2.3 CONSTRUCTION ON SITE
(WAC 463-42-145)

This section provides information on the proposed project and construction of the project in the following sections:

- Project Summary (Section 2.3.1)
- Power Plant Description (Section 2.3.2)
- Power Plant Construction (Section 2.3.3)
- Pipeline Description (Section 2.3.4)
- Pipeline Construction (Section 2.3.5)

2.3.1 PROJECT SUMMARY

~~The Washington Public Power Supply System~~ Energy Northwest and Duke Energy Grays Harbor, LLC (~~Supply System~~ the Applicant) is proposing to construct and operate the Satsop Combustion Turbine Project (CT Project) which will consist of two separate ~~and identical combined cycle power plants~~combustion turbine generators ~~(Units 1 and 2)~~ and a single steam turbine generator. A combined cycle plant uses exhaust gases from the combustion turbine that might otherwise be exhausted into the atmosphere without recapturing any of the heat content. In the proposed project, natural gas and air will be mixed and ignited in a combustion turbine. The combustion turbine produces about ~~two-thirds~~one-half of ~~an entire unit's~~the plant's electrical output and emits hot gases as a byproduct. The hot gases exhausted by the combustion turbines will be used to produce steam in a heat recovery steam generator (HRSG). The high energy steam from the HRSG will be piped into a steam turbine which generates the remaining one-~~third~~ half of the unit's electrical output.

The total estimated value of the Satsop CT Project ~~(two units)~~ at the completion of the construction is approximately $425 million, including approximately $~~400~~ 375 million for construction of the plant and approximately $~~25~~50 million for construction of the proposed natural gas pipeline. ~~The Supply System~~ Energy Northwest/Duke Energy estimate~~s~~ that the annual operating and maintenance costs will be approximately $14 million, including the following:

- Wages and salaries of operation, maintenance, and administrative personnel
- Procurement of goods and services
- Insurance
- Sales, property and other state and local taxes.

Figure 2.3-1 presents a ~~computer simulation~~ conceptual isometric diagram of the proposed project and Figure 2.3-2 is a ~~conceptual~~ process flow diagram of the Satsop CT Project showing the major component systems for each the plant. This illustration shows the major facilities/systems that will support the turbine trains, including the steam condensing/cooling system and the electrical interconnection system.

Process water will be supplied from the existing Ranney Collectors via the existing Satsop Power Plant Development Park make up water line and transported to the Satsop CT project through an existing water pipeline that passes adjacent to the site. The existing outfall structure to the Chehalis River will be used for discharge of the Satsop CT Project's process effluent.

Potable water will be obtained from the existing Satsop Power Plant Development Park raw water well. This system includes a supply tank and pump house located on the northeast corner of the laydown area (see Figure 2.3-3) and will provide high-quality water which will be treated as necessary for potable uses. Sanitary wastewater will be discharged through an on-site septic system and leach field constructed for each unitthe plant.

Fuel for the proposed project will be provided by a new natural gas pipeline that will connect to the existing 26-inch Ignacio-to-Sumas gas pipeline that is owned and operated by Northwest Pipeline Corporation. This spur will extend to the site from its connection near Vail on the east, a distance of approximately 48 miles (see Figure 2.1-3).

Power produced by the CT Project will be routed through transmission lines that will connect to the BPA system at the Satsop substation, approximately 4,000 feet east of the project site. As a part of the proposed project, new transmission lines will be installed in the existing BPA electric transmission line right-of-way (on land owned by the Supply System Grays Harbor Public Development Authority) from the site to the substation. Existing wooden power poles in the right-of-way will be replaced with steel towers.

2.3.2 POWER PLANT DESCRIPTION

The Supply System Applicant is proposing to construct and operate the CT Project to (1) generate electricity for sale to BPA (Unit 1), and (2) to help supply growing regional electrical loads (Unit 2). Each unitThis plant will be a combined cycle power plant with a nominal annual average output of 245 600 megawatts to be constructed on a site within the boundaries of the Supply System's Satsop Power PlantDevelopment Park. The Satsop Power Plant currently houses two of the Supply System's nuclear projects, WNP-3 and WNP-5.

Revised 03/08/01

2.3.2.1 Reference Plant

The proposed Satsop CT Project will be an application of ~~the Westinghouse Electric Corporation's~~Duke Energy's ~~240~~600-megawatt "reference plant". The reference plant philosophy is to develop plant equipment and system designs around a pre-designed base configuration. This philosophy is centered on the concept of a "modular" design approach with a matrix of predefined "base", "optional", and "special" design configurations. The application of reference plant designs to a specific project involves selection of system configurations from the predefined base, option, and special matrix~~ in order to best match customer requirements~~ and modified to the site specific requirements. The base and optional configurations are then ~~either duplicated directly from existing designs, or are~~ modified to meet the project conditions. If a system or piece of equipment is project-specific or a custom design (i.e., special), the reference plant application process focuses attention in these areas.

The base configuration of a system or piece of equipment is the standard offering, and is typically the lowest cost alternative for implementation. Optional configurations are items which are expected to be applied to multiple sites, or items which can simply be added to the base configurations or which replace the base configuration. Special configurations are those items which are site specific, or designs which are not deemed reusable. Application of the reference plant involves selecting from the matrix of base, optional, and special configurations to meet customer demands. The reference plant approach focuses on the uniqueness of specific applications rather than reinventing proven designs on each project.

The Satsop application of the reference plant is based on the performance of the ~~Westinghouse 501F~~ General Electric Frame 7FA combustion turbines in a 2~~1~~-x-1 combined cycle configuration with a ~~Westinghouse~~ GE D11 ~~two-case reheat~~ steam turbine. The ~~501F~~ GE 7FA combustion turbine generates a nominal gross power output of ~~160~~ 175 megawatts, while the steam turbine generates approximately ~~80~~ 300 megawatts gross. The Satsop project also features a GE 7H2 ~~Westinghouse~~ hydrogen-cooled generator for the combustion turbine~~,~~ and ~~Brush air-cooled generator for the~~ stream turbine~~, and a Westinghouse WDPF distributed control system.~~.

A basic description of the reference plant concept as applied to the Satsop CT Project is presented in Section 2.3.2.2, with additional information presented in Appendix B.

Detailed power plant design and specification information is contained in Appendix B1. A more detailed description of the generator systems are found in Appendix B5, "Combustion Turbine Generator and Static Excitation System" and in Appendix B6, "~~[~~Steam Turbine~~]~~ Generator and Brushless Excitation~~ Steam Turbine Generator~~;" a more detailed description of the steam turbine is provided in Appendix B4, "~~Two Case~~ Reheat Steam Turbine;" a more detailed description of the HRSG is provided in Appendix B3, "Heat Recovery Steam Generator (HRSG)." A more detailed description of the cooling systems is provided in Section 2.6, "System of Heat Dissipation." The basic building structures can be found on Figure 2.3-3A, "Plant Configuration~~ (One Plant)~~," and are shown in the Figure 2.3-1, "~~Computer Model of Proposed~~

~~Power Plants~~ Conceptual Isometric Diagram." Figure 2.3-3B Plant Elevation can be used with the following building heights to determine approximate building dimensions (number refers to key on Figure 2.3-3A):

Approximate
Building Heights

Key	Building	Approximate Height
(1)	~~Generation Building~~Gas Turbine Housing	~~55~~ 68 ft
(2)	Administration Building	~~20~~ 12 ft
(3)	Work Shops and Stores	~~20~~ 24 ft
(4)	Water Treatment Building	~~20~~ 22 ft
(7)	HRSG	~~64~~ 80 ft
(8)	Exhaust Stack	~~160~~ 180 ft
(10)	Cooling Tower	41 to ~~46~~ 55 ft.

2.3.2.2 Plant Components

Figure 2.3-3 shows the equipment configuration of ~~each unit of~~ the CT Project. The project ~~Each unit~~ is made up of the following components:

- Combustion Turbine Generator (two)
- Heat Recovery Steam Generator (two)
- Steam Turbine Generator (one)
- Fuel Supply
- Process Water and Wastewater Treatment
- Cooling System
- Electrical Interconnection
- Fire Protection
- Visual Barriers

The following is a summary description of the major components of each unit. ~~As noted above, the Satsop CT Project consists of two identical and independently operated units.~~

Combustion Turbine Generator (CTG)

The conceptual configuration incorporates ~~one~~ two ~~CTG~~GE 7FA trains with a gross capacity of approximately ~~160~~ 350 megawatts. The heat rate of the combustion turbines will be approximately ~~9590~~ 9500 British Thermal Units (BTU) per kilowatt hour, Lower Heating Value. The generator portion ~~of the~~

CTG will be connected to a two-winding transformer to step up the 13.8-kilovolt generator voltage to 230 kilovolts for transmission.

The project's design is based on utilization of a Westinghouse 501FGeneral Electric 7FA combustion turbine generators. The Westinghouse 501FGE 7FA is an industrial combustion gas turbine that represents the state-of-the-art in combustion turbine technology. This turbine has been specified as the basis for the heat and material balance, fuel use, and emissions calculations.

Heat Recovery Steam Generator (HRSG)

The high temperature exhaust produced by the CTGcombustion turbines will flow directly to an a HRSG. The HRSG will produce output steam at three pressure levels, all of which will supply steam directly to the steam turbine.

Emissions control (air pollution control) equipment is integrated within the HRSG. The Selective Catalytic Reduction (SCR) control equipment for removal of oxides of nitrogen (NO_x) and the oxidation catalyst for removal of carbon monoxide (CO) (labeled as SCR/CO catalyst in Figure 2.3-2) are located within the HRSG.

Steam Turbine Generator (STG)

The STG will have a throttle pressure of approximately 1,450 1,900 pounds per square inch, gravity absolute (psig) (psia) and will have an electrical generation gross capacity of approximately 80 300 megawatts (base load). An auxiliary power transformer will step down from the 13.818 kilovolt generator voltage to 4160 volts to supply power to the plant auxiliary systems.

An auxiliary boiler will be installed with a low NOx burner to produce steam at approximately 25,000 pounds per hour to provide sealing steam to the STG. It can also be used to maintain temperature in the HRSG and STG during long idle time to reduce startup duration.

Fuel Supply

The Satsop CT Project's primary fuel will be natural gas that will be supplied by a pipeline constructed and owned by the Supply System the Applicant. The pipeline will be approximately 48 miles in length and will connect with NWPC's mainline, a 26-inch line from Ignacio to Sumas that is parallel to and east of I-5 (see Figure 2.1-3). Back-up No. 2 distillate fuel oil will be provided from an above-ground, 1.8 million gallon fuel tank provided for each unit. Secondary containment will be designed to meet the appropriate federal and state regulations. Fuel will be delivered to the project site by tanker trucks.

Process Water and Wastewater Discharge

Revised 03/08/01

Process water requirements will be obtained through the existing Ranney Collectors, located west of the CT Project plant site. (See Revised Figure 2.3-4). The Ranney Collectors were constructed and permitted for nuclear projects WNP-3 and WNP-5. Ranney well water will be delivered to the Satsop CT Project plant site via the existing make up water line and an existing water pipeline that passes adjacent to the CT Project plant site. At the CT Project plant site, a pipe will be connected to the existing water pipeline to transport process make up water to the project. The CT Project will send its effluent back to the existing water pipeline via another connection downstream of the project intake, from where it will be transported and discharged to the Chehalis River through the existing outfall structure. The discharge will comply with the stipulations of the existing NPDES permit.

Cooling System

The proposed cooling system ~~of each plant~~ consists of two major components: (1) a circulating water system which will carry cold water from the cooling tower through the steam turbine condenser and back to the cooling tower, and (2) an auxiliary cooling water system which will be tied into the circulating water system to provide water for cooling major equipment within the combined cycle facility. The evaporative cooling tower ~~of each plant~~ will consist of ~~4~~ an eight- (8) cell~~s in a~~ structure approximately 216 feet long, ~~42~~ 110 feet wide, and 41 to ~~46~~ 55 feet high.

Electrical Interconnection

Power generated by the project will be exported through BPA's existing high-voltage transmission system. Capability for power export will be accomplished by stringing transmission lines from the project site to the BPA Satsop substation located approximately 4,000 feet to the east of the project site (see Figure 2.1-1). Power lines to the substation will be strung on replacement transmission towers installed within the BPA transmission line right-of-way, on land owned by ~~the Supply System~~ Grays Harbor Public Development Authority~~.~~ These towers will be similar in appearance to the existing steel transmission line towers (two separate rows) that are adjacent to the wooden poles in the right-of-way.

A switchyard containing necessary control, switching and transformer equipment will be constructed for each unit.

Fire Protection

The Fire Protection System, including the fire water system, fixed suppression systems, detection systems, and portable fire extinguishers, will provide the required fire protection for each plant and will consist of the following major components:

- Dry pipe sprinkler system
- Wet pipe sprinkler system

- Yard loop hydrant system
- Preaction spray/sprinkler system for the turbine generator bearings and lube oil equipment
- High pressure CO_2 system for the control room subfloor
- Independent smoke detection system
- Portable fire extinguishers
- Standpipes and fire hose stations at various locations throughout the buildings
- Instrumentation and control equipment for alarm, indication of equipment status, and actuation of fire protection equipment
- Halon/Halon Substitute system for the combustion turbine enclosure and electrical package
- Combined raw/fire water storage tank
- Fire water pumps
- Foam system for the fuel oil storage tank and area

Fire water will be stored in the on-site ~~415,000~~1,000,000 gallon storage tank~~s, one for each unit~~. These tanks will also serve as reservoirs for raw water. This storage capacity will be sufficient to provide the maximum automatic system demand plus ~~500~~ 400 gallons per minute for a 2-hour period. The fire water pumping system will consist of a primary motor-driven pump, a diesel-driven backup pump with independent fuel supply, and a pressure-maintaining jockey pump. CO_2 and Halon/Halon Substitute systems will be provided in areas where water systems will cause damage to plant equipment.

Visual Barriers

As shown on Figure 2.3-1, the proposed project will include visual barriers installed between the power plants and Keys Road. These barriers will consist of two vegetated berms, each of which will be approximately 12 feet high and 80 feet wide. The northern berm will be approximately 440 feet long, and the southern berm will be approximately 555 feet long. Each berm will be planted with native vegetation, including shrubs and grasses.

2.3.2.3 Project Layout

Figure 2.3-3 presents the facility layout for the project. Buildings located on the site for each unit are shown on Figure 2.3-1. The locations of key components of each plant are described below.

The combustion turbine and generator, the steam turbine and generator, and their associated support equipment will be located within the generation building, with the exception of the water treatment system, which will be housed in its own building directly adjacent to the generation building. The generation building will be located centrally on the site of each unit. The HRSG will be located outside and east of the generation building.

The ~~CTG~~CT-HRSG trains will be laid out in an in-line design parallel to the STG in a north-south orientation. ~~and the STG train of each unit will be laid out parallel to each other in an east-west orientation.~~ Within the CTG-HRSG train, the combustion turbine and the generator will be located at the ~~west~~ north end within the generation building and adjacent to the electrical switchyard. The ~~easternmost~~ northernmost structures ~~of the CTG-HRSG train~~ will be the exhaust stacks, with the HRSG (and emission control equipment within the HRSG) located between the stack and the combustion turbine. ~~The STG train of each unit will be located south of the CTG-HRSG train within the generation building~~.

An electrical switchyard will be located adjacent to the generator ends of ~~each of the CTG-HRSG and STG trains~~the combustion turbines on the ~~westernmost~~ southernmost end of the site. Transmission lines will extend from each switchyard to the Olympia-Aberdeen transmission line right-of-way which extends along the southern edge of the plant site (see Figure 2.3-3).

~~Each~~ The facility's main control room will be located at the ~~southern~~ western end of the generation building. The water treatment facilities will be located in a building adjacent to ~~each~~ the generator building ~~at the east end of the STG train~~. The ~~four-cell~~ cooling tower ~~for each unit~~ will be located on the ~~southern~~ northern edge of ~~each~~ the site~~, south of the STG train~~.

~~The No. 2 distillate fuel oil tank and containment system will be located on the easternmost portion of each site.~~ The natural gas pipeline will enter the center of the plant site from the east.

The HRSG structure will have a height of approximately ~~64~~ 80 feet. Heights for other major structures are ~~55~~ 68 feet for the ~~generation building~~gas turbine enclosure, ~~160~~ 180 feet for the exhaust stack, 68 feet for the gas turbine enclosure, and 41 to ~~46~~ 55 feet for the cooling tower.

2.3.3 POWER PLANT CONSTRUCTION

2.3.3.1 Construction Summary

The proposed plant site was previously graded and a layer of gravel was placed to prepare the site for use as a construction storage area. Materials currently stored on the site will be relocated to another storage area on Grays Harbor Public Development Authority's ~~the Supply System's~~ property, and gravel removed from the site will be stockpiled on a ~~Satsop Power Plant~~ storage area. The foundations currently on the site will be removed as will existing power and water distribution lines. Prior to facility construction, the two screening berms will be built to the extent possible without impeding site preparation activity.

After the berms are in place, foundations will be installed, as will the drainage system for the construction stage. Materials to be used during construction are expected to be staged on the construction storage areas located adjacent to and west of the project site (see Figure 2.1-2), just west of Keys Road. During construction, the plant site will remain fenced to provide site security.

The Supply System Applicant will purchase electricity needed for construction and startup. Approximately 2000 amperes of 480-volt, 3-phase temporary power will be installed at a single location within the project site boundary. Startup power will be obtained by back-feeding from the 230-kilovolt utility system.

Conventional construction equipment, including bulldozers, front-end loaders, trucks, tractor-scrapers, and graders will be used to final grade the site. During construction, dust will be controlled as needed by spraying water on dry, exposed soil. Prior to leaving the site during construction, vehicles will be sprayed with water and required to drive over a gravel pad to remove mud from the tires.

Erosion control measures will be used in accordance with the requirements of the Supply System's Applicant's existing Erosion and Sedimentation Control Plan (see Appendix J), as modified for the specific construction activities of the project (see Section 2.1 - Surface-Water Runoff [WAC 463-42-215]). Erosion control measures will include silt fences, hay bales, rock bases, temporary water conveyance structures, and retention ponds.

After site preparation is completed, Westinghouse's the contractors will install the combustion turbine, steam turbine, generators, electrical and other equipment, and support facilities of each unit. In addition, the earth berms will be constructed along the western site boundary. Once these facilities are in place, the site landscaping will be initiated. The berms will be landscaped using native vegetation, including grasses and shrubs.

Field toilets and temporary holding tanks will be placed on site for use by construction personnel. During construction, the Supply System the Applicant will provide potable water until the water supply system is installed, or the contractor may provide potable water in containers. Parking will be provided on the construction laydown area located west of Keys Road.

BPA will be responsible for work accomplished within the existing right-of-way between each plant site and the BPA substation located approximately 4,000 feet east of the 20-acre plant site. This work will include replacing the existing wooden poles with steel transmission towers, stringing transmission lines to the substation, and completing the interconnection at the substation. The Supply System Applicant will coordinate with BPA as appropriate throughout the construction process.

2.3.3.2 Site Preparation

There will be approximately 50,000 cubic yards (25,000 cubic yards per unit) of excavation for foundations, buried pipes (circulating water and fire loop), and the electrical duct banks. This material will be retained on site and later used for backfill and the berms on the western site boundary. In addition, there will be approximately 40,000 cubic yards (20,000 cubic yards per unit) of earth moved during site preparation to arrive at the appropriate elevation and leveling. With this amount of earth available there should be no need to import additional earth to the site.

A Phase I Environmental Site Assessment completed in April 1994 (Dames & Moore, 1994) indicated that there is no evidence of contamination with hazardous materials at the site and that the likelihood of such contamination being present in subsurface soils is low. If contamination is encountered during excavation and grading, the ~~Supply System~~ Applicant will notify EFSEC and take the appropriate remedial actions.

During site preparation, the ~~Supply System's~~ contractor will install a storm drainage system. This system will consist of a series of swales that will convey surface water runoff into the existing Satsop ~~Power Plant~~ Development Park storm drainage control system (see Section 2.10 - Surface-Water Runoff [WAC 463-42-215]).

A 6-foot high enclosure (chain link fence) will be constructed surrounding the plant site to provide security. To the extent possible, the existing fence around the site will be relocated and used for the CT Project. During the site preparation phase, earthworks necessary for construction activities will also be completed.

2.3.3.3 Foundations and Roadways

Foundations, including a pedestal for the steam turbine generator and foundations for the gas turbine generator and heat recovery steam ~~boiler~~ generator equipment, will be installed. ~~At the present time the Supply System anticipates using spread footer foundations with a soil bearing capacity of 3000 pounds per square foot for all equipment~~. As a part of final design studies, geotechnical investigations will be conducted to determine the appropriate types of foundations for the facilities. Based on currently available data, the ~~Supply System~~ Applicant anticipates that foundations will be Category 1 facilities (non-essential facilities) in accordance with ASCE document 7-88 ("Minimum Design Loads for Buildings and Other Structures). Foundations and buildings will be designed for Seismic Zone ~~2~~3. The initial phase of foundation construction will include foundations for all heavy equipment except for transformers and other electrical switchyard foundations, which will be constructed at a later time.

Construction of the project foundations will require the use of a number of types of heavy equipment, including excavation equipment, concrete-pumping equipment, and concrete finishing equipment. In addition, light and medium duty trucks, air compressors, generators, and other internal combustion engine driven equipment are anticipated.

On-site roadways and parking areas will be constructed with asphaltic concrete over a compacted subbase.

An on-site concrete batch plant will not be required.

2.3.3.4 Equipment Installation

A number of the component systems of the CT facility will be fabricated and delivered to the site. This includes the combustion turbine, CTG, HRSG, STG, major pumps, and electrical equipment. Fabrication and delivery of these components will be scheduled to coincide with their requirement in the construction sequence. Heavy and large equipment components will likely be delivered to the site by truck. A boom crane will be required to lift and place many of the pieces of component equipment into the required position.

In sequence with the installation of component equipment, support systems will be installed, including electrical equipment, control equipment, piping instrumentation, wiring cable, and conduits. Typical construction activities onsite will include mechanical fastening, welding, preparation, and painting.

Cathodic protection will be provided on all underground gas lines within the site boundary.

2.3.3.5 Startup Testing

At the completion of the construction sequence, ~~each~~ the plant system will be energized and operational testing undertaken. This will include testing each of the major component systems in a predetermined sequence and completion of Quality Assurance and Quality Control checks to ensure that each system is ready for full operation. After the total plant is fully operational, emission compliance testing will be conducted. At the end of the startup testing phase, each unit will be separately certified for commercial operation. The Quality Assurance and Quality Control checks are described in detail in Section 2.12 - Construction and Operation Activities, WAC 463-42-235.

2.3.4 PIPELINE DESCRIPTION

The CT Project's primary fuel will be natural gas that will be supplied by a pipeline constructed and owned by the ~~Supply System~~ Applicant. The line will be approximately 48 miles in length and will connect with NWPC's mainline, a 26-inch line from Ignacio to Sumas that is parallel to and east of I-5 (see Figure 2.1-3). The new pipeline will be between 16 and 20 inches in diameter, with the final size dependant upon the chosen gas pressure and the applicable state or federal regulations. The pipeline will be installed with an impressed-current cathodic protection system to minimize corrosion. A 50-foot-wide right-of-way will be maintained over the length of the pipeline during operation.

The planned pipeline route is shown on Figure 2.1-4a through 2.1-4d. Approximately 21 miles of the new pipeline will be constructed directly adjacent to an existing pipeline. For approximately the initial 8 miles, the new pipeline will also roughly parallel the existing Olympic Pipeline. Approximately 13 miles will be installed within the existing BPA transmission line right-of-way. Based on the (1) locations and numbers of present and planned compression stations along the NWPC system, and (2) the presence of compressors at the power plant, the proposed pipeline will not require additional compression stations.

2.3.5 PIPELINE CONSTRUCTION

Installation of the pipeline will involve construction across land and under rivers and streams, roadways, and railroads. The anticipated construction methods to be used for terrestrial construction of the pipeline are briefly described below along with general information on construction. The existing laydown areas adjacent to the proposed plant site will be used as the primary construction laydown area for the pipeline work. Procedures specific to water crossings and construction in wetlands are discussed in Section 2.14 - Construction Methodology, WAC 463-42-255.

2.3.5.1 Construction Right-of-Way

The width of the area required for pipeline construction will vary according to site-specific conditions. In general, the construction right-of-way will be approximately 65 feet wide with an additional 5-foot buffer on each side. As shown on Figures 2.1-4a through 2.1-4d, areas adjacent to river, stream, roadway, and railroad crossings require additional construction right-of-way width.

In areas where the Supply System Applicant does not own the property or have a right-of-way, easements will be negotiated with property owners. The Supply System Applicant anticipates making one payment to each affected property owner for the easement and expected inconvenience or the temporary loss of planting that may occur during construction. Landowners will also be compensated for crop damage and the other minor losses that may result from pipeline maintenance.

In general, the right-of-way easements obtained from public agencies and private landowners will give the Supply System Applicant the right to survey the route, clear and grade the right-of-way to accommodate construction, install the pipeline, clean up and return to grade, revegetate, and provide later access to it for operation and maintenance. Temporary access to the right-of-way across identified access roads will also be negotiated.

2.3.5.2 Terrestrial Pipeline Construction

Figures 2.3-5 through 2.3-7 illustrate typical construction methods expected to be employed for the proposed pipeline. Specific procedures will be selected for each pipeline segment to be constructed, dependent on the conditions identified during final engineering and design studies. New access roads will not be required since access to the construction areas is possible using existing roadways and logging roads.

The mainline construction is expected to be accomplished by a single pipeline "spread", which is a coordinated crew with the major construction equipment necessary to complete entire sections of pipeline installation from start to finish. Although one spread is anticipated, final engineering design studies may indicate that two spreads will be more appropriate.

Several construction units will make up the spread, with the work proceeding in the following sequence: temporary fence installation, timber clearing, clearing and grading the right-of-way, trenching, hauling and stringing the pipe, pipe bending, pipe laying and welding, x-ray inspection, applying external coating to field welds, coating checks, trenching, lowering-in, backfilling, hydrostatic testing, and cleaning and restoring the right-of-way. These activities are summarized below.

Temporary Fence Installation

A fencing crew will begin following the staked centerline of the pipeline and will install temporary gates and fencing as required. Fences will be braced prior to being cut to maintain integrity of the overall fence. Temporary gates will be installed across the width of the construction right-of-way that will allow the ditch to be excavated, as well as provide room for the pipe and construction equipment to pass.

Timber Clearing

Local timber crews will be utilized to clear the right-of-way of all merchantable timber. Logs will be removed to mills in accordance with agreements negotiated with landowners when the right-of-way is obtained. Smaller timber will be properly disposed of or cut and stacked on the right-of-way for use by the landowner for firewood or posts, if appropriate.

Right-of-Way Preparation

After temporary fencing and timber clearing have been accomplished, the right-of-way crew will be given access to the right-of-way. This crew will remove any salvageable topsoil and pile it separately along the outer extreme of the right-of-way. When the work is done along a hillside, the topsoil will normally be placed on the uphill side to prevent contamination with other excavated material during later stages of construction. The right-of-way will then be leveled to allow the construction equipment room to work. In areas along the sides of hills ("sidehilling"), two levels may be necessary. One level will contain the ditch and material removed from it. The second level will accommodate the pipe fabrication area and the construction equipment and passing lanes. This technique reduces the amount of material which must be displaced during the temporary construction phase of the work. Approaches at the tops and bottoms of hills will be made that will allow equipment and the pipe to transition from level areas to steep inclines.

Erosion Control

As clearing and equipment access crossings are completed, erosion control devices will be installed in accordance with the requirements of the ~~Supply System's~~ Applicant's existing Erosion and Sediment Control Plan as modified for the specific construction activities of the pipeline work (see Section 2.10 - Surface-Water Runoff [WAC 463-42-215]). Methods presented in the plan include silt fences, hay bales, rock bases, and retention ponds, with the specific methods used dependent on the soil conditions, slope,

Revised 03/08/01

and other site-specific variables. Once a level access is prepared, dust control will be accomplished as necessary by periodically spraying from water trucks.

Ditching

Figure 2.3-5 illustrates techniques typically used for digging trenches. Once the topsoil is segregated on the uphill side of the right-of-way and the right-of-way leveled, ditching will begin. Materials removed from the ditch will normally be placed adjacent to the topsoil pile. Trackhoe equipment will normally be used to dig the ditch in hilly or mountainous terrain. Extra ditch depth will be dug to ease the transition of the pipeline at the bottoms and tops of hills, at water crossings, road crossings, and railroad crossings. This will require additional temporary right-of-way width to accommodate the extra material excavated for the ditch.

If rock is encountered, the ditch will be dug by first breaking the rock with hoe rams or by blasting. Blasting will use controlled charges which will fracture the rock in the ditchline, but will not blow it across the right-of-way. After the rock is fractured, it will be excavated with backhoes. The ditching operation will have numerous pieces of equipment spread over several miles, all digging the ditch concurrently.

Stringing

Precoated pipe sections will be hauled to the right-of-way on stringing trucks. The pipe will be unloaded from the trucks with a sideboom tractor and placed end-to-end alongside the ditch. Where water and road crossings are to be accomplished, the appropriate pipe will be stockpiled on one or both sides of the crossing so it is available to the construction crews that will follow.

Bending

Before the pipe is welded, a bending crew will bend the pipe in place to match the contours of the ditch. The crew will use a hydraulic bending machine to put gradual bends in the pipe. The bending will be limited to making many small bends along the length of a pipe section until the desired bend angle is obtained. The pipeline centerline will be surveyed with bending limitations in mind. Where the bend could not be made gradually enough due to local conditions, a preformed factory bend will be inserted into the pipeline.

Welding

After bending has been completed, a welding crew will join the lengths of pipe together. The pre-bent pipe will be supported with sidebooms and rotated so the pipe matches the ditch contour. A lineup clamp will be used to temporarily hold the pipes in proper alignment until the welders can put an initial welding pass on the joint. Electric arc welding will be used to join the pipes together. As soon as sufficient weld material has been deposited into the joint, the clamp will be released and the crew will move forward to the next joint. Additional welding crews will follow and place the remainder of the weld material into the joint except for the final pass. A capping crew will follow immediately to put the finish "cap" weld on the joint. All welders that work on a joint have unique identifying codes. The codes are marked on the area adjacent to the pipe so complete records of the welding will be maintained.

After the pipe is welded, it will be placed on skids or earthen beams so the joint is supported above the ground. This will allow the joint to be X-rayed to check its quality and also will allow the coating crew to clean and coat the bare, welded joint.

Non-destructive Testing

Shortly after the welding crew has passed, an independent X-ray crew will test the welds. Department of Transportation code requires a minimum of 10 percent of the welds be tested in unpopulated areas of the pipeline. The minimum percentage increases as the population density in the surrounding area increases. Welds in ~~highly populated~~ all areas, ~~and~~ including under water and road crossings, ~~require~~ will be 100 percent ~~testing~~tested. ~~The 10 percent minimum of the daily welds ensures that each welder is tested randomly every day.~~ A portable lab will develop the X-rays shortly after they are taken, and an evaluation of the weld will be made. Defects in the welds will normally be corrected within a day of the original welding, and the joint will be X-rayed again to verify that the repair is good.

Coating and Lowering-in

After the welds have been checked, the coating crew will clean the exposed steel at the joint between the pipes and apply a protective coating to it, which is fusion bonded epoxy. ~~The coating will commonly be a heat-shrinkable polyethylene wrapped around the pipe. After the longitudinal ends are sealed, heat will be applied to the coating material to shrink it around the joint and form a tight, impervious covering on the joint.~~ After the joints have been coated, an inspection crew will check the pipe for nicks and abrasions in the coating with a high-voltage testing device. Chips or abrasions in the coating will sound an alarm on the test equipment and the crew will place a mark on the pipe to indicate the defect. Repair crews will patch the defects prior to lowering the pipe into the ditch.

The pipe will be lowered into the ditch by a team of sideboom tractors. All rock will be removed from the ditch prior to the lowering-in operation. In areas of rocky terrain, dirt or foam berms will be placed in the bottom of the ditch to suspend the pipe above the rocky bottom. If appropriate, heavy duty plastic mesh will be wrapped around the pipe in these rocky areas to protect the pipe and coating from damage during the lowering process.

Cathodic Protection

An impressed-current cathodic protection system will be installed to protect the pipeline from corrosion. The system components and locations along the alignment will be determined during final design and engineering studies.

Backfill

Backfill will normally be placed over the pipe within a day of the pipe being lowered into the ditch. Bulldozers will normally be used to push stockpiled materials removed from the ditch back into the ditch to cover the pipe. In areas that contain large quantities of rock, select fill material may be imported to put the first 1 foot of cover over the pipe, or special padding machines may be brought in to screen the rock from the backfill before it is placed in the ditch. Extreme care will be taken with the initial fill to avoid damage to the coating during backfill. After the initial 1 foot of screened material is placed on the pipe, the remaining soil and rock mixture will be returned to the open ditch to complete the backfill. The amount of backfill (cover) required between the top of the pipe and the ground level is presented in Table 2.3-1.

Cleanup

After backfill is complete and all miscellaneous sections within a given length of pipeline have been tied together, the cleanup operation will begin. Material which was pushed aside to make the temporary level working area will be placed back on the right-of-way. The original contours of the land will be restored as closely as possible. As part of the restoration process, all equipment access crossings will be removed. The banks of water courses will be stabilized where appropriate, and restored. Restoration will include revegetation with native riparian species where appropriate.

TABLE 2.3-1
COVER STANDARDS FOR BURIED PIPELINES

Location	Cover (inches)	
	Normal Excavation	Rock Excavation
Industrial, commercial and residential areas	42	30
Crossings of bodies of water with a width of at least 100 feet from high water mark to high water mark	48	18
Drainage ditches at public roads and railroads	48	36
Any other area	36	18

After the contours have been re-established, the topsoil that had been previously segregated will be redistributed across the surface of the right-of-way, and water bars will be graded across the slopes. This will prevent the formation of large rivulets of water during heavy rains by periodically diverting runoff to the sides of the right-of-way and away from the ditchline. This will protect the slopes during the first few years until the soil stabilizes and vegetation takes hold again.

The right-of-way will be chiseled and disc plowed to loosen the compacted soil. Native grasses and other native vegetation will be planted and fertilized in non-cultivated areas in accordance with landowners and agency requirements. Hydromulching will be used in areas of steep slopes and areas otherwise not accessible to farm type cultivating equipment.

The final step will be the establishment of access barriers to prevent trespass on the right-of-way. Much of the brush and stumps generated during the clearing portion of the project will be spread across the right-of-way to establish a natural barrier to travel down the pipeline corridor. Temporary fencing which was installed at the beginning of construction will be removed and the original fence re-established where appropriate.

Pipeline markers will be installed along the route to show the location of the pipeline, identify the owner of the pipeline, and provide a local or toll-free ("1-800") telephone number to contact the owner regarding activities that may affect the pipeline.

2.3.5.3 Crossings

Crossings will be installed concurrently with the mainline construction spread. Separate crews will install bored crossings of interstates, primary and secondary roads, and railroad crossings. These crews will perform the excavation, boring or ditching, welding and installation of the crossing pipe. All crossings of public thoroughfares will be 100 percent X-rayed before the pipe is installed.

Water crossings will also be installed by separate crews. Depending on the schedule requirements, the same crew that installs the road crossings could install the water crossings. Again, all welds in a water crossing will be 100 percent x-rayed. (Construction methods for water crossings are described in Section 2.14 - Construction Methodology, WAC 463-42-255.)

Road Crossings

At locations where the pipeline must cross a roadway, the crossing will be accomplished by either the open-cut or boring method. Figure 2.3-6 illustrates a typical road crossing. Boring will be the least disruptive method, but this technique cannot be used effectively in areas where boulders or rock are present or for crossings longer than approximately 200 feet. Where boring is not possible, the open cut method will generally be used.

Boring will require the digging of a large pit on one side of the road. The boring machine will be lowered into the pit to begin boring, with the pipe inserted into the hole as it is being drilled. The outside of the pipe will be coated with concrete or abrasion resistant material to protect the pipe coating from scarring and nicking as it is pushed through the bore hole. As each complete joint of pipe is installed, the boring shaft will be separated and another joint of pipe welded to the first joint. The shaft will then be reconnected through the new section of pipe and the boring will continue. This method will continue until the boring head and the pipe is received in a "capture" pit on the opposite side of the crossing. Since the pipe being installed will be the actual pipeline carrier pipe, all welds will be X-rayed as they are completed. Casing will not be installed, since the potential for future corrosion problems and potential failure of the pipe will be increased.

When the open-cut method is used, traffic will be diverted around the crossing via detours or temporary roads. To minimize the duration of traffic disruption, the pipe will be prepared prior to commencement of roadway excavation. Once the pipeline has been installed, the trench will be backfilled and compacted in lifts in accordance with relevant agency specifications. The roadway will then be resurfaced over the compacted trench. Final selection of crossing methods will be coordinated with EFSEC, the U. S. Army (for road crossings within the Fort Lewis Military Reservation) and when applicable, with private owners.

Railroad Crossings

Railroad crossings will be installed by the bored-crossing method only (see Figure 2.3-7) since open-cut construction is not feasible with railroads. The pipe will be installed in accordance with the latest requirements of the American Railroad Engineering Association. Since the minimum depth requirements for uncased crossings are 6 feet of cover in the ditches and a minimum 10 feet of cover below the rails, additional working space will generally be required to (1) allow the pipeline to reach the greater depth, and (2) provide an area to deposit the materials removed from the larger boring pit. The boring method used will be identical to that described above for roadways. Upon completion of boring, the pits will be backfilled, with the exception of the exposed ends of the pipe. These ends will be left exposed until the mainline spread reaches the railroad crossing and connects them to the rest of the pipeline.

2.3.6 HYDROSTATIC TESTING

The entire pipeline will be hydrostatically tested in accordance with DOT regulations and in compliance with the stipulations of the EFSEC Site Certification Agreement regarding water withdrawal and discharge. Pipe that is prepared for stream crossings will be ~~air~~ tested before placement. Pipe installed in rivers will be hydrostatically tested prior to installation. If leaks are detected, they will be repaired or the pipeline section replaced and the section retested.

Water for testing will be obtained from local streams or rivers and will be transferred to test sections. When hydrostatic testing is complete, the test water will be analyzed and treated if necessary to make it suitable for discharge back to the stream or river in compliance with the water withdrawal and discharge permits issued for the project. The water will be discharged into ponds or holding areas and discharged through filtering media before it enters any water course. Erosion protection measures will be incorporated into the water discharge procedures. Final discharge plans will be developed in consultation with EFSEC.

A minimum of three separate test sections will be required to test the pipeline. The middle section will not have access to enough water for testing; therefore, the water used to test the end sections will be pumped through the completed pipeline and used to fill and test the middle section.