Selective timber harvesting has occurred in the ponderosa pine forest habitat located along the southern section of the proposed electric transmission line near Bryant Mountain. Linear utilities in the area include three existing transmission lines and the PG&E GTN interstate gas pipeline system.

4.3 Habitat Types in the Study Area

4.3.1 Western Juniper Woodland

Western juniper woodland is the driest forest community in the Pacific Northwest and is generally found in the transition zone between ponderosa pine forest and shrub-steppe habitats. This type occurs widely throughout eastern Oregon on shallow, often rocky soil, at elevations ranging from 1,500 and 6,500 feet, and is widespread on low hills and terraces at elevations between 4,000 and 5,000 feet. It is found on well-drained stony to very stony loams derived from weathered tuff and basalt, as well as on loamy soil derived from lacustrine and alluvial deposits (NRCS, 1985).

Western juniper woodland is characterized by the almost sole dominance of western juniper (*Juniperus occidentalis*) in the canopy layer. Throughout much of this habitat type the trees are generally widely spaced, creating a savanna-like setting with shrub cover between 10 to 40 percent in the understory. In some areas, western juniper creates a woodland or forested habitat with only a few scattered shrubs in the understory. Low sagebrush (*Artemisia arbuscula*) is the dominant shrub in most areas with big sagebrush (*Artemisia tridentata*), desert gooseberry (*Ribes velutinum*), and rabbitbrush (*Chrysothamnus nauseosus*, *C. viscidiflorus*) also found within the shrub layer. Native bunchgrasses such as Sandberg's bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Thurber's needlegrass (*Achnatherum thurberianum*) and squirrel tail (*Elymus elymoides*) make up approximately 5 to 25 percent of the ground cover in most areas. Common native forbs include larkspur (*Delphinium nuttallianum*), lupine (*Lupinus lepidus*), phlox (*Phlox diffusa*), lomatium (*Lomatium* spp.), and alpine waterleaf (*Hydrophyllum capitatum*). Where intensive livestock grazing has occurred in this habitat type, the understory vegetation is relatively sparse and made up of non-native species. Shrubs and native perennial bunchgrasses are either absent or very sparse in these areas.

The majority of western juniper habitat observed during field surveys was along the proposed electric transmission line, with sparse distribution along the natural gas and water supply pipelines (Figure 4-1). Wildlife species observed within the western juniper woodland were typical of species associated with this habitat type. Several raptors including, bald eagles (*Haliaeetus leucocephalus*), red-tailed hawks (*Buteo jamaicensis*), Cooper's hawk (*Accipter cooperii*), sharp-shinned hawk (*Accipiter striatus*), and turkey vultures (*Cathartes aura*) were observed foraging and patrolling this habitat. In addition to raptors, numerous passerines were observed. Common species included ruby-crowned kinglet (*Regulus calendula*), mountain bluebird (*Sialia currucoides*), American robin (*Turdus migratorius*), spotted towhee (*Pipilo maculatus*), lark sparrow (*Chondestes grammacus*), golden-crowned sparrow (*Zonotrichia atricapilla*), house finch (*Carpodacus mexicanus*), and evening grosbeak (*Coccothraustes vespertinus*). A limited number of mammals were observed and included Nuttall's cottontail (*Sylvilagus nuttallii*), California ground squirrel (*Spermophilus beecheyi*), yellow-bellied marmot (*Marmota flaviventris*), bushy-tailed woodrat (*Neotoma cinerea*), coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), and pronghorn antelope (*Antilocapra americanc*). The western fence lizard (*Sceloporus occidentalis*) was the only common reptile observed in this habitat type.

4.3.2 Ponderosa Pine Forest

Ponderosa pine habitats are widely distributed throughout eastern Oregon and often are found adjacent to sagebrush-steppe and western juniper habitat types. Ponderosa pine forests generally occur on dry sites characterized by coarse-textured, well-drained soil at elevations between 1,000 and 6,000 feet. An isolated stand of ponderosa pine was observed along the southern portion of the proposed electric transmission line at elevations between 4,300 and 4,600 feet. This habitat type generally occurs on well-drained, loamy soil derived from weathered sandstone, basalt, and lacustrine sediments (NRCS, 1985).

Ponderosa pine (*Pinus ponderosa*) is the dominant species in the canopy layer of this forested habitat. Western juniper, curl-leaf mountain mahogany (*Cercocarpus ledifolius*), and Klamath plum (*Prunus subcordata*) are present in the lower canopy layer. The soil is covered by a moderate accumulation of duff, with Sandberg's bluegrass and Idaho fescue the most common species in the herbaceous layer, accounting for 10 to 50 percent of the cover. This habitat is considered to have moderately high commercial value (USDA, 1979). The isolated stand observed was surrounded by juniper woodland and appeared to have been selectively logged in the past.

The isolated ponderosa pine stand encountered along the southern end of the proposed electric transmission line represents less than 1.5 miles of the proposed 7.2-mile electric transmission line. In general, there was considerable overlap in the wildlife species observed in the ponderosa pine and western juniper habitats. One notable exception was the siting of a great horned owl (*Bubo virginianus*) along an existing access roadway in this habitat.

4.3.3 Sagebrush-Steppe

Sagebrush-steppe is extensively distributed throughout southeastern Oregon on stony shallow soil at elevations ranging from 3,500 to 7,000 feet. Within the analysis area this habitat type generally occurs between 4,000 and 5,000 feet, adjacent to western juniper habitats on well-drained and stony loams derived from weathered tuff and basalt (NRCS, 1985). Scattered sagebrush–steppe habitat was observed along the proposed electric transmission line.

This habitat is characterized by shrubs. Low sagebrush is the most common species, accounting for 15 to 30 percent of the cover. Big sagebrush and rabbitbrush are also common in some areas. Sandberg's bluegrass is the most common species in the herbaceous layer, accounting for 10 to 20 percent of the cover. Other grasses such as Idaho fescue, Thurber's needlegrass, cheatgrass, and intermediate wheatgrass (*Elytrigia intermedia*) were also present but generally made up less than 5 percent of the cover. Common forbs included blue-eyed Mary, stoneseed (*Lithospermum ruderale*), phlox, buckwheat (*Eriogonum umbellatum*), and fleabane (*Erigeron* spp.).

Sagebrush-steppe supports wildlife species comparable to the western juniper woodland, with the major exceptions being the Pygmy rabbit (*Brachylagus idahoensis*), which was observed at three locations along the proposed electric transmission line (see Exhibit P in the site certificate application).

4.3.4 Ruderal Areas

Ruderal areas were observed along the margins of agricultural and developed areas at elevations between 4,100 and 4,200 feet. In the project area, this habitat type occurs on loamy soil derived from weathered diatomite, basalt, and tuff as well as sandy loams formed from alluvial and lacustrine sediments. The vegetation in these areas is generally sparse and characterized by dominance of non-native species such as cheatgrass, tansy mustard, and clasping pepperweed (*Lepidium perfoliatum*). Native vegetation is either absent or provides only minimal cover.

Ruderal areas were encountered mainly along the proposed natural gas pipeline, which runs adjacent to West Langell Valley Road and Harpold Road and small areas along the proposed water supply pipeline (Figure 4-1). Typical wildlife species encountered were mule deer, turkey vulture, Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), mourning dove (*Zenaida macroura*), northern flicker (*Colaptes auratus*), western kingbird (*Tyrannus verticalis*), black-billed magpie (*Pica pica*), American crow (*Corvus brachyrhynchos*), loggerhead shrike (*Lanius ludovicianus*), and western meadowlark. The majority of these wildlife observations were made while the wildlife was moving from one natural habitat to another.

4.3.5 Agricultural Lands

The majority of the lowland areas within the analysis area have been converted to agricultural use. These areas occur on the loamy soil, formed in alluvial and lacustrine deposits on low terraces throughout the analysis area. Agricultural lands include cultivated crops, irrigated pasture, unimproved pasture, and fallow fields.

Cultivated crops areas are intensely managed for agricultural production. Common crops within the analysis area include alfalfa, hay, wheat, barley, and oats. Irrigated pastures are areas that have been disked and planted with livestock forage crops such as intermediate wheatgrass, tall fescue (*Festuca arundinacea*), and Kentucky bluegrass (*Poa pratensis*). Pasture land within the analysis area is used for cattle, sheep, and horses. In the higher elevations and more remote basins, pasture areas are not irrigated. The unimproved pasture areas appear to have been disked at some point and planted with forage grasses such as intermediate wheatgrass, tall fescue, and Kentucky bluegrass. Rabbitbrush and low sage are often present along the margins of unimproved pastures. These habitats are currently used for sheep and cattle grazing. Fallow fields are areas that were recently used for dryland farming of wheat and barley, but are no longer in production. These areas are characterized by a sparse cover (10 to 15 percent) of intermediate wheatgrass and ruderal species such as tansy mustard, clasping pepperweed, blue-eyed Mary, and yellowspine thistle (*Cirsium ochrocentrum*). Most of these lands are currently leased for seasonal cattle grazing.

Wildlife observed within the agricultural lands was similar to the wildlife observed within the ruderal lands. These areas have been altered by human activity and generally support few or no native plant species, but provide habitat for a variety of wildlife species including but not limited to ground squirrels, marmots, a badger and badger sign, kangaroo rats, and pack rats, all of which were observed within these areas.

4.4 Hydrologic Resources

4.4.1 Klamath River Basin

The Energy Facility site lies within the Klamath River Basin. By geographic definition, the Klamath Basin is the area drained by the Klamath River and its tributaries. The Klamath is one of only three rivers that pierce both the Cascades and the Coastal mountain ranges before emptying into the Pacific Ocean. In Oregon, the Klamath Basin occupies more than 5,600 square miles and covers almost all of Klamath County and smaller portions of Jackson and Lake Counties to the west and east. At the California-Oregon border, the Klamath River Canyon marks the Basin's low point and at an elevation of 2,755 feet, is its drain point.

4.4.2 Lost River

The project area is located in the Lost River watershed in the northeastern section of the Klamath Basin, approximately 20 miles east of the Upper Klamath Lake. The Lost River watershed is an interior basin covering approximately 3,000 square miles of southern Oregon and Northern California. The headwaters originate east of the Clear Lake Reservoir in Modoc County, California, and flow approximately 75 miles to the Tule Lake Sump. Seasonal flows in the Lost River are controlled by releases from the Clear Lake Dam and Gerber Reservoir. Historical channel modification, water diversion, and wetland drainage associated with the U.S. Bureau of Reclamation's Klamath Project have resulted in a highly altered system. The Link River is a canal constructed by the U.S. Bureau of Reclamation to connect the Lost River to the Klamath River system as part of the Klamath Basin Project. Water from the Lost River is currently used for domestic and industrial water supply, irrigation, and livestock.

4.4.3 Water Conveyance Features

Aquatic habitats within the survey area included intermittent creeks, freshwater marsh, seasonal wetlands, wet meadows, stock ponds, and agricultural canals.

Several intermittent creeks were observed along the electric transmission line. These creeks were dry at the time of the time of the surveys, but had defined bed and bank features. Most of the drainages contained lava rock substrate and either lacked vegetation or contained only sparse upland vegetation within the channel.

4.4.4 Wetlands

Freshwater marsh habitat was observed approximately 2,000 feet south of the water supply wells and was characterized by a mosaic of perennial, emergent monocots and areas of open water. Species such as cattail (*Typha latifolia*) and bulrush (*Scirpus* sp.) are found in the deeper areas where sedges (*Juncus* sp.) and rushes (*Carex* sp.) are found in the seasonally-flooded areas around the perimeter of the marsh. These wetlands occur on the somewhat poorly-drained soil formed in alluvial lacustrine sediments. A hardpan is present between 20 and 40 inches and the water table is typically shallow, ranging from 1 to 3.5 feet below the ground surface (bgs) (NRCS, 1985).

There were numerous aquatic associated wildlife species observed within the project area. The majority of the observations occurred near the Babson well and along the water supply pipeline route. A freshwater marsh is located approximately 1,200 feet southeast of the Babson well, and several irrigation ditches flow along the proposed water supply pipeline route. The footprint avoids wetland habitats and the Facility affects less than 0.5 acre of wetlands.

The wildlife species observed included pie-billed grebe (*Podilymbus podiceps*), great blue heron (*Ardea herodias*), sandhill crane (*Grus canadensis*), green-winged teal (*Anas crecca*), mallard (*Anas platyrhynchos*), northern shoveler (*Anas clypeata*), American wigeon (*Anas americana*), bufflehead (*Bucephala albeola*), common merganser (*Mergus merganser*), wouldet (*Catoptrophorus semipalmatus*), common snipe (*Gallinago gallinago*), gull (*Larus* sp.), Forster's tern (*Sterna forsteri*), common raven (*Corvus corax*), red-winged blackbird (*Agelaius phoeniceus*), tricolored blackbird (*Agelaius tricolor*), yellow-headed blackbird (*Xanthocephalus*

xanthocephalus), Brewer's blackbird (*Euphagus cyanocephalus*), brown-headed cowbird (*Molothrus ater*), and northern oriole (*Icterus galbula*).

4.4.5 Sedge Wet Meadow

Sedge wet meadow habitat is characterized by seasonal inundation, with surface water present during the winter and early spring, but absent by the end of the growing season. This habitat type occurs on soil derived from weathered diatomite, tuff, and basalt (NRCS, 1985). The vegetation is characterized by a dense cover of low-growing monocots such as sedges and rushes. A few forb species such as dock (*Rumex crispus*), mouse-tail (*Myosurus minimus*), and downingia (*Downingia* sp.) were observed along the outer margins during field surveys, but accounted for only a minimal amount of the total vegetative cover. Aquatic buttercup (*Ranunculus aquatilus*) was present where there was open water. This habitat was observed in the project area, with the nearest location approximately 2,000 feet east of the proposed electric transmission line.

4.4.6 Wet Meadow

Wet meadow habitats occurred on poorly-drained clay soil that formed in sediments from weathered tuff and basalt (NRCS, 1985). This habitat is characterized by the presence of surface water during the winter and early spring, and the absence of water during the summer months. Characteristic vegetation includes species such as tufted hairgrass (*Deschampsia cespitosa*), Baltic rush (*Juncus balticus*), and sedges (*Carex* spp.). Some areas have been disked and planted with pasture grasses such as tall fescue, timothy (*Phleum pratense*), and meadow foxtail (*Alopecurus pratensis*). This habitat was observed in the project area, with the nearest location approximately 2,000 feet east of the proposed electric transmission line.

4.4.7 Stock Ponds

Stock ponds were observed in areas where berms had been constructed within natural drainages to retain water for livestock. The hydrology in these areas was variable, with some ponds containing several inches of water and other areas dry at the time of the survey. Vegetation in these areas included sedges, rushes, aquatic buttercup, and dock. Stock ponds were observed in several areas along the electric transmission line, but none were located within the ROW.

4.4.8 Agricultural Drainages

Several irrigation canals have been constructed to facilitate surface drainage and water transport for agricultural crops and pasture lands in the basin areas. These channels appear to be routinely maintained and were largely devoid of vegetation.

Irrigation canals were observed in the following locations:

- Along the route of the water supply pipeline between the water supply wells and the Energy Facility, the pipeline would cross an irrigation canal in three locations.
- The route of the natural gas pipeline would cross an irrigation canal in one location.

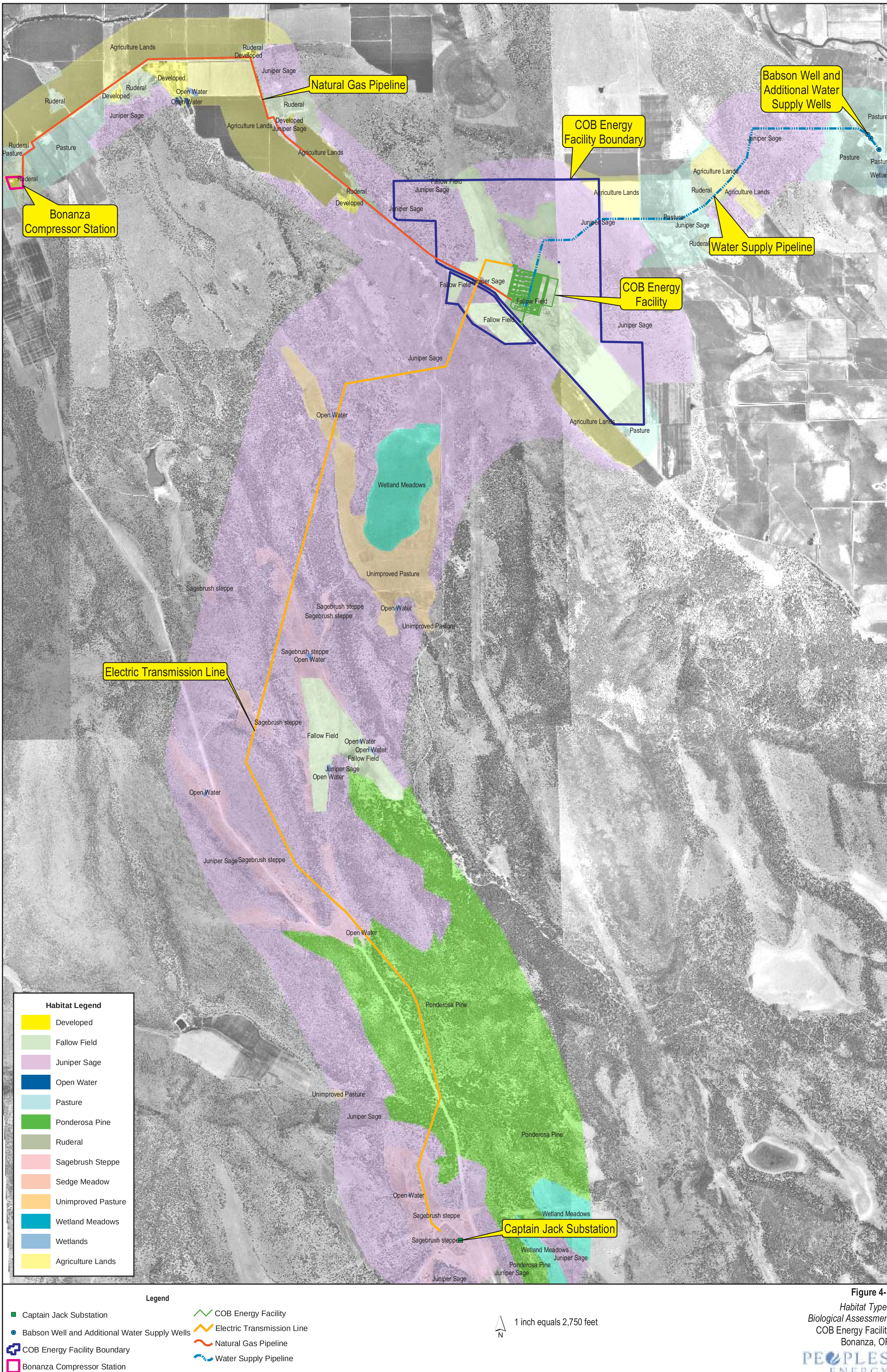


Figure 4-1
Habitat Types
Biological Assessment
COB Energy Facility
Bonanza, OR

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SECTION 5

Species Accounts and Status

Federally listed species are addressed in this section. Federal and state candidate or species of concern, state-listed species, and special wildlife corridors or other sensitive biological resources potentially affected in the project area are addressed in Exhibit P of the site certificate application filed with OOE (see Appendix B of this BA).

5.1 Federally Listed Plant Species

One federally listed plant species—the Applegate's milk-vetch—is evaluated in this biological assessment. Additional special-status plant species considered in the survey area but not evaluated further for project effects are discussed in Exhibit P of the site certificate application filed with OOE (see Appendix B).

Applegate's milk-vetch (*Astragalus applegatei*) was listed as an endangered species on July 23, 1993 (58 FR 40551). Applegate's milk-vetch is a perennial forb endemic to the Klamath Basin in southern Oregon. Information on the historical range of Applegate's milk-vetch is sparse. Presumably this species once occurred on alkaline floodplain habits throughout the lower Klamath Basin. Currently, the plant exists in only three populations near Klamath Falls, where it occurs on strongly alkaline, seasonally moist soil in areas with sparse vegetation (USFWS, 1998). The flowering period is between June and August. Population estimates suggest that there are approximately 12,000 individuals remaining, the majority of which occur on The Nature Conservancy's Ewauna Flat Preserve in Klamath Falls. Principle threats included invasion of non-native species, and hydrologic modification resulting from drainages and retention dikes.

There are no reported occurrences or historical records of Applegate's milk-vetch in the vicinity of the project area. Suitable soil conditions for this species are present in the analysis area. However, most of these areas have been converted to agricultural uses. No plants were identified during biological surveys. The project would have no effect on Applegate's milk-vetch.

5.2 Federally Listed Animal Species

5.2.1 Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was listed as an endangered species in the lower 48 states on March 11, 1967 (32 FR 4001). Bald eagles were reclassified to threatened status on August 11, 1995. Bald eagle populations have made a significant recovery since listing and the bald eagle was proposed to be removed from listing in the lower 48 states on July 6, 1999 (64 FR 36453). Bald eagles are large raptors that feed primarily on fish, but also take mammals, birds, reptiles, and carrion. They typically hunt by watching prey from a high perch and swooping down to catch birds, fish, or mammals in their talons. Bald eagles also feed on carrion, take prey from other predators, or hunt by slowly soaring over water bodies and land areas and often flushing flocks of birds, taking the weak individuals. The breeding season begins in late winter to early spring depending on latitude. Nest locations are found in tall trees and rocky cliffs, and may be located as far as 10 miles from foraging areas (Csuti et al., 1997). This species is found in a variety of habitats, but is most often associated with open water bodies such as rivers, lakes, and marshes with abundant fish and waterfowl populations.

Bald eagles historically ranged throughout North America. On the west coast they are found from middle Alaska to California. As many as 1,000 bald eagles migrate to the Klamath Basin during January and February, where they feed primarily on the abundant waterfowl populations wintering in the Basin. The Upper Klamath region also supports the largest nesting bald eagle population in Oregon, where approximately 80 percent of the nest locations occur in ponderosa pine habitat (Anthony et al., 1982). The bald eagle is known to occur in the survey area and suitable nesting habitat was identified within the isolated stand of ponderosa pine habitat along the southern portion of the proposed electric transmission line. No nests were observed. The isolated stand of ponderosa pine is located 3,000 feet north of the Captain Jack Substation. Suitable upland foraging habitat that supports small mammals and carrion in the form of pronghorn antelope, wintering and resident deer, and cattle occurs on the Energy Facility site and routes of the water supply and natural gas pipelines.

The BLM Klamath Falls Resource Area has been collecting information on bald eagle nest locations in the vicinity of the Energy Facility since 1984. As of 2003, nest locations have been identified at McFall Reservoir and Bryant Mount. Large, mixed-conifer forests on Bryant Mountain also are used as winter roost sites for bald eagles. BLM has been conducting mid-winter bald eagle counts in the Langell, Poe, and Yonna Valleys since 1996. Mid-winter observations along the Poe and Yonna Valley survey routes have ranged from four to 16 eagles, and seven to 22 eagles have been sighted along the Langell Valley route (Raby, 2003).

Survey Results

During the mid-June 2002 biological surveys conducted by CH2M HILL biologists, two adult and two juvenile bald eagles were observed at McFall Reservoir, approximately 1 mile east of the proposed electric transmission line (Figure 5-1). On June 11, 2002, Steve Hayner (biologist for the Bureau of Land Management) reported a nest site at McFall Reservoir to Frank B. Isaacs, Senior Faculty Research Assistant at Oregon State University. Mr. Isaacs is a recognized bald eagle expert in this region. At this time, two mostly-feathered chicks, two adults, and four juvenile bald eagles were observed in trees around the reservoir (Isaacs, 2002). Adult and juvenile bald eagles were also observed flying and foraging over the area of the water supply wells, the water supply pipeline, the electric transmission line, and the Energy Facility site during the May, June, and July 2002 surveys. On July 9, 2002, one adult and six juvenile bald eagles were observed at McFall Reservoir. Nest locations have also been reported in the Bryant Mountain area (Figure 5-1) approximately 2 miles east of the proposed electric transmission line (ONHP, 2002).

Potential Project Effects

Construction and operation of the proposed Energy Facility would result in loss of marginal upland foraging habitat, potentially modify breeding behavior when temporary loud construction noise is present, and potentially increase collision with electric transmission line wires.

Loss of Forage Habitat. The proposed Energy Facility site and associated linear features would result in the permanent loss during the 30-year operating life of the Energy Facility of approximately 103.5 acres of potential upland foraging habitat for bald eagles. This area is composed of 31.6 acres of juniper-sage, 10.4 acres of sagebrush-steppe, 12.4 acres of ponderosa pine, 0.3 acre of pasture, 2.1 acres of unimproved pasture, and 40.9 acres of fallow field. Approximately 76 percent of the affected area is currently fallow agricultural land (46.7 acres) and juniper-sagebrush woodland (31.6 acres). Waterfowl prey species like bald eagles typically do not use this type of habitat. Other habitat types affected to a lesser degree include sagebrush-steppe, ponderosa pine forest, and agricultural lands. The loss of forage associated with project impacts to these habitat types would be offset by the additional forage created in the approximately 236-acre mitigation area. At Facility retirement, the project proponent would implement a Facility Retirement and Site Restoration Plan (Exhibit W of the EFSC site certificate application) to ensure that soil in and around the Energy Facility site is returned to conditions suitable for agricultural use.

Bald eagles are piscivores, preferring to feed on fish, although part of their diet may be small mammals, water birds and carrion. Eagles forage over large areas close to large water bodies and would travel several miles to foraging areas. The minimum home range for bald eagles reported in EPA's *Wildlife Exposure Factors Handbook* is 4,500 acres. Because the Energy Facility site is located at least 2 miles from documented foraging areas (the Lost River and several lakes on the west side of Bryant Mountain), which are more preferable foraging areas.

Salinity in Process Wastewater. Table 5-1 lists biological effects on selected waterfowl observed at various salinity concentrations. Salinity is not precisely equivalent to TDS, but for most purposes, they can be considered equal (United States Department of the Interior, 1998). For sodium, levels as low as 821 parts per million (ppm) reduced growth in 1-day-old mallard ducklings exposed for 28 days (Mitcham and Wobeser, 1988a). Mallard ducklings that drank water with 3,000 ppm of sodium had reduced thymus size and bone strength (Mitcham and Wobeser, 1988b). No apparent effects were observed at concentrations up to 911 ppm in 14-day mallard duckling exposures, while concentrations between 8,800 and 12,000 ppm caused 100 percent mortality (Mitcham and Wobeser, 1988a). In adult waterfowl, sodium concentrations of 17,000 ppm of sodium caused a die-off in North Dakota when fresh water was unavailable (Windingstad et al., 1987). If the evaporation pond alternative for management of process wastewater is selected, the evaporation pond would be netted and enclosed by a chain-link fence to prevent access by wildlife and birds to the evaporation pond.

Air Emissions. Maintenance of resident aquatic resources is important to the success of bald eagles. Moreover, maintenance of resident terrestrial habitats also is important to bald eagles, which use upland areas during the winter months when lakes and rivers are frozen (Brown and Amadon, 1968). Therefore, a screening-level ecological risk assessment (ERA) was conducted to address the potential risk from air emissions (and subsequent deposition to surface water) to aquatic organisms and to the bald eagle (with exposure by way of food web transfer). Upland areas surrounding the Energy Facility also were evaluated for possible risks to terrestrial plants, soil invertebrates, and terrestrial birds and mammals resulting from terrestrial deposition of air emissions. The procedures used in conducting the ERA were consistent with standard ODEQ and EPA guidance and consisted of the following sections: problem formulation, including identification of the chemicals of potential ecological concern (COPECs); exposure assessment; effects assessment; and risk characterization, including uncertainty analysis. The full-text screening-level ERA, including methods, assumptions, receptors, and screening values, is attached as Appendix C.

Ecological risks were evaluated based on conservative assumptions, maximum estimated media concentrations, and screening toxicity values. Because this screening assessment was based on conservative assumptions, constituents that passed the screen were considered to pose no significant risk to ecological receptors. Failure to pass the screen, however, cannot be concluded to represent the presence of risk. Rather, these results indicate that available data are insufficient to support a conclusion that ecological risks are absent. Constituents that failed the screen were reevaluated using more realistic assumptions.

None of the COPECs exceeded benchmarks for aquatic receptors; therefore, deposition of air emissions from the Energy Facility to surface water would pose no risk to aquatic organisms and bald eagles. For terrestrial receptors (i.e., plants, soil invertebrates, and birds and mammals), chromium, manganese, and nickel failed to pass the screening evaluation when total (incremental + background) concentrations were evaluated. However, in each case, these exceedances were driven by background concentrations. Background concentrations were obtained from readily available literature and regulatory agency guidance. Receptor-specific evaluation of chromium and cobalt exposure to birds resulted in no exceedances of literature-based toxicity thresholds.

Therefore, exposure to arsenic, cadmium, cobalt, and mercury associated with air emissions from the Energy Facility would pose no risk to plants, soil invertebrates, and birds and mammals, whereas potential risks to plants, soil invertebrates, and birds from exposure to chromium, manganese, and nickel are expected to be negligible. The conclusion from the screening-level ERA is that air emissions from the Energy Facility would not pose significant risk to bald eagles or their habitat.

Beneficial Use of Process Wastewater for Irrigation Pasture. For the process wastewater management alternative consisting of beneficial use of the water for irrigated pasture, constituents in the process wastewater would not be expected to be toxic to wildlife. A screening-level ERA following EPA and ODEQ guidance was conducted to determine the potential risk to plants, soil invertebrates, and wildlife from the process wastewater application (see Appendix C). Soil screening-level values for plants, invertebrates, birds, and mammals were available from ODEQ (2001) for many of the inorganic wastewater constituents. For birds, cobalt, iron, silver, thallium, and tin were lacking ODEQ screening values, but studies from which benchmarks could be developed for these metals were available. Similarly, iron, silver, tin, cyanide, and phenol benchmarks were developed for mammals from other sources.

Unlike the ODEQ screening values, which are presented as milligram (mg) constituent per kilogram (kg) soil, these benchmarks are presented as a dose (mg constituent/kg body weight/day) to the receptor. For comparison of these benchmarks, doses based on the maximum soil concentration, literature-derived wildlife parameters (i.e., diet, body weight, food ingestion rate, and soil ingestion rate), and literature-derived bioaccumulation factors for wildlife food items (i.e., plants and arthropods) were calculated for one bird (western meadowlark) and one mammal (deer mouse) for which exposure is likely to be high.

The process wastewater constituents evaluated, except aluminum, barium, boron, chromium III, copper, fluoride, iron, manganese, molybdenum, and nickel, passed the screening evaluation and are considered to present no risk to ecological receptors. After further evaluation, background concentrations were found to be the primary driver for screening failures of aluminum, barium, chromium III, copper, fluoride, iron, manganese, and nickel, with negligible incremental contributions of these constituents to the risk estimation. Considering the bioavailability of boron to plants (less than 5 percent of total boron) substantially reduced the risk estimation for boron. Although both incremental and total (incremental + background) boron concentrations continued to exceed screening levels for sensitive plant species, incremental and total exposures were below toxicity thresholds for invertebrates and for boron-tolerant plant species when adjusted for boron bioavailability. Estimated maximum concentrations of molybdenum exceeded the soil benchmark for plants; however, risk to terrestrial plants from molybdenum exposure is considered low because of the low exceedance of the screening value and the highly conservative assumptions applied to the risk estimation. Thus, none of the constituents evaluated are considered to present significant risk to ecological receptors.

Noise. Construction and noise from operating the Energy Facility may affect foraging and nesting behavior of bald eagles in the project area. Noise modeling was conducted to predict the Energy Facility's noise emissions during operation. The modeling assumes a "worst-case" scenario, with the Energy Facility operating under steady-state conditions at full capacity and with the combustion and steam turbines at base load and cooling tower fans on. After Energy Facility noise emissions were determined, modeling was performed to predict sound levels in the area around the Energy Facility (Figure 5-2). This modeling conservatively assumes environmental conditions that facilitate sound transmission and does not take into account additional mitigation factors such as vegetation and topography.

The Energy Facility site is located in a rural and relatively quiet area with ambient background noise at approximately 20 to 30 dBA. Peaks exceed 70 dBA near farm equipment. Ambient noise levels resulting from the operation of the proposed Energy Facility are estimated to be 40 dBA at approximately 2,500 feet from the Energy Facility. For comparison, a typical cooling fan on a desktop computer is 40 to 45 dBA at the operator's ears, and rustling leaves in a light breeze are generally louder than 30 dBA. Operational noise levels are expected to dissipate to approximately 35 dBA at a distance of approximately 4,000 feet from the Energy Facility (Figure 5-2). Power plant noise is typically very steady in nature, with no significant tones or impact type noises. The noise is similar to an idling car or a neighbor's air conditioning unit. The Energy Facility noise would tend to be a steady faint background noise source that is part of the steady background noise environment.

Because the Energy Facility site would be located in a low area (relative to surrounding topography), noise impacts to nearby habitat areas would be limited in geographic area and would likely be minor. The noise level during operations is estimated to be a maximum of 50 dBA immediately adjacent to the Energy Facility (Figure 5-2). Maximum noise levels resulting from the electric transmission line are expected to be 43 dBA at the edge of the right-of-way, dissipating to less than 30 dBA beyond 3,000 feet. It is unlikely that operation of the Energy Facility would result in adverse effects on the wildlife-inhabiting areas near the Energy Facility site, as the operational noise levels would likely be below the reported levels (80 to 100 dBA) known to be detrimental to wildlife and wildlife typically become habituated to the relatively low operation noise levels (Bowles, 1995).

Noise resulting from construction activities is expected to be greater than operational noise. Noise during construction would be temporary, but may cause bald eagles to reduce their use of nearby habitats and alter their behavior during the day when construction noise is present by modifying foraging and nesting locations. Additional noise impacts may result if blasting is required for installation of transmission tower footings. Noise associated with blasting and intermittent noise from pile driving would result in disturbance to nesting eagles in the area. See Appendix D for more detailed discussion of noise impacts on wildlife.

Ambient Light. Operation of the Energy Facility would result in an increase in ambient light. The disturbance effects would be localized to the immediate area of the Energy Facility and eagles would be expected to habituate to these changes. Low-impact directional lighting would be used to focus the light directly toward the Energy Facility, thus reducing ambient light into adjacent areas.

Avian Electrocution. The electric transmission line should not pose risk of electrocution to eagles. The towers would be designed and constructed with adequate separation between phase conductors and conductors to ground so that they would be wider than a large bird's wings and would not bridge any space that could result in the conduction of current. With these design features, there should be no risk of electrocution from the electric transmission line.

Avian Collisions. The Energy Facility may affect the bald eagle through collisions with the electric transmission line. Critical factors in determining the potential for a strike include the height of the towers and lines compared with the normal flight behavior of the bird, wing-loading and its effects on maneuverability, visibility, and the number of times a bird crosses the electric transmission line during daily flight. Collisions by raptors and songbirds are considered to be low owing to the maneuverability and flight behavior of these birds (APLIC, 1994). Most areas with high rates of collisions are located close or parallel to areas used by waterfowl (high-wing-load birds) with adverse sight conditions (e.g., fog and low clouds). Collisions typically occur when birds are moving between foraging areas and resting areas during bad weather conditions. To reduce the potential of avian collisions, the project proponent would provide mitigation by installing BFDs on the top static wires along the entire electric transmission line.

Avoidance and Minimization Measures for Bald Eagles

Preconstruction Surveys. Preconstruction surveys would be conducted by qualified biologist for suitable nesting habitat within a 1/2 mile line-of-site and 1/4 mile no line-of-site radius of the proposed Energy Facility, water supply pipeline, natural gas pipeline, and electric transmission line. Surveys would note any foraging areas used by bald eagles. Any active nest locations identified within the survey area would be recorded using a submeter accuracy Global Positioning System (GPS) and mapped on aerial photo base maps of the survey area. Information on known nest locations would also be obtained from previous surveys conducted in the area.

Monitoring Active Nest Sites. In the event that an active nest location is identified in the study area, maps showing ½- to ¼-mile avoidance areas would be generated and construction timing restrictions would be implemented to minimize or avoid potential impacts to nesting birds. Potential impacts include abandonment of young birds or nests by adults, and disturbance of essential forage habitats that result in unsuccessful reproduction. Construction in areas within a ½-mile line-of-site or ¼-mile no-line-of-site from active nests should be postponed, if possible, until after the fledglings are no longer dependent on the nest tree. If construction cannot be postponed in the area of an active nest until the young are fledged, then the nest site would be monitored by a qualified biologist during courtship, nest building, incubation, and the period while raising their young in relation to project activities. The monitoring biologist would stop work if it appears the activities impede reproduction. The biologist would coordinate with ODFW and USFWS on when to allow construction to resume. Monitoring reports would be prepared and submitted.

Avian Electrocution. The electric transmission line would be designed to prevent avian electrocutions. To prevent electrocutions, conductor wires would be spaced further apart than the wing span of a large birds (24 feet on the vertical and 25 feet on the diagonal) (APLIC, 1996).

Avian Collision. Avian collision with the top groundwires could occur year-round. The potential for eagle collisions with the electric transmission line is considered to be low because their foraging behavior is relatively slow (compared to peregrine falcon and other raptors). To minimize impacts to bald eagles (and other birds in the area), colored BFDs would be installed on the top groundwires to make them more visible to birds during flight and minimize bird collisions. BFDs are 15-inch-long PVC tubing coiled to a height of 7 inches, spaced 16 feet apart along the wires (see the avian collision monitoring plan in Appendix E). BFDs are especially effective at increasing visibility of wires during fog and rain events and have reduced avian collisions by 57 to 89 percent (Brown and Drewien, 1995).

Annual monitoring of the lines would be conducted to determine if the lines have substantial effects on waterfowl and special-status birds that forage or nest in the area. Avian collision studies are being developed to monitor the effectiveness of the BFDs, as discussed in Appendix E. The monitoring plan would include observations at the Energy Facility site and along the route of the new electric transmission line. If monitoring results show that bald eagles are foraging at the water supply reservoir, remedial actions may be implemented as described in Appendix E.

Compensatory Mitigation Measures

Compensatory mitigation for the loss of upland bald eagle foraging habitat would be managed with the establishment and restoration of an approximately 236-acre mitigation area in fallow agricultural field and degraded juniper woodland habitat north and west of the Energy Facility (see Appendix A). The mitigation area would benefit the bald eagle by creating new forage to offset the relatively minor impacts to sagebrush-steppe and ponderosa pine stand. The mitigation would also benefit several wildlife species besides the bald eagle. The mitigation area would be fenced with wildlife-friendly fencing and include water troughs for wildlife.

5.2.2 Shortnose and Lost River Sucker

The shortnose sucker (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*) were listed as endangered on July 18, 1988 (53 FR 27130). The shortnose sucker is endemic to the Upper Klamath Basin of southern Oregon and northern California. Shortnose suckers are found in numerous lakes and rivers throughout the region, including Upper Klamath Lake, Clear Lake Reservoir, Gerber Reservoir, Tule Lake, the Klamath River, and the Lost River system. While primarily a lake-dwelling fish, it spawns between February and May in river habitats with gravelly substrates including the Sprague, Williamson, and Wood Rivers, as well as Crooked Creek and the Clear Lake watershed. Shoreline areas with a mosaic of open water, emergent vegetation, and woody structures are important for larval development. The shortnose sucker is a bottom feeder whose diet includes detritus, zooplankton, algae, and aquatic invertebrates.

Shortnose Sucker

Historically, shortnose suckers were abundant throughout the Klamath Basin (Federal Register, 1988). However, dams, diversion structures, irrigation canals, and development of the Klamath Basin have resulted in habitat fragmentation and population isolation. Additional factors leading to the population decline include loss of wetland habitat, hybridization, predation and competition from exotic fish species, and poor water quality. Hypereutrophication of lake habitats appears to be a principle factor in poor recruitment of this species (USFWS, 1993).

The shortnose sucker has historically been reported in the Lost River above Harpold Reservoir, approximately 4 miles south of the Energy Facility site, and at Bonanza Big Springs, located approximately 3 miles north of the Energy Facility Site (USFWS, 1993).

Lost River Sucker

The Lost River sucker is endemic to the Upper Klamath Basin of southern Oregon and northern California. The Lost River sucker is found in Upper Klamath Lake, Clear Lake Reservoir, Tule Lake, the Klamath River, and the Lost River. The Lost River sucker is a lake-dwelling fish that spawns between February and May in tributary rivers and streams with gravelly substrates. Shoreline habitats that have open water intermixed with emergent vegetation are important for larval and juvenile development. This species feeds on a variety of aquatic invertebrates, algae, detritus, and zooplankton found on lake bottoms.

Dams, diversion structures, irrigation canals, and development have resulted in habitat fragmentation and population isolation. Competition and predation by exotic species, wetland drainage, poor water quality, and eutrophication have also contributed to the decline of this species.

The Lost River sucker historically has been reported in the Lost River above Harpold Reservoir, approximately 4 miles south of the Energy Facility site, and at Bonanza Big Springs, located approximately 3 miles north of the Energy Facility Site (USFWS, 1993).

Survey Results

No perennial fish-bearing streams were identified in the area immediately adjacent to any of the proposed Facility features. However, irrigation canals may provide habitat for listed fish species (LeCaptain, 2002). While surveys were not conducted in any of the irrigation canals located in the project area, fish were observed in one of the irrigation drainages near the Babson well site during the Babson well pump test. Greg White, a fisheries biologist with CH2M HILL, met with Leonard LeCaptain of USFWS on September 24, 2002, to investigate this drainage and determined that these fish were most likely red shiners, a nonlisted minnow species. This discharge of water from the deep zone occurred only during the pump test and as described above. During operation of the Energy Facility, there would be no discharge of wastewater to surface water.

Critical Habitat

Critical habitat was proposed by USFWS for the shortnose sucker and the Lost River sucker on December 1, 1994 (FR 59, No. 230). Proposed units near the project area include:

- Unit 2—Tule Lake. Located approximately 13 air miles south of the project area, this unit includes Tule Lake and the Lost River up to the Anderson Rose Dam.
- Unit 3—Klamath River. Located approximately 20 air miles west of the project area, this unit includes the Klamath River from the Iron Gate Dam in northern California to the Link River Dam in southern Oregon.
- Unit 4—Upper Klamath Lake. Located approximately 22 air miles west of the project area, this unit includes Upper Klamath Lake and portions of the watershed on the west side and Agency Lake, including much of the Wood River Watershed.
- Unit 5—Williamson and Sprague River. Located approximately 20 air miles north of the project area, this unit includes the Williamson River from Upper Klamath Lake to the confluence with the Sprague River and the Sprague River upstream to the confluence with Brown Creek.
- Unit 6—Gerber Reservoir. Located approximately 10 air miles east of the project area, this unit includes Gerber Reservoir and portions of the Ben Hall, Barnes, Barnes Valley, Pitchlog, and Wildhorse Creek Watersheds.

Air Emissions. The potential risk from air emissions (and subsequent deposition to surface water) to aquatic organisms (e.g., shortnose and Lost River suckers) was included in the screening-level ERA described above for bald eagles. The full-text screening-level ERA, including methods, assumptions, receptors, and screening values, is attached as Appendix C.

Although these the shortnose and Lost River suckers are located north of the proposed Energy Facility, which is outside the area predicted to experience the maximum concentrations from the air emissions, the maximum concentration was used in the risk evaluation. Additionally, ODEQ screening level values for aquatic biota were used to evaluate potential risk to the two endangered fish species. These values are intended to protect 95 percent of aquatic species, 95 percent of the time. Therefore, constituents that passed the screen were considered to pose no significant risk to aquatic organisms.

None of the COPECs exceeded benchmarks for aquatic receptors; therefore, deposition of air emissions from the Energy Facility to surface water are considered to pose no risk to shortnose and Lost River suckers.

Project Impacts

Process Wastewater Management and Stormwater. Under the preferred alternative, the Energy Facility would not discharge to surface waters. Process wastewater from the Energy Facility (excluding the sanitary wastewater) would be managed by one of three alternatives:

- Beneficial use of the water for irrigated pasture
- Evaporation in an onsite, lined evaporation pond
- Storage and hauling to a WWTP for offsite disposal

Stormwater runoff from the Energy Facility would be collected in an engineered stormwater system and routed to a stormwater pond. The stormwater pond would be sized to detain approximately 750,000 gallons (2.3 acre-feet) of water based on a 25-year storm event. This stormwater pond would allow sediment and other suspended solids to settle before the stormwater is discharged and routed to a 4.7-acre infiltration basin. For these reasons, stormwater runoff from the Energy Facility would not likely have any measurable impact on surface water quality in the vicinity of the Energy Facility, including the Lost River or irrigation canals. The stormwater pond is located on the Energy Facility site immediately adjacent to the air-cooled condensers. Bald eagles and other birds are not expected to forage around the stormwater pond owing to the proximity of noise generating equipment.

No surface water would be used for Facility operations. The raw water for the Energy Facility would come from a well system that produces water from water-bearing zones below 1,500 feet bgs.

Improbable Worst-Case Connection. Previous borehole geophysics and aquifer testing at the Babson well identified the presence of two separate aquifer systems (CH2M HILL, 1994). The shallow aquifer system (above approximately 500 feet) is a heavily appropriated basalt aquifer that is in varying degrees of hydraulic connection with the Lost River and Bonanza Big Springs. The shallow system is used for irrigation and domestic water supply. The deep aquifer system produces water from water-bearing zones below 1,500 feet bgs. No data gathered from the monitoring well network during a pump test conducted in August and September 2002 indicate that the deep aquifer withdrawals would impact groundwater levels in the shallow aquifer, or flows at Bonanza Big Springs and the Lost River.

The available evidence supports the conclusion that there is no hydraulic connection between the deep and shallow zones, which include the Lost River. However, if one were to assume that an extremely efficient hydraulic connection did in fact exist between the deep system and the Lost River, any impact on the Lost River from the proposed pumping would be imperceptible. To demonstrate this fact, the project proponent conducted a "worst-case" analysis (Appendix F). The analysis is not intended to describe an outcome that is likely or even plausible, but rather shows that even if one makes the most conservative assumptions at every step of the process, there still is no potential for a measurable impact on the Lost River.

The assumptions used in this analysis are sufficiently conservative that they do not actually represent the most probable outcome: no impact at all. This analysis is provided only to create a framework for understanding the magnitude of any potential impact, not to describe a physical mechanism for what might actually occur. The repeatedly conservative assumptions used in this analysis indicate that the maximum reduction in the lowest range of summer flows of the Lost River is roughly 0.00074 gpm as the river passes through the 2-mile reach closest to the Babson well. This reduction would represent a 0.000004 percent reduction in the lowest range of summer flows. This degree of connection is unlikely, and it is additionally unlikely that this impact would result in an impact to fish habitat or passage if it were to occur.

Avoidance and Minimization Efforts

The use of water from a deep zone aquifer system would avoid impacts to surface water. The zero discharge wastewater system would minimize water use and water quality impacts to surface water and the shallow groundwater under the Energy Facility site. The stormwater system would minimize water quality impacts to irrigation canals and to the Lost River.

Mitigation Measures

No additional mitigation measures are proposed for listed fish species.

5.3 Cumulative Effects

In the Klamath Ecological Province, agricultural development and water diversions have had a significant impact on the amount of native plant communities and wetlands throughout the Klamath Basin. Biodiversity has been reduced by the loss and fragmentation of native habitats. The proposed Energy Facility would contribute marginally to the further loss of habitat. At Facility retirement, the project proponent would implement a Facility Retirement and Site Restoration Plan (Exhibit W in the EFSC site certificate application) to ensure that soil in and around the Energy Facility site is returned to conditions suitable for agricultural use.

The new electric transmission line could increase the overall avian collisions in the Bryant Mountain area. The installation of BFDs on the top groundwires of the proposed new electric transmission line would minimize the potential for increased collisions in the area.

No cumulative affects on the Applegate's milk-vetch, Lost River sucker, and shortnose sucker are expected to occur as a result of the proposed project.

TABLE 5-1
Known Effects to Selected Waterfowl Species from High Salinity Levels

Species	Salinity Concentration in Water (ppm)	Effects/Comments	Reference
Mallard	~ 11,000	Reduced growth	Swanson et al., 1984
	8,800–12,000 (as sodium)	100% mortality	Mitcham and Wobeser, 1988a
	9,000–12, 000	No Effect	Nystrom and Pehrsson, 1988
	10,000–15,000	Level of concern	Swanson et al., 1984
	15,000	100 percent mortality (7-day-old ducklings)	Barnes and Nudds, 1991
Mottled Duck	9,000	Threshold level for adverse effects	Moorman et al., 1991
	12,000	Reduced growth, 10% mortality	
	15,000	90% mortality	
	18,000	100% mortality	
Peking Duck	20,000	Level of concern	Nystrom and Pehrsson, 1988

Source: U.S. Department of the Interior. 1998. *Guidelines for Interpretation of the Biological Effects of Selected Constituents in Biota, Water, and Sediment*. National Irrigation Water Quality Program Information Report. No. 3. Table 30.

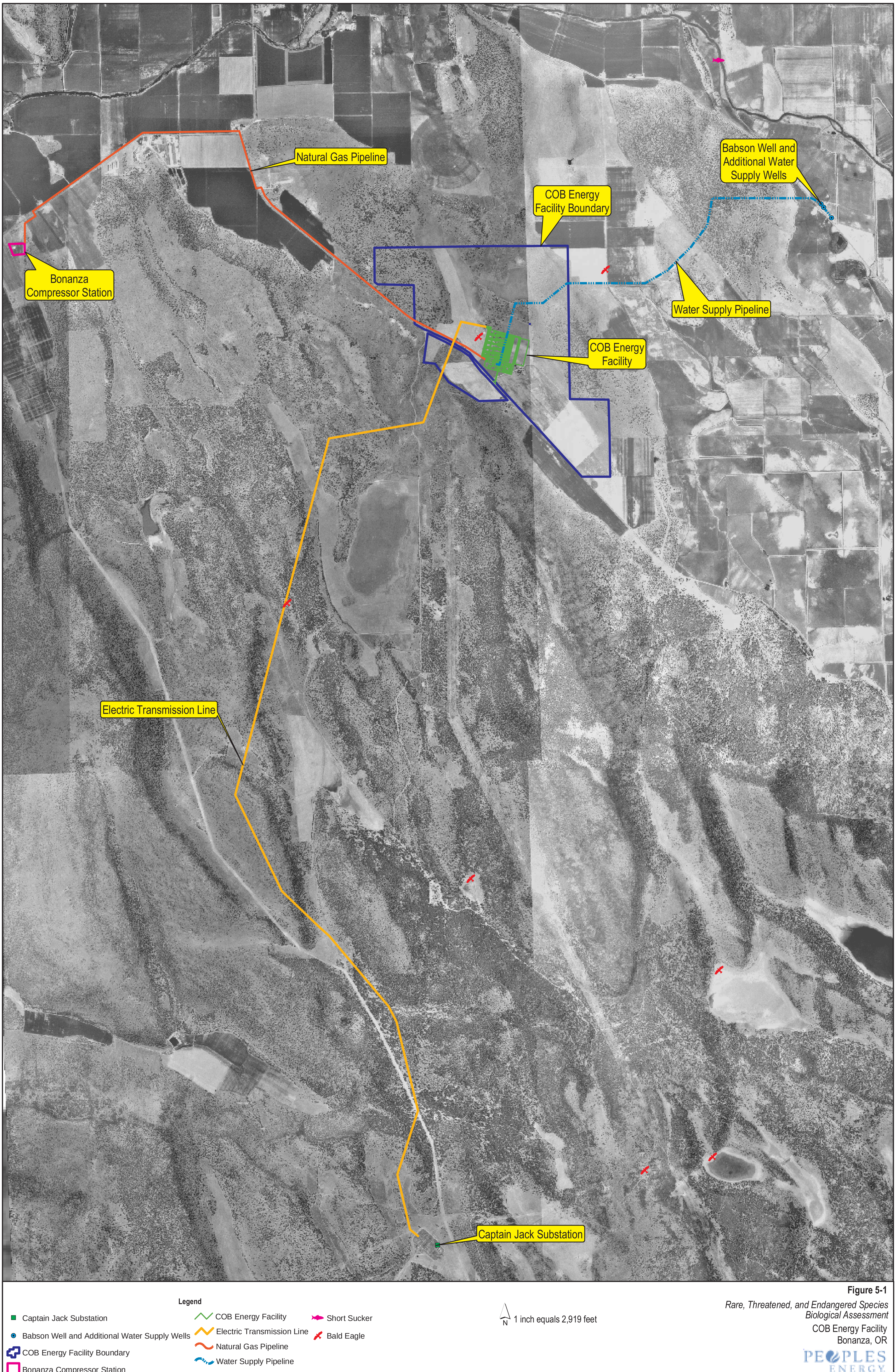

Figure 5-1

Rare, Threatened, and Endangered Species Biological Assessment

COB Energy Facility
Bonanza, OR

PEOPLES ENERGY RESOURCES

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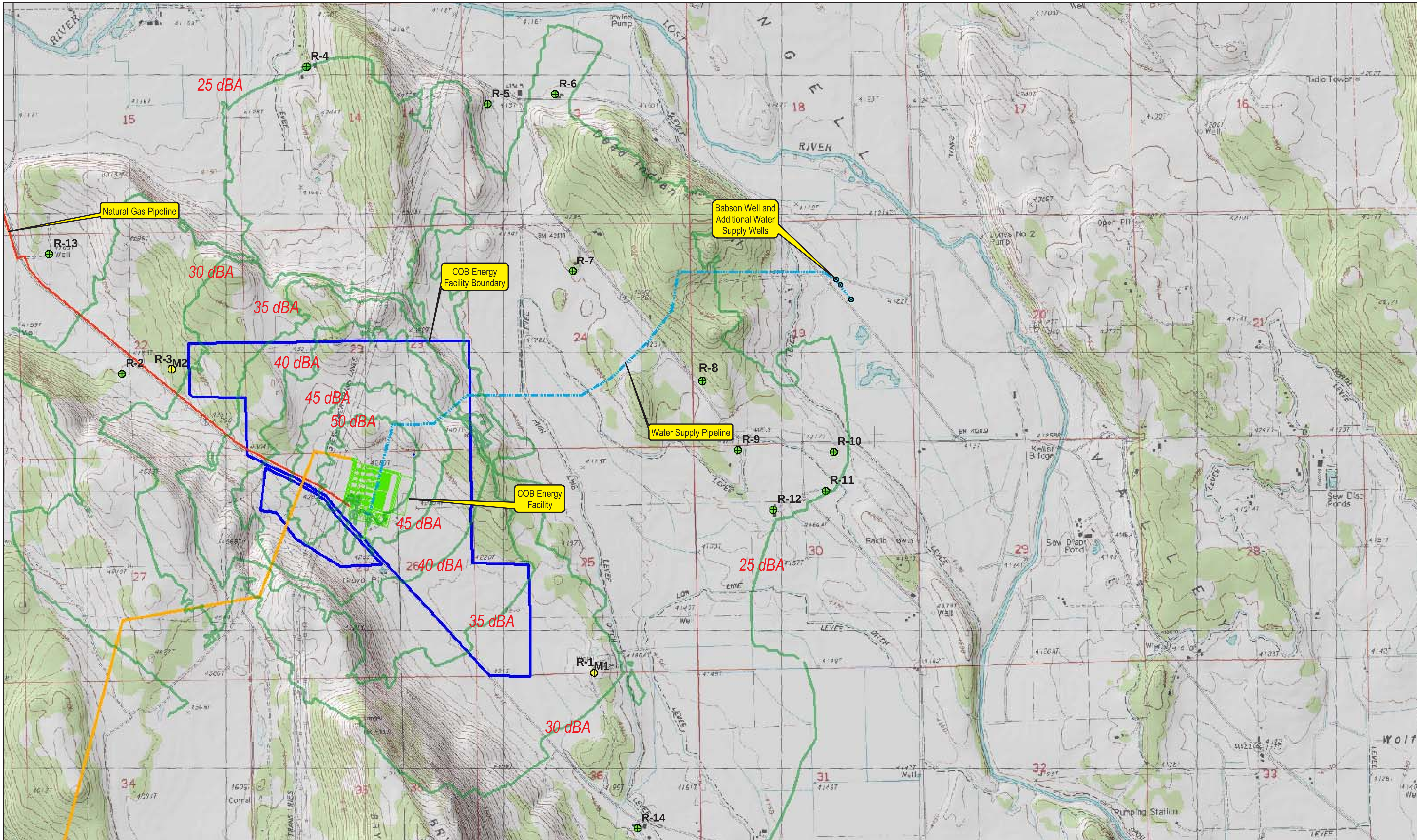

Legend

- Babson Well and Additional Water Supply Wells
- COB Energy Facility Boundary
- COB Energy Facility
- Electric Transmission Line
- Natural Gas Pipeline
- Water Supply Pipeline
- Noise Contours
- Monitoring Locations
- Receptors

N

1 inch equals 2,100 feet

0 800 1,600 3,200 Feet

Figure 5-2

Predicted Noise Levels
Biological Assessment
COB Energy Facility
Bonanza, OR

PEOPLES ENERGY

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SECTION 6

Conclusion

This section summarizes the conclusions reached for the following federally listed species.

6.1 Applegate's Milk-Vetch

The proposed project would have no effect on Applegate's milk-vetch. No populations of this species are known to occur in the vicinity of the project area and none were identified during field surveys.

6.2 Lost River and Shortnose Suckers

The proposed project would have no effect on either the Lost River sucker or the shortnose sucker. Water would be supplied from a deep aquifer system that is isolated from surface water features providing habitat to these species. The Energy Facility would be designed to be zero discharge. Therefore, no wastewater would be discharged into any surface water or irrigation canal.

6.3 Bald Eagle

The conclusion of the BA for bald eagles is as follows: "The project may affect, likely to adversely affect, bald eagles." Bald eagles are known to occur in nest locations that have been confirmed approximately 1 mile from the proposed new electric transmission line. Temporary effects to bald eagles foraging in the project area may occur from temporary construction noise at the Energy Facility site and along the route of the electric transmission line. Bald eagles are expected to acclimate to the continuous noise from the Energy Facility and the noise should not adversely affect foraging efforts. Preconstruction surveys and timing restrictions on certain activities would be required to minimize adverse effects if active nest locations are identified within ½ mile of project activities. Impacts to bald eagles from the loss of marginal foraging habitat at the Energy Facility site would be less than significant with implementation of the mitigation area.

The proposed new electric transmission line may cause an increase in avian collisions in the area. Bird flight diverters would be placed on the top groundwires to reduce the potential for collisions. Annual monitoring of the new lines would be conducted to determine if the lines cause substantial effects to the bald eagle population.

Implementing the compensatory mitigation measure (preserving, enhancing, and managing the approximately 236-acre mitigation area north and west of the Energy Facility) would benefit bald eagle foraging in the long-term, and would also benefit other wildlife such as mule deer, antelope, sagebrush lizard, and prey species for raptors such as mice and gophers. At Facility retirement, the project proponent would implement a Facility Retirement and Site Restoration Plan (Exhibit W in the EFSC site certificate application) to ensure that soil in and around the Energy Facility site is returned to conditions suitable for agricultural use.

SECTION 7

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APPENDIX A

Habitat Mitigation and Natural Area Revegetation Plan

APPENDIX A TO THE BIOLOGICAL ASSESSMENT

Habitat Mitigation and Natural Area Revegetation Plan

Introduction

The proposed COB Energy Facility would be a combined-cycle electric generating plant fired solely on natural gas. The biological assessment (BA) contains a detailed description of the Energy Facility and its associated related and supporting facilities, collectively referred to as the Facility.

This Habitat Mitigation and Natural Area Revegetation Plan (the Revegetation Plan) describes revegetation and habitat improvement practices to be employed by COB Energy Facility, LLC (the project proponent) in areas that are in native condition, and not in agricultural use. It has been adapted from the revegetation plan (Exhibit P, Attachment P-1) in the site certificate application filed for the COB Energy Facility with the Oregon Office of Energy on September 5, 2002, as amended by Amendment No. 1, filed with the Oregon Energy Facility Council (EFSC) on July 25, 2003.

Conclusion

The project proponent would mitigate for permanently disturbed habitat by restoring, enhancing, and protecting habitat in accordance with Oregon Department of Fish and Wildlife (ODFW) habitat mitigation goals. Mitigation would include preservation, restoration, and habitat improvement of approximately 236 acres, including fallow agricultural land that has been heavily grazed, and degraded juniper sagebrush habitat on land that would be purchased by the project proponent (Figure 2-2 in the Biological Assessment). Detailed revegetation and habitat improvement plans for the mitigation site would be developed through consultations with the U.S. Fish and Wildlife Service (USFWS), ODFW, and the Bureau of Land Management (BLM).

Permanently disturbed habitats during the 30-year operating life of the proposed Facility are described in Table 2-1 of the BA. Only the Energy Facility site, water supply well system, and electric transmission line would have permanent disturbance. The water supply and natural gas pipelines would not have permanent disturbance, but would have temporary construction disturbances of 4 months and 3 months, respectively.

The revegetation goal for mitigation of permanently disturbed habitat is no net loss in either existing habitat quantity or quality. The Revegetation Plan has been prepared to guide the revegetation efforts and achieve this mitigation goal. The proposed Facility would permanently disturb approximately 108.7 acres during the 30-year operating life of the Energy Facility. At Facility retirement, the project proponent would implement a Facility Retirement and Site Restoration Plan (Exhibit W in the site certificate application) to ensure that soil in and around the Energy Facility site is returned to conditions suitable for agricultural use. The electric transmission line would be removed (i.e., the transmission towers, conductors and ground wires, and insulators) and the transmission tower footings would be removed to a depth of 5 feet. The natural gas and water supply pipelines would be capped and left in place. Proposed habitat mitigation and revegetation for temporary disturbances are summarized in Tables A-1 and A-2, respectively.

As shown in Table A-3, included in the mitigation is 94.9 acres of Klamath County mapped, high-density deer winter range (ODFW Category 2). A total of 46.0 acres would be permanently disturbed and 48.9 acres would be temporarily disturbed by the Facility. However, a large portion (approximately 57.9 acres) actually consists of fallow agricultural fields, which provide minimal habitat and forage value for wintering deer. This land does not provide biological value consistent with its Category 2 designation. If the approximately 51.9 acres were to be rated based on biological criteria, they would be Category 4. Nonetheless, the project proponent has evaluated these areas and would mitigate for them as Category 2.

The mitigation for Category 2 habitats would include restoration and improvement of areas permanently disturbed during the 30-year operating life of the Energy Facility by disturbance from the footprint area of the various Facility features. Mitigation for these areas would also involve a net improvement of existing habitat through removal of western juniper trees to promote growth of desirable forage species and the addition of watering stations for wildlife. The revegetation goal for temporarily disturbed areas is to return the disturbed habitat to preconstruction (or better) conditions.

Preliminary seed mixes, planting methods, and weed control techniques have been developed for the Facility site through a biological evaluation of the existing plant communities in the area and reviews of relevant literature. Final seed mixtures would be developed during consultation with the BLM, USFWS, and ODFW staff. The revegetation plan specifies monitoring procedures to evaluate the success of the revegetation efforts, and contingency measures if initial revegetation efforts prove unsuccessful in certain areas.

Environmental Setting

The Facility is located within the Klamath Ecological Province (East Cascades Ecoregion) on the eastern side of the Cascade Mountains. This region is characterized by large basins surrounded by ancient lake terraces and basaltic fault block mountains. Elevations range from about 4,000 to 8,000 feet. The soil in the area is derived from basaltic parent material and generally has loamy surface horizons overlaying loamy to clayey subsurface horizons. A silica cemented hardpan occurs at depths of about 3 feet in many of the ancient dry lakebeds in the area (Anderson et al., 1998; Franklin and Dyrness, 1988).

Historically, ponderosa pine forest accounted for nearly 50 percent of the vegetative cover in this region. However, since 1936, western juniper woodlands and agricultural areas have significantly expanded (Anderson et al., 1998). Sagebrush-steppe is also a major habitat type throughout this ecoregion (Franklin and Dyrness, 1988).

Proposed Habitat Preservation and Mitigation Site

Much of the area proposed for habitat mitigation and enhancement is located on a fallow agricultural field, as shown on Figure 2-2 in the BA. Until 1999, this land was used for dryland farming of cereal rye grass. Existing vegetation is sparse and includes species such as tansy mustard (*Descurainia sophia*), clasping pepperweed (*Lepidium perfoliatum*), blue-eyed Mary (*Collinsia parviflora*), and yellowspine thistle (*Cirsium ochrocentrum*).

The remaining mitigation and enhancement area is characterized by juniper woodland habitat consisting of a sparse understory with few shrubs and native grasses. Mapped habitat types are shown on Figure 4-1 in the BA.

Climate

The regional climate is characterized by warm, dry summers and cool, moist winters. The average annual precipitation in Klamath County is 14 inches, of which only 27 percent occurs during the growing season (Anderson et al., 1998).

Data from the Oregon Climate Service for Klamath Falls collected between 1971 and 2000 suggest that the average yearly precipitation is 13.95 inches, with average annual snowfall of 32.36 inches. Most of the precipitation occurs between November and March. The average maximum temperature for the year is 61.8 °F, and the average minimum temperature is 35.3 °F. The growing season extends from late April through October.

Current Land Use

The Energy Facility site is located on a fallow field that was used for dryland grain farming until 1999. The vegetation in this area is sparse and consists primarily of ruderal, non-native grasses and forbs. The fallow field and adjacent juniper-sagebrush habitats are currently leased for seasonal cattle grazing.

Water Supply Well System

The water supply well system is located on the east side of East Langell Valley Road at the existing Babson Well. The present-day land use is irrigated pasture, which is currently grazed by sheep.

Water Supply Pipeline

Land uses observed along the water supply pipeline route include irrigated pasture, an alfalfa hay field, open rangeland/woodlands managed by private landowners, and dryland farming and cattle grazing on a fallow field. The rangeland/woodlands are characterized by western juniper with an understory of low sagebrush, rabbitbrush, and annual grasses and forbs. Most of the juniper woodland area has been heavily grazed. Understory vegetation in these areas is sparse and consists primarily of non-native annual species.

Natural Gas Pipeline

Land uses observed along the natural gas pipeline route include irrigated pasture, a dairy, industrial land (the compressor station), farming practices related to cattle feed (alfalfa hay and grain silage), rangeland/woodlands where residents are located, and dryland farming and cattle grazing on a fallow field (the last section of the natural gas pipeline before it connects with the Energy Facility).

Electric Transmission Line

Land uses observed along the electric transmission line route include existing electric transmission lines, fallow agricultural fields used for cattle grazing, ponderosa pine woodland, open rangeland/woodlands managed by federal and private landowners, and the PG&E Gas Transmission Northwest (PG&E GTN) interstate gas pipeline system. The ponderosa pine woodland is isolated in a lowland area and is surrounded by rangeland areas characterized by western juniper.

Irrigated Pasture Area

The vegetation in this area is sparse and consists primarily of ruderal, non-native grasses and forbs. The fallow field and adjacent juniper-sagebrush habitats are currently leased for seasonal cattle grazing.

Soil

Several soil types are present on the Facility site, but most of the lands subject to revegetation are mapped as part of the Calimus or Lorella series. Other soil series found in the vicinity of the Facility include Harriman, Henly, Calimus fine sandy Loam, and the Stukel-Capona complex. .

The excavated topsoil (upper 12 inches) from the natural gas and water supply pipelines would be salvaged and stored prior to trench excavation. Once the pipelines have been installed, the topsoil would be replaced over the refilled trench and the surface would be regraded to original contours. Prior to seeding, the soil may be disked to ensure good seedling establishment.

Existing Vegetation

General habitat and vegetation descriptions are provide in the BA. Juniper-sagebrush is the predominant natural habitat in the Facility vicinity. Other impacted natural habitat types include sagebrush-steppe and ponderosa pine woodland.

Noxious Weeds

A noxious weed is a plant that is considered aggressive and intrusive, resulting in detrimental impacts to important native species, habitats, and agriculture. Such plants are difficult to control or eradicate. The Oregon Department of Agriculture designates plant species as noxious weeds and classifies species on the size of the infestation, ability to control and eradicate, and economic as well as ecological significance.

The project proponent would use Best Management Practices (BMPs) to avoid and minimize potential impacts from noxious weeds. During construction, efforts would be made to minimize the spread of noxious weeds and other undesirable non-native species. Removal of exotic invasive plants would be performed on an as-needed basis during the revegetation process. Weed control treatment methods may include hand pulling of small, isolated, herbaceous populations; limited spot application of herbicide (e.g., Roundup); mechanically disking to a 6-inch depth; or cutting (e.g., weed-eaters, mowing).

The goal of weed control efforts would be to remove competitive, non-native vegetation and prevent the spread and establishment of noxious weeds and other undesirable plant species into new areas as a result of Facility construction. In areas where weedy species are present, the goal is to prevent increased weed density, control and maintain the spread, and reduce the population where possible. Complete eradication of undesirable species is not likely. However, weed populations should not exceed the baseline conditions in any of the revegetated areas. Establishment of native vegetation would prevent establishment of noxious weeds in the mitigation and enhancement areas.

The following noxious weeds have been observed in the Facility area and have the potential to spread as a result of increased disturbance, inhibit natural regeneration of desirable species, and reduce the success of revegetation efforts:

- Leafy spurge (*Euphorbia esula*)—Widespread, but not abundant in the project area.
- Bull thistle (*Cirsium vulgare*)—Widespread, but not abundant in the project area.
- Field bindweed (*Convolvulus arvensis*)—Common in fallow agricultural fields, but limited distribution in the project area
- Medusa-head (*Taeniatherum caput-medusae*)—Limited to the area around Captain Jack Substation; species is present, but not abundant
- Quack grass (*Elytrigia repens*)—Limited distribution in the project area in pastures and along roadsides
- Scotch thistle (*Onopordum acanthium*)—Locally common in disturbed areas, limited where dense native vegetation is present
- Musk thistle (*Carduus nutans*)—Locally common in disturbed areas, limited where dense native vegetation is present

Other non-native, weedy species common in the area included:

- Yellow spine thistle (*Cirsium ochrocentrum*)—Common in fallow agricultural fields
- Cheatgrass (*Bromus tectorum*)—Locally common in highly disturbed areas, but limited where dense native vegetation is present
- Tansy mustard (*Descurainia sophia*)—Common in fallow agricultural fields and highly disturbed areas
- Field pepperweed (*Lepidium campestre*)—Common in fallow agricultural fields
- Tumble mustard (*Sisymbrium altissimum*)—Common in fallow agricultural fields
- Tubercled crowfoot (*Ranunculus testiculatus*)—Common in some highly disturbed areas
- Common mullein (*Verbascum thapsus*)—Locally abundant in areas along the PGT natural gas easement

Erosion Control

The project proponent would implement and follow an erosion and sediment control plan as part of the 1200-C construction National Pollutant Discharge Elimination System (NPDES) permit. For temporary disturbance, control measures would be used to redirect surface runoff, decrease the velocity of surface runoff, capture suspended sediment, and stabilize exposed soil. These measures include, but are not limited to, the use of straw bales, sandbags, and silt fences. These erosion control measures would be used along the perimeters of the work areas and wherever else appropriate to prevent sediment runoff and debris from entering drainages or other sensitive habitat. Following construction, areas of disturbance would be seeded with native vegetation to provide long-term erosion control.

Restoration of Temporarily Disturbed Sites and Habitat Mitigation

Temporary Disturbance

The goal for revegetation of temporarily disturbed areas is to return the site to the predisturbance condition or better (with the exception of ponderosa pine trees within the electric transmission line easement). The existing vegetation in adjacent, undisturbed areas would provide reference conditions for revegetation of the disturbed areas. If the adjacent areas are generally denuded or characterized by undesirable species, the revegetation goal is to enhance the habitat by planting desirable native species. Where temporary disturbance occurs in areas that are considered relatively undisturbed, the mitigation goal is to return the habitat to predisturbance conditions.

Habitat Preservation, Mitigation and Enhancement

The goal for mitigation and enhancement areas for the Facility’s permanent disturbance during the 30-year operating life of the Energy Facility is to transform relatively poor quality habitat such as fallow agricultural land and barren juniper woodland into productive, high-quality wildlife habitat by planting desirable species for deer, antelope, pygmy rabbits, and other wildlife species. Improvement of Category 2 habitat areas would involve the removal of dense juniper to improve the growth and establishment of desirable species, and the addition of wildlife watering stations.

Revegetation and Habitat Improvement Procedures

Select Qualified Revegetation Contractor

The revegetation contractor would have a demonstrated record of successfully implementing revegetation projects of comparable size and type.

Determine Seed Mixture and Application Rates

A list of potential plant species to be used in temporarily and permanently disturbed natural habitats as well as in the habitat mitigation and enhancement area is provided in Table A-4. Species were selected based on existing vegetation, current land use, and habitat enhancement and mitigation goals in each disturbance location. The final seed mixture, planting rates, and seed source would be subject to approval by ODFW, USFWS, and the BLM prior to revegetation planting. Revegetation planting and management for temporary disturbance on private lands in native condition (including native areas in degraded condition), for which the project proponent has obtained a construction easement, would be subject to the approval of the landowner. These areas may include some non-native species (e.g., annual grasses) which are better suited for the current land use activities.

Planting Methods

Planting methods would be based on site-specific factors, such as slope, soil, and the size of the planting area. Certified weed-free seed would be used for all areas.

Rangeland Seed Drill Method

A seed drill would be used for revegetation of pastureland and natural areas along the natural gas and water supply pipelines, and for the mitigation and habitat enhancement of areas such as fallow agricultural fields.

Broadcast Seeding

Broadcast seeding would be used to replant small areas or sites where drill seeding is not possible, such as steep slopes and extremely stony or rocky soil. In these areas, seed would be spread using a belly grinder or some other form of dispersal mechanism.

Container Planting

Curl-leaf mountain mahogany (*Cercocarpus ledifolius*) and antelope bitterbrush (*Purshia tridentata*) have poor germination and survival when planted as seed. Therefore, establishment of these species would be accomplished by planting container grown plants. Mulch would be placed around the base and each plant would be protected with mesh to prevent browsing during initial seedling establishment.

Juniper Removal

Removal of western juniper trees would promote growth of desirable browse species as well as herbaceous vegetation. Juniper thinning would be done in areas of the 235.5-acre habitat preservation site as well as on the 62.3 acres of temporarily and permanently disturbed ODFW Category 2 habitat (see Figure 2-2 in the BA). Removal of juniper tree would most likely be done using a mechanical harvester with rubber tires.

Success Criteria

Revegetation success criteria would be determined through (1) comparison of the restored and enhanced habitats with vegetation on adjacent, undisturbed areas, (2) selected reference sites nearby the Facility, or (3) other success criteria established by ODFW, BLM, and/or USFWS. Restoration success would be based on the results as determined by the monitoring procedures discussed below.

Monitoring Procedures

During the year following each seeding, a qualified botanist or restoration expert would examine a representative sample of the revegetated sites. Care would be taken to survey areas in all the major habitat types and throughout the geographic extent of the revegetation area. At least 10 percent of the revegetated acreage would be examined.

Reference sites are areas of natural vegetation that have not been subject to disturbance as a result of the project. Restored and mitigation areas should be similar in composition and structure to undisturbed natural vegetation in the area or meet otherwise predetermined standards. Reference sites nearby the Facility would be selected on the basis of target plant community composition and environmental parameters (soil, slope, aspect, grazing pressure) similar to the revegetated areas. A minimum of three reference sites would be used to establish success criteria. Within each selected reference area, a minimum of three 16.5 feet by 16.5 feet sample plots would be randomly located. Data collected from each plot would include:

- Species composition
- Plant density
- Percent cover of vegetation (both native and non-native herbaceous and woody species), as well as bare soil and rock
- Community structure
- Degree of erosion due to construction activities (high, moderate, or low)
- Representative photos from each sampling location

The same sampling protocol would be used to assess the revegetation success of the disturbed natural habitats and the mitigation and enhancement planting areas. The objective of revegetation and mitigation planting is no net loss in habitat quantity or quality. Success of the revegetation areas would be determined relative to the conditions of the selected reference sites. Parameter measures in the revegetated areas should be within 15 percent of the reference locations. Access to revegetation sites would be provided to pertinent regulatory agencies with 48 hours advance notice.

Fencing

The habitat mitigation and improvement sites would be fenced prior to seeding. Fences would be designed to exclude cattle and other domestic ungulates, but would allow access to mule deer and antelope in accordance with ODFW guidelines. Domestic grazing would not occur in the habitat mitigation and enhancement areas unless it is determined that limited grazing would be a beneficial management practice. The fences would be maintained throughout the life of the Facility.

Maintenance

The COB Energy Facility would be responsible for the continued maintenance activities associated with the habitat mitigation and preservation areas. Maintenance activities could include fence repair, periodic weed control, juniper removal, monitoring of improvement success, and reseeding (in areas where vegetation establishment fails to meet the success criteria).

Remedial Actions

During the initial stages of monitoring, the germination and establishment success of target species would be closely tracked. In the event that the initial planting appears insufficient to achieve revegetation goals, additional seeding, mulching, or plug planting may be required.

Reporting Schedule

Within 60 days of completion of seeding and planting the revegetation project, an as-built report would be prepared. The as-built report would identify any changes from the original plan, such as changes in composition of the seed mix and application methods. The as-built report would serve as a baseline for future monitoring reports.

In addition, an annual monitoring report would be submitted by October 1 of each year that monitoring is conducted. The monitoring report would outline results of vegetation sampling and photo monitoring, and identify any remedial action recommended to meet goals.

References

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TABLE A-1
Proposed Mitigation for Permanent and Temporary Disturbance of Natural Habitat Areas

Summary of Disturbance	Proposed Mitigation Measures
54.4 acres of permanent disturbance during the 30-year operating life of the Energy Facility to natural habitats including juniper-sagebrush (31.6 acres), sagebrush- steppe (10.4 acres), and ponderosa pine woodland (12.4 acres).	Creation and preservation of an approximately 236-acre habitat mitigation site. Creation of a minimum of 2 snag trees per acre within the ponderosa pine woodland area.
46.0 acres of permanent disturbance during the 30-year operating life of the Energy Facility to high-density winter deer range habitat (ODFW habitat category 2). 48.9 acres of temporary disturbance to high-density winter deer range habitat (ODFW habitat category 2).	Creation and preservation of an approximately 236-acre habitat mitigation site. Implementation of net habitat improvement by thinning western juniper trees within the 154-foot easement for the electric transmission line on 79.7 acres of juniper-sage habitat. The purpose would be to promote growth of desirable browse species. Installation of wildlife watering stations on the mitigation site and along the electric transmission line.
Additional temporary disturbance to 26.2 acres of natural habitats including juniper-sagebrush (22.8 acres), sagebrush-steppe (1.8 acres), and ponderosa pine woodland (12.4 acres).	Revegetation of temporary disturbed sagebrush habitat areas to predisturbance conditions or better. Revegetation of temporary disturbed habitats within the right-of-way in the ponderosa pine habitat. Would include a variety of low-growing shrubs, native grasses, and forbs to promote habitat diversity, forage availability and wildlife habitat.

TABLE A-2
Revegetation and Restoration of Temporarily Disturbed Areas

Facility Feature	Habitat and Soil	Impacts	Revegetation and Habitat Enhancement[1]
Electric transmission line	Juniper-Sagebrush (35.2 acres) Lorella and Calimus gravelly, stony loams, with 2 to 35% slopes	Tree removal, tower construction, and conductor installation	Broadcast seeding of native grasses, forbs, and shrubs (mostly low sagebrush, with some serviceberry and gooseberry)
	Sagebrush-steppe (12.2 acres) Calimus fine sandy loam and Harriman loams, with 2 to 15% slopes	Tower construction and conductor installation	Broadcast seeding of native grasses, forbs, and big sagebrush. Plug planting of bitterbrush.
	Ponderosa Pine (14.0 acres) Harriman loam with 2 to 15% slopes	Tree removal, tower construction, and conductor installation	Juniper clearing, creation of snags. Broadcast seeding of native grasses, forbs, and shrubs (service berry, gooseberry), plug planting of curl-leaf mountain mahogany
	Pasture (2.4 acres) Harriman loam with 0 to 15% slopes	Tower construction and conductor installation	Minimization and mitigation practices in accordance with Attachment K-5 of the COB Energy Facility site certificate application
	Fallow Field (1.1 acres) Harriman loam with 0 to 15% slopes	Tower construction and conductor installation	Drill seeding of native grasses and forbs
Natural gas pipeline easement corridor (not including 3.6 acres of temporary disturbance on PG&E Gas Transmission Northwest property, which is industrially developed land)	Juniper-sagebrush (9.0 acres) Lorella and Calimus loam and gravelly, stony loam with 2 to 35% slopes	Clearing, trench excavation, and soil stockpiling	Drill seeding of native grasses, forbs, and shrubs (low sagebrush, gooseberry, and serviceberry). Plug planting of bitterbrush and curl-leaf mountain mahogany.
	Agricultural fields (23.9 acres) Calimus and Henly loams with 0 to 5% slopes and Stukel-Capona loams with 2-15% slopes.	Clearing, trench excavation, and soil stockpiling	Minimization and mitigation practices in accordance with Attachment K-5 of the COB Energy Facility site certificate application
	Pasture (0.8 acre) Calimus loam with 0 to 5% slopes and Stukel-Capona loams with 2 to 15 percent slopes	Clearing, trench excavation, and soil stockpiling	Minimization and mitigation practices in accordance with Attachment K-5 of the COB Energy Facility site certificate application

TABLE A-2
Revegetation and Restoration of Temporarily Disturbed Areas

Facility Feature	Habitat and Soil	Impacts	Revegetation and Habitat Enhancement[1]
	Fallow Field (3.5 acres) Calimus loam with 2 to 5% slopes	Clearing, trench excavation, and soil stockpiling	Drill seeding of native grasses, forbs
	Ruderal—private property (3 acres) Calimus loam with 0 to 5% slopes	Clearing, trench excavation, and soil stockpiling	Per landowner specifications
Water pipeline construction corridor	Juniper-Sagebrush (10.2 acres) Lorella and Calimus loam and gravelly, stony loam, with 2 to 35% slopes	Clearing, trench excavation, and soil stockpiling	Drill seeding of native grasses, forbs and shrubs (low sagebrush, gooseberry and serviceberry). Plug planting of bitterbrush and curl-leaf mountain mahogany.
	Agricultural fields (1.4 acres) Stukel-Capona loam, with 2-15% slopes	Clearing, trench excavation, and soil stockpiling	Minimization and mitigation practices in accordance with Attachment K-5.
	Pasture (6.3 acres) Calimus loams with 0-5% slopes, Laki and Henly loams with 0-2% slopes	Clearing, trench excavation, and soil stockpiling	Minimization and mitigation practices in accordance with Attachment K-5 of the COB Energy Facility site certificate application
	Fallow fields (0.8 acres) Calimus loam, 2-5% slope	Clearing, trench excavation, and soil stockpiling	Drill seeding of native grasses, forbs and shrubs (low sagebrush, gooseberry and serviceberry). Plug planting of bitterbrush and curl-leaf mountain mahogany.
	Ruderal (0.7 acre) Calimus fine sandy loam and Laki-Henly loams with 0-5% slopes	Clearing, trench excavation, and soil stockpiling	Minimization and mitigation practices in accordance with Attachment K-5 of the COB Energy Facility site certificate application.
Water supply staging area	Pasture (1.3 acres) Calimus loam, 0-5% slopes	Clearing and leveling	Minimization and mitigation practices in accordance with Attachment K-5 of the COB Energy Facility Site Certificate Application.
Irrigation pipeline	Fallow field (5.2 acres)	Clearing, trench excavation, and soil stockpiling	Drill seeding of native grasses and forbs

TABLE A-3
Permanent and Temporary Disturbances of ODFW Habitats (in acres)

Feature	Total	ODFW 2	ODFW 3	ODFW 4	ODFW 5	ODFW 6
Permanent						
Energy Facility site	50.6	13.9	4.2	32.5		
Water supply well system	0.3			0.3		
Water supply pipeline	0.0					
Natural gas pipeline	0.0					
Electric transmission line	57.3	31.6	25.7			
Access Road to Pasture	0.5	0.5				
Total—Permanent	**108.7**	**46.0**	**29.9**	**32.8**	**0.0**	**0.0**
Additional Temporary Disturbance						
Construction parking/laydown	71.0	19.7	6.4	44.9		
Water supply well system	1.0			1.0		
Water supply pipeline	19.4	6.6	1.8	11.0		
Natural gas pipeline	43.8	13.1		27.1		3.6
Electric transmission line	7.6	4.7	2.9			
Irrigation Pipeline	5.2	4.8		0.4		
Total—Additional Temporary Disturbance	**148.0**	**48.9**	**11.1**	**84.4**	**0.0**	**3.6**
Total—Permanent and Temporary	**256.7**	**94.9**	**41.0**	**117.2**	**0.0**	**3.6**

TABLE A-4
Proposed Native Plant Species for Revegetation

Native Grasses	
Thurber's needlegrass	*Achnatherum thurberianum*
Squirrel Tail	*Elymus elymoides*
Idaho Fescue	*Festuca idahoensis*
Sandberg's Bluegrass	*Poa secunda*
Bluebunch wheatgrass	*Pseudoroegneria spicata*
Native Forbs	
Sagebrush buttercup	*Ranunculus glaberrinus*
Common Lomatium	*Lomatium utriculatum*
Wooly sunflower	*Eryophylum lanatum*
Prairie lupine	*Lupinus lepidus*
Velvet Lupine	*Lupinus leucophyllus*
Spreading Phlox	*Phlox diffusa*
Showy Penstemon	*Penstemon speciosus*
Shrubs	
Low sagebrush	*Artemisia arbuscula*
Big Sagebrush	*Artemisia tridentata*
Antelope bitterbrush	*Purshia tridentata*
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*
Desert gooseberry	*Ribes velutinum*
Serviceberry	*Amelanchier alnifolia*

APPENDIX B

Plant and Wildlife Species Observed During Field Surveys in the Project Area

APPENDIX B TO THE BIOLOGICAL ASSESSMENT

Plant and Wildlife Species Observed During Field Surveys in the Project Area

TABLE B-1
Plant Species Observed During Botanical Surveys of the Project Area

Scientific Name	Common Name	Native/ Non-native	Habitat
Apiaceae			
Lomatium nudicaule	Pestle lomatium	Native	Perennial
Lomatium triternatum	Lewis' lomatium	Native	Perennial
Lomatium utriculatum	Common lomatium	Native	Perennial
Perideridia oregana	Oregon yampah	Native	Perennial
Asclepiadaceae			
Asclepias speciosa	Showy milkweed	Native	Perennial
Asteraceae			
Achillea millefolium	Yarrow	Native	Perennial
Agoseris glauca	Pale agoseris	Native	Perennial
Antennaria rosea	Rosy pussytoes	Native	Perennial
Anthemis arvensis	Corn chamomile	Non-native	Annual
Artemisia arbuscula	Low sagebrush	Native	Shrub
Artemisia tridentata	Big sagebrush	Native	Shrub
Balsamorhiza sagittata	Arrow-leaved balsam-root	Native	Perennial
Bidens cernua var. *cernua*	Nodding bur-marigold	Native	Perennial
Blepharipappus scaber	Blepharipappus	Native	Annual
*Carduus nutans**	Musk thistle	Non-native	Perennial
Chrysothamnus nauseosus	Grey rabbitbrush	Native	Shrub
Chrysothamnus viscidiflorus	Green rabbitbrush	Native	Shrub
*Cirsium ochrocentrum**	Yellow-spine thistle	Non-native	Perennial
*Cirsium vulgare**	Bull thistle	Non-native	Bien.
Crepis acuminata	Tapertip hawksbeard	Native	Perennial
Crepis modocensis	Low hawksbeard	Native	Perennial
Crocidium multicaule	Spring gold	Native	Annual
Erigeron bloomeri	Scabland fleabane	Native	Perennial
Erigeron filifolius var. *filifolius*	Thread-leaved fleabane	Native	Perennial
Eriophyllum lanatum	Wooly sunflower	Native	Perennial
Microseris laciniata	cutleaf silverpuffs	Native	Perennial
Microseris nutans	Nodding microseris	Native	Perennial
Onopordum acanthium ssp. *acanthium**	Scotch thistle	Non-native	Bien.
Psilocarphus brevissimus	Dwarf wooly-heads	Native	Annual
Senecio canus	Grey groundsel	Native	Perennial

TABLE B-1
Plant Species Observed During Botanical Surveys of the Project Area

Scientific Name	Common Name	Native/ Non-native	Habitat
Senecio integerrimus var. *exaltatus*	Western groundsel	Native	Perennial
Senecio integerrimus var. *major*	Lambstongue groundsel	Native	Perennial
Stenotus stenophyllus	Narrow -leaf goldenweed	Native	Annual
Taraxacum officinale	Dandelion	Non-native	Perennial
Tragopogon dubius	Goat's beard	Non-native	Perennial
Wyethia angustifolia	Narrow-leaf mule ears	Native	Perennial
Boraginaceae			
Amsinckia sp.	Fiddleneck	---	---
Cryptantha ambigua	Basin cryptantha	Native	Annual
Cryptantha sp.	Cryptantha	---	---
Hackelia cusickii	Cusicks stickseed	Native	Perennial
Lithospermum ruderale	Stoneseed	Native	Perennial
Plagiobothrys stipitatus	Popcorn flower	Native	Annual
Brassicaceae			
Alyssum alyssoides	Small alyssum	Non-native	Annual
Arabis X*divaricarpa*	Rockcress	Non-native	Perennial
Descurainia sophia	Tansy mustard	Non-native	Annual
Idahoa scapigera	Flat-pod	Native	Annual
Lepidium campestre	Field pepperweed	Non-native	Annual
Lepidium perfoliatum	Clasping pepperweed	Non-native	Annual
Phoenicaulis cheiranthoides	Daggerpod	Native	Perennial
Sisymbrium altissimum	Tumble mustard	Non-native	Annual
Campanulaceae			
Downingia sp.	Downingia	---	---
Caprifoliaceae			
Sambucus mexicana	Blue elderberry	Native	Shrub
Caryophyllaceae			
Arenaria aculeata	Needleleaf sandwort	Native	Perennial
Arenaria congesta var. *congesta*	Ballhead sandwort	Native	Perennial
Silene sp.	Campion	---	---
Chenopodiaceae			
Chenopodium album	Lambs quarters	Non-native	Annual
Salsola tragus	Russian thistle	Non-native	Annual
Convolvulaceae			
*Convolvulus arvensis**	Field bindweed	Non-native	Annual
Cupressaceae			
Juniperus occidentalis	Western juniper	Native	Tree
Cyperaceae			
Carex filifolia	Thread-leaf sedge	Native	Perennial
Carex sp.	Sedge	---	---

TABLE B-1
Plant Species Observed During Botanical Surveys of the Project Area

Scientific Name	Common Name	Native/ Non-native	Habitat
Eleocharis macrostachya	Creeping spikerush	Native	Perennial
Scirpus acutus	Tule	Native	Perennial
Dryopteridaceae			
Cystopteris fragilis	Fragile fern	Native	Fern
Euphorbiaceae			
*Euphorbia esula**	Leafy spurge	Non-native	Perennial
Fabaceae			
Astragalus curvicarpus var. *curvicarpus*	Curvepod milkvetch	Native	Perennial
Astragalus filipes	Basalt milkvetch	Native	Perennial
Astragalus purshii	Pursh's milkvetch	Native	Perennial
Lupinus lepidus var. *sellulus*	Prairie lupine	Native	Perennial
Lupinus leucophyllus	Velvet lupine	Native	Perennial
Medicago sativa	Alfalfa	Non-native	Perennial
Melilotus indica	Sour clover	Non-native	Annual
Vicia americana	American vetch	Non-native	Annual
Gentianaceae			
Swertia albicaulis	Whitestem gentian	Native	Perennial
Geraniaceae			
Erodium cicutarium	Storksbill	Non-native	Annual
Grossulariaceae			
Ribes velutinum	Desert gooseberry	Native	Shrub
Hydrophyllaceae			
Hydrophyllum capitatum	Alpine waterleaf	Native	Perennial
Nemophila pedunculata	Meadow nemophila	Native	Annual
Phacelia hastata	Silverleaf phacelia	Native	Perennial
Phacelia heterophylla ssp. *virgata*	Varileaf phacelia	Native	Perennial
Phacelia linearis	Threadleaf phacelia	Native	Annual
Juncaceae			
Juncus balticus	Baltic rush	Native	Perennial
Lamiaceae			
Agastache urticifolia	Nettle-leaved horsemint	Native	Perennial
Marrubium vulgare	Horehound	Non-native	Perennial
Lemnaceae			
Lemna minor	Duckweed	Native	Perennial
Liliaceae			
Calochortus macrocarpus	Sagebrush mariposa lily	Native	Perennial
Fritillaria atropurpurea	Spotted fritillary	Native	Perennial
Smilacina racemosa	Western Solomon's seal	Native	Perennial
Zigadenus venenosus var. *venenosus*	Death camas	Native	Perennial

TABLE B-1
Plant Species Observed During Botanical Surveys of the Project Area

Scientific Name	Common Name	Native/ Non-native	Habitat
Linaceae			
Hesperolinon micranthum	Threadstem flax	Native	Annual
Linum lewisii	Western blue flax	Native	Perennial
Loasaceae			
Mentzelia veatchiana	Veatchs blazingstar	Native	Annual
Malvaceae			
Malva neglecta	Common mallow	Non-native	Perennial
Sidalcea oregana	Oregon checker mallow	Native	Perennial
Onagraceae			
Camissonia tanacetifolia	Tansy-leaved evening primrose	Native	Perennial
Clarkia rhomboidea	Forest clarkia	Native	Annual
Pinaceae			
Pinus ponderosa	Ponderosa pine	Native	Tree
Poaceae			
Achnatherum thurberianum	Thurber's needlegrass	Native	Perennial
Alopecurus pratensis	Meadow foxtail	Non-native	Perennial
Agropyron desertorum	Desert crested wheatgrass	Non-native	Perennial
Agrostis exarata	Spike bentgrass	Native	Perennial
Beckmannia syzigachne	Slough grass	Native	Annual
Bromus madritensis ssp. *rubens*	Red brome	Non-native	Annual
Bromus tectorum	Cheat grass	Non-native	Annual
Deschampsia danthonioides	Annual hairgrass	Native	Annual
Elymus elymoides	Squirreltail	Native	Perennial
Elytrigia elongata	Tall wheatgrass	Non-native	Perennial
Elytrigia intermedia	Intermediate wheatgrass	Non-native	Perennial
*Elytrigia repens**	Quack grass	Non-native	Perennial
Festuca arundinacea	Tall fescue	Non-native	Perennial
Festuca idahoensis	Idaho fescue	Native	Perennial
Hordeum murinum spp. *leporinum*	Farmers foxtail	Non-native	Annual
Leymus triticoides	Creeping wildrye	Native	Perennial
Poa pratensis	Kentucky bluegrass	Non-native	Perennial
Poa secunda	Bluegrass	Native	Perennial
Polypogon monspeliensis	Annual beardgrass	Non-native	Annual
Pseudoroegneria spicata	Bluebunch wheatgrass	Native	Perennial
Secale cereale	Cereal rye	Non-native	Annual
*Taeniatherum caput-medusae**	Medusa head	Non-native	Annual
Polemoniaceae			
Collomia grandiflora	Mountain collomia	Native	Annual
Ipomopsis aggregata	Scarlet gilia	Native	Perennial

TABLE B-1
Plant Species Observed During Botanical Surveys of the Project Area

Scientific Name	Common Name	Native/ Non-native	Habitat
Navarretia leucocephala	White-headed navarretia	Native	Annual
Phlox diffusa	Spreading phlox	Native	Perennial
Polygonaceae			
Eriogonum sphaerocephalum var. *halimioides*	Rock buckwheat	Native	Perennial
Eriogonum umbellatum	Sulfur-flower buckwheat	Native	Perennial
Rumex crispus	Curly dock	Non-native	Perennial
Portulacacaea			
Claytonia perfoliata	Miner's lettuce	Native	Annual
Potomagetonaceae			
Potamogeton sp.	Pondweed	---	---
Primulaceae			
Dodecatheon conjugens	Shooting star	Native	Perennial
Dodecatheon pulchellum	Dark-throat shooting star		Perennial
Ranunculaceae			
Adonis aestivalis	Summer pheasant's eye	Non-native	Annual
Delphinium nuttallianum	Dwarf larkspur	Native	Perennial
Myosurus minimus	Mouse-tail	Native	Annual
Ranunculus aquatilus	Aquatic buttercup	Native	Perennial
Ranunculus glaberrimus	Sagebrush buttercup	Native	Perennial
Ranunculus testiculatus	Tubercled crowfoot	Non-native	Annual
Rosaceae			
Amelanchier alnifolia	Service-berry	Native	Shrub
Cercocarpus ledifolius	Mountain mahogany	Native	Perennial
Geum triflorum	Old man's beard	Native	Perennial
Prunus subcordata	Klamath Plum	Native	Perennial
Purshia tridentata	Antelope bitterbrush	Native	Shrub
Rosa woodsii	Interior rose	Native	Shrub
Rubiaceae			
Galium aparine	Common bedstraw	Native	Annual
Galium sp.	Bedstraw	---	---
Salicaceae			
Populus tremuloides	Quaking aspen	Native	Tree
Saxifragaceae			
Lithophragma parviflorum	Woodland star	Native	Perennial
Scrophulariaceae			
Castilleja linariifolia	Desert paintbrush	Native	Perennial
Collinsia parviflora	Blue-eyed Mary	Native	Annual
Penstemon laetus	Mountain blue penstemon	Native	Perennial
Penstemon rydbergii var. *oreocharis*	Meadow beardtongue	Native	Perennial
Penstemon speciosus	Showy penstemon	Native	Perennial

TABLE B-1
Plant Species Observed During Botanical Surveys of the Project Area

Scientific Name	Common Name	Native/ Non-native	Habitat
Verbascum thapsus	Common mullein	Non-native	Perennial
Veronica anagallis-aquatica	Water speedwell	Non-native	Perennial
Veronica peregrina var. *xalapensis*	Purslane speedwell	Native	Annual
Solonaceae			
Nicotiana attenuata	Coyote tobacco	Native	Annual
Typhaceae			
Typha latifolia	Broad-leaved cattail	Native	Perennial
Valerianaceae			
Plectritis brachystemon	Short-spurred plectritis	Native	Annual
Violaceae			
Viola bakeri	Baker’s violet	Native	Perennial

Note:

* Indicates that the species is an Oregon Department of Agriculture List B noxious weed.

Taxonomy follows the protocol in *The Jepson Manual—Higher Plants of California.* 1993. J.C. Hickman, ed. University of California Press, Berkeley.

TABLE B-2
Wildlife Species Observed During Field Surveys of the Project Area

Common Name	Scientific Name	Observed Habitat*
Birds		
Pied-billed grebe	*Podilymbus podiceps*	WO
American white pelican	*Pelecanus erythrorhynchos*	T, P
Great blue heron	*Ardea herodias*	WO
Sandhill crane	*Grus canadensis*	WO
Green-winged teal	*Anas crecca*	WO
Mallard	*Anas platyrhynchos*	WO, T
Northern shoveler	*Anas clypeata*	WO
American wigeon	*Anas americana*	WO
Bufflehead	*Bucephala albeola*	WO
Common merganser	*Mergus merganser*	WO
Turkey vulture	*Cathartes aura*	P, GP, WO, T
Bald eagle	*Haliaeetus leucocephalus*	WO, P, T, GP
Northern harrier	*Circus cyaneus*	WO, GP, P
Sharp-shinned hawk	*Accipiter striatus*	T
Cooper’s hawk	*Accipiter cooperii*	T
Red-tailed hawk	*Buteo jamaicensis*	T, WO, GP, P
Swainson’s hawk	*Buteo swainsoni*	WO, T, GP, P
Rough-legged hawk	*Buteo lagopus*	WO, GP, P
California quail	*Callipepla californica*	WO, P
American coot	*Fulica americana*	WO
Killdeer	*Charadrius vociferus*	T, WO, GP, P
Wouldet	*Catoptrophorus semipalmatus*	WO
Common snipe	*Gallinago gallinago*	WO
Gull	*Larus* sp.	WO, P, GP
Forster’s tern	*Sterna forsteri*	WO
Rock dove	*Columba livia*	WO, GP
Mourning dove	*Zenaida macroura*	T, GP
Great horned owl	*Bubo virginianus*	T
Common nighthawk	*Chordeiles minor*	T
Anna’s hummingbird	*Calypte anna*	T, WO
Calliope hummingbird	*Stellula calliope*	T
Red-breasted sapsucker	*Sphyrapicus ruber*	T
Downy woodpecker	*Picoides pubescens*	T

TABLE B-2
Wildlife Species Observed During Field Surveys of the Project Area

Common Name	Scientific Name	Observed Habitat*
Northern flicker	*Colaptes auratus*	T, WO, GP, P
Say's phoebe	*Sayornis saya*	T
Ash-throated flycatcher	*Myiarchus cinerascens*	T, WO
Western kingbird	*Tyrannus verticalis*	WO, GP, P, T
Cliff swallow	*Hirundo pyrrhonota*	WO, GP
Steller's jay	*Cyanocitta stelleri*	WO, T, P
Western scrub jay	*Aphelocoma coerulescens*	P, T, WO
Black-billed magpie	*Pica pica*	T, WO, GP, P
American crow	*Corvus brachyrhynchos*	GP
Common raven	*Corvus corax*	WO
Black-capped chickadee	*Parus atricapillus*	T
Mountain chickadee	*Parus gambeli*	P
White-breasted nuthatch	*Sitta carolinensis*	T
Rock wren	*Salpinctes obsoletus*	T
Ruby-crowned kinglet	*Regulus calendula*	T
Western bluebird	*Sialia mexicana*	WO, P
Mountain bluebird	*Sialia currucoides*	T
American robin	*Turdus migratorius*	WO, T
Northern mockingbird	*Mimus polyglottos*	WO, P
Loggerhead shrike	*Lanius ludovicianus*	GP
European starling	*Sturnus vulgaris*	WO, P
Warbling vireo	*Vireo gilvus*	WO, P
Yellow-rumped warbler	*Dendroica coronata*	WO
Western tanager	*Piranga ludoviciana*	WO, T
Spotted towhee	*Pipilo maculatus*	T
Lark sparrow	*Chondestes grammacus*	T, WO, P
Song sparrow	*Melospiza melodia*	WO
Golden-crowned sparrow	*Zonotrichia atricapilla*	T, WO, P
White-crowned sparrow	*Zonotrichia leucophrys*	WO
Dark-eyed junco	*Junco hyemalis*	P
Red-winged blackbird	*Agelaius phoeniceus*	WO
Tricolored blackbird	*Agelaius tricolor*	WO
Western meadowlark	*Sturnella neglecta*	WO, T, GP
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	WO

TABLE B-2
Wildlife Species Observed During Field Surveys of the Project Area

Common Name	Scientific Name	Observed Habitat*
Brewer's blackbird	*Euphagus cyanocephalus*	WO
Brown-headed cowbird	*Molothrus ater*	WO
Northern oriole	*Icterus galbula*	WO
House finch	*Carpodacus mexicanus*	GP, P, WO, T
Evening grosbeak	*Coccothraustes vespertinus*	WO, T
Mammals		
Pygmy rabbit	*Brachylagus idahoensis*	T
Nuttall's cottontail	*Sylvilagus nuttallii*	T, P, WO, GP
Black-tailed hare	*Lepus californicus*	WO, P
Least chipmunk	*Tamias minimus*.	T, P
Townsend's ground squirrel	*Spermophilus townsendii*	T, P, WO, GP
California ground squirrel	*Spermophilus beecheyi*	T, P, WO, GP
Golden-mantled ground squirrel	*Spermophilus lateralis*	T
Yellow-bellied marmot	*Marmota flaviventris*	WO, P, T
Northern pocket gopher	*Thomomys talpoides*	P
Ord's kangaroo rat	*Dipodomys ordii*	P
Dusky-footed woodrat	*Neotoma fuscipes*	P
Bushy-tailed woodrat	*Neotoma cinerea*	T
Coyote	*Canis latrans*	T, WO, GP, P
Badger	*Taxidea taxus*	T, WO, P
Mule deer	*Odocoileus hemionus*	WO, T, GP, P
Pronghorn	*Antilocapra americana*	T, P
Amphibians and Reptiles		
Western fence lizard	*Sceloporus occidentalis*	P, WO, GP, T
Sagebrush lizard	*Sceloporus graciosus*	P, WO, GP, T
Racer	*Coluber constrictor*	T
Garter snake	*Thamnophis elegans*	T
Bullfrog	*Rana catesbeiana*	WO

*Linear types in which species were observed during surveys.

WO = water pipeline supply route overland
GP = gas pipeline supply route
T = electric transmission line route
P = Facility site

Appendix C

Screening-Level Ecological Risk Assessment

Screening-Level Ecological Risk Assessment COB Energy Facility, Bonanza, Oregon

PREPARED FOR: Mark Bricker/CH2M HILL-PDX

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DATE: October 2, 2003

1. Introduction

A screening-level ecological risk assessment (ERA) following U.S. Environmental Protection Agency (EPA) and Oregon Department of Environmental Quality (ODEQ) guidance was conducted to determine the potential risk to plants, soil invertebrates, and wildlife from air emissions at the COB Energy Facility, and the potential risk of using process wastewater to irrigate 31 acres of pasture and to improve grazing forage yield in areas currently without irrigation. Because there is an active bald eagle nesting area near McFall Reservoir, located approximately 6 miles south of the proposed facility location, the U.S. Fish and Wildlife Service (USFWS) has expressed concern about the potential impacts of the air emissions of the Energy Facility on bald eagles and their habitat. Two endangered fish species (shortnose sucker and Lost River sucker) that historically have been found in the Lost River, located 2 miles north of the Energy Facility, and one plant species (Applegate's milk-vetch) are of concern as well.

The screening-level ERA was conducted as part of the biological assessment (BA) to address the potential risk from air emissions (and subsequent deposition to surface water) to aquatic organisms and to the bald eagle (with exposure via food web transfer). Upland areas surrounding the Energy Facility site also were evaluated for possible risks to terrestrial plants, soil invertebrates, and terrestrial birds and mammals resulting from terrestrial deposition of air emissions and from reuse of the process wastewater for irrigation.

The procedures used in conducting the ERA are consistent with those described in the following ODEQ and EPA guidance documents:

- Guidance for Ecological Risk Assessment: Level II Screening Level Values (ODEQ, 2001)
- *Framework for Ecological Risk Assessment* (EPA, 1992a)
- *Final Guidelines for Ecological Risk Assessment* (EPA, 1998a)

Ecological risks were evaluated on the basis of conservative assumptions, maximum estimated media concentrations, and screening toxicity values. As is appropriate for a screening-level assessment, risk is not discussed in terms of the potential to cause risk, but in terms of passing or failure to pass the screening evaluation. This screening assessment was based on conservative assumptions such that constituents that passed the screen can be considered to pose no significant risk to ecological receptors. Failure to pass the screen, however, cannot be concluded to represent the presence of risk. Rather these results indicate that available data are insufficient to support a conclusion that ecological risks are absent. Constituents that failed the screen were reevaluated using more realistic assumptions.

This ERA is presented in four sections: problem formulation, exposure assessment, effects assessment, and risk characterization.

2. Problem Formulation

The problem formulation is the first and most critical component of any risk assessment. It involves identifying the problem and chemicals to be addressed, describing the affected site, selecting assessment and measurement endpoints, and developing a site conceptual model and data quality objectives. The problem formulation serves to provide direction and focus to the assessment process.

2.1 Site Description

This section summarizes the location and environmental setting of the Energy Facility (see Sections 2 and 4 of the BA for a more detailed discussion). Briefly, the Energy Facility site is located 3 miles south of Bonanza, Oregon, and 34 miles east of Klamath Falls, Oregon. The Lost River is located approximately 2 miles north of the Energy Facility site and Bryant Mountain is located approximately 1 mile south of the Energy Facility site. Various habitat types within the expected impact area of the Energy Facility include western juniper woodland, Ponderosa pine forest, sagebrush-steppe, ruderal areas, agricultural lands, and several riparian areas associated with the water resources in the area (e.g., Klamath River and tributaries).

2.2 Contaminants of Potential Ecological Concern

Contaminants of potential ecological concern (COPECs) are those chemicals that are present at the site in concentrations that may exceed toxicity thresholds for ecological receptors. This ERA evaluates estimated media concentrations modeled from the air emissions predicted from the natural gas combustion at the Energy Facility and estimated soil concentrations from land application of process wastewater. Because the primary deposition area for air emissions is outside the Energy Facility site (see Figure 1), the deposition from air emissions is not expected to overlap with the process wastewater application area. These two inputs, therefore, were considered separately and were not considered to be additive in soil. Methods used for estimating soil and water concentrations are described below.

2.2.1 Air Emissions

Predicted hazardous air pollutants (HAPs) and their estimated annual emissions are presented in Table 1 along with the estimated annual emissions of particulate matter under 10 microns (PM_{10}). Additionally, the distribution of ground-level air concentrations of PM_{10} was modeled for a radius of 6 miles around the Energy Facility. The area predicted to have the highest PM_{10} concentrations is depicted in Figure 1. Although organic constituents are estimated in the air emissions (see Table 1), all the organic HAPs are in the vapor phase (vapor phase fraction 100 percent; EPA, 1999), and thus are not expected to have significant deposition to soil or water in the Energy Facility area. Most of the polycyclic aromatic hydrocarbons (PAHs) also are in the vapor fraction (greater than 75 percent; EPA, 1999), and will not have significant deposition in the modeling domain. As a result, the organic HAPs are assumed to vaporize and are not evaluated in this ERA. Metals are of primary concern because of their potential for deposition and low, if any, loss rate from soil and water. These metals include arsenic, cadmium, chromium, cobalt, manganese, mercury, and nickel.

To determine air concentrations of the metals in soil and surface water, the concentration of PM_{10} was multiplied by the ratio of PM_{10} annual emission rate and annual emission rate of the metal. This approach was based on the assumption that all metals are a fraction of the PM_{10} air concentration. The estimated ground-level air concentration of each metal then was used to calculate soil and water concentrations using the following equation from the EPA combustion guidance (EPA, 1998b):

$$Cs = 100 * [(Dydw + Dyww)/(Zs*BD)]*tD$$

Where,

Cs = average soil or water concentration over exposure duration (mg/kg or mg/L),

100 = units conversion factor ($mg\text{-}m^2/kg\text{-}cm^2$),

Dydw = deposition rate of dry matter ($g/m^2\text{-}yr$),

Dyww = deposition rate of wet matter ($g/m^2\text{-}yr$),

Zs = soil or water mixing zone depth (cm) = 1 cm for soil, 609.6 cm for surface water in a generic reservoir, and 60.96 cm for surface water in a generic river,

BD = soil or water bulk density (g/cm^3) = 1.5 g/cm^3 for soil and 1 g/cm^3 for water,

tD = time over which deposition occurs (time period of combustion) (yr) = 30 yrs.

These calculations were based on the following conservative assumptions:

- A literature-derived deposition rate of 0.02 m/s (CAPCOA, 1993). This rate includes both dry and wet deposition and is highly conservative. In some cases, it has overestimated deposition by an order of magnitude (Howroyd, 1984).
- The value for "(Dydw + Dyww)" in the above equation was calculated by multiplying the predicted air concentration of the COPEC at ground level by the deposition rate. Although McFall Reservoir and Lost River are outside the area predicted to receive the highest concentration of PM_{10} (see Figure 1), the maximum predicted air concentration was used to estimate soil and surface water concentrations.
- No volatilization of metals occurs that results in 100 percent deposition of emissions. This is especially conservative for mercury because 100 percent of elemental mercury remains in the vapor fraction, and 85 percent of mercuric chloride is generally volatile (EPA, 1999).
- After deposition, no loss to processes, such as erosion, occurs.
- A mixing depth of 1 cm for soil was used as recommended in the combustion guidance (EPA, 1998b). For water bodies, a mixing depth of 20 feet (609.6 cm) for a generic

reservoir (surrogate for McFall Reservoir) and 2 feet (60.96 cm) for a generic river (surrogate for Lost River) were selected on the basis of best professional judgment given the latitude and elevation of areas surrounding the Energy Facility.

Table 2 presents summary statistics for predicted concentrations of each COPEC.

2.2.1 Process Wastewater Application

Maximum soil concentrations for the process wastewater application area were calculated from the predicted constituents in the process wastewater at 75 percent recovery (see Table 3). Aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, tin, and zinc were not detected in the aquifer source water; however, these metals are common in groundwater and likely exist at concentrations below the method reporting limits (MRLs). Therefore, as a conservative assumption, the MRLs for these metals were assumed to represent their concentration in the aquifer source water. Concentrations of these metals were predicted in the process wastewater by multiplying the MRL by a factor (1.954) based on the ratio of raw aquifer water concentration to predicted reject water concentration for metals with detected values (see Table 3). Maximum soil concentrations (MSC) were determined using the following equation:

$$\text{MSC} = \frac{(PWC * AWP * L)}{(AA * MD * BD)}$$

Where,

MSC = maximum soil concentration (mg/kg)

PWC = predicted wastewater concentration of constituent (mg/L),

AWP = annual wastewater production (24.3 million gallons or 1,985,500 L),

L = life-span of the energy plant (30 years),

AA = wastewater application area (31 acres or 125,452 m^2),

MD = soil mixing depth for agricultural lands (20 cm or 0.2 m; EPA, 1998b),

BD = bulk density for soil (literature-derived value of 1,500 kg/m^3; EPA, 1998b).

This calculation assumes that constituents accumulate during the 30-year life span of the Energy Facility with no loss from biodegradation, erosion, leaching, or other biotic or abiotic loss mechanisms (see Table 3 for estimated MSCs).

2.2.3 Background Soil Concentrations

Soil concentrations derived from air emissions or process wastewater application represent incremental exposure. Plants, soil invertebrates, and wildlife also are exposed to background concentrations of many of the COPECs. Therefore, background values alone were also compared to screening benchmarks to determine the contribution of background to the total risk estimate. For this ERA, background values for Klamath County as reported by the U.S. Geological Service (USGS) (Boerngen and Shacklette, 1981) were used, as were

Washington statewide background values (San Juan, 1994) when USGS values were lacking. These values are presented in the risk characterization.

2.3 Assessment Endpoints and Measures of Exposure and Effects

Assessment endpoints are the ecological resources (e.g., potential receptors) that are present at a site and are to be protected. Measures of exposure and effects are the measures evaluated to provide an indication of whether assessment endpoints are sufficiently exposed such that adverse effects may have occurred or are likely to occur.

The areas surrounding the Energy Facility contain a variety of habitats, including riverine systems that support shortnose suckers, Lost River suckers, and bald eagles, which are all federally listed threatened or endangered species. Maintenance of resident aquatic resources is important to the success of these species. Moreover, maintenance of resident terrestrial habitats also is important to bald eagles, which use upland areas during the winter months when lakes and rivers are frozen (Brown and Amadon, 1968). Although Applegate's milk-vetch has been identified as a federally threatened or endangered species endemic to the area, this plant has not been observed in the area of major air emission deposition or in the process wastewater application area. EPA (1992a) identifies four criteria to consider when selecting assessment endpoints. The following is a summary of these criteria and their relationship to the assessment endpoints for the Energy Facility:

- Societal value: Threatened and endangered species (e.g., shortnose sucker, Lost River sucker, and bald eagle) are valued by society as evidenced by special protective legislation.
- Environmental policy goals: Threatened and endangered species (e.g., shortnose sucker, Lost River sucker, and bald eagle) are protected at the individual level.
- Ecological relevance: Aquatic organisms (aquatic plants, invertebrates, and fish) are integral components of the riverine ecosystem present in the Energy Facility area and plants, soil invertebrates, and terrestrial birds and mammals are integral components of the terrestrial ecosystem present in the Energy Facility area.
- Susceptibility to the stressor: Research has shown that aquatic organisms, plants, soil invertebrates, birds, and mammals may be adversely affected by exposure to the COPECs.

Aquatic organisms, terrestrial plants, soil invertebrates, birds, and mammals are potentially sensitive to contaminants and are considered ecologically important. Complete definitions of an assessment endpoint have three components (Suter et al., 2000): the entity, the attribute, and a level of effect. Table 4 summarizes the appropriate assessment endpoints and measures of exposure and effects.

Aquatic organisms, including fish, and bald eagles were evaluated for the aquatic pathways associated with air emissions. Terrestrial pathways for both air emissions deposition and irrigated reuse of process wastewater were evaluated using terrestrial plants, soil invertebrates, and terrestrial birds and mammals as receptors. Specific bird and mammal receptors included the western meadowlark and the deer mouse for the terrestrial assessment and the bald eagle for the aquatic assessment. Western meadowlarks and deer mice have foraging behaviors that are closely associated with the soil and, therefore, are likely to be highly exposed to COPECs in soil. Table 5 outlines life-history parameters for these species.

2.4 Conceptual Site Model

The conceptual site model (CSM) is a description of predicted relationships between ecological receptors and the COPEC to which they might be exposed.

An exposure pathway can be described as the physical course that a COPEC takes from the point of release to a receptor. An exposure pathway is complete (i.e., there is exposure) if there is a way for the receptor to take in chemicals through ingestion, inhalation, or dermal absorption. To be complete, an exposure pathway must have all the following components:

- Chemical source
- Mechanism for chemical release
- Environmental transport medium
- Exposure point
- Feasible route of intake

In the absence of any of these components, an exposure pathway is considered incomplete, and, by definition, there can be no risk associated with that particular exposure pathway. Exposure can occur when chemicals migrate from their source to an exposure point (i.e., a location where receptors can come into contact with the chemicals) or when a receptor moves into direct contact with chemicals or contaminated media.

2.4.1 Air Emissions

For purposes of this ERA, the air emissions from natural gas combustion at the Energy Facility are considered the primary source of the COPECs. These COPECs may deposit from air to the soil and surface water within the areas surrounding the Energy Facility. Significant transport of COPECs from the deposition area is not expected. Soil and surface water are the affected media and both aquatic and terrestrial routes of exposure to the COPECs are evaluated in this ERA. Receptors are potentially exposed by way of root or foliar uptake, dermal contact, inhalation, direct ingestion, and ingestion of prey items.

A wide variety of wildlife is supported by the Klamath Basin mix of habitats, and both terrestrial and aquatic routes of exposure to COPECs exist. Contaminants in water may be directly bioaccumulated by aquatic organisms resident in water bodies located in the vicinity of the Energy Facility, and contaminants in soil may be directly bioaccumulated by terrestrial plants or soil invertebrates. Both aquatic and terrestrial wildlife may be exposed directly to contaminants in soil or surface water by direct ingestion, by dermal contact, or by the inhalation of wind-borne particles. Little information is available on foliar uptake and inhalation routes, and exposure via these routes is expected to be minimal; therefore, these pathways will not be evaluated. Although the dermal contact route of exposure exists for many birds and mammals, dermal exposure is likely to be low because of the presence of protective dermal layers (e.g., feathers, fur, scales). Wildlife also may receive contaminant exposure through food-web transfer of chemicals from lower trophic levels (e.g., plants to herbivores, plants and prey animals to omnivores) and this is expected to be the primary exposure route for wildlife.

2.4.2 Process Wastewater Application

For purposes of this ERA, the process wastewater from the Energy Facility is considered the primary source of the COPECs. These COPECs are transferred to soil in the 31-acre pasture area. Process wastewater will only be applied 8 months of the year and will not be applied during the winter. Soil is the affected medium and only terrestrial routes of exposure to the COPECs are evaluated in this ERA. No aquatic routes of exposure are expected. Receptors are potentially exposed via root and/or foliar uptake, dermal contact, inhalation, direct ingestion, and ingestion of prey items.

Contaminants in soil may be directly bioaccumulated by terrestrial plants or soil invertebrates. Terrestrial birds and mammals may be exposed directly to contaminants in soil or surface water by direct ingestion, by dermal contact, or by the inhalation of wind-borne particles. Little information is available on foliar uptake and inhalation routes and exposure via these routes is expected to be minimal; therefore, these pathways will not be evaluated. Although the dermal contact route of exposure exists for many birds and mammals, dermal exposure is likely to be low because of the presence of protective dermal layers (e.g., feathers, fur, scales). Wildlife also may receive contaminant exposure through food-web transfer of chemicals from lower trophic levels (e.g., plants to herbivores, plants and prey animals to omnivores) and this is expected to be the primary exposure route for wildlife.

3. Exposure Assessment

3.1 Aquatic Organisms

Aquatic organisms (aquatic plants, invertebrates, fish) experience exposure based on concentrations in water (i.e., exposure is water-mediated). Water-mediated exposure occurs as a consequence of living in a contaminated medium. Uptake of COPECs can be through the skin (dermal), through the gills, or through the diet, including ingestion of contaminated water and food. Water-mediated exposure to aquatic organisms is measured as a function of the concentration of contaminants in water (milligrams COPEC per liter water [mg/L]). Water-mediated exposure is used because most information on the effects of contaminants on aquatic organisms (described in Section 4.1) has been obtained from experiments where the exposure to contaminants was reported as a function of the concentrations of contaminants in water. To be conservative, the maximum estimated water concentration for each surface water type (i.e., generic reservoir and generic river) was selected as the suitable exposure point concentration.

3.2 Terrestrial Plants

Terrestrial plants experience exposure based on concentrations in soil (i.e., exposure is soil-mediated). Soil-mediated exposure occurs as a consequence of living in a contaminated medium. For plants, uptake of COPECs can be through roots. Soil-mediated exposure to plants is measured as a function of the concentration of contaminants in soil (milligrams lead per kilogram soil [mg/kg]). Soil-mediated exposure is used because most information on the effects of contaminants on plants (described in Section 4.2) has been obtained from experiments where the exposure to contaminants was reported as a function of the concentrations of contaminants in soil. Because plants are not mobile and to be highly conservative, the maximum estimated concentration was selected as the suitable exposure point concentration.

3.3 Soil Invertebrates

Like plants, soil invertebrates also experience soil-mediated exposure. Uptake of COPECs can be through the skin (dermal), or through the diet, including ingestion of contaminated soil and food. As with plants, most information on the effects of contaminants on soil invertebrates (described in Section 4.3) has been obtained from experiments where the exposure to contaminants was reported as a function of the concentrations of contaminants in soil. Therefore, the focus of the exposure characterization for soil-mediated exposures is the derivation of soil exposure point concentrations. Because mobility of terrestrial invertebrates is low, the maximum concentration was selected as the suitable exposure point concentration.

3.4 Birds and Mammals

Birds and mammals experience exposure through multiple pathways including ingestion of abiotic media (soil, sediment, and surface water) and biotic media (food) as well as inhalation and dermal contact. To address this multiple pathway exposure, modeling is required. Generally, the end product or exposure estimate for birds and mammals is a dosage (amount of chemical per kilogram receptor body weight per day [mg/kg/d]) rather than a media concentration as is the case for the other receptor groups (aquatic organisms, terrestrial plants, and soil invertebrates). This is a function of both the multiple pathway approach as well as the typical methods used in toxicity testing for mammals. However, ODEQ has developed soil screening-level values for birds and mammals and water screening-level values for birds for some contaminants based on conservative assumptions (ODEQ, 2001). These values are intended to be protective of terrestrial birds and mammals and aquatic birds, respectively, and were used as available. To be conservative, the maximum concentration was selected as the suitable exposure point concentration for comparison to the ODEQ screening values.

If no screening value was available for a COPEC, or a screening value was exceeded, receptor-specific exposure was calculated and compared to literature-derived toxicity values. Moreover, receptor-specific exposure was calculated for bald eagles because it is a special-status species. Summaries of total (i.e., sum over all pathways) and partial (pathway-specific) exposure estimates, as needed, are presented and compared to toxicity values in Section 5. The model used for estimating receptor-specific exposure and associated assumptions is described below.

Model

The general form of the model (Suter et al., 2000) used to estimate exposure of birds and mammals to COPECs in soil, surface water, and food items is as follows:

$$E_t = E_o + E_d + E_i$$

Where:

E_t = the total chemical exposure experienced by wildlife

E_o, E_d, and E_i = oral, dermal, and inhalation exposure, respectively

Oral exposure occurs through the consumption of contaminated food, water, or soil. Dermal exposure occurs when contaminants are absorbed directly through the skin. Inhalation exposure occurs when volatile compounds or fine particulates are inhaled into the lungs.

Although methods are available for assessing dermal exposure to humans (EPA, 1992b), data necessary to estimate dermal exposure generally are not available for wildlife (EPA, 1993). Similarly, methods and data necessary to estimate wildlife inhalation exposure are poorly developed or generally not available (EPA, 1993). Therefore, for the purposes of this ERA, both dermal and inhalation exposure are assumed to be negligible. As a consequence, most exposure must be attributed to the oral exposure pathway. There are no surface water sources on the 31-acre process wastewater application area and, given the arid environment, all water applied to soil is assumed to be rapidly absorbed; therefore, water ingestion is considered an incomplete or insignificant exposure pathway. In contrast, deposition from air emissions is likely to occur in surface waters; therefore, water ingestion is included in the exposure calculations for air emission deposition. By replacing E_o with a generalized exposure model modified from Suter et al. (2000), the previous equation was rewritten as follows:

$$E_j = \left[Water_j \times WIR\right] + \left[Soil_j \times P_s \times FIR\right] + \left[\sum_{i=1}^{N} B_{ij} \times P_i \times FIR\right]$$

Where:

E_j = total exposure (mg/kg/d)

$Water_j$ = concentration of chemical (j) in water (mg/L)

WIR = species-specific water ingestion rate (L water/kg body weight/d)

$Soil_j$ = concentration of chemical (j) in soil (mg/kg)

P_s = soil ingestion rate as proportion of diet

FIR = species-specific food ingestion rate (kg food/kg body weight/d)

B_{ij} = concentration of chemical (j) in biota type (i) (mg/kg)

P_i = proportion of biota type (i) in diet

Assumptions

To establish parameters for the exposure model, various assumptions were necessary. These assumptions are outlined below.

Exposure Point Concentrations. As with the comparisons to ODEQ screening values, a highly conservative approach was taken and the maximum estimated concentration was incorporated into the exposure model as the exposure point concentrations for soil and surface water. Because there is primary concern for bald eagles utilizing the McFall Reservoir, the generic reservoir surface water values (maximum concentrations) were used as exposure point concentrations for bald eagles.

Life History Parameters. The specific life-history parameters required to estimate exposure of birds and mammals to COPECs include body weight, ingestion rate of food, ingestion rate of water (for air emissions analysis only), dietary components and percentage of the overall diet represented by each major food type, and approximate amount of soil that may be incidentally ingested based on feeding habits. These parameters, as well as home range information, were obtained from the literature and are presented in Table 5.

Bioaccumulation Values. Measurements of concentrations of COPECs in wildlife foods are a critical component for the estimation of oral exposure in birds and mammals. Although the preferred data are direct measurements of concentrations in samples collected from the site, such data were not available in the vicinity of the Energy Facility. Therefore, literature-reported bioaccumulation factors (BAFs), regressions, or Kow-based models for terrestrial food items (foliage and insects) and literature-reported bioconcentration factors (BCFs) for aquatic food items were used.

BAFs or regressions were available for foliage (Bechtel-Jacobs, 1998; CH2M HILL, 2002), and insects (CH2M HILL, 2002) for the inorganics, models (K_{ow}-based) from EPA (2000) were used to estimate bioaccumulation factors (BAFs) for phenol in foliage and earthworms. The earthworm model was used as a surrogate for insects. To be conservative, the fraction of organic carbon required for the earthworm bioaccumulation model was assumed to be 1 percent. No foliage BAFs were available for cyanide, silver, thallium, or tin and no insect BAFs were available for cyanide, or tin; therefore, a BAF of one was assumed for these COPECs. BCFs were available for fish (Sample et al., 1997) for all COPECs, except cobalt and manganese. A BCF of one was assumed for these two COPECs. Table 6 summarizes the BAFs and BCFs used in the ERA.

4. Characterization of Ecological Effects

4.1 Aquatic Organisms

Screening-level toxicity values for aquatic organisms are provided by ODEQ guidance (ODEQ, 2001) and are shown in Table 7. For most cases, these values are the same as the National Ambient Water Quality Criteria (EPA, 2002) or chronic values developed at the Oak Ridge National Laboratory (ORNL) (Suter and Tsao, 1996). These values are intended to protect 95 percent of aquatic species, 95 percent of the time. Screening values are only shown for the COPECs associated with air emissions. An aquatic pathway is not complete for the process wastewater application.

4.2 Terrestrial Plants

Screening-level toxicity values for terrestrial plants are provided by ODEQ guidance (ODEQ, 2001) and are shown in Table 7. Most of these screening values are from the ORNL plant benchmarks report (Efroymson et al., 1997a). The protection of terrestrial plant communities from a 20 percent reduction in growth, reproduction, or survival is an assessment endpoint in this ERA. Therefore, benchmarks used to determine risk to this receptor group must be based on adverse effects related to these endpoints. The ORNL plant benchmarks were developed from studies that demonstrated at least a 20 percent reduction in the growth or yield of test plant species, which is consistent with the goals of the ERA.

Additionally, growth and yield are important to plant populations and to the ability of the vegetation to support higher trophic levels; therefore, these are ecologically significant responses (Efroymson et al., 1997a).

4.3 Soil Invertebrates

Single-chemical screening-level toxicity values for soil invertebrates are provided by ODEQ guidance (ODEQ, 2001) and are shown in Table 7. Most of these screening values are from the ORNL soil invertebrate benchmarks report (Efroymson et al., 1997b) and are represented primarily by earthworms. The protection of terrestrial invertebrate communities from a 20 percent reduction in growth, reproduction, or survival is an assessment endpoint this assessment. Therefore, benchmarks used to determine risk to this receptor group must be based on adverse effects related to these endpoints. The ORNL soil invertebrate benchmarks were developed from studies that demonstrated at least a 20 percent reduction in the growth or survival of test invertebrate species, which is consistent with the goals of the ERA.

4.4 Birds and Mammals

Screening-level values for birds and mammals provided by ODEQ (ODEQ, 2001) were used as available in the ERA and are presented in Table 7. For birds, cobalt, iron, silver, thallium, and tin were lacking ODEQ screening values, but studies from which benchmarks could be developed for these metals were available. Similarly, iron, silver, tin, cyanide, and phenol benchmarks were developed for mammals from other sources. No data for birds were available for development of benchmarks for cyanide or phenol. Unlike the ODEQ screening values, which are presented as mg constituent per kg soil, these benchmarks are presented as a dose (mg constituent/kg body weight/day) to the receptor and were selected as described below.

Single-chemical toxicity data for birds and mammals consist of no observable adverse effect levels (NOAEL) or lowest observable adverse effect levels (LOAEL) derived from toxicity studies reported in the literature. The benchmarks for birds and mammals were obtained from several sources, including wildlife toxicity reviews, literature searches, wildlife benchmarks developed at ORNL (Sample et al., 1996), the EPA Region IX Biological Technical Assistance Group (BTAG) toxicity reference values (TRV) developed for the U.S. Navy (EFA West, 1998), and a Review of the Navy-EPA Region IX BTAG TRVs for Wildlife (CH2M HILL, 2000). Appropriate studies were selected based on the following criteria:

- Studies were of chronic exposures or exposures during a critical life-stage (i.e., reproduction).
- Exposure was oral through food, to ensure data were representative of oral exposures expected for wildlife in the field.
- Emphasis was placed on studies of reproductive impacts, to ensure relevancy to population-level effects.
- Studies presented adequate information to evaluate and determine the magnitude of exposure and effects (or no effects concentrations).

Multiple toxicity studies were available for birds and mammals for several analytes. Toxicity studies were selected to serve as the primary toxicity value if exposure was chronic or during reproduction, the dosing regime was sufficient to identify both a NOAEL and a LOAEL, and the study considered ecologically relevant effects (i.e., reproduction, mortality, growth). If multiple studies for a given COPEC met these criteria, the study generating the lowest reliable toxicity value was selected to be the primary toxicity value. Primary toxicity values were used for all initial evaluations of the exposure estimates and are highlighted in Table 8. Information concerning assumptions made as part of the extraction of data from each study is presented in the one attachment to this memorandum.

NOAELs and LOAELs for avian and mammalian receptors were estimated from literature data using allometric scaling methods presented in Sample et al. (1996) and Sample and Arenal (1999). Using the following equation, NOAEL or LOAEL for wildlife ($NOAEL_w$ or $LOAEL_w$) were determined for each species:

$$NOAEL_w = NOAEL_t \left(\frac{BW_t}{BW_w} \right)^{1-b} \text{ or } LOAEL_w = LOAEL_t \left(\frac{BW_t}{BW_w} \right)^{1-b}$$

where:

$NOAEL_t$	=	the NOAEL for a test species (obtained from the literature),
$LOAEL_t$	=	the NOAEL for a test species (obtained from the literature),
BW_t and BW_w	=	the body weights (in kg) for the test and wildlife species, respectively, and
b	=	the class-specific allometric scaling factor.

Scaling factors of 0.94 and 1.2 were applied for mammals and birds, respectively (Sample and Arenal, 1999). Table 9 presents these receptor-specific NOAELs and LOAELs.

5. Risk Characterization

In the risk characterization, exposure and effects data are combined to draw conclusions concerning the presence, nature, and magnitude of effects that may exist at the site. For all receptors (i.e., aquatic organisms, terrestrial plants, soil invertebrates, and birds and mammals), only literature-derived benchmarks were available. These were compared to maximum soil or water concentrations or dose based on maximum soil or water concentration to determine hazard quotients (HQs = exposure measure/effects measure) for each COPEC. Screening-level benchmarks are conservative; therefore, COPECs that are below these thresholds pass the screen and are not considered in future evaluations. However, HQs greater than one indicate a failure to pass the screen. Failure to pass the screen, however, cannot be concluded to represent the presence of risk. Rather, these results indicate that available data are insufficient to support a conclusion that ecological risks are absent. Constituents that failed the screen were reevaluated using more realistic assumptions.

Results of the screening evaluations for deposition from air emissions and process wastewater application are discussed below. Uncertainties that may influence these screening-level results are summarized in Section 5.3.

5.1 Air Emissions

Screening results for incremental, background, and total soil concentrations and incremental surface water concentrations (generic reservoir and generic river) against ODEQ screening values are presented in Tables 10 and 11, respectively. Table 12 presents bird and mammal screening evaluations based on receptor-specific parameters for COPECs that failed the ODEQ screen (chromium for birds), for COPECs lacking ODEQ screening values (cobalt for birds), and for bald eagles.

For terrestrial receptors (i.e., plants, soil invertebrates, and birds and mammals), chromium, manganese, and nickel failed to pass the screening evaluation when total (incremental + background) concentrations were evaluated (Table 10). Chromium exceeded the ODEQ screening values for plants, soil invertebrates, and birds; manganese exceeded the screening value for plants and soil invertebrates, and nickel exceeded the screening value for plants. However, in all cases, these exceedances were driven by background concentrations and no HQs greater than one were observed based on incremental concentrations. Because total chromium concentrations exceeded the ODEQ benchmark (HQ = 11.25) for birds and because no ODEQ avian screening value was available for cobalt, these COPECs were further evaluated using receptor-specific parameters to calculate exposure to western meadowlarks (see Table 11). In this evaluation, estimated oral exposure to chromium and cobalt was less than literature-derived benchmarks for these COPECs (see Table 11). Therefore, potential risks from chromium, manganese and nickel to plants, soil invertebrates, and birds are considered to be negligible.

Estimated maximum concentrations of all COPECs under both the generic reservoir and generic river scenarios were below ODEQ benchmarks for aquatic biota and aquatic birds (see Table 11). Therefore, no risk is expected from any of these COPECs. Because no ODEQ aquatic bird screening value was available for cobalt, this COPEC was further evaluated using receptor-specific parameters to calculate exposure (see Table 11). Additionally, exposure calculations using receptor-specific parameters were performed for bald eagles because it is a special-status species that is of special concern within the deposition area of air emissions from the Energy Facility (see Table 11). None of the COPECs evaluated further exceeded oral exposure benchmarks for birds (i.e., all HQs were less than one) (see Table 11). Thus, deposition of metals from air emissions is considered to present no risk to aquatic organisms or bald eagles using reservoirs in the vicinity of the Energy Facility. Moreover, no risk to aquatic organisms, including the shortnose sucker and Lost River sucker, or birds using the riverine habitats in the vicinity of the Energy Facility is expected.

5.2 Process Wastewater Application

Screening results for incremental, background, and total soil concentrations against ODEQ screening values are presented in Table 13. Bird and mammal screening evaluations for COPECs lacking ODEQ values are presented in Table 14.

As indicated in Table 13, several process wastewater constituents (aluminum, barium, boron, chromium III, copper, fluoride, iron, manganese, molybdenum, and nickel) failed to pass the screening evaluation (i.e., HQs greater than one for any receptor) when total (incremental + background) concentrations were evaluated. However, the exceedances of all but boron and molybdenum were driven by background concentrations. It is notable that the ODEQ plant screening value for iron is not a soil concentration, but in fact, represents the screening value for iron in solution. Because it is not applicable to soil, this benchmark was considered inappropriate for use in the screening evaluation. Although risk to plants from iron exposure is uncertain, no incremental risk was found for soil invertebrates, birds, and mammals.

Additionally, incremental exposure to iron is only 0.02 percent of the background exposure and is likely insignificant compared to background. Of the constituents evaluated separately for birds and mammals (dose calculations), only iron exceeded the NOAELs with HQs of 17 and 3,139 for meadowlarks and deer mice, respectively (see Table 14). As with the evaluation in Table 13, these exceedances were driven by background iron concentrations with no exceedances of the toxicity reference values based on wastewater discharge alone. HQs for incremental exposure to iron were 0.003 and 0.504 for meadowlarks and deer mice, respectively. Therefore, the incremental exposure to plants, soil invertebrates, birds, and mammals from the process wastewater application is expected to be minor for all constituents, except for boron and molybdenum exposures to plants and boron exposures to invertebrates. Constituents for which toxicity benchmarks are lacking were not evaluated and remain an uncertainty. Additionally, salts and total dissolved solids (TDS) were evaluated elsewhere in the BA.

Estimated maximum incremental boron concentrations in soil were 93 times the screening value of 0.5 mg/kg. However, the screening value represents the toxicity level for highly sensitive plant species. For boron-tolerant species (e.g., alfalfa), toxicity thresholds are approximately 2 to 4 mg/kg (Brown et al., 1983). This reduces the HQ from 53.4 to approximately 23.3 to 11.7 for the boron-tolerant species selected for planting in the application area. Moreover, less than 5 percent of the total boron in soil is available for uptake to plants (Eisler, 2000), reducing the estimated incremental exposure from 26.7 mg/kg to 1.33 mg/kg and the total exposure from 46.7 to 2.33 mg/kg. Though these concentrations still exceed the screening level derived for sensitive plants species, they are below concentrations associated with toxic effects to boron-tolerant plants when considering boron bioavailability. Boron concentrations adjusted for bioavailability are also below the screening level for invertebrates.

Molybdenum is an essential micronutrient that is not highly toxic to plants, but bioaccumulates in plant tissue and is generally of concern to higher trophic organisms (Eisler, 2000). Ruminants (e.g., cattle and sheep) in particular can be sensitive to molybdenum exposure in forage because excess molybdenum may result in a copper deficiency (Eisler, 2000). However, the maximum estimated total molybdenum concentration in soil did not exceed the screening benchmarks for birds and mammals and is therefore unlikely to pose risk to these receptors.

Although the molybdenum benchmark for plants was exceeded, risk to terrestrial plants from molybdenum exposure is considered low because of the low exceedance of the screening value (HQ = 2.7 for total molybdenum). Additionally, the highly conservative assumptions applied to the risk estimation likely result in an overestimation of molybdenum exposure. First, molybdenum was not measured in the raw aquifer water and was therefore estimated using the minimum reporting limit. Moreover, the maximum soil concentration of molybdenum was estimated assuming a wastewater output of 24.3 million gallons based on a 72 percent capacity factor for the Energy Facility. The actual capacity of the Facility will likely be closer to 40 percent, resulting in the creation of 13.5 million gallons of wastewater. At 40 percent capacity, the estimated soil concentration of molybdenum from wastewater application would be reduced from 2.41 to 1.34 mg/kg, a value below the screening benchmark for plants. Finally, the calculation used to estimate soil concentrations from wastewater application assume that there is no loss due to abiotic or biotic factors. As a consequence, the calculated molybdenum concentration likely represents an overestimate of exposure to organisms.

5.3 Uncertainty Analysis

Uncertainties are inherent in all risk assessments. The nature and magnitude of uncertainties depend on the amount and quality of data available, the degree of knowledge concerning site conditions, and the assumptions made to perform the assessment. The following is a qualitative evaluation of the major uncertainties associated with this assessment, in no particular order of importance:

- Concentrations of COPECs in soil and surface water were wholly estimated on the basis of predicted concentrations of COPECs in air emissions and process wastewater from the Energy Facility. Although this uncertainty may result in underestimation of exposure (and risk), the conservative assumptions applied to air emission and process wastewater predictions, as well as the conservative assumptions used to convert these concentrations to soil and water concentrations, likely result in an overestimation of risk.

- Literature-derived values for bulk density of soil, soil and water mixing depths, and deposition rate of air emissions were used to calculate soil and water concentrations. The suitability of these literature values is unknown, although these are conservative values. Therefore, risk may be underestimated, but is likely overestimated.

- Based on best professional judgment, mixing depths of 20 feet for reservoirs and 2 feet for rivers were selected for estimating surface water concentrations from air emissions deposition. The suitability of these values is unknown. Consequently, risk may be over- or underestimated.

- Constituents in wastewater were estimated assuming a 72 percent capacity factor for the Energy Facility. It is more likely that the Facility will be operated at approximately 40 percent capacity. Therefore, wastewater concentrations and resulting risk are likely overestimated.

- Molybdenum, copper, and sulfur have complex interactions in soil that can result in increased or decreased toxicity to foraging animals. For example, excess molybdenum can cause a copper deficiency, though adequate molybdenum can decrease toxicity associated with excess copper. Because of the uncertainties in the risk estimation (e.g., copper and molybdenum were not detected in the raw aquifer water) and the complex nature of these constituents, it is uncertain whether risk was over- or underestimated for copper and molybdenum, although effort was made to overestimate risk through the conservative set of assumptions.

- Data concerning soil ingestion rates for bird and mammal receptors were not available. As a consequence, the soil ingestion rates were estimated on the basis of assumed similarities to other species for which data were available. The suitability of these assumptions is unknown. Although this uncertainty may result in underestimation of exposure (and risk), it is more likely that exposure and risk are overestimated.
- No life history data specific to the COB Energy Facility area were available; therefore, exposure parameters were either modeled on the basis of allometric relationships (e.g., food ingestion rates) or were based on data from the same species in other portions of its range. Because diet composition as well as food, water, and soil ingestion rates can differ among individuals and locations, published parameter values may not accurately reflect individuals present at the site. As a consequence, risk may be either overestimated or underestimated.
- No site-specific data on COPEC concentrations in fish, terrestrial plants, and soil invertebrates were available for wildlife exposure estimate calculations. Therefore, concentrations in these prey items were estimated from literature-reported bioaccumulation models (BCFs, 90^{th} Percentile BAFs, regressions, or Kow-based). The suitability of these bioaccumulation models is unknown. As a consequence, concentrations of COPECs in prey items of wildlife may be either greater than or less than data used in this assessment.
- Literature-derived toxicity data based on laboratory studies were used to evaluate risk to all receptor groups. It was assumed that effects observed in laboratory species were indicative of effects that would occur in wild species. The suitability of this assumption is unknown. Consequently, risk may be either overestimated or underestimated.
- Literature-derived toxicity data are not available for western meadowlarks, bald eagles, or deer mice. Therefore, laboratory studies on the effects of COPECs on test species (e.g., quail, chicken, mallard, rat, mouse, rabbit) were used to evaluate risks to these receptors. It was assumed that effects observed in these test species were indicative of effects that would occur in the receptor. However, sensitivity to COPECs can vary between species, and this variation may be even more varied between taxonomic groups (i.e., galliforms versus raptors). Consequently, risk may be either overestimated or underestimated.
- Toxicity data are not available for all COPECs considered in this ERA. As a consequence, COPECs for which toxicity data are unavailable were not evaluated. Exclusion of COPECs from evaluation underestimates aggregate risk.
- Bioavailability in the toxicity studies used for screening is generally high because many toxicity tests are performed using soluble salts of inorganic chemicals. Therefore, risk based solely on literature-derived toxicity values may be overestimated.
- Because toxicity data are not available for individual bird and mammal receptors, it was necessary to extrapolate toxicity values from test species to site receptor species. Although improved class-specific scaling factors were employed (Sample and Arenal,

1999), these factors are not chemical-specific and are based on acute toxicity data. As a consequence, risk may be either overestimated or underestimated.

- In this assessment, risks from COPECs each were considered independently (i.e., no ambient media toxicity data were available). Because chemicals may interact in an additive, antagonistic, or synergistic manner, evaluation of single-chemical risk may either underestimate or overestimate risks associated with chemical mixtures.

6. Conclusions

6.1 Air Emissions

For terrestrial receptors (i.e., plants, soil invertebrates, birds, and mammals), chromium, manganese, and nickel failed to pass the screening evaluation when total (incremental + background) concentrations were evaluated. However, in all cases, these exceedances were driven by background concentrations. Receptor-specific evaluation of chromium and cobalt exposure to birds resulted in no exceedances of literature-based toxicity thresholds. Therefore, exposure to arsenic, cadmium, cobalt, and mercury associated with air emissions from the Energy Facility poses no risk to plants, soil invertebrates, birds, and mammals, whereas potential risks to plants, soil invertebrates, and birds from exposure to chromium, manganese, and nickel are considered to be negligible.

None of the COPECs exceeded benchmarks for aquatic receptors; therefore, deposition of air emissions from the Energy Facility to surface water poses no risk to aquatic organisms, such as the shortnose sucker, Lost River sucker, and bald eagle.

6.2 Process Wastewater Application

Process wastewater constituents evaluated, except aluminum, barium, boron, chromium III, copper, fluoride, iron, manganese, molybdenum, and nickel, passed the screening evaluation and are considered to present no risk to ecological receptors. After further evaluation, background concentrations were found to be the primary driver for screening failures of aluminum, barium, chromium III, copper, fluoride, iron, manganese, and nickel, with negligible incremental contributions of these constituents to the risk estimation. Considering the bioavailability of boron to plants (less than 5 percent of total boron) substantially reduced the risk estimation for boron. Although both incremental and total (incremental + background) boron concentrations continued to exceed screening levels for sensitive plant species, incremental and total exposures were below toxicity thresholds for invertebrates and for boron-tolerant plant species when adjusted for boron bioavailability. Estimated maximum concentrations of molybdenum exceeded the soil benchmark for plants; however, risk to terrestrial plants from molybdenum exposure is considered low owing to the low exceedance of the screening value and the highly conservative assumptions applied to the risk estimation. Thus, none of the constituents evaluated are considered to present significant risk to ecological receptors.

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Tables

TABLE 1
Summary of Predicted Hazardous Air Pollutant (HAP) and Particulate Matter Less Than Ten Microns (PM_{10}) Emissions
Screening-Level Ecological Risk Assessment
COB Energy Facility, Klamath County, Oregon

	Facilitywide Emissions (tons/yr) *				
HAP	**CTGs and Duct Burners**	**Gas Heaters and Auxiliary Boilers**	**Fire Water Pump**	**Wellhead Emergency Generator**	**Total All Sources**
Benzene	1.7E-01	5.6E-04	5.0E-05	2.0E-05	0.17
Formaldehyde	3.0E+00	2.0E-02	6.3E-05	2.0E-06	2.98
Hexane	6.9E+00	4.8E-01			7.33
Naphthalene	2.0E-02	1.6E-04			0.02
Toluene	1.7E+00	9.1E-04	2.2E-05	7.2E-06	1.73
Acetaldehyde	5.3E-01		4.1E-05	6.5E-07	0.53
Acrolein	8.5E-02			2.0E-7	0.08
Ethylbenzene	4.2E-01				0.42
PAH	2.9E-02	1.4E-05	9.0E-06	5.4E-06	0.03
Xylenes (total)	8.5E-01		1.5E-05	5.0E-06	0.85
Dichlorobenzene	4.6E-03	3.2E-04			0.005
Arsenic	1.7E-03	5.3E-05			0.002
Cadmium	9.3E-03	2.9E-04			0.010
Chromium	1.2E-02	3.7E-04			0.012
Cobalt	7.1E-04	2.2E-05			0.001
Manganese	3.2E-03	1.0E-04			0.003
Mercury	2.2E-03	6.9E-05			0.002
Nickel	1.8E-02	5.6E-04			0.018
PM_{10}	2.5E+02	2.0E+00	1.7E-02	2.6E-03	247

* See Section 3.7.1.4 and Table 3.7.5 in the *COB Energy Facility Environmental Impact Statement* (BPA, 2003) for a summary of hazardous air pollutant (HAP) emissions.

CTG = combustion turbine generator

TABLE 2

Summary Statistics of Estimated Hazardous Air Pollutants (HAPs) and Particulate Matter Less Than Ten Microns (PM_{10})
Concentrations in Soil and Two Surface Water Sources (Generic Reservoir and Generic River) Over 30 Years
Screening-Level Ecological Risk Assessment
COB Energy Facility, Klamath County, Oregon

Analyte	Max	99% percentile	95% percentile	90% percentile	Mean	50% percentile (median)	Min
Soil (mg/kg) [a]							
Arsenic	0.012	8.4E-03	3.2E-03	1.8E-03	9.1E-04	4.9E-04	1.5E-05
Cadmium	0.061	0.042	0.016	9.1E-03	4.5E-03	2.4E-03	7.4E-05
Chromium	0.074	0.051	0.019	0.011	5.4E-03	2.9E-03	8.9E-05
Cobalt	6.1E-03	4.2E-03	1.6E-03	9.1E-04	4.5E-04	2.4E-04	7.4E-06
Manganese	0.018	0.013	4.8E-03	2.7E-03	1.4E-03	7.3E-04	2.2E-05
Mercury	0.012	8.4E-03	3.2E-03	1.8E-03	9.1E-04	4.9E-04	1.5E-05
Nickel	0.11	0.076	0.029	0.016	8.2E-03	4.4E-03	1.3E-04
PM_{10}	1500	1000	390	220	110	60	1.8
Surface Water - Generic Reservoir (mg/L) [b]							
Arsenic	3.0E-05	2.1E-05	7.8E-06	4.5E-06	2.2E-06	1.2E-06	3.7E-08
Cadmium	1.5E-04	1.0E-04	3.9E-05	2.2E-05	1.1E-05	6.0E-06	1.8E-07
Chromium	1.8E-04	1.2E-04	4.7E-05	2.7E-05	1.3E-05	7.2E-06	2.2E-07
Cobalt	1.5E-05	1.0E-05	3.9E-06	2.2E-06	1.1E-06	6.0E-07	1.8E-08
Manganese	4.5E-05	3.1E-05	1.2E-05	6.7E-06	3.3E-06	1.8E-06	5.5E-08
Mercury	3.0E-05	2.1E-05	7.8E-06	4.5E-06	2.2E-06	1.2E-06	3.7E-08
Nickel	2.7E-04	1.9E-04	7.0E-05	4.0E-05	2.0E-05	1.1E-05	3.3E-07
PM_{10}	3.72	2.55	0.96	0.55	0.27	0.15	0.00
Surface Water - Generic River (mg/L) [c]							
Arsenic	3.0E-04	2.1E-04	7.8E-05	4.5E-05	2.2E-06	1.2E-05	3.7E-07
Cadmium	1.5E-03	1.0E-03	3.9E-04	2.2E-04	1.1E-05	6.0E-05	1.8E-06
Chromium	1.8E-03	1.2E-03	4.7E-04	2.7E-04	1.3E-05	7.2E-05	2.2E-06
Cobalt	1.5E-04	1.0E-04	3.9E-05	2.2E-05	1.1E-06	6.0E-06	1.8E-07
Manganese	4.5E-04	3.1E-04	1.2E-04	6.7E-05	3.3E-06	1.8E-05	5.5E-07
Mercury	3.0E-04	2.1E-04	7.8E-05	4.5E-05	2.2E-06	1.2E-05	3.7E-07
Nickel	2.7E-03	1.9E-03	7.0E-04	4.0E-04	2.0E-05	1.1E-04	3.3E-06
PM_{10}	37.2	25.5	9.6	5.5	2.7	1.5	0.045

Notes:

[a] HAP and PM_{10} concentrations are calculated based on the entire air modeling domain with no abiotic or biotic loss of metals from wet and dry deposition. A 1-cm mixing depth and a soil density of 1.5 g/cm^3 were assumed (USEPA, 1998b).

[b] HAP and PM_{10} concentrations are calculated over a generic reservoir receiving the maximum wet and dry deposition of the entire modeling domain with no abiotic or biotic loss of metals from total and wet deposition. A 20-foot mixing depth and a water density of 1.0 g/cm^3 were assumed.

[c] HAP and PM_{10} concentrations are calculated over a generic river receiving the maximum wet and dry deposition of the entire modeling domain with no abiotic or biotic loss of metals from total and wet deposition. A 2-foot mixing depth and a water density of 1.0 g/cm^3 were assumed.

TABLE 3

Calculation of Maximum Soil Concentration from Wastewater Application to 31 Acres During the 30-Year Life of the Energy Facility

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Parameter/Analyte	(From Aquifer) Raw Water Max Value	Units	Laboratory MRL [a]	Units	RO Reject (75% Recovery) Max Value	Units	Ratio Raw/Reject	RO Reject Estimated from Nondetects	Units	Wastewater Values for ERA [b]	Units	Maximum Estimated Soil Concentration [c] (mg/kg)
Flow Rate	208	gpm	--	--	49	gpm				49		
Inorganics												
Aluminum			100	ug/L				0.1954	mg/L	0.1954	mg/L	9.65
Ammonia as N			0.1	mg/L	< 0.00	mg/L		0.1954	mg/L	0.1954	mg/L	9.65
Antimony			2	ug/L				0.00391	mg/L	0.00391	mg/L	0.193
Arsenic			2	ug/L				0.00391	mg/L	0.00391	mg/L	0.193
Barium			25	ug/L				0.04885	mg/L	0.04885	mg/L	2.413
Beryllium			4	ug/L				0.00782	mg/L	0.00782	mg/L	0.386
Boron	< 0.275	mg/L	275	ug/L	< 0.54	mg/L	1.964			0.540	mg/L	26.68
Cadmium			0.5	ug/L				0.00098	mg/L	0.00098	mg/L	0.048
Calcium	14.8	mg/L	500	ug/L	< 28.92	mg/L	1.954			28.920	mg/L	1429
Chloride	2.12	mg/L	0.1	mg/L	< 4.14	mg/L	1.953			4.140	mg/L	204.5
Chromium III			1	ug/L				0.00195	mg/L	0.00195	mg/L	0.097
Chromium VI			2	ug/L				0.00391	mg/L	0.00391	mg/L	0.193
Cobalt			10	ug/L				0.01954	mg/L	0.01954	mg/L	0.965
Copper			10	ug/L	< 0.00	mg/L		0.01954	mg/L	0.01954	mg/L	0.965
Fluoride	< 0.1	mg/L	0.1	mg/L	< 0.20	mg/L	2.000			0.200	mg/L	9.88
Iron	0.0736	mg/L	100	ug/L	< 0.14	mg/L	1.902			0.140	mg/L	6.92
Lead			3	ug/L				0.00586	mg/L	0.00586	mg/L	0.290
Magnesium	6.01	mg/L	500	ug/L	< 11.74	mg/L	1.953			11.740	mg/L	580
Manganese	< 0.01	mg/L	10	ug/L	< 0.02	mg/L	2.000			0.020	mg/L	0.988
Mercury			0.1	ug/L				0.00020	mg/L	0.00020	mg/L	0.010
Molybdenum			25	ug/L				0.04885	mg/L	0.04885	mg/L	2.413
Nickel			20	ug/L				0.03908	mg/L	0.03908	mg/L	1.931
Nitrate as N	0.43	mg/L	0.01	mg/L	< 0.84	mg/L	1.953			0.840	mg/L	41.5
Nitrite as N	< 0.01	mg/L	0.01	mg/L	< 0.02	mg/L	2.000			0.020	mg/L	0.988
Phosphorous			0.05	mg/L	< 0.05	mg/L				0.050	mg/L	2.470
Potassium	2.16	mg/L	100	ug/L	< 4.22	mg/L	1.954			4.220	mg/L	208.5
Selenium			2	ug/L				0.00391	mg/L	0.00391	mg/L	0.193
Silver			0.5	ug/L				0.00098	mg/L	0.00098	mg/L	0.048
Sodium	10.3	mg/L	1000	ug/L	< 20.12	mg/L	1.953			20.120	mg/L	994
Strontium			100	ug/L				0.1954	mg/L	0.1954	mg/L	9.65
Sulfate	3.22	mg/L	0.1	mg/L	6.29	mg/L	1.953			6.290	mg/L	310.7
Sulfide			1	mg S^2/L				1.954	mg/L	1.954	mg/L	96.5
Sulfite			2	mg/L	< 1.00	mg/L		3.908	mg/L	1.00	mg/L	49.4
Thallium			2	ug/L				0.00391	mg/L	0.00391	mg/L	0.193
Tin			25	ug/L				0.04885	mg/L	0.04885	mg/L	2.413
Titanium			100	ug/L				0.1954	mg/L	0.1954	mg/L	9.65
Zinc			20	ug/L				0.03908	mg/L	0.03908	mg/L	1.931
Organics												
Cyanide, total			0.01	mg/L				0.01954	mg/L	0.01954	mg/L	0.965
Oil & Grease			5	mg/L	< 0.30	mg/L		9.77	mg/L	0.300	mg/L	14.82
Orthophosphate as P			0.01	mg/L	< 0.05	mg/L		0.01954	mg/L	0.05	mg/L	2.470
Phenol			0.005	mg/L				0.00977	mg/L	0.00977	mg/L	0.483
TDS	104	mg/L	5	mg/L	0 203	mg/L	1.952			203	mg/L	10028
TSS			2	mg/L	< 1.00	mg/L		3.908	mg/L	1	mg/L	49.4
Water Properties												
pH	8.4	std Units	--	--	7.5-9	std Units		--		7.5-9	std Units	--
Silica	36.4	mg/L	0.4	mg/L	< 71.120	mg/L	1.954			71.12	mg/L	9222

TABLE 3

Calculation of Maximum Soil Concentration from Wastewater Application to 31 Acres During the 30-Year Life of the Energy Facility

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Parameter/Analyte	(From Aquifer) Raw Water Max Value	Units	Laboratory MRL [a]	Units		RO Reject (75% Recovery) Max Value	Units	Ratio Raw/Reject	RO Reject Estimated from Nondetects	Units	Wastewater Values for ERA [b]	Units	Maximum Estimated Soil Concentration [c] (mg/kg)
Total Alkalinity	84	mg/L as $CaCO_3$	5	mg/L as $CaCO_3$		164.120	mg/L as $CaCO_3$	1.954			164.12	mg/L as $CaCO_3$	21280
Total Organic Content (TOC)			0.5	mg/L	<	1.50	mg/L		0.977	mg/L	1.500	mg/L	194.5

Notes:

[a] Laboratory MRL = the method reporting limit provided by the analytical laboratory.

[b] Wastewater values used for the Ecological Risk Assessment (ERA) assume that nondetected constituents are present at some concentration below the detection limit. For these constituents, the method reporting limit was multiplied by 1.954 (raw/reject ratio for all other detected metals) to obtain the wastewater value for the ERA.

[c] The maximum soil concentration (MSC) (mg constituent/kg soil) was calculated using the following equation: MSC = (PWC * AWP * L)/(AA * MD * BD), where PWC = predicted wastewater values (mg/L); AWP = annual wastewater production (24.3 million gallons or 91,985,506 L); L = life span of the energy plant (30 years); AA = application area (46 acres or 186,200 m^2); MD = mixing depth for tilled agricultural land (20 cm or 0.2 m); and BD = literature-based bulk density of soil (1500 kg/m^3). This calculation assumes that all constituents accumulate during the 30 years and that nothing is lost to biodegradation, erosion, leaching, or other biotic or abiotic loss mechanisms.

TABLE 4

Assessment Endpoints and Measures of Exposure and Effects

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Assessment Endpoints					
Entity	**Attribute**	**Effect Level**	**Receptor**	**Measures of Exposure**	**Measures of Effects**
Aquatic Organisms *	Growth, reproduction or survival	Reduction of attribute	NA	Estimated concentrations of COPECs in water.	Comparison of maximum estimated water concentrations to benchmark values for toxic effects that could affect growth, reproduction, or survival
Plants	Growth, reproduction or survival	20% reduction of attribute	NA	Estimated concentrations of COPECs in soil.	Comparison of maximum estimated soil concentrations to benchmark values for toxic effects that could affect growth, reproduction, or survival.
Soil Invertebrates	Growth, reproduction or survival	20% reduction of attribute	NA	Estimated concentrations of COPECs in soil.	Comparison of maximum estimated soil concentrations to benchmark values for toxic effects that could affect growth, reproduction, or survival.
Birds	Growth, reproduction or survival	20% reduction of attribute	Western Meadowlark	Estimated concentrations of COPECs in soil.	Comparison of exposure estimates (based on maximum estimated soil concentrations) to literature-derived benchmark values.
	Individual health and survival	No acceptable effect	Bald Eagle	Estimated concentrations of COPECs in water.	Comparison of exposure estimates (based on maximum estimated water concentrations) to literature-derived benchmark values.
Mammals	Growth, reproduction or survival	20% reduction of attribute	Deer Mouse	Estimated concentrations of COPECs in soil.	Comparison of exposure estimates (based on maximum estimated soil concentrations) to literature-derived benchmark values.

Note:

* Includes fish such as the shortnose sucker and the Lost River sucker.

COPEC = chemicals of potential ecological concern

NA = not available

TABLE 5

Exposure Parameters for Wildlife Receptors

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

	Exposure Factors								
	Body Weight			Ingestion rate - dry wt.			Ingestion rate - water		
Species	Mean (kg)	Notes	Reference	(kg/kg BW/d)	Notes	Reference	(L/kg BW/d)	Notes	Reference
Birds									
Western Meadowlark *Sturnella neglecta*	Mean: **0.110**	Data for Colorado	Wiens and Innis 1974	**0.04**	Daily food consumption for western meadowlarks estimated at 3 times the stomach capacity (3.9 g). Ingestion rate based on body weight of 0.110 kg.	Sample et al. 1997	**0.12**	Based on a minimum water consumption for weight maintenance of 66% of the ad libitum rate and a body weight of 0.1115 kg.	Sample et al. 1997
Bald Eagle Haliaeetus leucocephalus	Male: 4.014 Female: 5.089 Both: **4.552** Range: 3.524 - 5.756	Data for Alaska	Imler and Kalmbach 1955	**0.0163**	Average ingestion rate based on diet of chum salmon at temperatures of -10, 5, and 20^{o} C (14, 41, and 68^{o} F).	Stalmaster and Gessaman 1984	**0.036**	Estimated using allometric equation for birds and a body weight of 4.552 kg.	Calder and Braun 1983
Mammals									
Deer Mouse *Peromyscus maniculatus*	Male: 0.026 **Female: 0.023**	Means for values reported for California	Silva and Downing 1995	**0.45**	Maximum value reported. Represents lactating female.	EPA 1993	0.14	Estimated using allometric equation for mammals and a body weight of 0.026 kg.	Calder and Braun 1983

	Feeding Habits and Foraging Range														
	Biotic Dietary Items (% Diet)							Abiotic Media Ingestion (% diet)			Foraging Range				
Species	Plants	Terrestrial Invertebrates	Mammals and Birds	Fish	Notes	Major food items	Reference	Soil	Notes	Reference	Hectares	other (miles, km)	Reference	Notes
Birds															
Western Meadowlark *Sturnella neglecta*	**36.7**	**63.3**			Data for North America.	Western meadowlarks are ground foragers that consume both plant material (primarily seeds) and invertebrates.	Lanyon 1994	**2.08**	Data not available for western meadowlarks. Assumed to be similar to value derived for the American robin.	Sample et al. 1997	5.04		Lanyon 1994, Kendeigh 1941, and Schaef and Picman 1988	Median from 3 studies.
Bald Eagle Haliaeetus leucocephalus			24	66		Opportunistic feeder, primarily fish, waterfowl, and other animals. For this assessment assumed diet of **100 percent fish**.	Ofelt 1975	**0**	Data not available for bald eagle. Assumed to be negligible due to foraging behavior.			radius = 0.64 km	Mahaffy and Frenzel 1987	
Mammals															
Deer Mouse *Peromyscus maniculatus*	**50**	**50**			Approximate diet of mice in Colorado over all seasons.	Seeds and terrestrial invertebrates, mainly insects.	EPA 1993	**2**	assumed comparable to white-footed mouse	adapted from Beyer et al. 1994	0.1 - 0.2		Brylski 1990	

Note:

Bold values were used for the exposure calculations.

TABLE 6

Bioaccumulation Values and Models for Plants, Soil Invertebrates, and Aquatic Organisms for Calculation of Wildlife Exposure

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Analytes	N	BAF	Regression Model Slope (B1)	Regression Model Intercept (B0)	Form	Transfer Type	Comments	Reference
Plants								
Antimony	17	0.1487				soil-plant	90^{th} percentile value	CH2M HILL, 2002
Arsenic		--	0.564	-1.992	Len(plant) = B0+B1(Len[soil])	soil-plant	represents bioaccumulation into aboveground plant	Bechtel-Jacobs, 1998
Beryllium		--						
Cadmium		--	0.546	-0.476	Len(plant) = B0+B1(Len[soil])	soil-plant	represents bioaccumulation into aboveground plant	Bechtel-Jacobs, 1998
Chromium	28	0.041				soil-plant	median of 28 values	Bechtel-Jacobs, 1998
Cobalt	28	0.0075					median of 28 values	Bechtel-Jacobs, 1998
Cyanide		***1***					assumed value	
Iron	27	1				soil-seed	90^{th} percentile value; seeds surrogate for plants	CH2M HILL, 2002
Magnesium	8	7.333					mean value (90^{th} Percentile highly skewed)	CH2M HILL, 2002
Manganese	28	0.0792					median of 28 values	Bechtel-Jacobs, 1998
Mercury		--	0.544	-0.996	Len(plant) = B0+B1(Len[soil])	soil-plant	represents bioaccumulation into aboveground plant	Bechtel-Jacobs, 1998
Nickel		--	0.748	-2.224	Len(plant) = B0+B1(Len[soil])	soil-plant	represents bioaccumulation into aboveground plant	Bechtel-Jacobs, 1998
Phenol		5.5963			$BAF=10\hat{}^{1.31-0.385(log10Kow)}$	soil-plant	calculated with log Cow of 1.46 using model from USEPA 2000	
Silver		***1***					assumed value	
Thallium		***1***					assumed value	
Tin		***1***					assumed value	
Arthropods								
Antimony	6	0.025				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Arsenic	44	0.1258				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Beryllium	24	0.0286				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Cadmium	210	4.078				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Chromium	28	0.546				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Cobalt	24	0.023				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Cyanide		***1***					assumed value	
Magnesium	26	1.5047				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Manganese	26	0.2267				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Mercury	24	2				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Nickel	28	0.5118				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Phenol		26.58			$BAF=10\hat{}^{(logKow-0.6)/(foc*10\hat{}(0.983*logKow+0.00028))}$	soil-earthworm	calculated with log Cow of 1.46 using model from Sample et al. 1997; foci assumed to be 0.01	
Silver	22	0.12				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Thallium	18	0.256				soil-insect	90^{th} percentile value	CH2M HILL, 2002
Tin		***1***					assumed value	
Aquatic Organisms								
Arsenic		17	--	--	--	water-fish	BCF, trophic level 3 and 4 BAF	Sample et al, 1997
Cadmium		12400	--	--	--	water-fish	BCF, trophic level 3 and 4 BAF	Sample et al, 1997
Chromium		3	--	--	--	water-fish	Based on Chromium 6+	Sample et al, 1997
Cobalt		--	--	--	--			
Manganese		--	--	--	--			
Mercury		27900	--	--	--	water-fish	Trophic level 3 BAF	Sample et al, 1997
Nickel		106	--	--	--	water-fish	BCF, trophic level 3 and 4 BAF	Sample et al, 1997

Note:

All biological accumulation factors (BAFs) were assumed to be in dry weight.

TABLE 7

Screening-Level Benchmark Values for Soil and Water

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Analyte	Oregon ODEQ Soil Screening Level Values (mg/kg) [a]				Oregon ODEQ Aquatic Screening Level Values (mg/L) [b]	
	Plants	Invertebrates	Birds	Mammals	Aquatic Biota	Birds
Inorganics						
Aluminum	50	600	450	107		
Antimony	5	--	--	15		
Arsenic	10	60	10	29	0.15	18
Barium	500	3000	85	638		
Beryllium	10	--	--	83		
Boron	0.5	20	120	3500		
Cadmium	4	20	6	125	0.0022	10
Chromium III	1	0.4	4	340000	0.011	7.2
Chromium VI	--	--	--	410		
Cobalt	20	1000		150	0.023	--
Copper	100	50	190	390		
Fluoride	200	30	32	2285		
Iron	10	200		--		
Lead	50	500	16	4000		
Manganese	500	100	4125	11000	0.12	7242
Mercury	0.3	0.1	1.5	73	0.00077	3.3
Molybdenum	2	200	15	14		
Nickel	30	200	320	625	0.052	562
Selenium	1	70	2	25		
Silver	2	50	--	--		
Strontium	--	--	--	32875		
Thallium	1	--	--	1		
Tin	50	2000	--	--		
Titanium	--	1000	--	--		
Zinc	50	200	60	20000		
Organics						
Phenol	70	30	--	--		

Notes:

[a] Screening values from the Oregon Department of Environmental Quality (ODEQ) *Guidance for Ecological Risk Assessment: Level II Screening Level Values* (ODEQ, 2001).

[b] Screening values from the ODEQ *Guidance for Ecological Risk Assessment: Level II Screening Level Values* (ODEQ, 2001). Only values required for screening of air emissions deposition in surface water presented. Wastewater application will not impact surface water.

-- not available

TABLE 8

Summary of Wildlife Toxicity Data for Analytes Lacking Oregon Department of Environmental Quality (ODEQ) Screening-Level Values or Requiring Further Evaluation

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Analyte	Analyte/surrogate	Study	Test species	Body Weight (kg)	Endpoint	Endpoint 2	Duration	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Notes
Birds										
Arsenic	Sodium arsenate	Stanley et al. 1994	mallard duck	1	reproduction	ducklings/successful nest	4 wks prior to pairing through 14 d post hatch (chronic)	9.3	40.3	CH2M HILL 2000 (ALT BTAG)
Arsenic	Sodium arsenate	Stanley et al., 1994	mallard duck	1	reproduction	ducklings/successful nest	4 wks prior to pairing through 14 d post hatch (chronic)	5.5	22.01	EFA West 1998 (BTAG)
Arsenic	Sodium arsenite	USFWS 1964	mallard duck	1	mortality	mortality	128 d (chronic)	5.14	12.84	
Cadmium	Cadmium Chloride	Cain et al., 1983	mallard duck	0.8	hematology	hematological effects	12 wks (chronic)	0.08	NA	EFA West 1998 (BTAG)
Cadmium	Cadmium Chloride	Richardson et al., 1974	Japanese quail	0.084	growth	body weight	6 wks (chronic)	NA	10.43	EFA West 1998 (BTAG)
Cadmium	Cadmium Chloride	White and Finley 1978	mallard duck	1.153	reproduction	eggs/hen	90 d (critical life-stage = chronic)	1.45	20.03	CH2M HILL 2000 (ALT BTAG)
Chromium	$CrK(SO_4)^2$	Haseltine et al., 1985	black duck	1.25	reproduction	duckling survival	10 mo (chronic)	1	5	
Cobalt		Diaz et al., 1994	broiler chicken	0.45	growth	weight	14 d (critical life-stage = chronic)	12.36	24.72	assumed BW for 120 day-old chicken
Iron		NRC 1980 in McDowell 1992	white leghorn chicken	1.5	NA	maximum tolerable level	chronic	70.5	NA	
Manganese	Manganese Oxide	Laskey and Edens 1985	Japanese quail	0.072	growth	growth	75 d (chronic)	977	NA	CH2M HILL 2000 (ALT BTAG)
Manganese	Manganese Oxide	Laskey and Edens 1985	Japanese quail	0.072	behavior	aggressive behavior	75 d (chronic)	98	977	
Manganese	Manganese oxide	Laskey and Edens, 1985	Japanese quail	0.072	growth, behavior	weight gain, aggressive behavior	75 d (chronic)	77.6	776	EFA West 1998 (BTAG)
Mercury	MeHg Dicyandiamide	USEPA, 1995	mallard duck	1	reproduction	number eggs and ducklings	3 gen (chronic)	0.039	0.18	EFA West 1998 (BTAG)
Mercury	MeHgCl	Heinz, 1976; Heinz and Hoffman, 1998	mallard duck	1	reproduction	duckling 7 day survival	2.5 mo - 2 gen (chronic)	0.068	0.37	CH2M HILL 2000 (ALT BTAG)
Nickel	Nickel sulfate	Cain and Pafford 1981	mallard	0.782	physiological	tremors, joint edema	90 d (chronic)	17.6	77.4	CH2M HILL 2000 (ALT BTAG)
Nickel	Nickel sulfate	Cain and Pafford, 1981	mallard	0.58	physiological	tremors, joint edema	90 d (chronic)	1.38	55.3	EFA West 1998 (BTAG)
Nickel	Nickel sulfate	Weber and Reid 1968	chicks	0.45	growth	growth	4 wks (chronic)	25.3	42.2	
Silver		USEPA 1997	mallard duck	1	NR	NA	14 days (acute)	17.8	NA	multiplied acute value (1780) by 0.01
Thallium		Schafer 1972	starling	0.82	survivorship	% survival	acute	0.053	NA	multiplied acute value (5.3) by 0.01
Tin	bis (Tributyltin) oxide (TBTO)	Schlatterer et al. 1993	Japanese quail	0.15	reproduction	reduced egg hatchability	6 wks (chronic)	6.8	16.9	
Mammals										
Iron		Sobotka et al., 1996	rat	0.35		subchronic NOAEL	subchronic	2.8	NA	multiplied subchronic value (28) by 0.1
Silver	AgNO3	Rungby and Dascher 1984	mouse	0.03	behavior	activity	125 d (chronic)	2.38	23.8	
Tin	bis (Tributyltin) oxide (TBTO)	Davis et al. 1987	mouse	0.03	reproduction	reduced fetal weight and survival	d 6-15 of gestation (chronic)	23.4	35	
Cyanide	Potassium cyanide	Tewe and Maner 1981	rat	0.35	reproduction	fetal growth	gestation and lactation (chronic)	68.7	NA	
Phenol		Bishop et al. 1997	Mouse	0.03	reproduction, body weight	reproduction, weight gain	6 mo (chronic)	17.1	NA	

Note:
Highlighted studies used in risk evaluation.

TABLE 9

Receptor-Specific NOAELs and LOAELs Estimated from Literature-Derived Data Using Allometric Scaling Methods Presented in Sample et al. (1996) and Sample and Arenal (1999)[a].

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Receptor	Analyte	Study	Test species	Test Body Weight (kg)	Test NOAEL (mg/kg/d)	Test LOAEL[b] (mg/kg/d)	Scaling Factor	Receptor Body Weight (kg)	Receptor NOAEL	Receptor LOAEL[b]
Birds										
Western Meadowlark	Arsenic	Stanley et al. 1994	mallard duck	1	9.3	40.3	1.2	0.11	5.98	25.92
	Cadmium	White and Finley 1978	mallard duck	1.153	1.45	20.03	1.2	0.11	0.91	12.52
	Chromium III	Haseltine et., al., 1985	black duck	1.25	1	5	1.2	0.11	0.62	3.08
	Cobalt	Diaz et al., 1994	broiler chicken	0.45	12.36	24.72	1.2	0.11	9.33	18.65
	Iron	NRC 1980 in McDowell 1992	white leghorn chicken	1.5	70.5	NA	1.2	0.11	41.81	NA
	Manganese	Laskey and Edens 1985	Japanese quail	0.072	977	NA	1.2	0.11	1063.42	NA
	Mercury	Heinz, 1976; Heinz and Hoffman, 1998	mallard duck	1	0.068	0.37	1.2	0.11	0.04	0.24
	Nickel	Cain and Pafford 1981	mallard	0.782	17.6	77.4	1.2	0.11	11.89	52.29
	Silver	USEPA 1997	mallard duck	1	17.8	NA	1.2	0.11	11.45	NA
	Thallium	Schafer 1972	starling	0.82	0.053	NA	1.2	0.11	0.04	NA
	Tin	Schlatterer et al. 1993	Japanese quail	0.15	6.8	16.9	1.2	0.11	6.39	15.88
Mammals										
Deer Mouse	Iron	Sobotka et al., 1996	rat	0.35	2.8	NA	0.94	0.023	3.30	NA
	Silver	Rungby and Dascher 1984	mouse	0.03	2.38	23.8	0.94	0.023	2.42	24.18
	Tin	Davis et al. 1987	mouse	0.03	23.4	35	0.94	0.023	23.78	35.56
	Cyanide, total	Tewe and Maner 1981	rat	0.273	68.7	NA	0.94	0.023	79.69	NA
	Phenol	Bishop et al. 1997	Mouse	0.03	17.1	NA	0.94	0.023	17.37	NA

[a] Calculations are based on toxicity values and body weights for test species from Table 8 and body weights for receptors from Table 5. Scaling factors of 0.94 and 1.2 were applied for mammals and birds, respectively (Sample and Arenal, 1999). Allometric equation is in the form of $NOAEL_{receptor} = NOAEL_{test} (BW_{test}/BW_{receptor})^{(1\text{-scaling factor})}$.

[b] NA = Toxicity values for this analyte were not available.

References:

Bishop, J.B., R.W. Morris, J.C. Seely, L.A. Hughs, K.T. Kain, and W.M. Generoso. 1997. Alterations in the reproductive patterns of female mice exposed to xenobiotics."*Fundamental and Applied Toxicology* 40: 191-204.

Davis, A., R. Barale, G. Brun, et al. 1987. Evaluation of the genetic and embryotoxic effects of bis(tri-n-butyltin)oxide (TBTO), a broad-spectrum pesticide, in multiple in vivo and in vitro short-term tests *Muta. Res.* 188: 65-95.

Rungby, J., and G. Danscher. 1984. Hypoactivity in silver exposed mice. *Acta Pharmacol. Et. Toxicol.* 55:398-401.

Sobotka TJ, Whittaker P, Sobotka JM, Brodie RE, Quander DY, Robl M, Bryant M, Barton CN. 1996. Neurobehavioral dysfunctions associated with dietary iron overload. Physiol Behav. Feb. 59(2):213-9.

Tewe, O.O., and J.H. Maner. 1981. Long-term and carry-over effect of dietary inorganic cyanide (KCN) in the life cycle performance and metabolism of rats. *Toxicol. Appl. Pharmacol.* 58:1-7.

TABLE 10

Comparison of Oregon Department of Environmental Quality (ODEQ) Soil Screening Level Values to Estimated Soil Concentrations (Incremental, Background, and Total) From Air Emissions Deposition

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Analyte	Maximum Incremental (mg/kg)	Background (mg/kg) [a]	Total (Incremental + Background) (mg/kg)	Oregon Screening Level Values [b]				Hazard Quotients - Incremental [c]				Hazard Quotients - Background [c]				Hazard Quotients - Total [c]			
				Plant	Soil Invertebrate	Bird	Mammal	Plant	Soil Invertebrate	Bird	Mammal	Plant	Soil Invertebrate	Bird	Mammal	Plant	Soil Invertebrate	Bird	Mammal
Arsenic	0.193	4.1	4.11	10	60	10	29	0.019	0.003	0.019	0.007	0.410	0.068	0.410	0.141	0.411	0.069	0.411	0.142
Cadmium	0.048	***1***	1.06	4	20	6	125	0.012	0.002	0.008	0.000	0.250	0.050	0.167	0.008	0.265	0.053	0.177	0.008
Chromium	0.097	45	45.07	1	0.4	4	340000	0.097	0.241	0.024	0.000	45.000	112.500	11.250	0.000	45.074	112.684	11.268	0.000
Cobalt	0.965	15	15.01	20	1000	--	150	0.048	0.001		0.006	0.750	0.015		0.100	0.750	0.015		0.100
Manganese	0.988	600	600.02	500	100	4125	1100	0.002	0.010	0.000	0.001	1.200	6.000	0.145	0.545	1.200	6.000	0.145	0.545
Mercury	0.010	0.06	0.07	0.3	0.1	1.5	73	0.032	0.097	0.006	0.000	0.200	0.600	0.040	0.001	0.241	0.723	0.048	0.001
Nickel	1.931	32.5	32.61	30	200	320	625	0.064	0.010	0.006	0.003	1.083	0.163	0.102	0.052	1.087	0.163	0.102	0.052

Notes:

[a] Background values are the mean of Klamath County background concentrations reported by USGS (Boerngen, J. G. and H. T. Shacklette, 1981. Chemical Analyses of Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey, Open-File Report 81-197.). Italicized and bold values are Washington Statewide Background levels (San Jaun, C. 1994. Natural Background Soil Metals Concentrations in Washington State. Toxics Cleanup Program, Washington State Department of Ecology. Publication # 94-115, October.) and were used when Klamath County values were not available.

[b] Screening values from the Oregon Department of Environmental Quality (Guidance for Ecological Risk Assessment: Level II Screening Level Values, December 2001).

[c] Hazard Quotient (HQ) = soil concentration (Incremental, Background, or Total)/Oregon screening level value. Incremental HQs represent risk estimate from wastewater only; background HQs represent risk estimate from background levels; and total HQs represent the combined incremental and background risk.

-- Not available

Highlighted values represent exceedance of the screening levels.

TABLE 11

Exposure and Hazard Quotient (HQ) Calculations for Air Emissions Constituents Lacking Oregon Department of Environmental Quality (ODEQ) Screening Values for Birds or for Analytes that Exceed ODEQ Screening Values and for Bald Eagles. [a]

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

			Bioaccumulation Values									Exposure Estimates [e]						Literature Benchmarks			
	Maximum Soil	Maximum Water	Plants [b]			Invertebrates [c]			Fish [d]												
	Concentration	Concentration		Regression Model			Regression Model													NOAEL	LOAEL
Analytes	**(mg/kg)**	**(mg/L)**	**BAF**	**B1**	**B0**	**BAF**	**B1**	**B0**	**BCF**	**B1**	**B0**	**Plant**	**Invert**	**Fish**	**Soil**	**Water**	**Total**	**NOAEL**	**LOAEL**	**HQ**	**HQ**
Western Meadowlark																					
Incremental																					
Chromium	0.290	0.000181	0.041			0.306			3	0.7338	-1.4599	0.0002	0.0022	0.0000	0.0002	0.0000	0.0027	0.615	3.075	0.004	0.001
Cobalt	0.965	0.000015	0.0075			0.122			--			0.0016	0.0265	NA	0.0087	0.0000	0.0368	1.413	14.129	0.026	0.003
Background																					
Chromium	45	0.000181	0.041			0.306			3	0.7338	-1.4599	0.0273	0.3470	0.0000	0.0374	0.0000	0.4118	0.615	3.075	0.670	0.134
Cobalt	15	0.000015	0.0075			0.122			1			0.0017	0.0461	NA	0.0125	0.0000	0.0603	9.325	18.650	0.006	0.003
Total																					
Chromium	45.290	0.000181	0.041			0.306			3	0.7338	-1.4599	0.0275	0.3492	0.0000	0.0377	0.0000	0.4144	0.615	3.075	0.674	0.135
Cobalt	15.965	0.000015	0.0075			0.122			1			0.0018	0.0491	NA	0.0133	0.0000	0.0641	9.325	18.650	0.007	0.003
Bald Eagle																					
Arsenic	0.012	0.000030		0.564	-1.992		0.706	-1.421	17			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	12.593	54.569	0.000	0.000
Cadmium	0.061	0.000151		0.546	-0.476		0.795	2.114	12400			0.0000	0.0000	0.0306	0.0000	0.0000	0.0306	1.908	26.361	0.016	0.001
Chromium	0.074	0.000181	0.041			0.306			3	0.7338	-1.4599	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.295	6.475	0.000	0.000
Cobalt	0.006	0.000015	0.0075			0.122			1			0.0000	0.0000	NA	0.0000	0.0000	0.0000	19.634	39.269	0.000	0.000
Manganese	0.018	0.000045	0.0792				0.682	-0.809	1			0.0000	0.0000	NA	0.0000	0.0000	0.0000	2239.074	NA	0.000	NA
Mercury	0.012	0.000030		0.544	-0.996		0.118	-0.684	27900			0.0000	0.0000	0.0138	0.0000	0.0000	0.0138	0.092	0.501	0.149	0.027
Nickel	0.111	0.000272		0.748	-2.224	1.059			106	0.4658	-0.2462	0.0000	0.0000	0.0005	0.0000	0.0000	0.0005	25.033	110.088	0.000	0.000

Notes:

[a] Because bald eagles utilizing the McFall Reservoir are of concern, the maximum values for the generic reservoir (i.e., 20-ft mixing depth) were used in the exposure calculation

[b] Bioaccumulation values for plants from CH2M HILL (2002).

[c] Bioaccumulation values for invertebrates (arthropods) from CH2M HILL (2002).

[d] Bioaccumulation values for fish from Sample et al. 1997 for all analytes, except cobalt and manganese. No bioaccumulation values were available for these analytes; therefore a value of 1 was assumed.

[e] Exposure estimates calculated using the life-history parameters presented in Table 5.

NA = not available

TABLE 12

Comparison of Aquatic Screening Values to Maximum Estimated Surface Water Concentrations (Generic Reservoir and Generic River) From Air Emissions Deposition

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Analyte	Maximum Concentration (mg/L)	Oregon DEQ Screening Level Values [a]		Hazard Quotients [b]	
		Aquatic Biota	Birds	Aquatic Biota	Birds
Generic Reservoir (20-ft mixing depth)					
Arsenic	0.0000302	0.15	18	0.000	0.000
Cadmium	0.0001512	0.0022	10	0.069	0.000
Chromium	0.0001814	0.011	7.2	0.016	0.000
Cobalt	0.0000151	0.023	--	0.001	
Manganese	0.0000454	0.12	7242	0.000	0.000
Mercury	0.0000302	0.00077	3.3	0.039	0.000
Nickel	0.0002721	0.052	562	0.005	0.000
Generic River (2-ft mixing depth)					
Arsenic	3.0E-04	0.15	18	0.002	0.000
Cadmium	1.5E-03	0.0022	10	0.687	0.000
Chromium	1.8E-03	0.011	7.2	0.165	0.000
Cobalt	1.5E-04	0.023	--	0.007	
Manganese	4.5E-04	0.12	7242	0.004	0.000
Mercury	3.0E-04	0.00077	3.3	0.393	0.000
Nickel	2.7E-03	0.052	562	0.052	0.000

Notes:

[a] Screening values from the Oregon Department of Environmental Quality (ODEQ) (Guidance for Ecological Risk Assessment: Level II Screening Level Values, December 2001).

[b] Hazard Quotient (HQ) = maximum water concentration/ODEQ or NAWQC values.

-- Not available

Highlighted values represent exceedance of the screening levels.

TABLE 13

Comparison of Oregon Department of Environmental Quality (DEQ) Soil Screening Level Values to Estimated Soil Concentrations (Incremental, Background, and Total) Assuming a 20-cm Mixing Depth for Tilled Agricultural Land

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

Analyte	Incremental Soil Concentration (mg/kg)	Background (mg/kg) [a]	Total (Incremental) + Background) (mg/kg)	Oregon DEQ Screening Level Values [b]				Hazard Quotients -Incremental [c]				Hazard Quotients - Background [c]				Hazard Quotients -Total [c]			
				Plants	Inverts	Birds	Mammals	Plants	Inverts	Birds	Mammals	Plants	Inverts	Birds	Mammals	Plants	Inverts	Birds	Mammals
Inorganics																			
Aluminum	9.653	100000	100009.65	50	600	450	107	0.193	0.016	0.021	0.090	**2000.000**	**166.667**	**222.222**	**934.579**	**2000.193**	**166.683**	**222.244**	**934.670**
Ammonia as N	9.653	--	9.65	--	--	--	--												
Antimony	0.193	0	0.19	5	--	--	15	0.039			0.013	0.000			0.000	0.039			0.013
Arsenic	0.193	4.05	4.24	10	60	10	29	0.019	0.003	0.019	0.007	0.405	0.068	0.405	0.140	0.424	0.071	0.424	0.146
Barium	2.413	700	702.41	500	3000	85	638	0.005	0.001	0.028	0.004	**1.400**	0.233	**8.235**	**1.097**	**1.405**	0.234	**8.264**	**1.101**
Beryllium	0.386	1	1.39	10	--	--	83	0.039			0.005	0.100			0.012	0.139			0.017
Boron	26.677	20	46.68	0.5	20	120	3500	**53.354**	**1.334**	0.222	0.008	**40.000**	**1.000**	0.167	0.006	**93.354**	**2.334**	0.389	0.013
Cadmium	0.048	**1**	1.05	4	20	6	125	0.012	0.002	0.008	0.000	0.250	0.050	0.167	0.008	0.262	0.052	0.175	0.008
Calcium	1428.7	38000	39428.69	--	--	--	--												
Chloride	204.52	--	204.52	--	--	--	--												
Chromium III	0.097	**41.9**	42.00	1	0.4	4	340000	0.097	0.241	0.024	0.000	**41.900**	**104.750**	**10.475**	0.000	**41.997**	**104.991**	**10.499**	0.000
Chromium VI	0.193	--	0.19	--	--	--	410				0.000								0.000
Cobalt	0.965	15	15.97	20	1000		150	0.048	0.001		0.006	0.750	0.015		0.100	0.798	0.016		0.106
Copper	0.965	70	70.97	100	50	190	390	0.010	0.019	0.005	0.002	0.700	**1.400**	0.368	0.179	0.710	**1.419**	0.374	0.182
Fluoride	9.880	200	209.88	200	30	32	2285	0.049	0.329	0.309	0.004	**1.000**	**6.667**	**6.250**	0.088	**1.049**	**6.996**	**6.559**	0.092
Iron	6.916	**43106**	43112.92	10	200		--	0.692	0.035			**4310.600**	**215.530**			**4311.292**	**215.565**		
Lead	0.290	10	10.29	50	500	16	4000	0.006	0.001	0.018	0.000	0.200	0.020	0.625	0.003	0.206	0.021	0.643	0.003
Magnesium	580.0	20000	20579.97	--	--	--	--												
Manganese	0.988	600	600.99	500	100	4125	11000	0.002	0.010	0.000	0.000	**1.200**	**6.000**	0.145	0.055	**1.202**	**6.010**	0.146	0.055
Mercury	0.010	0.06	0.07	0.3	0.1	1.5	73	0.032	0.097	0.006	0.000	0.200	0.600	0.040	0.001	0.232	0.697	0.046	0.001
Molybdenum	2.413	3	5.41	2	200	15	14	**1.207**	0.012	0.161	0.172	**1.500**	0.015	0.200	0.214	**2.707**	0.027	0.361	0.387
Nickel	1.931	32.5	34.43	30	200	320	625	0.064	0.010	0.006	0.003	**1.083**	0.163	0.102	0.052	**1.148**	0.172	0.108	0.055
Nitrate as N	41.497	--	41.50	--	--	--	--												
Nitrite as N	0.988	--	0.99	--	--	--	--												
Phosphorous	2.470	750	752.47	--	--	--	--												
Potassium	208.47	13500	13708.47	--	--	--	--												
Selenium	0.193	0.1	0.29	1	70	2	25	0.193	0.003	0.097	0.008	0.100	0.001	0.050	0.004	0.293	0.004	0.147	0.012
Silver	0.048	--	0.05	2	50	--	--	0.024	0.001							0.024	0.001		
Sodium	994.0	22500	23493.96	--	--	--	--												
Strontium	9.653	700	709.65	--	--	--	32875				0.000				0.021				0.022
Sulfate	310.74	--	310.74	--	--	--	--												
Sulfide	96.53	--	96.53	--	--	--	--												
Sulfite	49.401	--	49.40	--	--	--	--												
Thallium	0.193	0	0.19	1	--	--	1	0.193			0.193	0.000			0.000	0.193			0.193
Tin	2.413	--	2.41	50	2000	--	--	0.048	0.001							0.048	0.001		
Titanium	9.653	--	9.65	--	1000	--	--		0.010								0.010		
Zinc	1.931	45	46.93	50	200	60	20000	0.039	0.010	0.032	0.000	0.900	0.225	0.750	0.002	0.939	0.235	0.782	0.002
Organics and Other Constituents																			
Cyanide, total	0.965	--	0.96530	--	--	--	--												
Oil & Grease	14.820	--	14.82	--	--	--	--												
Orthophosphate as P	2.470	--	2.47	--	--	--	--												
Phenol	0.483	--	0.48265	70	30	--	--	0.007	0.016							0.007	0.016		
TDS	10028	--	10028.50	--	--	--	--												
TSS	49.40	--	49.40	--	--	--	--												

Notes:

[a] Background values are the mean of Klamath County background concentrations reported by USGS (Boerngen, J. G. and H. T. Shacklette, 1981. Chemical Analyses of Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey, Open-File Report 81-197.). Italicized and bold values are Washington Statewide Background levels (San Jaun, C. 1994. Natural Background Soil Metals Concentrations in Washington State. Toxics Cleanup Program, Washington State Department of Ecology. Publication # 94-115, October.) and were used when Klamath County values were not available.

[b] Screening values from the Oregon Department of Environmental Quality (Guidance for Ecological Risk Assessment: Level II Screening Level Values, December 2001).

[c] Hazard Quotient (HQ) = soil concentration (Incremental, Background, or Total)/Oregon screening level value. Incremental HQs represent risk estimate from wastewater only; background HQs represent risk estimate from background levels; and total HQs represent the combined incremental and background risk.

-- Not available

Highlighted values represent exceedance of the screening levels.

TABLE 14

Exposure and Hazard Quotient (HQ) Calculations for Wastewater Constituents Lacking Oregon Department of Environmental Quality (ODEQ) Screening Values for Birds and Mammals

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

		Bioaccumulation Values		Exposure Estimates [c]				Literature Benchmarks				
Analytes	Maximum Soil Concentration (mg/kg)	Plants [a]	Invertebrates [b]	Plant	Invert	Soil	Total	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Source	NOAEL HQ	LOAEL HQ
Incremental												
Western Meadowlark												
Antimony	0.19	0.1487	0.025	0.0004	0.0001	0.0002	0.0007					
Beryllium	0.39		0.0286		0.0003	0.0003	0.0006					
Cobalt	0.97	0.55	0.023	0.0079	0.0006	0.0008	0.0092	9.325	18.650	Diaz et al. 1994	0.001	0.000
Iron	6.92	1	0.027	0.1024	0.0047	0.0058	0.1128	41.807	NA	NRC 1980 in McDowell 1992	0.003	NA
Magnesium	579.97	7.333	1.5047	62.9435	21.9917	0.4825	85.4178					
Silver	0.05	1	0.12	0.0007	0.0001	0.0000	0.0009	11.447	NA	USEPA 1997	0.000	NA
Strontium	9.65					0.0080	0.0080					
Thallium	0.19	1	0.256	0.0029	0.0012	0.0002	0.0043	0.035	NA	Schafer 1972	0.120	NA
Tin	2.41	1	1	0.0357	0.0608	0.0020	0.0985	6.391	15.884	Schlatterer et al. 1993	0.015	0.006
Titanium	9.65					0.0080	0.0080					
Cyanide, total	0.96530	1	1	0.0143	0.0243	0.0008	0.0394					
Oil & Grease	14.82					0.0123	0.0123					
Orthophosphate as P	2.47					0.0021	0.0021					
Phenol	0.48265	5.5963	26.58	0.0400	0.3233	0.0004	0.3637					
Deer Mouse												
Iron	6.92	1	0.027	1.5561	0.0420	0.0622	1.6604	3.297	NA	Sobotka et al. 1996	0.504	NA
Magnesium	579.97	7.333	1.5047	956.9121	196.3542	5.2198	1158.4860					
Silver	0.05	1	0.12	0.0109	0.0013	0.0004	0.0126	2.418	24.182	Rungby and Dascher 1984	0.005	0.001
Tin	2.41	1	1	0.5430	0.5430	0.0217	1.1077	23.776	35.562	Davis et al. 1987	0.047	0.031
Titanium	9.65					0.0869	0.0869					
Cyanide, total	0.96530	1	1	0.2172	0.2172	0.0087	0.4431	79.693	NA	Tewe and Maner 1981	0.006	NA
Oil & Grease	14.82					0.1334	0.1334					
Orthophosphate as P	2.47					0.0222	0.0222					
Phenol	0.48265	5.5963	26.58	0.6077	2.8865	0.0043	3.4986	17.375	NA	Bishop et al. 1997	0.201	NA
Background												
Western Meadowlark												
Antimony		0.1487	0.025	0.0000	0.0000	0.0000	0.0000					
Beryllium	1		0.0286		0.0007	0.0008	0.0016					
Cobalt	15	0.55	0.023	0.1221	0.0087	0.0125	0.1433	9.325	18.650	Diaz et al. 1994	0.015	0.008
Iron	43106	1	0.027	637.9688	29.3293	35.8642	703.1623	41.807	NA	NRC 1980 in McDowell 1992	16.819	NA
Magnesium	20000	7.333	1.5047	2170.5680	758.3688	16.6400	2945.5768					
Silver		1	0.12	0.0000	0.0000	0.0000	0.0000	11.447	NA	USEPA 1997	0.000	NA
Strontium	700					0.5824	0.5824					
Thallium	0	1	0.256	0.0000	0.0000	0.0000	0.0000	0.035	NA	Schafer 1972	0.000	NA
Tin		1	1	0.0000	0.0000	0.0000	0.0000	6.391	15.884	Schlatterer et al. 1993	0.000	0.000
Titanium						0.0000	0.0000					
Cyanide, total		1	1	0.0000	0.0000	0.0000	0.0000					
Oil & Grease						0.0000	0.0000					
Orthophosphate as P						0.0000	0.0000					
Phenol		5.5963	26.58	0.0000	0.0000	0.0000	0.0000					
Deer Mouse												
Iron	43106	1	0.027	9698.8500	261.8690	387.9540	10348.6730	3.297	NA	Sobotka et al. 1996	3138.963	NA
Magnesium	20000	7.333	1.5047	32998.5000	6771.1500	180.0000	39949.6500					
Silver		1	0.12	0.0000	0.0000	0.0000	0.0000	2.418	24.182	Rungby and Dascher 1984	0.000	0.000
Tin		1	1	0.0000	0.0000	0.0000	0.0000	23.776	35.562	Davis et al. 1987	0.000	0.000
Titanium						0.0000	0.0000					

TABLE 14

Exposure and Hazard Quotient (HQ) Calculations for Wastewater Constituents Lacking Oregon Department of Environmental Quality (ODEQ) Screening Values for Birds and Mammals

Screening-Level Ecological Risk Assessment

COB Energy Facility, Klamath County, Oregon

		Bioaccumulation Values		Exposure Estimates [c]				Literature Benchmarks				
Analytes	Maximum Soil Concentration (mg/kg)	Plants [a]	Invertebrates [b]	Plant	Invert	Soil	Total	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Source	NOAEL HQ	LOAEL HQ
Cyanide, total		1	1	0.0000	0.0000	0.0000	0.0000	79.693	NA	Tewe and Maner 1981	0.000	NA
Oil & Grease						0.0000	0.0000					
Orthophosphate as P						0.0000	0.0000					
Phenol		5.5963	26.58	0.0000	0.0000	0.0000	0.0000	17.375	NA	Bishop et al. 1997	0.000	NA
Total												
Western Meadowlark												
Antimony	0.19	0.1487	0.025	0.0004	0.0001	0.0002	0.0007					
Beryllium	1.39		0.0286		0.0010	0.0012	0.0022					
Cobalt	15.97	0.55	0.023	0.1300	0.0093	0.0133	0.1525	9.325	18.650	Diaz et al. 1994	0.016	0.008
Iron	43112.92	1	0.027	638.0712	29.3340	35.8699	703.2751	41.807	NA	NRC 1980 in McDowell 1992	16.822	NA
Magnesium	20579.97	7.333	1.5047	2233.5115	780.3605	17.1225	3030.9946					
Silver	0.05	1	0.12	0.0007	0.0001	0.0000	0.0009	11.447	NA	USEPA 1997	0.000	NA
Strontium	709.65					0.5904	0.5904					
Thallium	0.19	1	0.256	0.0029	0.0012	0.0002	0.0043	0.035	NA	Schafer 1972	0.120	NA
Tin	2.41	1	1	0.0357	0.0608	0.0020	0.0985	6.391	15.884	Schlatterer et al. 1993	0.015	0.006
Titanium	9.65					0.0080	0.0080					
Cyanide, total	0.96530	1	1	0.0143	0.0243	0.0008	0.0394					
Oil & Grease	14.82					0.0123	0.0123					
Orthophosphate as P	2.47					0.0021	0.0021					
Phenol	0.48265	5.5963	26.58	0.0400	0.3233	0.0004	0.3637					
Deer Mouse												
Iron	43112.92	1	0.027	9700.4061	261.9110	388.0162	10350.3334	3.297	NA	Sobotka et al. 1996	3139.467	NA
Magnesium	20579.97	7.333	1.5047	33955.4121	6967.5042	185.2198	41108.1360					
Silver	0.05	1	0.12	0.0109	0.0013	0.0004	0.0126	2.418	24.182	Rungby and Dascher 1984	0.005	0.001
Tin	2.41	1	1	0.5430	0.5430	0.0217	1.1077	23.776	35.562	Davis et al. 1987	0.047	0.031
Titanium	9.65					0.0869	0.0869					
Cyanide, total	0.96530	1	1	0.2172	0.2172	0.0087	0.4431	79.693	NA	Tewe and Maner 1981	0.006	NA
Oil & Grease	14.82					0.1334	0.1334					
Orthophosphate as P	2.47					0.0222	0.0222					
Phenol	0.48265	5.5963	26.58	0.6077	2.8865	0.0043	3.4986	17.375	NA	Bishop et al. 1997	0.201	NA

Notes:

[a] Bioaccumulation values for plants from CH2M HILL (2002) for all constituents, except cyanide, silver, thallium, and tin. No bioaccumulation values were available for these analytes; therefore a value of 1 was assumed.

[b] Bioaccumulation values for invertebrates (arthropods) from CH2M HILL (2002) for all constituents, except cyanide, and tin No bioaccumulation values were available for these analytes; therefore a value of 1 was assumed.

[c] Exposure estimates calculated using life-history parameters presented in Table 5.

Western Meadowlark
Body weight = 0.11 (Wiens and Innes 1974)
Food Ingestion Rate = 0.04 (Sample et al. 1997)
Diet = 37% plant and 63% invertebrate (Lanyon 1994)
Soil Ingestion = 2.08% (Sample et al. 1997)

Deer Mouse
Body weight = 0.023 (Silva and Downing 1995)
Food Ingestion Rate = 0.45 (USEPA 1993)
Diet = 50% plant and 50% invertebrate (USEPA 1993)
Soil Ingestion = 2% (adapted from Beyer et al. 1994)

Highlighted values represent exceedance of the screening levels.

Figure

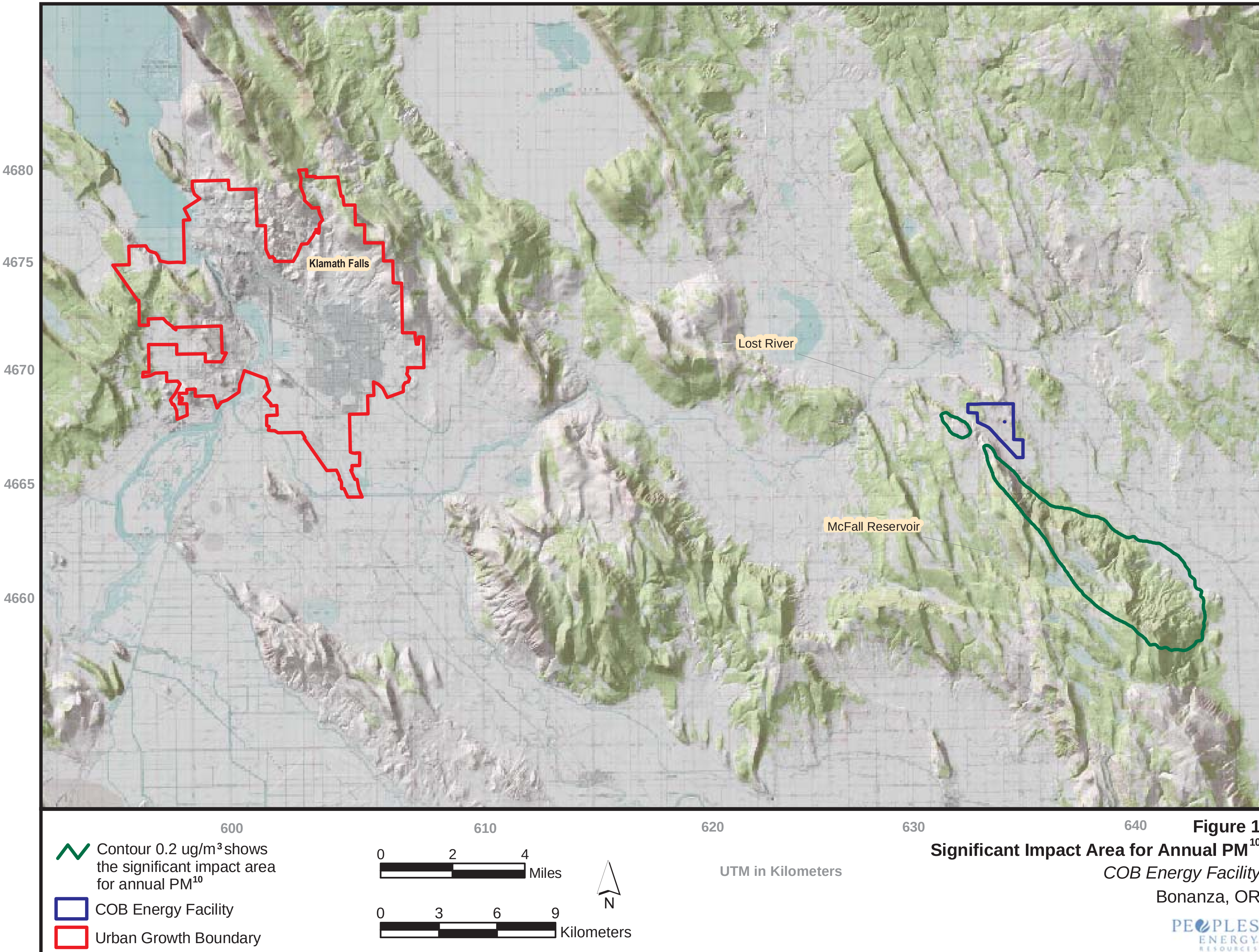

Figure 1
Significant Impact Area for Annual PM10
COB Energy Facility
Bonanza, OR

File Path: \\rosa\proj\PERC\167426\Gis\EIS\mxds\EIS_8-7-03\1_Annual_PM10.mxd, Date: 08 28, 2003 12:07:54 PM

Attachment

Descriptions of Studies Used to Calculate NOAELs and LOAELs

Study descriptions for no observed adverse effect levels (NOAELs) and lowest observable adverse effect levels (LOAELs) developed by EFA West (1998) are presented in that document and are not shown below. Additionally, acute studies (e.g., silver and thallium for birds and polyacrylate for mammals) are not described below as these studies are self-descriptive.

Compound: Arsenic
Form: Sodium arsenate
Reference: Stanley et al., 1994
Test Species: mallard
Body weight: 1 kg (Heinz et al., 1989)
Food Consumption: 0.1 kg/d (Heinz et al., 1989)
Exposure Duration: 4 wks prior to breeding, through nesting, incubation, and hatch, to 14 d post hatch (> 10 week and during critical lifestage=chronic)
Endpoint: reproduction
Exposure Route: oral in diet
Dosage: 4 dose levels (As concentrations measured in food)
0.26, 22, 93, and 403 mg/kg
Calculations:

$$\left(\frac{0.26\,mg\ As}{kg\ food}\ x\ \frac{100\,g\ food}{day}\ x\ \frac{1\,kg}{1000\,g}\right)/1\,kg\ BW = 0.026\,mg/kg/d$$

$$\left(\frac{22\,mg\ As}{kg\ food}\ x\ \frac{100\,g\ food}{day}\ x\ \frac{1\,kg}{1000\,g}\right)/1\,kg\ BW = 2.2\,mg/kg/d$$

$$\left(\frac{93\,mg\ As}{kg\ food}\ x\ \frac{100\,g\ food}{day}\ x\ \frac{1\,kg}{1000\,g}\right)/1\,kg\ BW = 9.3\,mg/kg/d$$

$$\left(\frac{403\,mg\ As}{kg\ food}\ x\ \frac{100\,g\ food}{day}\ x\ \frac{1\,kg}{1000\,g}\right)/1\,kg\ BW = 40.3\,mg/kg/d$$

Comments: Although As did not increase duckling mortality, As at 40.3 mg/kg/d significantly reduced duckling production. No reductions in duckling production or other adverse effects were observed at the other dose levels. Because the study considered exposure over 10 weeks and through reproduction, the 40.3 mg/kg/d dose was considered to be a chronic LOAEL.

Final NOAEL: 9.3 mg/kg/d

Final LOAEL: 40.3 mg/kg/d

Compound: Arsenic
Form: Sodium arsenite (51.35% As^{+3})
Reference: USFWS 1964
Test Species: Mallard ducks
Body weight: 1 kg (Heinz et al. 1989)
Food Consumption: 0.100 kg/d (Heinz et al. 1989)
Exposure Duration: 128 d (> 10 wk=chronic)
Endpoint: mortality
Exposure Route: oral in diet
Dosage: four dose levels (nominal):
100, 250, 500, and 1000 ppm Sodium Arsenite;
NOAEL = 100 ppm
mg/kg As^{+3} = 0.5135 x 100 mg/kg = 51.35 mg/kg
Calculations:

$$\left(\frac{51.3\, mg\ As^{+3}}{kg\ food} x \frac{100\, g\ food}{day} x \frac{1\, kg}{1000\, g}\right) / 1\, kg\ BW = 5.135\, mg/kg/d$$

$$\left(\frac{128.375\, mg\ As^{+3}}{kg\ food} x \frac{100\, g\ food}{day} x \frac{1\, kg}{1000\, g}\right) / 1\, kg\ BW = 12.837\, mg/kg/d$$

$$\left(\frac{256.75\, mg\ As^{+3}}{kg\ food} x \frac{100\, g\ food}{day} x \frac{1\, kg}{1000\, g}\right) / 1\, kg\ BW = 25.675\, mg/kg/d$$

$$\left(\frac{513.5\, mg\ As^{+3}}{kg\ food} x \frac{100\, g\ food}{day} x \frac{1\, kg}{1000\, g}\right) / 1\, kg\ BW = 51.35\, mg/kg/d$$

Comments: Mallards in the 1000, 500, and 250 ppm groups experienced 92%, 60%, and 12% mortality, respectively. Because those in the 100 ppm group experienced 0% mortality, and the study considered exposure over 128 days, the 100 ppm Sodium Arsenite (51.35 mg/kg As^{+3}) dose was considered to be a chronic NOAEL. The 250 ppm Sodium Arsenite (128.375 mg/kg As^{+3}) dose was considered to be a chronic LOAEL.
Final NOAEL: 5.14 mg/kg/d
Final LOAEL: 12.84 mg/kg/d

Compound: Cadmium
Form: Cadmium Chloride
Reference: White and Finley 1978
Test Species: Mallard Ducks
Body weight: 1.153 kg (from study)
Food Consumption: 0.110 kg/d (from study)
Study Duration: 90 d (> 10 wk and during a critical lifestage =chronic)
Endpoint: reproduction

Exposure Route: oral in diet
Dosage: 4 dose level:
0.08, 1.6, 15.2, and 210 ppm Cd
NOAEL = 15.2 ppm
Calculations:

$$\left(\frac{15.2\,mg\,Cd}{kg\ food}\,x\,\frac{0.110\,kg\ food}{day}\right)/\,1.153\,kg\ BW = 1.45\,mg\,/\,kg\,/\,d$$

$$\left(\frac{210\,mg\,Cd}{kg\ food}\,x\,\frac{0.110\,kg\ food}{day}\right)/\,1.153\,kg\ BW = 20\,mg\,/\,kg\,/\,d$$

Comments: Mallards in the 210 ppm group produced significantly fewer eggs than those in the other groups. Because the study considered exposure over 90 days, the 15.2 ppm Cd dose was considered to be a chronic NOAEL and the 210 ppm does was considered to be a chronic LOAEL.
Final NOAEL: 1.45 mg/kg/d
Final LOAEL: 20 mg/kg/d

Compound: Chromium
Form: Cr^{+3} as $CrK(SO_4)_2$
Reference: Haseltine et al. 1985
Test Species: Black duck
Body weight: 1.25 kg ($mean_{male+female}$; Dunning 1993)
Food Consumption: Congeneric Mallard ducks, weighing 1 kg consume 100 g food/d (Heinz et al.1989). Therefore, it was assumed that a 1.25 kg black duck would consume 125 g food/d.
Study Duration: 10 mo. (>10 weeks and during a critical lifestage = chronic)
Endpoint: reproduction
Exposure Route: oral in diet
Dosage: two dose levels:
10 and 50 ppm Cr^{+3} in diet; NOAEL = 10 ppm

$$\left(\frac{10\,mg\,Cr^{+3}}{kg\ food}\,x\,\frac{125\,g\ food}{day}\,x\,\frac{1\,kg}{1000\,g}\right)/\,1.25\,kg\ BW = 1\,mg\,/\,kg\,/\,d$$

$$\left(\frac{50\,mg\,Cr^{+3}}{kg\ food}\,x\,\frac{125\,g\ food}{day}\,x\,\frac{1\,kg}{1000\,g}\right)/\,1.25\,kg\ BW = 5\,mg\,/\,kg\,/\,d$$

Comments: While duckling survival was reduced at the 50 ppm dose level, no significant differences were observed at the 10 ppm Cr^{+3} dose level. Because the study considered exposure throughout a critical lifestage (reproduction), the dose 50 ppm dose was considered to be a chronic LOAEL and the dose 10 ppm dose was considered to be a chronic NOAEL.
Final NOAEL: 1 mg/kg/d
Final LOAEL: 5 mg/kg/d

Compound: Cyanide
Form: Potassium Cyanide
Reference: Tewe and Maner 1981
Test Species: Rat
Body weight: 0.273 kg (from study)
Food Consumption: 0.0375 kg/d (from study)
Study Duration: gestation and lactation (during a critical lifestage = chronic)
Endpoint: reproduction
Exposure Route: oral in diet
Dosage: one dose level:
500 ppm CN = NOAEL
Calculations:

$$\left(\frac{500\,mg\,CN}{kg\ food}\,x\,\frac{37.5\,g\ food}{day}\,x\,\frac{1\,kg}{1000\,g}\right)/\,0.273\,kg\,BW = 68.7\,mg\,/\,kg\,/\,d$$

Comments: Consumption of 500 ppm CN significantly reduced offspring growth and food consumption, however values for treated individuals were only marginally less than controls (reductions were 7% or less). While the effects of 500 ppm CN in the diet were statistically significant, they were not considered to be biologically significant. Because the study considered exposure throughout a critical lifestage (reproduction), this dose was considered to be a chronic NOAEL.

Final NOAEL:68.7 mg/kg/d

Compound: Iron
Form: Fe
Reference: NRC 1980 in McDowell 1992
Test Species: poultry
Body weight: 1.5 kg (EPA 1988)
Food Consumption: 0.106 kg/d (calculated using allometric equation from EPA 1988)
Study Duration: chronic
Endpoint: maximum tolerable level
Exposure Route: oral in diet
Dosage: McDowell (1992) reports the maximum tolerable level of 1000 ppm Fe in diet for poultry.
Calculations:

$$\left(\frac{1000\,mg\,Fe}{kg\ food}\,x\,\frac{106\,g\ food}{day}\,x\,\frac{1\,kg}{1000\,g}\right)/\,1.5\,kg\,BW = 70.5\,mg\,/\,kg\,/\,d$$

Comments: The maximum tolerable level reported for poultry (1000 ppm Fe in diet) was assumed to be the chronic NOAEL. Body weight and food consumption rate are those for white leghorn chickens and are derived from EPA (1988).

Final NOAEL: 70.5 mg/kg/d

Compound: Manganese

Form: Manganese oxide (Mn_3O_4)

Reference: Laskey and Edens 1985

Test Species: Japanese Quail (males only, starting at 1 day old)
Body weight: 0.072 kg (for 3 wk-old male quail; Shellenberger 1978)

Study Duration: 75 d (>10 weeks = chronic)

Endpoint: growth, aggressive behavior

Exposure Route: oral in diet

Dosage: one dose level:
5000 ppm supplemented Mn + 56 ppm Mn in base diet = NOAEL

Calculations: NA

Comments: While no reduction in growth was observed, aggressive behavior was 25% to 50% reduced relative to controls. Daily Mn consumption was reported to range from 575 mg/kg/day for adults at the end of the study and 977 mg/kg/d for 20 d-old birds. Because the study was >10 weeks in duration, the 977 mg/kg/d dose was considered to be a chronic NOAEL based on a growth endpoint and a chronic LOAEL based on a behavior endpoint. A chronic behavior NOAEL was estimated by applying an LOAEL-NOAEL UF of 0.1

Final $NOAEL_{growth}$: 977 mg/kg/d

Final $NOAEL_{behavior}$: 98 mg/kg/d

Final $LOAEL_{behavior}$: 977 mg/kg/d

Compound: Mercury

Form: methyl mercury chloride/dicyandiamide

Reference: Heinz (1976) and Heinz and Hoffman (1998)

Test Species: mallard
Body weight: 1 kg (Heinz et al. 1989)
Food Consumption: 0.128 kg/d (from Heinz 1979)

Study Duration: 2 generations (lowest doses), 2.5 months (highest dose) (during a critical lifestage = chronic).

Endpoint: reproduction

Exposure Route: oral in diet

Dosage: four dose levels:

0, 0.53, 2.88, and 9.2 ppm Hg

Calculations:

$$\left(\frac{0.53\, mg\ Hg}{kg\ food}\ x\ \frac{0.128\ kg\ food}{day}\right) / \ 1\,kg\ BW = 0.068\, mg/kg/d$$

$$\left(\frac{2.88\, mg\ Hg}{kg\ food}\ x\ \frac{0.128\ kg\ food}{day}\right) / \ 1\,kg\ BW = 0.37\, mg/kg/d$$

$$\left(\frac{9.2\ mg\ Hg}{kg\ food}\ x\ \frac{0.128\ kg\ food}{day}\right) /\ 1\ kg\ BW = 1.18\ mg/kg/d$$

Comments: Although duckling survival at 7 days was significantly reduced at the two highest dose levels, no significant difference was observed at the 0.068 mg/kg/d dose. Because exposure occurred during reproduction, the 0.37 mg/kg/d dose was considered to be a chronic LOAEL.

Final NOAEL: 0.068 mg/kg/d
Final LOAEL: 0.37 mg/kg/d

Compound: Nickel
Form: Nickel Sulfate
Reference: Cain and Pafford 1981
Test Species: Mallard Duckling
Body weight: 0.782 kg (mean$_{\text{control male+female}}$ at 28 and 60 days; from study)
Food Consumption: Adult Mallard ducks, weighing 1 kg consume 100 g food/d (Heinz et al. 1989). Therefore, it was assumed that a 0.782 kg mallard duckling would consume 78.2 g food/d.
Study Duration: 90 d (>10 week = chronic)
Endpoint: mortality, growth, behavior
Exposure Route: oral in diet
Dosage: three dose levels:
176, 774, and 1069 ppm Ni;
NOAEL = 176 ppm
Calculations:

$$NOAEL : \left(\frac{176\,mg\ Ni}{kg\ food} \times \frac{78.2\,g\ food}{day} \times \frac{1\,kg}{1000\,g}\right) / 0.782\,kg\ BW\ = 17.6\ mg/kg/d$$

$$LOAEL : \left(\frac{774\,mg\ Ni}{kg\ food} \times \frac{78.2\,g\ food}{day} \times \frac{1\,kg}{1000\,g}\right) / 0.782\,kg\ BW\ = 77.4\ mg/kg/d$$

Comments: While consumption of up to 774 ppm Ni in diet resulted in a significant increase in tremors and joint edema, 176 ppm did not. Because the study considered exposure over 90 days, the 176 ppm dose was considered to be a chronic NOAEL and the 774 ppm dose was considered to be a chronic LOAEL. To estimate daily Ni intake throughout the 90 day study period, food consumption of 45-day-old ducklings was calculated. While this value will over- and underestimate food consumption by younger and older ducklings, it was assumed to approximate food consumption throughout the entire 90-day study.

Final NOAEL: 17.6 mg/kg/d
Final LOAEL: 77.4 mg/kg/d

Compound: Nickel
Form: Nickel sulfate and nickel acetate
Reference: Weber and Reid 1968

Test Species: Chicks
Body weight: 0.45 kg (EPA 1988)
Food Consumption: 0.038 kg/d (calculated using allometric equation from EPA 1988)
Study Duration: 4 weeks
Endpoint: growth, metabolism
Exposure Route: oral in diet
Dosage: 8 dose levels:
0, 100, 300, 500, 700, 900, 1100, 1300 mg Ni/kg
Calculations:

Doses (mg/kg/d) estimated based on data presented by authors								
Ni in diet	0	100	300	500	700	900	1100	1300
Sulfate	0	5.8	16.9	31.0	39.1	57.3	74.0	95.4
Acetate	0	5.9	16.5	28.3	40.7	56.4	67.4	93.7

Comments: No significant differences were obtained in growth at doses below 500 ppm. Significant differences in growth were noticed in doses starting at 500 ppm. This dose is considered a subchronic LOAEL, the 300 ppm dose is a subchronic NOAEL.
Final NOAEL: 25.3 mg/kg/d
Final LOAEL: 42.2 mg/kg/d

Compound: Silver
Form: $AgNO_3$ (63.5% Ag)
Reference: Rungby and Danscher 1984
Test Species: mouse
Body weight-0.03 kg (EPA 1988)
Exposure duration: 125 days
Endpoint: activity
Exposure route: oral in water
Dosage: one dose level (concentration is in $AgNO_3$)
0.015% $AgNO_3$ = 150 mg/L $AgNO_3$=95.25 mg/L Ag
Calculations:

$$\left(\frac{95.25\text{ mg Ag}}{\text{L}}\text{x}\frac{0.0075\text{ ml}}{\text{.day}}\right)/0.03\,kg = 23.8\,\text{mg Ag/kg/day}$$

Comments: A significant reduction in activity was observed among treated mice. Because the study was performed over 125 days, the 23.8 mg/kg/d dose was considered a chronic LOAEL. A chronic NOAEL was estimated by multiplying the LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1.
Final NOAEL: 2.38 mg/kg/day
Final LOAEL: 23.8 mg/kg/day

Compound: Phenol
Form: not applicable
Reference: Bishop et al. 1997
Test Species: Mouse

Exposure Duration: 347 days (during critical lifestage = chronic)
Endpoint: reproduction
Exposure Route: intraperitoneal
Dosage: one dose level:
350 mg/kg (1 ip injection prior to each of 17 breeding cycles)
Calculations: normalized 17 doses of 350 mg/kg over 347 days
17.1 mg/kg/d

Comments: No effects on reproductive performance were observed. Because injections were given at critical lifestage periods, a dose of 17.1 mg/kg/d was considered to be the chronic NOAEL.

Final NOAEL: 17.1 mg/kg/d

Compound: Tin
Form: bis (Tributyltin) oxide (TBTO)
Reference: Davis et al. 1987
Test Species: mouse
Body weight: 0.03 kg (EPA 1988a)
Study Duration: days 6-15 of gestation (during a critical lifestage = chronic)
Endpoint: reproduction
Exposure Route: oral intubation
Dosage: six dose levels:
1.2, 3.5, 5.8, 11.7, 23.4, and 35 mg/kg/d;
NOAEL= 23.4 mg/kg/d
Calculations: not applicable

Comments: Mice dosed with 35 mg/kg/d TBTO displayed reduced fetal weight and fetal survival and increased frequency of litter resorption. Adverse effects were not observed at lower dose levels. Because the study considered exposure during gestation, the 23.4 and 35 mg/kg/d dose levels were considered to be chronic NOAELs and LOAELs, respectively.

Final NOAEL: 23.4 mg/kg/d
Final LOAEL: 35 mg/kg/d

Compound: Tin
Form: bis (Tributyltin) oxide (TBTO)
Reference: Schlatterer et al. (1993)
Test Species: Japanese Quail
Body weight: 0.15 kg (Vos et al. 1971)
Food consumption: 0.0169 kg/d (calculated using allometric equation of Nagy 1987)
Study Duration: 6 wks (during a reproduction = chronic)
Endpoint: reproduction
Exposure Route: oral in diet
Dosage: four dose levels:
24, 60, 150, and 375 mg/kg in diet;
NOAEL= 60 mg/kg

Calculations:

$$NOAEL:\left(\frac{60\,mg\,TBTO}{kg\ food}\times\frac{16.9\,g\ food}{day}\times\frac{1\,kg}{1000\,g}\right)/\,0.15\,kg\,BW=6.76\ mg/kg/d$$

$$LOAEL:\left(\frac{150\,mg\,TBTO}{kg\ food}\times\frac{16.9\,g\ food}{day}\times\frac{1\,kg}{1000\,g}\right)/\,0.15\,kg\,BW=16.9\ mg/kg/d$$

Comments: While egg weight and hatchability were reduced among quail consuming diets containing 150 mg TBTO/kg, no consistent adverse effects were observed among the 60 mg/kg groups. Because the study considered exposure during reproduction, the 60 and 150 mg/kg dose levels were considered to be chronic NOAELs and LOAELs, respectively.

Final NOAEL: 6.8 mg/kg/d
Final LOAEL: 16.9 mg/kg/d

APPENDIX D

Literature Research on Potential Noise Impacts to Wildlife

APPENDIX D TO THE BIOLOGICAL ASSESSMENT

Literature and Research on Potential Noise Impacts to Wildlife

Introduction

The proposed COB Energy Facility would be a combined-cycle electric generating facility fired solely on natural gas. The biological assessment (BA) contains a detailed description of the Energy Facility and its associated related and supporting facilities, collectively referred to as the Facility. This attachment describes available literature and research conducted on potential noise impacts to wildlife.

Conclusion

Construction of the Facility would result in sporadic noise at a level approximately similar to the noise resulting from existing farm operations, but Facility noise would be more frequent during the construction period. Construction noise may result in some reduced wildlife use of habitat areas directly around the Energy Facility site, but this reduced use would be limited in scope and temporary.

During operations, noise levels are predicted to be 40 decibels on an A-weighted scale (dBA) or lower at the closest wildlife habitat area to the Energy Facility and the project proponent's proposed mitigation area. This level would be well below the levels documented to have adverse affects on wildlife (Bowles, 1995; CDT et al., 1995). It is expected that wildlife would habituate to the continuous, relatively low operational noise levels and that operational noise would not appreciably reduce the quality of habitat areas surrounding the Facility.

Results of Prior Research

Most of the research that addresses behavioral effects of noise on wildlife has focused on the effects of loud, sudden, intermittent noises from airplanes, helicopters, military exercises, and off-road vehicles in laboratory experiments. Specific effects of noise on wildlife are highly dependent on the particular characteristics of the noise and whether a visual stimulus is associated with it. Data indicate that human activity results in wildlife responding through one of three adaptation mechanisms: (1) avoidance, (2) habituation, or (3) attraction (Knight and Temple, 1995). Avoidance of the area may result in (1) no measurable effect, (2) reduced fitness, potentially decreasing over winter survival, or (3) decreased reproduction (i.e., individual animals may not reproduce or reproduction may be unsuccessful because of decreased available resources or abandonment of offspring to escape disturbance).

Impulse or intermittent noise is defined as a high-intensity, short duration, and sporadic or unpredictable sound, such as pile driving, dump trucks, gunshot, explosion, low-elevation airplanes, or a collision. There is evidence that such impulse noises can result in adverse physical, physiological, and behavioral effects on wildlife (Larkin, 1996).

On the other hand, continuous noise is less likely to result in adverse effects to wildlife, as many animals become habituated to the presence of the elevated noise levels (Conomy et al., 1998; Weisenberger et al., 1996). For example, domestic pigs showed no change in behavior when subject to a constant noise level exceeding 80 dBA, but demonstrated significant aversion to the same noise level played intermittently (Talling et al., 1998). Habituation is defined as "the elimination of the organism's response to often recurring, biologically irrelevant stimuli without impairment of its reaction to others" (Lorenz,1965). Thus, habituation to increased noise levels should not interfere with mating, distress, or warning calls. This phenomenon has been demonstrated in laboratory studies in which hooded rats exposed to background noise of 70 dB sound pressure level (SPL) showed the same startle response to a range of sounds as rats which were not exposed to the background noise (Blaszczyk and Tajchert, 1997).

In some instances, long-term exposure to continuous noise may help protect animals from adverse effects of more extreme impulse noises through sound conditioning (McFadden et al., 2000). It is therefore possible that increased background noise from the Energy Facility would help minimize the effects of noise spikes from farm equipment in the proposed Facility area.

Existing Conditions at the Facility Site

Habituation has been found to be highly variable among species (Conomy et al., 1998). However, it is likely that the species currently occupying the sage scrub habitats near the Energy Facility site have developed some habituation based on the present ambient noise levels from farm equipment and noise from existing electric transmission lines.

The primary source of background noise at the Energy Facility site is farm equipment on West Langell Valley Road and in adjacent fields. Measurements of ambient noise levels indicate the current ambient noise level is approximately 20 to 30 dBA with peaks exceeding 70 dBA near farm equipment (see Exhibit X). Levels may be greater along the road. Modeled estimates of plant operational noise indicate that the ambient noise at the edge of the Energy Facility site would be a continuous level of approximately 60 dBA. Noise during operations would dissipate with distance to approximately 30 dBA within 4,000 to 6,000 feet of the Energy Facility (see Figure 5-2 in the BA). Topographic buffering from surrounding hills would reduce the effective noise from the Energy Facility.

Analysis of Potential Impacts from Construction Noise

During construction, temporary and intermittent noise levels from typical construction equipment at 50 feet are expected to be 73 to 88 dBA. The noise levels at 3,000 feet are expected at 37 to 52 dBA.

Both mammals and birds can suffer temporary hearing impairment from 24-hour exposure to noise levels of 80 to 110 dB (CDT et al., 1995). While many species acclimate to elevated noise levels resulting from human activities, excessive, intermittent noise levels can be detrimental to wildlife. High levels of noise can cause hearing loss and other adverse physiological affects to wildlife, as well as behavioral modification such as moving to areas outside their home range. Activities that generally involve high levels of intermittent or impulse noise such as loud construction noise, low flying aircraft , military training activities, or off-road vehicles that stress wildlife into an avoidance response, have adverse effects on wildlife (Maier et al., 1998; Larkin, 1996).

Sporadic noise associated with heavy construction equipment and related construction activities may cause many species to either abandon areas directly adjacent to construction, alter use patterns to access habitat when construction is not occurring, or cause increased stress. For example, evidence suggests that terrestrial wildlife stratify themselves from roads based on the distance they can detect vehicle noise (Knight and Temple, 1995).

Accordingly, it is expected that the temporary construction noise from the Energy Facility site would cause some wildlife species to reduce their use of nearby habitats during the construction period. Major earthwork activity for the Energy Facility closest to wildlife habitat areas are expected to occur during a short period of 6 months out of the 23-month construction time frame. Similarly, piling driving for the Energy Facility would occur during a short, approximately 4-month period.

The extent of these indirect disturbances would depend on the particular tolerances of species. Because of the location of the proposed Energy Facility site in a low area (relative to surrounding topography) and the short duration of the loudest construction activity, noise impacts to nearby habitat areas is likely to be minimized.

Construction noise is not likely to result in direct physiological impacts to wildlife. Some species, such as nesting birds, deer, and others, may modify their behavior when construction noise is present by moving foraging and nesting locations slightly. However, most noise-related nest abandonments last for less than 5 minutes (Knight and Temple, 1995). Vertebrate species often habituate or adapt behaviorally and physiologically to repeated exposure to noise either through sensitization or avoidance (Bowles, 1995). Individual animals may reoccupy habitats once they become habituated. This does not mean that wildlife would continue to use the area as they did before the noise, but that their avoidance distance is expected to decline as they habituate to the disturbance.

Operations Noise

Operational noise disturbances would be substantially lower compared to construction noise. Noise levels decrease with distance and, as shown on Figure 5-2 in the BA noise levels are predicted to be 50 dBA at a distance of approximately 1,000 feet from the Energy Facility. Noise levels are predicted to be 40 dBA at a distance of approximately 2,500 feet from the Energy Facility, where habitats may be used by wildlife.

In addition, animals are more likely to habituate to a relatively constant noise level during operations than to impulse or sporadic noise during construction. In fact, constant natural noise is part of every environment and wildlife have developed adaptations to noise long before the advent of modern technology. In some instances natural ambient sounds along with diverse vegetation structure can reduce the direct effects of human noises on wildlife. Natural waterfalls can have continuous noise levels of 76 dBA, and many species of wildlife occupy areas with waterfalls. White-tailed deer were shown to habituate to snowmobile noise after some years of exposure. However, in areas with no previous exposure, deer might increase the area in which they home range in an effort to avoid snowmobile trails, potentially causing deer to expend more energy (stress) and endangering their health during the winter season (Radle, undated).

Continuous sound pressure levels at 70dB are considered a safe limit to wildlife (Bowles, 1995). The nearest wildlife habitat area is approximately 2,500 feet from the Energy Facility and the predicted noise level during operations at this distance is 40 dBA (see Figure 5-2 in the BA). This same general area is where the project proponent proposes to mitigate for permanently disturbed habitat by restoring, enhancing, and protecting habitat in accordance with ODFW habitat mitigation goals and pursuant to the revegetation plan described in Attachment P-1. Based on Figure 5-2 in the BA, operations noise levels are predicted to be 40 dBA or lower at the mitigation area. This level would be well below the reported levels (80 to 100 dB SPL) known to be detrimental to wildlife.

Biological surveys around the Energy Facility site found no evidence of wildlife species that would be uniquely sensitive to sound. Given the background noise levels from farm equipment, it is more than likely that the species currently inhabiting the area around the Energy Facility site can become habituated to a slight increase in continuous noise levels. Based on the best available information, the existing sound levels, and the estimated noise increases, it is not expected that operation of the Energy Facility would result in adverse effects on the wildlife inhabiting area around the Energy Facility site.

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APPENDIX E

Avian Collision Monitoring Plan

Report

Avian Collision Monitoring Plan

Prepared for

U.S. Fish and Wildlife Service

October 2003

COB Energy Facility, LLC

Prepared by

CH2MHILL

Contents

Figures

1. Introduction

This section provides an overview of the project, a description of the electric transmission line and power stacks, and a summary of the proposed mitigation measures.

Project Description and Background

This monitoring plan describes how the site certificate applicant or "project proponent" (COB Energy Facility, LLP) would monitor for bird impacts, if any.

The electric transmission line route would cross natural habitats west of Bryant Mountain, including sagebrush-steppe, juniper sage, and ponderosa pine habitats. These habitats provide upland forage habitat for bald eagle and other birds in the area. The bald eagle is a federally-threatened species that nests within 3 miles of the Energy Facility where the stacks would be located and the electric transmission line route would pass within 2 miles of the nests. The nests are located around McFall Reservoir as shown in Figure E-1.

Other raptors in the project area include Northern goshawk, red-tailed hawk, Northern harrier, white-tailed kite, Swainson's hawk, and turkey vulture. Additional bird species known to occur within the project area include tri-colored blackbird, greater sage-grouse, black tern, olive-sided flycatcher, yellow rail, willow flycatcher, yellow-breasted chat, western least bittern, mountain quail, American white pelican, and Lewis' woodpecker.

Electric Transmission Line and Stack Descriptions

The COB Energy Facility would deliver electric power to the regional power grid by a new electric transmission line, approximately 7.2 miles in length, from the Energy Facility site to the Bonneville Power Administration (BPA) Captain Jack Substation. Approximately 38 transmission towers would be required. Typical transmission towers would range in height from 100 to 165 feet, with most towers in the 105- to 110-foot range. On average, the towers would be spaced approximately 990 feet apart, with a range from 380 to 1,500 feet. Two parallel groundwires would be strung on top of the transmission towers for protection from lightening. Groundwires typically would be thinner in diameter than conductor wires. Groundwires would not conduct electricity.

The electric transmission line would run cross-country in a north-south direction west of Bryant Mountain (Figure 2-2 in the Biological Assessment [BA]). Access for travel by wheeled vehicles would be required for construction and to access the new electric transmission line for maintenance during operation. Access would occur through approximately 6.6 miles of new access roads and the use of approximately 4.9 miles of existing roads. Figure 2-2 in the BA shows the route of the electric transmission line.

The proposed stacks are 150 to 200 feet tall with a diameter of 18 feet each. The stacks would be located within the security fence of the Energy Facility. They would be positioned approximately 200 feet apart and would be constructed of steel. Carbon dioxide, water, nitrogen, and air are the primary gases exhausted by the stacks along with oxides of nitrogen, carbon monoxide, and fine particulates.

Mitigation Measures

Mitigation measures are being developed for the project through consultation with the United State Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA). In addition, BPA, Oregon Department of Fish and Wildlife (ODFW), and the United States Bureau of Land Management (BLM) were consulted for appropriate measures that would minimize impacts to bald eagles (and other birds) from collisions and electrocutions. The resulting mitigation measures include:

- Locate the new electric transmission line route to avoid areas of dense bald eagle populations.
- Locate the new electric transmission line away from the three existing transmission line to avoid creating a cluster of electric transmission lines or a "net effect" that would pose additional obstacles to flight.
- Install colored bird flight diverters (BFDs) or swan flight diverters (SFDs) to allow better avian visualization of the thin groundwires during fog and rain events (Figure E-1).
- Design the conductor wires for spacing greater than the wing spans of large birds (24 feet on the vertical and 25 feet on the diagonal) to prevent electrocutions (Figure E-1).
- Conduct annual monitoring of the new electric transmission line.

2. Monitoring Plan Objectives

This section summarizes plan objectives based on the federal Endangered Species Act and the Migratory Bird Treaty Act.

Federal Endangered Species Act

Projects subject to the federal ESA require consultation with USFWS on impacts to federally-listed species. During informal consultation with USFWS, the project proponent anticipated that special-status birds could be incidentally taken as a result of implementing the proposed project.

The special-status bird species anticipated to be in the project area include bald eagle, peregrine falcon, greater sandhill crane, Aleutian Canada goose, and Swainson's hawk. These species are listed as threatened or endangered by USFWS or ODFW. The BA prepared for formal consultation under the ESA describes the potential significant impacts to federally-listed species and mitigation measures expected to avoid and/or minimize unavoidable impacts. To minimize impacts to bald eagles and other birds in the project area, the project proponent would install bird flight diverters and implement a monitoring program for bird collisions.

The USFWS Biological Opinion (BO) or authorizations would identify the amount or extent of incidental take allowed by the proposed project. Incidental take is defined in the Endangered Species Act as take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species) that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Incidental take of listed species could occur incidental of the COB Energy Facility project if bald eagle or other special-status birds collide with the new electric transmission line or the stacks at the Energy Facility.

The significance criteria used in this monitoring plan are the number of each listed bird species allowed by USFWS to be taken incidental to the project. The significance criteria (number of birds allowed) would be defined in the BO. Monitoring plan objectives include describing the methods that would be used to determine if the significance criteria are exceeded, and determining whether BFDs deflect the bald eagle, and other special-status bird species sufficiently to meet the USFWS incidental take restrictions.

Migratory Bird Treaty Act

In addition to the ESA, the Migratory Bird Treaty Act (MTBA) provides federal protection for migratory waterfowl and resident herons, egrets, ducks, and raptors. The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit (50 CFR 21.11). The installation of BFDs on the electric transmission line along with the implementation of an avian collision monitoring program would minimize impacts to migratory bird species.

3. Methods

The methods described in this section would be used to determine whether (1) the significance criteria for bald eagles incidentally taken under Section 7 of the ESA by the proposed project are exceeded, (2) the incidental take of migratory bird species protected under the MBTA by the proposed project area exceed the incidental take restrictions in the BO that would result from consultation with USFWS, and (3) BFDs deflect the bald eagle, waterfowl, and special-status bird species sufficiently to meet the USFWS incidental take restrictions under the ESA and MBTA.

Installing Bird Flight Diverters

BFDs and SFDs are 15-inch-long (38-centimeter-long) polyvinyl chloride (PVC) tubing coiled to a height of 7 inches (18 centimeters), and are typically spaced approximately 16 feet (5 meters) apart along the ground wires (Figure E-1). BFDs are especially effective at increasing visibility of wires during fog and rain events and have reduced avian collisions by 57 to 89 percent (Brown and Drewien, 1995). They would be staggered over the two groundwires so that each wire supports one-half of the markers, and are spun onto the groundwire after it is pulled into place and secured on the transmission towers. The BFDs come in gray or yellow with ultraviolet (UV) stabilizers for exposure to sunlight. Conductor wires are normally large enough in diameter to be seen by birds in flight and would not require marking with BFDs.

Monitoring for Bird Collisions

This monitoring plan is based on the studies described by the Avian Power Line Interaction Committee (APLIC) in "Mitigating Bird Collisions With Power Lines: The State of the Art in 1994." The plan includes dead bird searches along the new electric transmission line and around the stacks at the Energy Facility. These searches include studies to develop searcher and scavenger bias estimates that affect the total number of collisions expected to occur. The USFWS and ODFW would be notified if any bald eagles or other special-status birds are found dead from collisions during the dead bird searches.

Conducting Dead Bird Searches

Field searches for dead birds and feather spots (location where feathers are left after removal of carcass by predator or scavenger) would be conducted along the new electric transmission line and in the area around the stacks at the Energy Facility to determine if the project causes significant impacts to birds. Monitoring the new electric transmission line for avian collisions would begin after construction is complete and BFDs are installed. Monitoring of avian collisions with the stacks would occur after construction of the COB Energy Facility is complete.

The searchers would follow a zig-zag pattern through the search areas to allow observations of the entire area. Two to three people would simultaneously conduct the surveys on either side of the new electric transmission line.

If dead birds are found, the following information would be collected:

- Location of each dead bird
- Bird species, sex, age (adult or juvenile), approximate time of death, and physical condition (broken bones, burns, open wounds, gunshot wounds, discoloration, and damage by scavengers)

These data would be recorded on field data sheets in the field (Figure E-2). Necropsies in the lab would be conducted to determine probable cause of death. The USFWS and the ODFW would be notified if any bald eagles of other special-status birds are found dead from collisions.

Analysis of the winter and summer dead bird searches includes evaluation of the field search results, computation of bias estimates and estimated total collisions (see Section 4), and a comparison of observed collision mortality relative to the significance criteria.

Searchers

Qualified biologists familiar with the above-mentioned special-status birds would conduct the dead bird searches. Information would be obtained from Energy Facility personnel if they find dead birds during daily activities, especially around the portion of the new electric transmission line near the Energy Facility. This information would be included in the annual reports. A search bias would be calculated for each searcher (see Search Bias subsection in Section 4) and included in the estimate of total collisions.

Dogs would not be used to conduct searches because there are too many variables in their results (wind, temperature, vegetation height) and a search bias would have to be calculated for each dog, every search day. Search equipment includes binoculars, spotting scope, pin flags, and bird tags.

Search Area

Dead bird searches would be conducted along the entire route of the new electric transmission line. The width of the search area would be determined in relation to the height of the transmission poles (APLIC, 1994). The searches would be conducted in a corridor 164 feet from the outside conductor on either side of the new electric transmission line route (APLIC, 1994). Searches for dead birds around the stacks would be conducted in a 180-foot radius from the stacks, entirely within the security fenceline of the Energy Facility.

Monitoring Schedule

Bald eagles are expected to be in the project area year round (Isaacs, 2002). Surveys for dead bird searches along the new electric transmission line and the stacks would focus on the change of seasons, with two surveys scheduled during the fledging period for the bald eagle. Searches would be conducted once a month in February (winter), May (spring), June or July (summer and probable fledging time), and October (fall).

The dead bird searches would be conducted for the first 3 years after beginning commercial operation of the COB Energy Facility and the new electric transmission line. If monitoring shows insignificant impacts to bald eagles from the project at the end of 3 years, the monitoring frequency would be reduced or monitoring would be discontinued upon approval by USFWS. Annual monitoring reports would be submitted to the USFWS by December 31 of each monitoring year.

4. Data Analysis

Biases can occur in searches for dead and injured birds. Four biases are identified that could cause an underestimation of the number of birds that collide with the new electric transmission line or with the stacks at the Energy Facility: search bias, removal (or predator) bias, habitat bias, and crippling bias (APLIC, 1994). To compensate for the underestimation of avian collisions, these biases would be analyzed and included in the estimated total bird collisions for the project.

Search Bias (SB)

A search bias takes into consideration a searcher's ability and experience, terrain, and vegetation conditions. A bias is measured for each searcher. Dead birds are randomly placed in the search area and the searcher tries to locate as many of the planted birds as possible. A search bias would be calculated for each searcher for each season of the year to adjust for changes in vegetation heights. The proportion of "planted" birds not found determines the search bias. The formula for calculations is as follows:

$$SB = (TDBF/PBF) - TDBF,$$

Where SB = search bias, TDBF = total dead birds and feather spots found in the search area, and PBF = proportion of planted birds found during the recovery.

Example. If eight dead birds are found, including four out of five of the planted birds:
$SB = (8/(4/5)) - 8 = 2$ birds would not be found by this particular searcher.

Removal Bias (RB)

A removal bias is determined to consider the number of birds scavengers remove from the search area before a search. To measure a removal bias, a number of dead birds are marked and placed in the search area and the condition of the birds are monitored daily for 1 week. Removal bias is the percentage of missing birds with no trace remaining after 1 week. A removal bias would be calculated for each season of the year. The formula to determine removal bias is:

$$RB = (TDBF + SB)/PNR - (TDBF + SB),$$

Where RB = removal bias by scavengers, PNR = proportion of "planted birds not removed by scavengers," TDBF = total dead birds found, and SB = search bias.

Example. If eight dead birds are found and four out of five planted birds are recovered:
$RB = (8 + 2)/(4/5) - (8 + 2) = 2.5$ birds are expected to be removed by scavengers.

Habitat Bias (HB)

A habitat bias is used only when some portion of a search area is not accessible because of water or dense vegetation. The habitat bias estimates the percent of unsearchable habitat for each transmission line segment. Habitat bias should only be used in limited situations where unsearchable habitat is finely interspersed with searchable habitat and where searchers can demonstrate the number of birds found in searchable and unsearchable habitats are similar. Habitat bias should only be included in the calculation for estimate of total collisions if credible numbers are calculated onsite. The formula to determine habitat bias is:

$$HB = (TDBF + SB + RB)/PS - (TDBF + SB + RB),$$

Where HB = habitat bias, and PS = proportion of area that is searchable

Example. If 95 percent of the search area is searchable:
$HB = (8 + 2 + 2)/(95/100) - (8 + 2 + 2) = 0.6$ bird may not be found.

Crippling Bias (CB)

A crippling bias is determined to consider the number of birds that fall or move outside the search area. Crippling bias is difficult to obtain (time and effort are involved in monitoring flights and collisions) and estimates from other studies may be inappropriate or misleading. Crippling bias should only be used in the estimate of total collisions if credible numbers are obtained onsite. The formula to determine crippling bias is:

$$CB = (TDBF + SB + RB + HB)/PBK - (TDBF + SB + RB + HB),$$

Where CB = crippling bias and PBK = the proportion of observed collisions falling within the search area.

Example. If four out of five birds that collide with the lines land in the search area, then:
$CB = (8 + 2 + 2 + 0.6)/(4/5) - (8 + 2 + 2 + 0.6) = 3.15$ birds are expected to collide and go out of the search area.

Estimate of Total Collisions (ETC)

An estimate of total avian collisions can be calculated using the field search results and the above bias estimates. The ETC adds the total dead birds and feather spots found and each of the calculated biases. An ETC would be calculated for each special-status species found during the dead bird searches. The formula to determine ETC is:

$$ETC = TDBF + SB + RB + HB + CB,$$

Where ETC is the estimate of total avian collisions with the segment of electric transmission line studied.

Example: If eight birds are found during the search, then:
ETC = 8 + 2 + 2 + 0.6 + 3.15 = 15.75 birds are estimated to be killed from collisions with the wires in this segment.

Habitat bias and crippling bias should be eliminated if reliable calculations are not available.

An ETC would be determined for each special-status species and averaged over the first 3-year monitoring period. The ETC would be compared to the significance criteria set forth by the USFWS. If the results of the dead bird searches are above the significance criteria after the first 3 years of monitoring, the monitoring program would continue on an annual basis and remedial actions would likely be implemented. If monitoring results show a decrease in the number of special-status birds incidentally taken by the project during the first 3 years, or during the following 3 years, the frequency of monitoring would be reduced or monitoring would be discontinued upon approval by USFWS. If during the dead bird searches large numbers of migratory and/or special-status birds were to be recorded during the dead bird searches, the USFWS and ODFW would be notified immediately.

5. Remedial Actions

If the new electric transmission line or the stacks at the Energy Facility cause significant impacts to bald eagles protected under the ESA, or any special status bird species protected under the MBTA, remedial actions to decrease the incidental take at or below the significance criteria would be implemented.

Remedial actions may include:

- Increase the number of BFDs along the top groundwires.
- Decrease the spacing of BFDs along the top groundwires.
- Add BFDs to the conductor wires.
- Implement a study to determine the cause of excess avian collisions, then develop an appropriate remedial action plan.

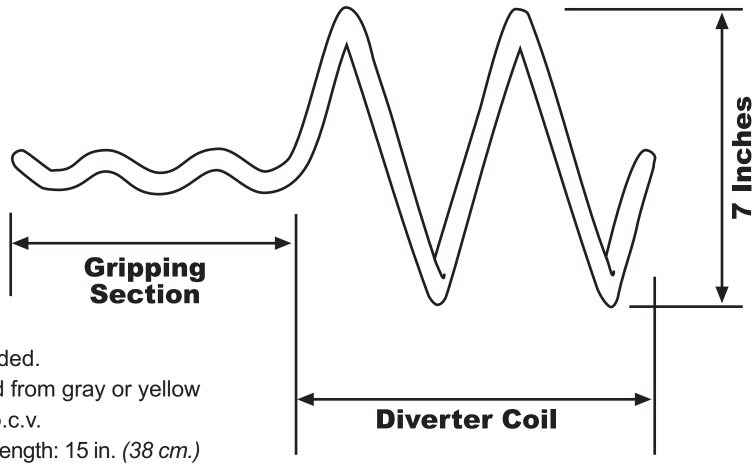
The project proponent would reinitiate consultation with USFWS prior to implementing remedial actions.

6. References

Avian Power Line Interaction Committee (APLIC). 1994. "Mitigating Bird Collisions With Power Lines: The State of the Art in 1994."

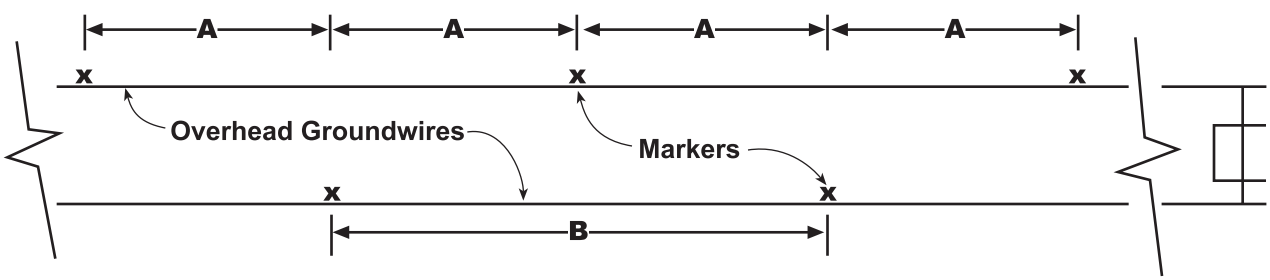
Brown, W., and Drewien, R. 1995. "Evaluation of Two Power Line Markers to Reduce Crane and Waterfowl Collision Mortality." Wildlife Society Bulletin, 23(2): 217-227.

Isaacs, Frank B. 2002. Senior Faculty Research Assistant, Oregon State University. Personal communication on August 6, 2002.



Notes:
1. Ends are sanded.
2. Manufactured from gray or yellow high-impact p.c.v.
3. Approximate length: 15 in. *(38 cm.)*

Dulmison bird flight diverter (BFD-7)



Spacing	Dimensions	
	A	B
16 feet *(5 meters)*	16 feet	32 feet *(10 meters)*
32 feet *(10 meters)*	32 feet	66 feet *(20 meters)*
49 feet *(15 meters)*	49 feet	98 feet *(30 meters)*

Marker spacing diagram for overhead groundwires

Figure E-1
Example of Bird Flight Diverter and Suggested Spacing on Groundwires
Avian Collision Monitoring Plan
COB Energy Facility
Bonanza, OR

CH2MHILL

PEOPLES ENERGY Resources

Figure E-2. Avian Collision Data Sheet

Project: Survey objective: Page_____of______

Date: Observer(s): Individual search bias:

T-line segment: Time start:

Equipment: Time end:

Weather conditions: Field conditions:

(wind direction/speed, precipitation, visibility, cloud cover, temperature) (vegetation height, habitat type, flooded)

Time	Location ID on Map	Species	Sex	Age	Approximate Time of Death	Physical Condition	Probable Cause of Death	Remarks

APPENDIX F

Worst-Case Analysis of COB Energy Facility Water Impacts

APPENDIX F TO THE BIOLOGICAL ASSESSMENT

Worst-Case Analysis of COB Energy Facility Water Impacts

The available evidence supports the conclusion that there is no hydraulic connection between the deep and shallow zones, which include the Lost River. However, if one were to assume that an extremely efficient hydraulic connection did in fact exist between the deep system and the Lost River, any impact on the Lost River from the proposed pumping would be imperceptible. To demonstrate this fact, COB Energy Facility, LLC (the project proponent) conducted this "worst-case" analysis. The analysis is not intended to describe an outcome that is likely or even plausible, but rather shows that even if one makes the most conservative assumptions at every step of the process, there still is no potential for a measurable impact on the Lost River.

Summary

The assumptions used in this analysis are sufficiently conservative that they do not actually represent the most probable outcome: no impact at all. This analysis is provided only to create a framework for understanding the magnitude of any potential impact, not to describe a physical mechanism for what might actually occur. The repeatedly conservative assumptions used in this analysis indicate that the maximum reduction in the lowest range of summer flows of the Lost River is roughly 0.00074 gpm as the river passes through the 2-mile reach closest to the Babson well. This reduction would represent a 0.000004 percent reduction in the lowest range of summer flows. This degree of connection is unlikely, and it is additionally unlikely that this impact would result in an impact to fish habitat or passage if it were to occur.

Aquifer Testing and Investigation

Previous borehole geophysics and aquifer testing at the Babson well identified the presence of two separate aquifer systems (see *Groundwater Development Potential and Hydrogeologic Assessment for the Lorella Pumped Storage Project, Klamath County, Oregon* [CH2M HILL, 1994]). The shallow aquifer system (above approximately 500 feet) is a heavily appropriated basalt aquifer that is in varying degrees of hydraulic connection with the Lost River and Bonanza Big Springs. The shallow system is used for irrigation and domestic water supply. The deep aquifer system produces water from water-bearing zones deeper than 1,500 feet below the ground surface (bgs). No data gathered from the monitoring well network during a pump test conducted in August and September 2002 at 6,800 gallons per minute (gpm) for 30 days indicate that the deep aquifer withdrawals would affect groundwater levels in the shallow aquifer, or flows at Bonanza Big Springs and the Lost River. The proposed maximum withdrawal rate of 308 gpm is unlikely to have any measurable effect in the deep zone, much less the shallow zone that lies 1,000 feet higher.

Worst-Case Analysis

The worst-case analysis consisted of the following steps:

1. Predict the worst-case drawdown beneath the Lost River from pumping at the Babson well.
2. Predict the worst-case change in flow of the Lost River resulting from the drawdown.
3. Compare that worst-case change in flow to the average summer flow of the Lost River.

Drawdown Beneath the Lost River

The Babson well investigation shows that the shallow basalt aquifer system at the well extends from approximately 60 to 430 feet bgs. Above the shallow basalt aquifer system lie the typically low-permeability sediments of the Yonna formation. The Babson well lies approximately 0.75 mile west of the Lost River at its closest point. The log for observation well MW-1 shows that the Yonna formation sediments thicken substantially between the Babson well and the Lost River—from 60 feet at the Babson well to 285 feet at MW-1. The progressively deeper bedrock in the center of the valley is expected, and is consistent with the fault-block extension of this basin and range setting.

For this analysis, a conservative assumption was made that the depth of the Yonna formation sediments remains approximately 300 feet throughout the central portion of the valley in the Babson well vicinity, and the shallow basalt aquifer system lies roughly 300 feet below the base of the Lost River (it is likely to be much deeper).

There was a hydraulic response in the observation well network attributable to a leaking well packer during the August and September 2002 pump test (see *Water Supply Supplemental Data Report: Deep Aquifer Testing at the COB Energy Facility Water Supply Well* [CH2M HILL, November 2002]). This slight leak in the seal between the borehole wall and the packer seal resulted in drawdown in the Babson well immediately above the packer. Under worst-case conditions (i.e., the transmissivity of the shallow aquifer system is extremely high), approximately 625 gpm, or 9 percent of the total discharge, would have come from the shallow aquifer system to produce the observed response in the Babson borehole. In order for this analysis to be considered “worst case”, a 10 percent contribution will be assumed.

The maximum production rate from the deep aquifer system would be limited to 300 gpm. A 10 percent connection between the shallow and the deep system would result in 30 gpm draining from the shallow basalt aquifer system to the deep aquifer system. Although the average production rate from the well would be substantially less than 300 gpm, this rate was used for the worst-case analysis.

The high shallow basalt aquifer system transmissivity used to speculate about the upper limit degree of possible hydraulic connection was roughly 2.5 million gallons per day per foot (gpd/ft). This value was used to estimate the amount of drawdown in the shallow aquifer system resulting from a 30 gpm withdrawal, 0.75 mile from the Babson well. This distance represents the Lost River’s closest point, where drawdown would be at its greatest. The Jacob-Theis equation predicts the first response (defined here as 0.01 foot of head change) would occur approximately 53 hours after the onset of pumping. The drawdown in the shallow aquifer system 300 feet below the Lost River increases to 0.017 foot (0.21 inch), after approximately 1 year of pumping and to 0.021 foot (0.25 inch) after 30 years of pumping.

For the purpose of this worst-case analysis, a maximum theoretical drawdown in the basalt aquifer system 300 feet below the Lost River of 0.03 foot was assumed.

Change in Flow of the Lost River Resulting from Drawdown

The maximum 0.03 foot of drawdown in the shallow basalt aquifer system has to be transmitted vertically upward through the Yonna formation sediments before any potential impact to the Lost River occurs. The vertical hydraulic conductivity of the Yonna formation sediments is unknown. Based on the geologic log CH2M HILL produced for MW-1, the 285 feet of Yonna formation in the Babson well vicinity can be generalized as follows:

- Surface to 35 feet: silt and sand
- 35 feet to 150 feet: clay and diatomite (low-permeability sediments, commonly referred to as "chalk")
- 150 to 250 feet: volcanic sand and gravel
- 255 to 270 feet: clay and diatomite
- 270 to 285 feet: volcanic sand and gravel

Hydraulic conductivity is a term that describes the ease with which a fluid (water) will move through a material (the aquifer). Effective *horizontal* hydraulic conductivity values are controlled by the high-permeability portions of the aquifer. That is, water tends to move preferentially through the higher-permeability potions of the aquifer. Effective *vertical* hydraulic conductivity is controlled primarily by the low-conductivity portions of the aquifer. That is, the low-permeability portions of the aquifer are the controlling factor limiting the vertical movement of water. To be conservative and predict a worst-case result, the higher-permeability portion of the Yonna formation sediments (volcanic sand and gravel) were ignored (they dampen the vertical movement of a change in head by supplying water horizontally), and the formation was assumed to consist of 130 feet of clay and diatomite.

The horizontal hydraulic conductivity of clay typically ranges from 10E-3 to 10E-5 gallons per day per feet squared (gal/day/ft^2) (Freeze and Cherry, 1979). For this analysis, the maximum value in this range, 0.01 gal/day/ft^2 was used. Vertical hydraulic conductivity is typically a factor of 10 lower than the horizontal hydraulic conductivity. To make this a worst-case analysis, this correction was ignored.

Darcy's equation was used to estimate the flow through the Yonna formation sediments that would result from this change in head at the base of the sediments:

$$Q = KAi$$

Where:

Q = flux (or flow) in gal/d

K = the hydraulic conductivity (0.01 gal/day/ft2)

A = the area over which the flux is calculated

i = the hydraulic gradient (ft/ft)

The Lost River was assumed to be 50 feet across. The area for the flux calculation was a 1-foot-wide strip of Yonna formation sediments, 50 feet wide, or 50 ft^2. The hydraulic gradient was calculated as the 0.03 foot of maximum head change after 30 years divided by the thickness of the sediments (130 feet), or 0.0002 feet per foot (ft/ft).

Using these values, the volume of water flowing vertically downward through a 1-foot-wide strip of Yonna formation sediments would be 0.0001 gallon per day (gpd), or 0.00000007 gpm.

Change in Flow of the Lost River Compared to Average Summer Flow

The amount of drawdown diminishes with distance from the point of withdrawal. A well pumping 0.1 gpm from the low-permeability Yonna sediments (a rate more than 14,000 times higher than the worst-case predicted flux through 50 ft^2 of Yonna formation) for 30 years would extend a radius of influence of only 6,500 feet. For this analysis, the flux through the Yonna formation was assumed to affect a 2-mile length of the Lost River. To make this worst-case analysis even worse, the flux rate was assumed to remain constant at the peak calculated value along this length, when in fact it would diminish with distance from the well.

The worst-case flow through the 1-foot-by-50-foot strip of Yonna formation sediments was 0.00000007 gpm, and was assumed to be supplied entirely by the Lost River. Along a 2-mile length (10,600 feet), the worst-case change in flow in the Lost River would be 0.00074 gpm.

Summer flows in the Lost River between Keller Bridge and Bonanza typically range from 40 to 80 cubic feet per second (cfs) (Bruce McCoy, Horsefly Irrigation District, Personal Communication, July 2003). This is equivalent to 18,000 to 36,000 gpm. As of August 2003, flows exceed 80,000 cfs. To make this a worst-case analysis, summer flow in the Lost River was assumed to be the lower 18,000 gpm.

If the Lost River flows diminish 0.00074 gpm as the river passes through the 2-mile reach closest to the Babson well, a 0.000004 percent reduction in flow would occur. This reduction could not impact fish habitat or passage.