SECTION 02020

SOIL INVESTIGATION DATA

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. This section summarizes available soil investigations.

1.2 PREVIOUS INVESTIGATIONS

A. Geotechnical engineering investigation reports for the design of the Northeast Oregon Hatchery Project (please note there may be references to sites that are no longer part of the project) include:

	Title/(Site)	By	Date
1.	Geotechnical Engineering Services, Proposed Fish Hatchery Facilities, Nez Perce Tribe, North Idaho (Cedar Flats, Yoosa Creek)	GeoEngineers	7/7/98
2.	Geotechnical Engineering Services, Proposed Fish Hatchery Facilities, Nez Perce Tribe, North Idaho (Cedar Flats, Yoosa Creek, Luke's Gulch, Newsome Creek, North Lapwai Valley)	GeoEngineers	10/9/98
3.	Geotechnical Engineering Services, Proposed Sweetwater Fish Hatchery, Nez Perce Indian Reservation, Sweetwater, ID.	GeoEngineers	10/16/98
4.	Results of Testing Exploratory Wells, Nez Perce Reservation, Idaho. Proprietary Report for the Nez Perce Tribe, Lapwai, ID (North Lapwai Valley)	P.G. Crosthwaite	1989
5.	Geophysical Evaluation of Potential Water Sources. Nez Perce Reservation. Proprietary Report for the Nez Perce Tribe, Lapwai, ID (North Lapwai Valley)	K.F. Sprenke	1988
6.	Hydrogeologic Analysis of Water Supply Potential for the Proposed North Lapwai Valley Hatchery Facility.	D.R. Ralston and K.F. Sprenke	10/98

7.	Hydrogeological Analysis of the Stites Site, Nez Perce Reservation, Idaho (Luke's Gulch)	Sprenke and Associates	1991a
8.	Reconnaissance Hydrogeologic Evaluation of Potential Water Well Locations South of Stites, Idaho, Nez Perce Reservation, Idaho.	Sprenke and Associates	1991b
9.	Hydrogeological Analysis of the Luke's Gulch Site, Nez Perce Reservation, Idaho.	Sprenke and Associates	1992b
10.	Geotechnical Exploration and Analysis, Sweetwater Springs Hatchery, Waha, ID; Project S98030.	Budinger and Associates	1998
11.	Hydrogeologic Analysis of the Sweetwater Springs Area, Idaho.	Sprenke and Ralston	1998

B. Copies of the reports discussed in the paragraph above are available for the Contractor's review; however, the Contractor shall satisfy themselves as to actual field conditions and shall assume full responsibility for any use or interpretations of the information and recommendations contained in the report. Owner, BPA, the Nez Perce Tribe and their representatives do not guarantee the correctness of the designations of any materials shown on the drawings or in the reports and other documents, nor any interpretations, deductions, or conclusions in any documents relative to subsurface conditions.

C. Copies of these reports may be reviewed by Contractors after March 28, 2000 at BPA's office at 905 NE 11th Ave. Portland, OR, the Nez Perce Tribal Fisheries office at 145 Lolo St. Lapwai, ID, and the office of Owner at 3780 SE Mile Hill Dr. Port Orchard, WA. One copy of each report will be provided to the single successful proposer upon receipt of a written request for the information.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all material, equipment and labor to perform demolition and demolition-related activities as shown on the Drawings and specified herein.

1.2 GENERAL

A. This section covers the dismantling, demolition, removal, and disposal of the designated facilities and clean-up and removal of existing site refuse. All materials resulting from the demolition work, unless specified otherwise, will become the property of the Contractor and will be disposed of in accordance with SECTION 02100.

1.3 SUBMITTALS

A. The following will be submitted for acceptance in accordance with SECTION 01340:

B. The Procedures Proposed for Demolition Work.

1. This procedure manual will provide for safe conduct of the work, removal and disposition of materials as specified, whether shown on the drawings or not, protection of property which is to remain undisturbed, and coordination with other work in progress. The procedures shall include a detailed description of the methods and equipment to be used for each operation and the sequence of operations.

1.4 DUST CONTROL

A. In addition to the requirements of SECTION 02100 the amount of dust resulting from demolition shall be controlled to prevent the spread of dust to haul road right-of-way, occupied portions of buildings, and to avoid creation of a nuisance or damage to crops in the surrounding area. Use of water will not be permitted when it will result in or create hazardous or objectionable conditions such as ice, flooding, and pollution.

1.5 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

A. In addition to the Contract Clause, same subject this paragraph, before beginning any demolition work, the Contractor will carefully survey all work areas and examine the drawings and specifications to determine the extent of the work. All necessary precautions will be taken to ensure against damage to existing facilities and trees to remain in-place, to be reused, or to remain the property of designated receivers of such property, and any damage to such facilities shall be repaired or replaced as approved. Existing facilities shall not be removed prior to approval of the submittal required by subparagraph 1.3.B.

B. The contractor shall install temporary fencing around those items trees, buildings, etc. to be protected. In the case of the trees the temporary fencing shall be placed at a point outside of the drip line.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 SALVAGE

A. Any items requiring salvaging are to be disassembled and carefully loaded into a lockable, transportable, container that affords protection during transport and is suitable for transportation to an off site location for long term storage unless otherwise approved by the ENGINEER.

B. The disassembled and removed components will be documented to allow re-assembly by others in reverse sequence at some point in the future.

C. All components shall be labeled and locations noted in the documentation above.

D. All small parts shall be placed in durable containers and identified by location/application for use in re-assembly.

E. All components shall be carefully blocked/stabilized in the shipping container(s) to avoid shifting and/or damage during transport including loading and unloading operations.

F. Any components damaged during disassembly, loading, transport or the off-loading of the holding container will be replaced in kind at the Contractor's expense.

3.2 DEMOLITION

A. All existing concrete slabs and other items not designated for salvage or to remain shall become property of the contractor and will be demolished and removed from the project sites.

3.3 DISPOSAL

A. Materials resulting from the demolition work shall be disposed of as stated in SECTION 02100. Rubbish and debris will be removed daily to prevent hazardous accumulation within the work areas. Materials that cannot be removed daily will be stored in areas as directed.

3.4 RESTORATION OF WORK AREAS

A. Work areas shall be graded and finished to designed contours and provide smooth transitions into natural drainage patterns, and grass will then be seeded. Depressions resulting from the removal of pavements, concrete and buildings will be filled with compacted Class I or II structural fill material and 6 inches of topsoil in accordance with SECTION 02200.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all material, equipment and labor to perform site preparation activities as shown on the Drawings and as specified herein.

1.2 GENERAL INFORMATION

A. This section covers clearing and grubbing areas as required for mobilization, excavation, topsoil placement, areas designated for replanting, and work where not specifically covered. Before commencing any work under this section, all existing utilities will be marked by the Contractor and protected during construction. Any artifacts found are considered to be archeologically sensitive and all work in the area shall be stopped No work shall proceed without the approval of the Nez Perce Cultural Resources Department.

1.3 SUBMITTALS

A. Submit a clearing plan for review in accordance with SECTION 01340.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 CLEARING OPERATIONS

A. General:

1. The areas to be cleared include all areas which are to form foundations for both gravel and asphalt pavements, all areas to receive surcharge fill, walks, buildings, shelters, tanks, topsoil and other landscaped areas, and other structures and paving materials.

2. Vegetative matter including grasses, trees, brush, roots, etc. shall be completely removed from the area within the project footprint, unless otherwise shown on the drawings.

3. No trees outside of the project footprint shall be disturbed without approval from the ENGINEER. Trees to be removed shall be cut as close to the ground level as possible. Stumps are to be pulled.

4. All trees, snags, brush, and other timber to be removed shall be felled onto the area designated to be cleared. The clearing away of down timber, vines, and vegetative growth will be performed in such manner as to remove all evidence of their presence from the surface of the areas involved, and shall be inclusive of sticks, stumps and branches, vines and grasses, weeds, and growing crops.

5. Brush and other vegetation removal will be cut off at ground level and the roots removed by grubbing methods described in this specification.

6. Contractor shall provide a 7-day notification to the Engineer and the Nez Perce Cultural Resources Department (NPCRD) prior to commencing site preparation activities. Contractor shall include 60 hours downtime for site preparation activities to allow for possible work stoppage orders for cultural resource investigations. Contractor shall coordinate with and cooperate with the NPCRD staff as directed by the Engineer. Contractor shall not recommence work until clearance is given by the Engineer.

7. Improvements: Storm drainage and structures shall be protected and kept open. Materials will be prevented from entering waterways.

3.2 GRUBBING OPERATIONS

A. Grubbing consists of the elimination of organic matter occurring below ground surface and of stumps, trunks, canes and stems of timber, root clumps, vegetative matter, and other debris remaining as a result of the clearing work. In areas to be grubbed for excavation, all stumps will be completely removed and the area grubbed through the use of a spike-tooth harrow or other method that will extract organic matter below the surface with no displacement of the soils to a depth of not less than 4 inches.

3.3 AREAS TO BE GRUBBED

A. The areas are as follows: all areas which are to form foundations for both gravel and asphalt pavements, walks, pads, buildings, embankments, ponds, shelters, tanks, topsoil and other landscaped areas, and other structures and paving material.

3.4 OWNERSHIP AND DISPOSAL OF MATERIALS

A. Unless otherwise directed, all materials, items, and debris (hereinafter collectively referred to as "material") involved, occurring or resulting from the clearing, grubbing, and cleanup work, shall become the property of the Contractor to be disposed of in conformance with the following: all material will be removed from the project area and will not be deposited on any property owned or controlled by BPA, the US Forest Service or the Nez Perce Tribe nor will any such material be left in an unsightly condition nor at any location which is visible to users of any public highway, road, or access point. Written permission to place material on private property or on land not owned or controlled by the BPA/Confederated Tribes will be obtained by the Contractor from the owner or other responsible party prior to placing the material thereon and evidence of such permission shall be furnished to the ENGINEER. The permit is to be in writing and will be so phrased as to absolve BPA, the Nez Perce Tribe and Owner from all responsibility and releases them from liabilities and claims in connection with the placement of material on such property.

3.5 PRESERVATION AND TRIMMING OF TREES, SHRUBS AND OTHER VEGETATION

A. Roots of trees outside of the excavation limits shall be protected from severe injury during all construction-related operations. All roots impacted by these operations will be cleanly cut so as to be flush with adjacent soil surface, using a hand-saw or other approved method. Injury to vegetation outside the designated clearing and grubbing area is to be avoided. All damaged trees other than those to be cleared and grubbed shall be repaired within 10 working days from date of original damage. Tree roots and limbs to be cut and repairs to damaged trees are to be performed under the supervision of a professional arborist.

B. A minimal amount of low hanging or unsound branches shall be removed as required from trees and shrubs, which are to remain in-place, utilizing approved tree surgery techniques. Branches over roadways and structures will be trimmed in conformance with good tree surgery practice under the supervision of a professional Arborist, to provide at least a 20-foot clearance above grade.

3.5 FILLING, BACKFILLING AND RESHAPING

A. Except in areas to be excavated, stump holes and other holes created during grubbing will be backfilled and compacted with compacted Class I or II structural fill material specified in SECTION 02200. All areas lying outside the clearing and grubbing limits on which work under this specification has been performed and all areas which have been disturbed by other operations in connection with this contract shall be smoothed and reshaped to blend them to surrounding contours or contiguous undisturbed areas; shaping requiring hand tools may be required. Fill material shall not be placed against tree trunks above original ground lines.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all material, equipment and labor necessary to install and maintain all pumps, piping, drains, well points, wells, and other facilities for the control, collection and disposal of groundwater or surface water for the proper construction of all work shown on the Drawings or specified within the contract documents.

B. Maintaining foundations and other parts of the Work free from water as required for constructing each part of the Work.

1.2 SUBMITTALS

A. The Contractor shall submit the following information in accordance with SECTION 01340.

1. A dewatering plan that includes details regarding the anticipated types and locations of various dewatering facilities and appropriate design calculations required to substantiate the dewatering plan.

2. Review by CRS of the dewatering system proposed by the Contractor will only be with respect to the basic principles of the methods the Contractor intends to employ. Review by CRS does not relieve the Contractor of the full responsibility for the adequacy of the dewatering system and for conforming with local, state, and Federal regulations.

1.3 DEFINITIONS

A. Special Dewatering: Dewatering by single- or multiple-stage well points or deep wells.

B. Hydrostatic Groundwater Level: The groundwater level at any location at the time of construction and prior to dewatering.

PART 2 PRODUCTS

2.1 DEWATERING

A. Dewatering wells, if used, will be single- or multiple-stage wellpoints or deep wells used for special dewatering and which fulfill the dewatering requirements specified in this Section. The materials and construction of the dewatering wells and any required observation wells shall be those selected by the Contractor and his dewatering specialist.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall review the available subsurface data for the project site prior to bidding. It is the Contractor's responsibility to evaluate the subsurface conditions at the project site with respect to required dewatering facilities.

B. The Contractor shall, at all times during construction, provide ample means and devices to remove promptly and dispose of properly all water entering excavations. Bottoms of the excavations shall be kept firm and acceptably free of standing water until the structures to be built therein are completed. The pumping and dewatering operations shall be carried out in such a manner that no disturbance to the bearing soil or to soil supporting overlying and adjacent structures from this or any other work will result. Discharged water shall be piped to an area acceptable to the Engineer and appropriate government entities. Such discharge shall not cause siltation or other negative environmental impacts on natural waterways or other property and will be in accordance with applicable Federal, State and Local regulations. At streamside construction and other locations where siltation or erosion may occur, silt fencing and/or other control measures acceptable to the jurisdictional authority for each site shall be installed, as required, to control and prevent siltation.

C. Precautions must be taken to ensure that partially completed structures will not float during construction. For structures, dewatering must be continuous, or other positive measures must be taken to prevent flotation or uplift of the structures until they are sufficiently heavy or strong to resist water pressures.

D. When failure to provide adequate dewatering and drainage causes disturbance of the soils below bottom grade, the Contractor must provide adequate dewatering, and excavate and refill the disturbed areas. Such extra work will be at the Contractor's expense.

3.2 DEWATERING REQUIREMENTS

A. The Contractor shall be responsible for designing, furnishing, installing, maintaining, and operating a dewatering system which will prevent loss of fines, boiling, quick conditions, or softening of foundation strata and maintain stability of bottoms of excavations so that every phase of the Work can be performed in the dry. The dewatering operations shall be such that the bottoms of all excavations are kept, at all times, firm, and in all respects acceptable to the Engineer as good foundation.

B. Wherever dewatering is used, in addition to the requirements of paragraph 3.1.D, the dewatering system must lower the groundwater level in the entire excavation at least 1 foot below bottom grade or the bottom of overexcavation of unsuitable material.

C. Existing wells and pumps may not be utilized for the Contractor's dewatering purposes.

D. Special dewatering will be required in any location where the soil and groundwater conditions are such that special dewatering is needed to prevent boiling or other disturbance to the subsoils and/or walls of the excavation.

3.3 INSTALLATION AND OPERATION

A. The location of every element of the dewatering system will be such that interference with excavation and construction activity is minimized

B. Prior to any excavation below the hydrostatic groundwater level, the dewatering system is to be placed into operation to lower the water levels as required and then will be operated continuously 24 hours per day, 7 days per week until all facilities and structures affected by the dewatering have been satisfactorily constructed; including placement of fill materials to an elevation above the hydrostatic groundwater level. In any event, the Contractor shall maintain the water levels low enough to fulfill the requirements of this Section and not allow the water level to rise until the constructed facilities are so complete that the water can be allowed to rise without damaging any facility and its foundation, or surrounding areas and structures. The Contractor shall provide continuous superintendence during all periods of dewatering.

C. The Contractor shall provide complete standby equipment and power sources available for immediate operation as may be required, to adequately maintain the dewatering on a continuous basis in the event that all or any part of the dewatering system may become inadequate or fail.

D. The Contractor may use sheeting in areas with no excavation restrictions, at their option, to help achieve the dewatering requirement as specified in this Section. If

the Contractor uses sheeting, he will submit a sheeting design by a Structural Engineer, registered in the state of Oregon.

E. When the dewatering system does not meet the specified requirements, and as a consequence loosening or disturbance of the foundation's strata, instability of the slopes or damage to the foundations or structures occur, the contractor will at his own expense supply all materials, labor and perform all work required for restoration of foundation soil, slopes, foundation, or structures, to the satisfaction of the Engineer.

3.4 REMOVAL

A. An adequate weight of backfill material to prevent flotation of pipes or structures will be in place before any dewatering systems are shut off.

B. At the completion of the dewatering work, all units of the dewatering system installed by the Contractor shall be removed and the holes backfilled with clean sand or low strength cement grout.

END OF SECTION

SECTION 02170

COFFERDAMS AND PROTECTIVE WORKS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all design, labor and equipment necessary to construct and maintain all cofferdams and protective works necessary during construction of facilities located in or adjacent to static or moving bodies of water as specified herein.

B. Remove all of cofferdams or other temporary protective works upon completion of the facilities located in or adjacent to bodies of water.

C. Restoration of the areas impacted back to their original condition.

1.2 SUBMITTALS

A. The contractor shall submit a proposed plan for cofferdams and protective works in accordance with SECTION 01340 which will address, as a minimum, the following items:

1. Type of cofferdam or other protective works to be used.
2. Sequence of construction for cofferdam or other protective works related Work items.
3. Provision for limiting siltation or other effects on the rivers, streams and creeks and water bypass areas.
4. Provisions for removal of temporary cofferdams or protective works and replacement or grading of the foundation areas following removal.
5. Provisions for excavating and dewatering insides of the cofferdams or protective works.
6. Regulatory requirements for cofferdams sand cofferdam related activities.
7. All calculations required to substantiate the design of the cofferdam and protective works.

B. The submittal will be prepared and signed by a Professional Engineer registered in the State of Oregon experienced with cofferdam design.

C. The plan shall be submitted a minimum of 20 days prior to planned cofferdamming work, shall be subject to review, permitting and acceptance by governing authorities and the owners of any facilities utilized for water conveyance; as well as Owner however, these reviews will not relieve the Contractor of full responsibility for the adequacy of the cofferdams and protective works.

1.3 DEFINITIONS

A. Original Ground. The elevation of the original ground surface before construction (including original ground surfaces under water).

B. Finish grade. Represents the grade required by the Contract Documents to be the finished ground surface upon completion of construction.

PART 2 PRODUCTS

2.1 GENERAL

A. The type of construction used for cofferdams or other protective works (e.g., sheetpile cofferdams, or sandbag cofferdam) shall be at the choice of the Contractor, provided that the selected alternative fulfills the requirements of project permits and the Contract Documents.

B. Cofferdams or other protective works shall be constructed, maintained, and removed using materials and methods which do not produce siltation or other degradation of the water quality of the river or stream which exceeds the limits of applicable federal, state and local regulations.

C. Cofferdams shall be designed and constructed of such a size that in no instance they encroach within 10 feet of disturbed areas for other work.

D. Sheeting or any other methods requiring disturbance below original ground surface may not be used in any archeologically sensitive areas.

2.2 WOOD SHEETING

A. Wood used for sheeting, shoring and bracing will be sound; straight grained; free from shakes, loose knots, and other defects liable to impair its strength or durability; and will be Southern Yellow Pine, Douglas Fir, or equivalent and will be either tongue-and-grooved or splined. Wood sheeting will not be less than nominal 2 inches thick.

2.3 STEEL SHEETING

A. Steel sheeting will conform to ASTM A328.

2.4 STRUCTURAL STEEL

A. All structural steel will conform to ASTM A36.

2.5 SANDBAGS IN WATER

A. All temporary sandbags if used to be placed in water will conform to all applicable federal, state and local laws and regulations.

PART 3 EXECUTION

3.1 COFFERDAMS

A. Cofferdams shall be designed and construction methods will be selected by the Contractor.

The design of the cofferdams will take into account the range of flows which can be expected during the time allowed for in-water construction. The contractor/designer shall review available flow records to make this determination and if there are not flow records available, utilize generally accepted hydrologic models to approximate the range of expected design flows with an appropriate factor of safety.

B. Cofferdammed areas shall be dewatered such that the bottoms of the excavations within the cofferdams are firm, free of standing water, and in all respects acceptable to the Engineer as foundation. The dewatering methods used shall prevent boiling, quick conditions, or softening of foundation strata and shall maintain the bottom of the excavation in a condition so that every phase of the Work can be performed in the dry. Dewatering shall be performed in accordance with the requirements of SECTION 02140.

C. After construction, the cofferdams shall be removed after areas are graded to finished grade, where indicated, or otherwise returned to original grades; however, removal of cofferdams will not occur prior to the installation and backfill of all buried utilities which lie within 30 feet of the cofferdammed areas. If options have been selected with below grade construction, it may be possible to cut off the structures at grade if the Contractor obtains approval of the appropriate jurisdictional authority.

D. Any loss of water and any damage to ground, structures, facilities, agricultural projects, fishery resources, or any other existing items that may be affected by the

Contractor's cofferdam operations, shall be the responsibility and liability of the Contractor and will be repaired or restored by the Contractor as required, to the Engineer's satisfaction. Any damage or injury to a person directly or indirectly caused by the Contractor's cofferdam operations shall be the responsibility of the Contractor.

E. It is the Contractor's responsibility to design, install, and maintain functionally effective and structurally sound cofferdams. The failure of the cofferdam either in function or structurally for any reason, subsurface conditions inclusive, and the consequences of such a failure and liability for such a failure, will be the responsibility of the Contractor. In the event the cofferdam has failed or is not functional as designed; the Contractor shall repair or rebuild the cofferdam at no additional cost to Owner

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all labor, equipment, and materials for such items as excavation for underground vaults, inwater excavation, subgrade excavation, embankment and grading fill, surcharge grading, shaping, topsoil, and topsoil placement, and finishing to the lines and grades shown for construction of roads, paved areas, sidewalks, and topsoil areas as shown on the Drawings and as specified herein.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

ASTM C136-96a	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D1557-91	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
ASTM D 4759-88 (R1992)	(1988; R 1992) Determining the Specification Conformance of Geosynthetics

B. United States Department of Agriculture - Forest Service

Forest Service Handbook 2509.22 - Soil and Water Conservation Practices Handbook (USFS 2509.22).

C. Oregon Department of Transportation Standard Specifications for Construction (ODOT)

1.3 MATERIALS SUBMITTALS

A. Source acceptance of all material shall be as described in SECTION 01340, SUBMITTALS, except as stated below.

B. The Independent Testing Laboratory will obtain material samples and perform the testing of the material. Up to two samples for each material will be tested.

C. Samples of geotextiles fabrics and data indicating physical properties an materials utilized in the manufacturing of the geotextile.

D. Do not deliver materials to the site prior to submittal acceptance.

E. The contractor shall be aware of measures necessary for the control of noxious weeds and other specific requirements for sites within the jurisdictional boundaries of the US Forest Service as established in USFS 2509.22.

1.4 QUALITY ASSURANCE SUBMITTALS

A. The contractor shall hire an independent commercial testing laboratory to establish moisture/density curves and to conduct field testing. Prior to the start of the earthwork, submit to the Engineer (for record purposes) the laboratory's name and experience.

B. Submit laboratory test reports for each test. The reports shall be consecutively numbered, stamped in red as "Conforming" or "Non-Conforming" with the specifications, signed by the laboratory's authorized representative, and sent by the laboratory direct to the Engineer and the owner by the contractor.

PART 2 PRODUCTS

2.1 US FOREST SERVICE REQUIREMENTS

A. The contractor shall be aware of measures necessary for the control of noxious weeds and other specific requirements for sites within the jurisdictional boundaries of the US Forest Service as established in USFS 2509.22.

2.2 MATERIALS

A. Embankment Material for Paved Areas

1. Embankment material for paved areas shall be gravely, free of soft, organic material, roots, refuse, other extraneous or harmful materials, and shall meet the requirements of ODOT Section 00330 Earthwork and sub-section 00330.42 Embankment fills and backfills and other related sub-sections.

B. Embankment Fill

1. Embankment Fill material shall consists of crushed rock and sand uniformly graded from coarse to fine. It shall be free of soft, organic or frozen material, roots, refuse, other extraneous or harmful materials, and shall meet the following requirements of ODOT Section 00330 Earthwork and sub-section 00330.15 selected stone backfill and other related sections.

C. Topsoil

1. Topsoil shall be in accordance with ODOT Section 01040, sub-section 01040.14 and other related sections.

2. Testing Topsoil: Topsoil from supplier shall be tested for the following by an approved soils laboratory:

   a. Standard soil test for Oregon including: organic content pH analysis and chemical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plants specified.

   b. Mechanical gradation analysis.

D. Geotextile

1. Geotextiles shall be in accordance with ODOT Sections 00350 Geo-synthetic installation, 02000 Materials sub-section 02302 and Section 02270 of the specifications

2. Geotextiles shall be labeled, handled, and stored in accordance with ASTM D 4873 and as specified herein. Each roll shall be wrapped in an opaque and waterproof layer of plastic during shipment and storage. The plastic wrapping shall not be removed until deployment. Each roll shall be labeled with the manufacturers name, geotextile type, lot number, roll number, and roll dimensions (length, width, gross weight). Geotextile or plastic wrapping damaged as a result of storage or handling shall be repaired or replaced, as directed. Geotextile shall not be exposed to temperatures in excess of 60 degrees C (140 degrees F) or less if recommended by the manufacturer.

J. Rock Excavation

1. Rock excavation is defined as solid ledge rock, which in the opinion of the Engineer requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with power-operated tools.

2. No soft or disintegrated rock; hard-pan or cemented gravel that can be removed with a hand pick or power operated excavator or shovel; no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere; and no rock outside of the minimum limits of measurement allowed, which may fall in to the excavation, will be measured or allowed.

K. Boulder Excavation

1. Boulder excavation is defined as the removal of masses of igneous, sedimentary or metamorphic stone material which has one or more dimensions of 18" or greater or a displacement of 3 cubic feet or more, which is removed without drilling, blasting or splitting.

PART 3 EXECUTION

3.1 GRADE CONTROL

A. The Contractor is responsible for setting grade stakes. Grade stakes will be set showing alignment and grade to the nearest 0.05 foot.

3.2 EXCAVATION

A. All excavation work shall be performed with mechanical equipment. Blasting shall not be performed at any of the sites.

B. All rock of the site that is determined by the Engineer as potentially unstable shall be removed.

3.3 CONSTRUCTION OF SUBGRADE

A. Excavation and Compaction of Subgrade for Pavement Areas, Foundations and Areas that will Receive Vehicular Traffic.

1. The existing ground or embankment shall be removed to a depth which will allow construction of the subgrade to the lines, grades, and slopes indicated on the drawings. If the established slopes of the excavation are undercut, the undercut slopes shall be reformed. The subgrade shall be processed to eliminate materials too large for grading and compacted.
2. No boulders or rock shall protrude above the tip of the base course. Boulders and rock encountered in excavation of subgrade shall be removed to a depth of 6-inches below finished subgrade elevation.

3. The moisture content of the subgrade shall be within 2 percent of optimum as determined by ASTM D1557 during the compaction effort.

4. Underlying material which is too soft to permit proper compaction shall be loosened, aerated (or excavated and replaced with satisfactory materials) and the entire subgrade shall be compacted and shaped to line, grade, and cross section as specified. The underlying material will be considered too soft where weaving, pumping, wheel deflections, or rutting occurs under the

weight of a fully loaded 10 yard dump truck filled with aggregate, or if so determined by the Engineer.

Soft spots that can not be corrected as stated above shall be excavated to a 2-foot depth and backfilled with crushed rock material compacted in equal lifts. Grading, temporary ditching, pumping, or other operations shall be performed as are necessary to provide drainage of the excavation areas during construction. Grading operations shall not take place while the materials are too wet to achieve satisfactory compaction.

B. Topsoil Areas

1. Area to receive topsoil shall be staked and approved prior to initiation of work. The existing ground designated to receive topsoil shall be cleaned of all loose debris and vegetation; the subgrade soil shall be scarified to a two-inch depth for bonding of topsoil and subsoil.

3.4 PLACEMENT OF FILTER FABRIC

A. Surface Preparation

1. The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Compaction of the subgrade shall follow the procedures specified in paragraph 3.3. The materials making up the subgrade shall not be frozen. The installation of filter fabric and the placing and compaction of fills shall not be performed when the underlying materials are frozen.

B. Installation

1. The Engineer shall be present during handling and installation. No hooks, tongs or other sharp instruments shall be used for handling geotextile. Rolls shall not be lifted by use of cables or chains in contact with the geotextile. Geotextile shall not be dragged along the ground. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced. The geotextile shall be laid smooth so as to be free of tensile stresses, folds, and wrinkles. On slopes the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

C. Protection

1. The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed by the Engineer in accordance with the manufacturer's recommendations. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. Staples or pins shall not be used to hold the

geotextile in place. The geotextile shall not be left uncovered for more than 5 days during installation. The initial loose soil lift height over the geotextile shall be between 8 inches and 12 inches. Equipment with reduced ground pressures shall be used to place the first lift over the geotextile. Overlying materials shall be deployed such that the geotextile is not shifted, damaged, or tensioned. Cover soil shall be placed from the bottom of any slope upward. Cover soil placed from a bucket shall be dropped from a height no greater than 12 inches.

D. Seaming

1. Seams shall be sewn as recommended by the manufacturer. Seams shall be tested at a frequency as specified in ASTM D 4884. Seam strength shall meet the minimum requirements specified in Table 1. The thread at the end of each seam run shall be tied off to prevent unraveling. Seams shall be on the top side of the geotextile to allow inspection. Skipped stitches or discontinuities shall be sewn with an extra line of stitching with 18 inches of overlap.

E. Repairs

1. Geotextile damaged during installation shall be repaired as recommended by the manufacture. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile which cannot be repaired shall be replaced.

3.5 CONSTRUCTION OF SURCHARGE EMBANKMENT AND GRADING FILLS

A. Preparation of Ground Surface for Embankment and Grading Fill

1. Clearing and grubbing of ground surfaces shall be completed before placement of any materials. Sloped ground surfaces steeper than 1V on 4H on which fill is to be placed shall be scarified in such manner that the fill material will bond with the existing surface. The top 4 inches of the entire existing ground surface on which an embankment, fill or surcharge is to be placed shall be scarified or broken up with a spike-tooth harrow in such manner that the material will bond with the existing surface. Embankments and fills shall not be constructed on frozen materials. Where embankments or fills on side hill slopes are so narrow that the construction and equipment cannot place the materials in horizontal layers, the side hill shall be excavated sufficiently, or the embankment or fill shall be widened to permit hauling, placement, and compaction equipment operation.

B. Placement of Embankment Material for Paved Areas and Grading Fills

1. Embankments for Paved Areas: Embankment material for paved areas will be placed and compacted to the lines, grades, and slopes shown. The material shall be spread in layers not more than 8 inches in uncompacted thickness in such manner to avoid segregation and obtain a reasonably well graded mass. The moisture content of the embankment material shall be within 2 percent of optimum as determined by ASTM D1557.

2. Grading Fill: Grading fill shall be placed and spread in layers not more than 8-inches in uncompacted thickness in such manner to avoid segregation and obtain a reasonably well graded mass. Materials shall be dumped on top of the lift being placed at the leading edge and spread. The existing ground or grading fill for topsoil areas shall be built-up to a depth which will allow placement of topsoil to the depth indicated for that area, with a final grade to match finished drawing contour elevations shown on the drawings.

C. Placement of Embankment and Surcharge Fill

1. Embankment Fill: Embankment fill shall be placed and compacted to the lines, grades, and slopes shown. The material shall be spread in layers not more than 8 to 10 inches in uncompacted thickness in such manner to avoid segregation and obtain a reasonably well graded mass. The moisture content of the embankment material shall be within 2 percent of optimum as determined by ASTM D1557. Each lift of embankment fill material placed up to the finished grade shall be compacted to a minimum of 95% of the maximum dry density as per ASTM D1557.

2. Surcharge Fill: Surcharge fill shall be placed and compacted to the lines, grades, and slopes shown. The material shall be spread in layers not more than 8 to 10 inches in uncompacted thickness in such manner to avoid segregation and obtain a reasonably well graded mass. The moisture content of the embankment material shall be within 2 percent of optimum as determined by ASTM D1557. Each lift of surcharge fill material placed above finish grade for the purpose of preloading shall be compacted to a minimum of 95% of the ASTM D1557 Dry density.

3. Embankment and Grading fill slopes shall be dressed and compacted to near continuous lines consistent with the materials being placed. All irregularities shall be smoothed out by repositioning the slope materials to a tolerance of minus 0.0 feet to plus 0.25 feet. Materials displaced outside of the toe of the slope shown shall be retrieved.

3.6 COMPACTION

A. Compaction Operation

1. A coverage of the compaction equipment shall consist of sufficient trips of the specified equipment to provide complete coverage of the area being compacted.

2. Succeeding layers of embankment or fill shall not be placed until the preceding layer has been compacted as specified. If the surface of any layer is crusted, it shall be moistened and scarified as directed before the succeeding layer is placed.

B. Sprinkling

1. Water shall be applied to each layer of material, to provide near optimum moisture content for the compaction operation. Adequate water supply and sufficient water trucks shall be furnished to assure delivery of sufficient water as required.

3.7 PLACEMENT OF TOPSOIL

A. Prior to placement of topsoil, the grades and slopes of areas to receive topsoil shall be verified to ensure positive drainage and that the areas are acceptable to the Engineer. Topsoil shall be evenly spread over the specified areas to the depth shown. After topsoil has been spread, all large clods, hard lumps, rocks 1 inch in diameter and larger, and litter shall be racked up and removed.

B. Topsoil shall be placed at near optimum water content for compaction. Contour irregularities shall not exceed plus 0.1 feet or minus 0.0 feet.

C. Topsoil shall not be placed when the ground is frozen or excessively wet. A coverage of the compaction equipment shall consist of sufficient trips of the equipment to provide complete coverage of the area being compacted.

3.8 DRAINAGE AND DEWATERING

A. Drainage

1. Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes, and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation will be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

B. Dewatering

1. Ground water flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation, and to eliminate interference with orderly progress of construction. French drains, sumps, ditches, or trenches will not be permitted within 3 feet of the foundation of any structure except with specific written approval, and only if restoration of the affected foundation areas can be made in conformance with these specifications. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in-situ material. While the excavation is open, the water level shall be maintained continuously at least 1 foot below the working level.

3.9 MAINTENANCE WORK

A. After work in this section is completed and accepted for each site, temporary or permanent erosion control measures, berms, embankments, grading fillers and topsoil areas shall be maintained until the end of the contract. Sloughed slopes and settlement areas, and eroded areas with rills greater than 1 inch deep shall be repaired and reseeded, and all obstructions, deposits or loose materials, debris, or other objectionable materials shall be removed. Repairs shall be made to the same specification requirements as the original construction. Erosion control measures specified in SECTION 02270 shall be used to prevent reoccurrence of damage.

END OF SECTION

SECTION 02220

STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all materials, labor and equipment for the excavation, backfill and compaction required for the installation and construction of structures and other items not specified elsewhere as shown on the Drawings and as specified herein.

1.2 RELATED SECTIONS

A. SECTION 01400 - Quality Control

B. SECTION 02050 - Demolition

C. SECTION 02140 - Dewatering

D. SECTION 02170 - Cofferdams and Protective Works

E. SECTION 02221 - Trenching, Backfill, and Compaction

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM):

ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D1557	Moisture-Density Relations of Soils Using a 10 pound (4.54 kg) Rammer and an 18-inch (457 mm) Drop

B. United States Department of Agriculture - Forest Service

Forest Service Handbook 2509.22 - Soil and Water Conservation Practices Handbook (USFS 2509.22).

C. Oregon Department of Transportation Standard Specifications for Construction (ODOT).

1.4 SUBMITTALS

A. Submit the following information in accordance with SECTION 01340:

1. Certified test results that Structural Fill, Structural Backfill, Structural Backfill, and vapor barrier Geotextile Fabric, Structural Gravel Base Course and Sand Bedding meet all requirements specified herein.

2. Proposed method of excavating and backfilling in areas within 30 feet of any water body, still or moving, natural or man-made. Shoring, if used, will be indicated, as will backfill material types and mixes.

1.5 JOB SITE CONDITIONS

A. Utilities

1. The Contractor shall at all times take extreme and proper precautions for the protection of utility lines and other surface and subsurface improvements. The Contractor shall be responsible for the repair of any items damaged by construction operations and they shall be repaired at the Contractor's expense and in compliance with the requirements of the utility owner and/or Owner

B. Stockpiles

1. All stockpile locations shall be acceptable to the Engineer and shall be located so as not to interfere with other work or disturb adjoining property owners.

C. Weather Limitations

1. The work described in this section of the Specifications shall not be performed unless the weather conditions are appropriate, in the opinion of the Engineer, for such work. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction. Work in muddy or frozen ground will not be allowed.

1.6 SUBSURFACE CONDITIONS

The Contractor shall thoroughly familiarize himself with the existing soil conditions at the site by personal examination of the site and the subsurface investigation data described in SECTION 02020.

PART 2 PRODUCTS

Work completed as part of 02220 Structural Excavation, Backfill and Compaction shall completed in accordance with ODOT Section 00501 Bridges, 00501 Structural Excavation and Backfill and related sub-sections**.**

2.1 STRUCTURAL FILL

A. Structural fill shall be a free-draining mineral soil, free from organic matter, frozen or lumpy materials, vegetation, roots, debris and any other deleterious matter. Structural fill shall meet the following requirements when tested in accordance with ASTM C136.

B. Structural fill may be imported from off-site sources or, at the Contractor's option and if feasible, may be developed from on-site materials with proper processing such that it meets specified requirements.

2.2 STRUCTURAL EXCAVATION

A. Structural excavation includes, but is not restricted to, earth, gravel, and all such hard and compact materials such as boulders, hardpan, and bedrock that may be encountered in performing structural excavation. All structural excavation required for completion of the work shall be considered unclassified.

2.3 VAPOR BARRIER

A. A vapor barrier shall be installed where indicated on the Drawings.

B. The vapor barrier shall consist of an opaque 6-mil polyethylene sheeting..

2.4 SWALE ROCK LINING

A. Swale rock lining (rock) shall consist of sub-rounded, naturally occurring river rock. Such rock will have smoothly rounded corners at the edges of all fractured faces with no sharp angles allowed. The rock selected for this material shall closely resemble those rocks found in the local river basins with consideration given to long term stability of the installation.

B. Swale rock lining material shall consist of hard, dense, sound stone. Thin slab type stones and flaking rock will not be acceptable. River rock shall be resistant to weathering and to water action, free from overburden, spoil, shale and organic material and shall range from 35 lbs. (0.2 cu.ft.) to 60 lbs. (36 cu.ft.) with at least 75% weighing 45 lbs. or more.

C. Neither breadth nor thickness of a single stone should be less than one-fourth its length. Fully rounded stone or boulders will not be acceptable. Thin slab stone, shale or stone with shale seams will not be acceptable.

D. The sources from which the swale rock will be obtained shall be selected well in advance of when the rock will be required in the Work. If, in the opinion of the Engineer, testing is required, suitable samples of rock shall be taken in the presence of the District at least 25 days in advance of the time when placing river rock is expected to begin.

E. Each load of swale rock shall be reasonably well graded.

2.7 GEOTEXTILE FABRIC

A. Geotextile fabric if required shall meet the requirements as specified in Section 02200.

PART 3 EXECUTION

3.1 PREPARATION

A. Dewatering as required shall be performed in accordance with the provisions of SECTION 02140.

B. Cofferdamming, where necessary, shall be performed in accordance with the provisions of SECTION 02170.

3.2 EXCAVATION

A. General

1. The Contractor shall perform all excavation and backfill work to the lines, dimensions and elevations indicated on the Drawings; except, that where organic or other unsuitable foundation materials are encountered, such materials will be removed by and at the expense of the Contractor and as directed by the Engineer.

2. Where unsuitable foundation materials such as silty soils are found they shall be removed to a depth of 2 feet below subgrade or to granular material free of silts and replaced with compacted..

3. Suitable excavated material required for backfill shall be separately stockpiled in project areas that do not interfere with construction activities and are acceptable to the Engineer.

4. Excess material from excavation operations either unsuitable for Class III Backfill or beyond the needs of the project, shall be legally disposed of off the project site by the Contractor at their expense. Any excess material from excavation and other operations, suitable for backfill, shall be utilized as much as possible for grading fill in accordance with SECTION 02200.

5. Proper allowances shall be made for construction, dewatering, and shoring.

6. Protect bottoms of all excavations from free-standing water and frost. Do not pour concrete on wet or frozen ground.

7. Where soft spots are encountered, all defective material shall be removed and replaced with compacted structural backfill as specified herein at no additional cost to the contract.

8. Provide adequate survey control to avoid unauthorized over-excavation.

9. Do not over-excavate without written authorization of Engineer.

B. Excavation Supports

1. All excavations over five (5) feet in depth shall be either be sloped to a maximum slope of 1 (horizontal) to 1 (vertical), provided that overhanging boulders, if encountered, are not excessively loosened and extensive caving does not occur, or properly braced. Should boulders be present or caving conditions exist, slopes shall be inclined at a flatter angle.

2. The Contractor shall provide and use whatever sheeting, bracing, shoring, or cribbing access and escape devices as may be required to properly protect the workmen and their work and insure safe working conditions in accordance with all applicable regulations.

3. Sheeting, bracing, and shoring shall be designed by a Professional Engineer, registered in the State of Oregon, and built to withstand all loads that might be caused by earth pressures, surcharges, hydrostatic pressure and/or by adjacent structures and shall be rigid, maintaining shape and position under all circumstances.

4. Bracing, sheeting, and shoring shall be arranged so as not to place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.

5. Care shall be exercised in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported unless prior acceptance of cutting off and leaving below grade materials is obtained from the Engineer.

6. In addition to the provisions specified here, the Contractor will abide by the rules and regulations governing excavation work of the Occupational Safety and Health Administration (OSHA), if a conflict exists, the more stringent of the provisions, rules or regulations shall apply.

3.2 FOUNDATION PREPARATION

A. No backfill materials shall be placed until the foundation has been suitably dewatered and prepared as specified herein.

B. The upper 12 inches of the foundation subgrade shall be moistened or dried, and compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D1557.

1. The subgrade shall be proof rolled with a fully loaded dump-truck provided with an operator by the Contractor at no additional cost to Owner in accordance with the requirements specified in SECTION 02200.

2. Any zones of soft or loose soil identified during proof rolling shall be repaired at the Contractor's expense through excavation to a depth of 2 feet or, in the opinion of the Engineer , firm soil, whichever is less and replacement with structural fill placed in accordance with this specification.

C. After preparation and acceptance of the foundation subgrade, geotextile shall be placed and seamed in accordance with the manufacturer's instructions if required**.**

3.3 BACKFILL AND COMPACTION

A. All backfill placement shall be performed in accordance with the details shown on the Drawings and the provisions contained in these Specifications; except that for surface water intake structures. At surface water intake structures Class II Structural Backfill will not be used in the indicated zones. Embankment Zone I materials will be substituted for Class II Structural Backfill.

B. When backfilling, extra care must be taken so that no damage will occur to foundations or related structures.

C. Backfill materials shall not be placed, spread, or compacted at an unsuitably high moisture content during adverse weather conditions. When work is interrupted by heavy rain, backfill operations shall not be resumed until field tests indicate the moisture content density of the backfill areas are within specified limits.

Should the addition of water to backfill materials be required to achieve specified densities, the Contractor shall obtain, transport and add such water at his expense.

D. The distribution of embankment backfill shall be such that the backfill is free from lenses, pockets, streaks, lumps or layers of material differing substantially in texture or gradation from the surrounding material. The right to designate locations for placement of each load of Embankment backfill material is reserved for the Engineer.

E. Jetting will not be permitted.

F. Structural fill shall be placed in a single loose lift of sufficient depth to achieve a 6 inch compacted in place depth structural fill will be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557.

G. Structural Backfill shall be placed in loose lifts not exceeding 8 inches in thickness and uniformly compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

H. Structural Backfill shall be placed in loose lifts not exceeding 10 inches in thickness and uniformly compacted tot least 90 percent of the maximum dry density as determined by ASTM D1557.

I. Structural Gravel Base material shall be placed in lifts not exceeding 8 inches in thickness and uniformly compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Install to overall thickness as shown on Drawings.

J. Vapor barriers shall be placed as on subgrade as noted on the Drawings. All subgrade receiving vapor barrier shall be prepared such that there are no exposed protrusions or sharp edges which would be harmful to the integrity of the polyethylene sheeting.

1. The vapor barrier shall be lapped a minimum of 12 inches where necessary to place adjoining sheets.

2. The vapor barrier shall be anchored in such a manner to minimize disturbance of the sheeting when structural fill is placed.

K After each layer has been compacted, it shall be tested to verify that the required density has been achieved. Copies of the test results shall be submitted to the Engineer. Any layer or portion of a layer which has not attained the required density shall be scarified, moisture added if required, and recompacted until the required density is obtained at no additional expense to the contract

3.4 SAND BEDDING

A. Sand bedding shall be placed on the prepared geofabric and shall be placed as close as possible to the lines, grades, and thicknesses shown on the Drawings.

B. Sand bedding shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing of sand bedding material in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.

C. A tolerance of plus or minus 2 inches from the thickness of the sand bedding is allowable, except that either extreme of such tolerance shall not be continuous over an area greater than 50 square feet.

3.5 TOLERANCES

A. Finished surfaces will be tested with a 10-foot straightedge or other acceptable device. The variation above or below the testing edge of the straightedge between any two contacts with the surface shall not exceed 0.10 foot. Any areas not complying with this tolerance will be reworked and retested at the expense of the Contractor to obtain conformity.

3.6 FIELD QUALITY CONTROL

A. Any area tested and shown as not meeting the Specifications shall be reworked and retested at the Contractor's expense until it complies with the requirements of these Specifications.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILL AND COMPACTION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes control of trenching, backfilling and compaction for the installation of structures and utility lines of all types to the depths and dimensions shown on the Drawings and as specified herein.

1.2 EXCAVATION

A. All excavation for the Work is considered to be unclassified and includes but is not restricted to earth, gravel, sand, and hard and compact materials such as cobbles, boulders, hardpan, and rock.

1.3 SAFETY AND PROTECTION

A. The Contractor shall barricade open excavations occurring as part of this work and post warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required by applicable safety regulations.

B. The Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining washout, and other hazards created by all earthwork related operations.

C. The Contractor shall proceed with caution in the excavation so that exact location of underground structures, both known and unknown, may be determined.

D. Trenches and excavations shall be sheeted, shored, and braced where required in a manner consistent with established safe practices and in accordance with all applicable safety regulations.

E. The Contractor shall provide all materials, equipment and labor necessary to provide support to pipes, manholes, footings and foundation walls, etc. during excavation and backfilling at all locations.

1.4 EXISTING CONDITIONS

A. No existing underground utilities are shown on the Drawings. It shall be the Contractor's responsibility to determine and verify the location of underground utilities and to protect all utilities not designated for removal. Should incorrectly or improperly shown piping or other utilities be encountered during trenching, the Contractor shall notify the Engineer. Any damage shall be repaired to the satisfaction of Owner and utility owner at the Contractor's expense.

1.5 SUBMITTALS

A. Submit certified gradation and uniformity coefficient laboratory results from source or supply for all bedding material specified herein and as outlined in SECTION 01340.

1.6 SOIL INVESTIGATION DATA

A. Contractor shall thoroughly familiarize himself with the existing soil conditions of the site by personal examination of the site and the soil investigation data described in SECTION 02020.

PART 2 PRODUCTS

2.1 BEDDING MATERIAL FOR PIPE

A. The following pipe materials shall be considered as Rigid pipe; ductile iron and cast iron; flexible pipe; steel pipe, concrete cylinder pipe, polyvinyl chloride (PVC) and high density polyethylene (HDPE):

B. Bedding material for flexible pipe shall be clean sand/gravel mixture in accordance with ODOT section 00405 subsection 00405.12 and free from organic matter and conforming to the following gradation when tested in accordance with ASTM D 422:

2.3 STRUCTURAL FILL

A. Structural backfill material shall be as described in SECTION 02220 as noted on the Drawings.

PART 3 EXECUTION

3.1 CONTROL OF WATER

A. The Contractor shall furnish, install and operate all necessary equipment to keep trenches free from water during construction and shall dewater and dispose of the water in accordance with all local, state, and federal requirements. The Contractor shall at all times have available and in good working condition sufficient pumping equipment for dewatering for all emergencies, including power outage, and shall have available at all times competent workmen for the operation of the pumping equipment. All dewatering activities, including dismantling, shall comply with Oregon Department of Environmental Quality requirements.

B. Prior to excavation activities, the Contractor shall submit a complete dewatering plan to Owner as specified in SECTION 02140.

3.2 EXCAVATION

A. Contractor shall excavate as required to construct facilities shown. All noncombustible excavated material not required as fill elsewhere in the project shall be disposed in areas designated for waste disposal on the Drawings.

B. Except with specific approval of the Engineer not more than 100 feet of open trench shall be excavated in advance of laying pipe. All operations shall be carried out in an orderly fashion.

C. Width of trenches for pipes shall be not less than outside pipe diameter plus 12 inches nor greater than outside pipe diameter plus 18 inches of the pipe installed, unless otherwise specified on the Drawings or where existing conditions shall not permit.

D. Bottom of trench: carried to the lines and grades shown on the Drawings with proper allowance for thickness and type of pipe bedding specified.

E. Should Contractor, through his own negligence or other fault, excavate below designated lines, such excavation shall be replaced by the Contractor at the Contractor's expense. Excess excavation below pipes shall be replaced with material meeting the requirements of section 2.1 B compacted to a minimum of 95% of maximum density as determined by ASTM D1557.

F. The Contractor shall protect excavations from caving, flooding or other source of

3.3 PLACING PIPE BEDDING MATERIAL

A. After bottom of trench has been excavated to proper depth and grade and brought to a reasonably flat surface and dewatered, bedding material shall be placed as shown on the Drawings.

B. Pipe bedding material shall be placed, by the Contractor, in trench without causing any excavated material to slide into trench or any cave-in of trench walls. Place and compact to 95% of maximum density, as determined by ASTM D1557.

C. Any pipe bedding material required due to unauthorized over-excavation or made unsuitable due to mixture with trench side material or excavated material shall be removed and replaced by the Contractor at the Contractor's expense.

3.4 BACKFILLING OF TRENCHES

A. Trenches at pipe joints shall not be backfilled until pipeline has been tested.

B. Remove screeds, shoring, wood forms, debris and other decomposable matter from areas to be filled.

C. Initial backfill: Hand backfill in a maximum of 6 inch lifts using bedding material the level shown on the Drawings. Backfill to contact entire periphery of pipe.

D. Place and compact each lift; placement and compaction of fill shall be done so pipe is not displaced. Misalignment of pipe or other damage shall be repaired at by the Contractor at the Contractor's expense. Material shall be carried up evenly on both sides of pipe in lifts, not exceeding six (6) inches in loose depth, and compacted to at least 95% of maximum density as determined by ASTM D1557.

E. Subsequent backfill: Structural backfill material shall be carefully placed and compacted, to prevent damage to pipe, to finish grades shown on drawings. Compact to at least 95% of maximum dry density as determined by ASTM D1557.

F. Place final backfill in layers not exceeding twelve (12) inches in loose depth. Each layer shall be compacted to the specified compaction before succeeding layers are placed.

G. Backfill material shall be left neatly mounded over trenches not located in roadways or parking areas so that a depression is not formed if backfill settles. Any depression formed by settlement within one year from final acceptance shall be fully restored to the requirements of the drawings and specifications by the Contractor.

H. Backfill includes restoration of existing road surfaces, cut or damaged during construction, to original grade and type of surface.

I. Water used for compaction or other purposes shall be furnished by Contractor. The Contractor shall furnish all necessary materials, equipment and labor to convey and apply water at the point of use.

END OF SECTION

SECTION 02232

AGGREGATE BASE COURSE AND SURFACING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all labor, materials and equipment required for the construction of base course and leveling course on the existing subgrade as specified herein.

1.2 REFERENCES

A. The Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM).

ASTM C88-90	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C117-90	Standard Test Method for Materials Finer than 75-Micrometer (No. 200) Sieve in Mineral Aggregate by Washing.
ASTM C131-89	Standard Test Method for Resistance to Degradation of Small of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C136-92	Standard Test Method for Sieve Analysis of Fine and Course Aggregates.
ASTM D4318-84	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

Oregon Department of Transportation Standard Specifications for Construction (ODOT).

American Association of State Highway and Transportation Officials (AASHTO).

AASHTO T176-90	Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test.

AASHTO T180-90	Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb [4.54-kg] Rammer and an 18-in [457-mm] Drop.

1.3 SUBMITTALS

A. The following shall be submitted for informational purposes:

1. Certificate of Compliance, 10 days prior to construction certifying that the base and leveling course aggregates comply with the requirements as specified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Base and leveling course materials shall consist of crushed rock, crushed gravel, or a combination thereof meeting the requirements of ODOT Section 00600 Bases. The proposed aggregate source shall be designated in writing.

B. 3/4" - 0" Crushed Rock shall meet the requirements of ODOT section 00641.10 for 3/4" nominal maximum size aggregate.

C. 2" - 0" Crushed Rock shall meet the requirements of ODOT section 00641.10 for 2" nominal maximum size aggregate.

2.2 EQUIPMENT

A. General: All equipment necessary for the satisfactory performance of this construction shall be on the project prior to beginning work.

B. Sprinkling Equipment: Sprinkling equipment shall be equipped with spray bars to assure uniform, accurate distribution of water.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. General: Base and leveling course shall normally be placed on dry, prepared surfaces and when air temperature in the shade is 40°F and warmer. During rain or other adverse weather conditions, placing may occur if the prepared surface is free from pools or flow of water and if all other requirements of these specifications are met. Hauling equipment shall be routed over the work in such manner as to be most effective in the compaction of the base and leveling course. Hauling over any portion of any base or leveling course, which is in the process of being compacted, shall not be permitted when the effect shall be detrimental. Any base or leveling course material contaminated with fines after placement shall be replaced.

B. Grade Stakes: The Contractor shall set stakes showing the proper alignment and grade for both the finished base course and for the finished leveling course. These stakes shall indicate the top of the course to the nearest 0.01-foot; they shall be set at centerline, edges of traveled lanes, edges of shoulders, and at other cross-section break points at intervals not to exceed 25 feet or other closer intervals if required.

C. Placing and Spreading: Each layer of each course of material shall be spread in lifts not to exceed 6 inches.

D. Compaction: The compacted layer shall have a smooth, tight, uniform surface true to the line, grade, and cross section shown on the contract drawings. At the time the compacting begins, the moisture content of the material shall be near optimum. Compaction of each layer shall begin immediately following spreading and final shaping and shall continue until compaction requirements have been met. Maximum in-place density shall be 95% of maximum density determined in accordance with ASTM D 1557.. Density tests shall be performed every 500 feet on roads and an additional 5 tests performed in parking areas as directed by the Engineer. Test results shall be documented with one copy available for review by the Engineer. Testing is for informational purposes only.

E. Maintenance Requirements: The surface of each layer of each course shall be maintained true to line, grade, and cross section by blading, watering, and rolling until placing the next succeeding layer, course, or pavement as the case may be. Should irregularities develop in the surface of any course or layer of course during or after compaction, they shall be remedied by loosening the surface and correcting the defects after which the entire area including the surrounding surface shall be thoroughly compacted. Any additional materials that are necessary to make the repairs shall be provided by the Contractor at no additional cost to Owner

F. Surface Tests: The surface of the base course shall not vary from the line, grade, and cross section shown by more than 0.05 feet. The finished surface of the leveling course when tested with a 10-foot straight edge shall not vary from the testing edge by more than 0.02 feet at any point. After each course is completely compacted, the top surface shall be checked for smoothness of grade and crown, and if portions are found to lack smoothness of grade and crown by more than 0.02 feet from a 10-foot straight edge applied parallel with the centerline of the road or from cross section, such portions shall be scarified, recompacted, and otherwise manipulated until the desired smoothness and accuracy is obtained after which they shall be tested again for compaction. For the purpose of testing the base and leveling course, a 10-foot straight edge shall be furnished by the Contractor at the job site for use by the Engineer for verification.

END OF SECTION

SECTION 02270

SLOPE PROTECTION AND EROSION CONTROL

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all labor, materials and equipment required for the installation and maintenance of both permanent and temporary erosion control measures as shown on the drawings and as specified herein.

B. The following soil erosion control measures are required, and shall be in place while potential for erosion exists from construction activities at the site and disposal area, during the duration of the contract and warranty period;

1. Protect and stabilize soils susceptible to erosion. This includes areas were vegetative cover cannot be achieved due to soils, slopes or time of year.

2. Prevent sediment or sediment laden water from entering all creeks and the storm drain systems or to be discharged from the construction site in accordance with the U.S. Environmental Protection Agency and other applicable regulations.

3. Allow no mud, dirt rocks, etc., to be transported onto roads by motor vehicles or stormwater run-off.

1.2 SUBMITTALS

A. Submit soil erosion control plans for acceptance in accordance with the provisions of SECTION 01340.

PART 2 PRODUCTS

2.1 SPECIAL RESTRICTIONS

A. The contractor shall be aware of and conform to measures necessary for the control of noxious weeds and the specific requirements within the jurisdictional boundaries of the U.S. Forest Service as established in USFS 2509.22.

2.2 MULCH MATERIAL

A. Wood or grass straw cellulose fiber: The following mulch materials are acceptable for use:

1. Grass mulch, a grass straw cellulose fiber manufactured by Grass Fiber, Inc., Junction City, Oregon 97448.

2. Silva-fiber, a wood cellulose fiber manufactured by Weyerhaeuser, Tacoma, Washington 98477.

3. Spray Mulch X-80, a wood cellulose fiber manufactured by Pacific Wood Fibers, Redmond, Washington 98052.

4. Grass straw: J_TAC manufactured by Reclamare Company, Seattle, Washington 98190

2.2 SEED

A. Use a seed mix as recommended by local county extension agencies (must be acceptable to the U.S. Forest Service) that shall allow for a quick growing species and conforms with other specification requirements established elsewhere, providing a temporary cover which shall not compete with the grasses sown later for permanent cover.

2.3 FERTILIZER

A. Fertilizer applied within 50 feet of water bodies shall be a non-phosphorus type.

B. In addition to inorganic fertilizers; an acceptable phosphorus type fertilizer is 14-19-19 with 50% slow release Ureaform or Isobutylidene Diurea (IDBU).

2.4 RIPRAP

A. Riprap for this work shall be hard, sound and durable fractured face rock of accepted quality, free from seams and other structural defects from an accepted source. The grading of the riprap shall be determined by visual inspection of the load before it is placed

B. Loose riprap shall be nearly rectangular stone with approximately 50 percent having a volume greater than the size specified on the Drawings. The size shall not exceed the minimum depth of riprap as specified on the Drawings.

C. Riprap bedding shall be 2-1/2" minus pit run sand and gravel, or river gravel, of similar size or of a size noted on the Drawings. Place a minimum layer of filter blanket material under all riprap. Dress material to design slopes shown on the Drawings.

D. Quarry spalls shall be hard, sound and durable stone of the size noted on the Drawings. It shall be free from segregation, seams, cracks, and other defects that may destroy its resistance to weather.

D. Quarry spalls shall meet the following requirements for grading.

Sieve Size	Percent Passing
8 inch	100
3-inch	40 Max.
0.75-inch	10 Max.

2.5 GABIONS

A. Gabion baskets shall meet the following requirements.

1. Gabion baskets shall be filled with hard, sound and durable stone free of seams and other structural defects.

2. The stone placed in gabion baskets shall meet the following gradation:

Sieve Size	Percent Passing
8 inch square	100
6-inch square	75-90.
4-inch square	0-10.

2.6 SPECIALTIES

A. Erosion mat: TC Mirafi Miramat TM8 or approved equal.

B. Filter Fabric:

PHYSICAL PROPERTY	TEST	REQUIREMENTS
Filtering Efficiency	VTM-51	75% (min.)
Tensile Strength at 20% (max.) Elongation*****	VTM-52	Extra Strength-50 lbs./lin. in. (min.) Standard Strength-30 lbs./lin. in. (min.)
Flow Rate	VTM-51	0.3 gal./sq. ft. /min. (min.)

*****Requirement reduced by 50 percent after 6 months of installation.

Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F.

C. Wire fabric 2" x 2" x 14 gauge.

D. Plastic sheeting: Clear polyethylene plastic with a minimum thickness of 6 mils.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Grass seed mixtures

1. Free area to be seeded of weeds, debris and other matter detrimental or toxic to the growth of grass or other approved cover crop.

2. Scarify top of surface soil directional along the contours of the final grade. Form minor ridges and irregularities on roadbed cut and fill slopes to retard erosion, and improve germination.

3.2 FERTILIZER

A. Apply fertilizer as per supplier's recommendations and uniformly to areas that are receiving grass seed mixtures.

3.3 SEEDING

A. Grass seed mix shall have a minimum of 100 pounds of seed per acre or as specified by the County Extension Office or Forest Service which ever is greater. Mix 2 parts sand or dolomite to 1 part seed mix for uniform broadcast.

B. Rake in lightly, covering seed to a depth of about 2-3 times their thickness.

C. Hydroseed rocky terrain and slopes greater than 10%.

D. Bonding agents: Use tackifier per supplier recommendations, to apply grass seeding to disturbed areas.

E. Watering: Apply water as required. Control rate of water applications to provide adequate moisture without causing run-off.

3.4 MULCH MATERIALS

A. Immediately following seeding, apply mulch to a thickness of 1/8 inches.

B. If using dry grass-straw mulch provide a uniform, 2-inch minimum cover. Anchor straw by working by hand or with equipment (rollers, cleat tracks, etc.).

C. Mulching should immediately follow seeding and fertilizing except for the following conditions:

1. When mulch is punched in the soil by mechanical means such as modified sheepsfoot rollers or serrated discs;

2. When it is necessary to hold down the mulch with wire netting or like material; and,

3. On slopes steeper than 1-1/2 horizontal to 1 vertical where a slurry mixture would tend to run down the slope.

D. Mulch shall be applied to all disturbed areas with a 2:1 or less slope.

E. Mulch shall be spread uniformly at a rate of 2 tons/acre for grass straw cellulose fiber or 1 ton per acre of wood fiber mulch.

3.5 PLASTIC SHEET COVERING

A. Install covering and maintain tightly in place by using sandbags or tires on ropes with a maximum 10 foot grid spacing in all directions.

B. Tape or weigh down all seams along the full length of the covering. Leave a minimum overlap of 12 inches for all seams.

C. For seams parallel to the slope contour, the uphill sheet shall overlap the downhill sheet.

D. Do not allow drainage from areas covered by plastic sheeting to discharge directly onto unprotected, disturbed areas of the construction site.

3.6 SILT FENCE

A. Construct silt fence to the lengths and at the locations where shown on the plans or as noted in submittal.

B. Cut fabric in a continuous length to avoid the use of joints. Where joints are unavoidable, overlap splice a minimum of 6 inches.

C. On sloped grades, fastened the silt fence filter fabric to the uphill side posts.

D. Do not extend the fabric more than 30 inches above the original ground surface.

E. Do not attach fabric to trees.

F. When extra strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated.

3.7 EROSION BLANKET

A. Erosion mat shall be installed on all disturbed slopes with a steepness of 2:1 or greater.

B. Site Preparation: Grade surface of installation areas so ground is smooth and compact. Prepare surface by loosening 2" to 3" of topsoil. Spread seed before mat installation. Remove all large rocks, dirt clods, stumps, roots, grass clumps, trash and other obstructions from lying in direct contact with the soil surface and the mat.

1. Initial and terminal anchor trenches are required at the mat ends. Initial and terminal anchor trenches should be a minimum 12" deep and 6" wide while intermittent trenches need be only 6" deep and 6" wide.

C. Channel Installation: Excavate initial and terminal trenches, 12" deep and 6" wide, across the channel at the upper and lower end of the lined channel sections and excavate intermittent trenches, 6" wide and deep, across the channel at 40' intervals. Excavate longitudinal trenches 6" deep and wide along channel edges in which to bury the outside mat edges. Place the first mat at the downstream end of the channel. Place the end of the first mat in the initial trench and pin it at 1" intervals along the bottom of the trench. Mat shall be placed upside down in the trench – loops against the ground – with the roll on the downstream side of the trench. Once pinned and backfilled, the mat shall be deployed by wrapping over the top of the trench and unrolling upstream with the loops now facing up. If the channel is wider than 12', place ends of adjacent rolls in the terminal trench, overlapping the adjacent rolls a minimum of 6". Side slope shingling shall be avoided. Pin at 1' intervals, backfill and compact. Unroll mat in the upstream direction until reaching the first intermittent trench. Unroll the mat back over itself, positioning the roll on the downstream side of the trench, and allowing the mat to conform to the trench. Then pin the mat (two layers) to the bottom of the trench, backfill and compact. Continue up the channel repeating this step at other intermittent trenches, until reaching the upper terminal trench. At the upper terminal trench, allow the mat to conform to the trench, secure with pins or staples, backfill, compact and then bring the mat back over the top of the trench and onto the existing mat, 2' to 3' overlap in the downstream direction, and pin at 1' intervals across the mat.

When starting installation of a new roll, begin in a trench or shingle-lap end of rolls a minimum of 1' with upstream mat on top to prevent uplifting. Place the outside edges of the mat(s) in longitudinal trenches, pin, backfill and compact.

D. Slope Installation: Place mat 2' to 3' over the top of the slope and into an excavated trench measuring at least 6" deep and wide. Pin the mat at 1' intervals along the bottom of the trench, backfill and compact. Unroll the mat down the slope maintaining intimate contact between the soil and the smooth side of the mat (loops up). Overlap adjacent rolls a minimum of 6". Pin the mat to ground using staples or pins in a 3' pattern.

E. Securing Devices: 11 gauge, 6" x 1" x 6" metal staples of 18" pins, having 3/16" shank diameter and an attached 1-1/2" washer, for fastening the mat to the ground. Drive staples or pins so that the top of the staple or washer is flush with ground surface. Staple or pin each mat every 3' along its center. Longitudinal overlaps must be a minimum of 3" and uniform along the entire length of the overlap and stapled or pinned every 3' along the overlap length. Roll ends may be spliced by overlapping 1' with the upstream mat placed on top of the downstream mat. This overlap should be secured by staples or pins at 1' spacing across the mat.

3.8 RIPRAP PLACEMENT

A. Excavation for riprap shall be to lines and grades as shown. Place no stone until excavation is observed and accepted by the Engineer.

B. Place geotextile fabric in accordance with manufacturer's requirements prior to placing any riprap bedding.

C. No riprap shall be laid until the slopes are approved. Riprap shall be placed so the larger stones are in contact with each other and the voids filled with finer materials, producing a well-graded compact mass. The stone shall be placed on the slope in a manner to ensure the specified thickness in one operation. When placing, care shall be used to avoid disturbing underlying material. Placing in layers parallel to the slope shall not be permitted. When placing, care shall be taken to avoid disturbing the underlying bedding. Do not, at any time, dump riprap where there would be direct contact with a watercourse during placement operations.

3.9 REPAIR/RESTORATION

A. Vegetated slopes: Areas which fail to establish vegetative cover adequate to prevent erosion shall be reseeded as soon as such areas are identified. Contractor shall obtain approval from the Engineer prior to reseeding.

B. Plastic sheet covering: Re-secure sheeting where wind or water have loosened the sheeting and left exposed earth.

C. Sediment fence: Do not allow accumulation of sediment behind fence to exceed 9-inch depth. Remove and regrade sediment into slopes. Repair and re-establish sediment fences as needed.

D. Erosion mat: Re-secure mat where wind or water has loosened the blanket and left exposed earth.

3.10 RE-INSTALLATION

A. Re-install temporary soil erosion control measures when they cease to function as originally intended.

3.11 MAINTENANCE AND REMOVAL

A. Temporary erosion control devices shall be removed only after they have performed their intended function and removal has been recommended by the Engineer.

B. Maintenance: Maintain the soil erosion control features (including replacement and upgrading of the facilities when needed) through the warranty period.

C. Repair soil erosion control devices as necessary to ensure proper function.

D. Removal: Remove sediment fences in their entirety when no longer required by the Engineer.

E. All pipes, end sections, drainage curbs, sand bags, sediment fences and other materials which are removed from temporary erosion control devices and not incorporated into the permanent work shall become the property of the Contractor and shall be removed from the area.

END OF SECTION

SECTION 02434

PIPE CULVERTS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all labor, materials and equipment necessary to install and construct corrugated steel pipe culvert, joints and accessories and bedding and slope protection at pipe end as shown on the drawings and as specified herein.

1.2 REFERENCES

A. ASTM A444/A444M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Storm Sewer and Drainage Pipe.

B. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12 inch Drop.

C. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 inch Drop.

D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Willow Depth).

E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 SUBMITTALS

A. The following shall be submitted in accordance with SECTION 01340.

1. Product Data: Provide data on pipe, fittings and accessories.

2. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

PART 2 PRODUCTS

2.1 STEEL CULVERT PIPE

A. Corrugated Steel Pipe: ASTM A444/A444M, galvanized:

1. Helical lock seam.
2. Shape and size: As scheduled on the drawings.

B. Coupling Bands: Galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.2 BEDDING AND COVER MATERIALS

A. Bedding material shall conform to the requirements of SECTION 02221 for pipe.

B. Backfill as specified in SECTION 02221 for structural fill.

2.3 CONCRETE

A. All concrete required (headwalls, etc.) for a complete culvert installation shall meet the requirements of SECTION 03300.

2.4 ACCESSORIES

A. Geotextile Fabric: Specified in SECTION 02200.

B. Riprap as specified in SECTION 02270.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor will verify that excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Remove stones or other hard matter within 6" of trench excavation which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate culvert trench to 12 inches below pipe invert, in accordance with SECTION 02221. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent of maximum density as determined by ASTM D1557.

C. Backfill around sides and to top of pipe with fill, tamped in place and compacted to 95 percent of maximum density as determined by ASTM D1557.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe and accessories in accordance with manufacturer's instructions

B. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

C. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope.

D. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.

E. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.

F. Refer to SECTION 02221 for trenching requirements. Do not displace or damage pipe when placing and compacting bedding or backfill.

3.5 ERECTION TOLERANCES

A. Lay pipe to alignment and slope gradients noted on drawings;

B. Maximum Variation From Intended Elevation of Culvert Invert: 1/2 inch.

C. Maximum Offset of Pipe From True Alignment: 1 inch

D. Maximum Variation in Profile of Structure From Intended Position: 1 percent.

3.6 FIELD QUALITY CONTROL

A. The Contractor will request observation by the Engineer prior to and immediately after placing aggregate cover over pipe.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest in accordance with SECTION 02221 at no additional cost to the Owner.

C. Frequency of Tests: 2 per installation.

3.8 PROTECTION

A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02451

TRAFFIC GUARDRAIL

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all labor, materials and equipment necessary to install and construct the traffic guardrails called for on the drawings and as specified herein.

1.2 SUBMITTALS

A. Contractor shall submit shop drawings and product data in accordance with the requirements of SECTION 01340.

1. Clearly indicate plan layout, grid, spacing of components, accessories, fitments and anchorage on the shop drawings.

2. Submit product data and materials list for traffic guardrail components.

1.3 REFERENCES

A. This section references the latest edition of the following documents. They are a part of this section as specified and modified. In a case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Idaho Transportation Department Standard Specifications for Highway Construction (ISSHC).

1.4 INSTALLATION

A. The work shall be done by an installer qualified for and experienced with the installation of guardrail.

PART 2 PRODUCTS

2.1 MATERIALS

A. Guardrail Posts and Blocks

1. Timber blocks and posts shall be sized as shown on the drawings and shall be pressure treated in accordance with ISSHC Section 710 - Timber and Preservatives.

2. All posts shall be stamped with the length of the post on the top surface. The stamped lettering shall be 1 1/2" high and 1/4" deep. If the lettering is disturbed during installation it will be restamped.

B. Guardrails

1. Guardrails shall be as shown on the drawings, and shall be W-Beam Rail Section in accordance with ISSHC standard drawing G-1-A-1. Guardrails will be 12 gauge galvanized steel.

C. Hardware

1. Hardware shall be per ISSHC standard drawing G-1-A.

2. All guardrail post hardware and accessories shall be galvanized in accordance with ASTM A123 or ASTM A153, except as otherwise noted. All nuts shall comply with American hex ANSI specification B 18.22.

PART 3 EXECUTION

3.1 GUARDRAIL

A. General

1. Guardrails will be lapped in the direction of traffic to prevent snagging.

B. Posts

1. Set posts at a maximum of 6' - 3" on center.

2. The guardrail posts will be plumbed and set vertically, and in accordance to ISSHC, Section 612.

C. END SECTIONS

1. Contractor shall install terminal Type 1 end sections on all guardrail ends.

END OF SECTION

SECTION 02500

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all the labor, materials and equipment necessary to accomplish the paving work shown on the Drawings and as specified herein.

B. This section covers construction of asphalt concrete on prepared surfaces to the lines, grades, and sections shown on the Drawings.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Association of State Highway and Transportation Officials (ASSHTO).

AASHTO M208-90	Standard Specification for Cationic Emulsified Asphalt.
AASHTO M301-90	Standard Specification for Joint Sealants, Hot Poured, for Concrete and Asphalt Pavements

2. American Society for Testing and Materials (ASTM).

ASTM C127-88	Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
ASTM C128-88	Standard Test Method for Specific Gravity and Absorption of Fine Aggregate.
ASTM D2041-91	Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
ASTM D2922-91	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

3. Oregon Department of Transportation Standard Specifications for Construction. (ODOT)

1.3 SUBMITTALS

A. The following will be submitted in accordance with SECTION 01340.

1. Certificate of compliance for ODOT Dense Graded Level 3asphalt concrete with 3/4 inch aggregate. Specimens shall be taken and tested by an independent laboratory according to the Marshall method (see MIL-STD-620A), each specimen being subject to 50 blows of the standard Marshall hammer on each side of the specimen.

2. Within 30 days after Notice to Proceed and at least three weeks prior to placing of any asphalt concrete, the name and/or location of the proposed asphalt concrete plant and aggregate sources will be provided.

3. Provide a written certificate of compliance certifying that the asphalt cement complies with the requirements of these specifications.

4. Provide a written certificate of compliance certifying that the tack coat complies with AASHTO M208-90.

5. Provide copies of the manufacturer's job mix design and test results.

6. Provide copies of in-place density tests specified herein.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

A. The work shall be done using a hot-laid asphalt plant mix. The mix shall be from a commercial plant generally acceptable to public contracting bodies in the area. The asphalt material and any additives shall comply with AASHTO MP-1 and manufacturer's certificates of compliance supplied before any asphalt concrete is placed. Prior to paving a Marshall test shall be taken on the proposed job mix and both mix design and test results shall be approved. In no case shall pavement be placed before the job mix design is approved. The gradation and asphalt cement content of the mix shall be generally the same as called for in the Oregon Department of Transportation Department Standard Specifications for Construction Dense Graded Level 3 with 3/4-inch aggregate as specified in ODOT Section 00700 Wearing Surfaces subsection 00745 Hot Mix Asphalt Concrete. The mix design is to be made by the asphalt manufacturer. Representative samples of the asphalt concrete being furnished is to be tested by an independent laboratory according to the Marshall method (see MIL-STD-620A) each specimen being subject to 50 blows of the standard Marshall hammer on each side of the specimen.

2.2 TACK COAT

A. Tack coat shall meet the specifications of ODOT Section 00730.

2.3 CRACK SEALANT

A. Sealing material for sealing cracks shall be a hot-poured material conforming to AASHTO M301-90.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Installation on construction of all asphalt concrete paving shall meet the applicable requirements specified in the ODOT Standard Specifications for Construction

3.3 TESTING DURING CONSTRUCTION

A. Maximum in-place density shall be measured on roads every 500 feet as directed by the Engineer, plus an additional five tests as directed by the Engineer. The additional tests may be directed to be made on the parking area for informational purposes only. Test results shall be provided in triplicate. Two copies shall be provided to the Engineer.

END OF SECTION

SECTION 02520

ROADWAY SIGNING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. This work includes furnishing all equipment, labor and materials required for providing and placing all roadway signs shown on the Drawings and as specified herein.

1.2 REFERENCES

A. This section references the latest edition of the following documents. They are a part of this section as specified and modified. In a case of conflict between the requirements of this section and those of the listed documents, the requirements of this section **shall** prevail.

Reference

1. U.S. Department of Transportation, Manual on Uniform Traffic Control Devices, 1984 (UTCD).

2. Idaho Transportation Department Standard Specifications for Highway Construction (ISSHC).

PART 2 PRODUCTS

2.1 SIGNS

A. Sign Blanks

1. Sign blanks are to be sheet aluminum conforming to Type B Section 616 of ISSHC.

B. Reflective Sheeting

1. All sign faces are to be reflective sheeting in accordance with Section **712** of ISSHC. The color of the reflective sheeting will be silver-white for those signs without a UTCD code.

C. Posts

1. Sign posts will consist of 4-inch square timber. At the Contractor's option, posts will be one of the following: untreated Western Cedar, treated Douglas Fir, or treated Hem-Fir conforming to Section 710 of the ISSHC.

PART 3 EXECUTION

3.1 SIGNS

A. Sign legends shall conform to the U.S. Department of Transportation, Manual on Uniform Traffic Control Devices (UTCD). Sign locations and installation shall be in accordance with the scheduling shown on the drawings.

END OF SECTION

SECTION 02660

POTABLE WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all labor, materials and equipment necessary to install and construct all exterior potable water distribution systems called for on the Drawings and as specified herein.

B. This section covers construction of all exterior potable water line including excavation, bedding, backfill, final cleanup, testing, and service connections.

C. Reference 15100 for outdoor potable valves and fittings and 15400 for all potable piping above and below grade inside buildings.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM).

ASTM A53-94	Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
ASTM D1784-92	Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
ASTM D1785-91	Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D2241-89	Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
ASTM D2564 (REV A-91)	Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems.
ASTM D2855-90	Standard Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.

B. American Water Works Association (AWWA).

AWWA B300-92	Hypochlorites
AWWA B301-92	Liquid Chlorine
AWWA C600	

1.3 SUBMITTALS

A. The following shall be submitted in accordance with SECTION 01340:

1. The manufacturer's recommendations for each material or procedure to be utilized which is required to be in accordance with such recommendations. A copy of the manufacturer's instructions shall be available at the construction site at all times.

2. As-Constructed Coordinates of each pipeline corner marker.

3. Contractor's crossing plans.

4. Valves listed in paragraph 2.2.

5. Manufacturers catalog cuts and data for gate valves and valve boxes.

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND CEMENT

A. Pipe, fittings, and cement shall be as follows:

1. PVC Plastic Pipe. Plastic pipe and fitting shall be rigid polyvinyl chloride (PVC) and shall be approved by NSF for conveying drinking water. Piping shall be pressure rated, Class 160, SDR-26 in accordance with ASTM D 2241. Pressurized plastic pipe is allowable for underground and outdoor applications. It shall not be installed under concrete floor slabs, in air plenums, or within building interiors. All joints shall be solvent weld, bell and spigot, or rubber sealing rings. Bell and spigot rubber gasketing seal ring pipe shall be Johns-Manville, "Ring-Tite' or Portco "Sentry-Lock" or approved equal. All plastic pipe shall conform to ASTM D 1785. Pipe material shall conform to ASTM D 1784, Type I, Grade 1245B, designated as PVC 1120.

2. Plastic Pipe Fittings. Plastic pipe fittings shall be Schedule 40, solvent weld.

3. Joint Cement. PVC joint cement material shall be a solvent welded cement conforming to ASTM D 2564 or as specified by pipe manufacturer.

4. Potable Water Treatment System. Refer to SECTION 11200 for piping, components, and valves for the potable water treatment system.

5. Interior Building Piping. Refer to SECTION 15400 for potable water piping inside buildings and under building slabs.

2.2 VALVES

A. Valves shall be as follows:

1. Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve.

2. Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve. The operating nut or wheel shall have an arrow cast in the metal, indicating the direction of opening.

3. Curb Stop Valves shall be as specified in SECTION 15100.

4. Valve boxes shall be cast iron. concrete or prefabricated plastic except concrete or plastic boxes may only be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be heavy industrial with flared base. Concrete and plastic boxes shall be a standard product manufactured for this purpose.

2.3 PIPE JOINTS

A. Pipe joints designed for such purposes shall connect pipe of different materials and shall be made in accordance with the manufacturer's recommendation or as approved.

2.4 DISINFECTANTS

A. Chlorinating materials shall conform to the following:

1. Chlorine Liquid. AWWA B 301.

2. Hypochlorite, Calcium. AWWA B 300.

2.5 METALLIC CORE MARKING TAPE

A. Marking tape shall be plastic with a metallic core in a width of 4 inches or 6 inches. Color shall be blue and it should have wording as follows: "Water Main Below" or wording with similar meaning.

2.6 BEDDING MATERIAL

A. Bedding material shall conform to the requirements of SECTION 02221.

2.7 TRENCH BACKFILL

A. Trench backfill material shall conform to the requirements of SECTION 02221.

2.8 DRAIN ROCK

A. Drain rock shall be a 1 1/2-inch to 3/4-inch round river rock. All dirt, dust, clay, and other objectionable material shall be removed by washing and screening.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Trench Excavation: Trenches shall be excavated in accordance with SECTION 02221 paragraph 3.2.

B. Pipe Bedding: All pipes shall be installed on bedding material as specified in SECTION 02221 paragraph 2.2. Bedding shall be installed in accordance with SECTION 02221 paragraph 3.3.

C. Trench Backfill: Trenches shall be backfilled in accordance with SECTION 02221 paragraph 3.4.

3.2 INSTALLATION

A. Handling: Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, repairs shall be made. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will not be permitted. The interior of pipe and accessories shall be thoroughly cleaned of

foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material. Rubber gaskets that are not to be installed immediately shall be stored in a cool, dark place.

B. Cutting of Pipe: Cutting of pipe shall be done without damage to the pipe. Unless otherwise recommended by the manufacturer and approved, cutting shall be done with an approved type mechanical cutter. All burrs shall be removed.

C. Locating: Water lines shall be laid a minimum 30 inches below ground surface. Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer than 6 feet horizontally from a sewer and the bottom of the water pipe shall be a minimum of 12 inches above the top of the sewer pipe. Joints in the sewer main, closer than 3 feet horizontally to the crossing, shall be encased in concrete. The above shall apply unless an alternative acceptable to the Engineer is demonstrated.

D. Placing and Laying: Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly on the bedding material, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until jointing is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings.

E. Jointing: Jointing shall conform to AWWA C 600 applicable for elastomeric-gasket joints and shall conform to ASTM D 2855 and the manufacturer's specific recommendations for solvent weld joints.

F. Service Connections: "Water line" includes the lines to and connections with the building services. Where building services are not installed, the water line shall be terminated at the designated point. Such service lines shall be closed as noted on the Drawing with either a valve and plug or a hosebibb located in a prefabricated metal box with a ball type “curb-stop” valve drain as shown on the Drawings (for sites with temporary housing). All service stops and gate valves shall be provided with a valve box of the length required by the depth of service-line stops or valves. The valve box shall be installed as shown so as not to transmit shock or stress to the valve. The valve box shall be centered over the

operating nut of the valve with the box covering flush with the surface of the ground.

3.3 HYDROSTATIC TESTS

A. General: Where any section of a water line is provided with concrete thrust blocking for fittings, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise accepted by the Engineer. All testing equipment, gauges, pumps, temporary blocking and any other materials or equipment required for testing shall be furnished and installed by the contractor prior to testing.

B. Pressure Test: After the pipe is laid, the joints completed and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi without loss of pressure of more than 5 percent or 11 1/4 psi in that hour. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, or valves shall be removed and replaced, and the test repeated until the test results are satisfactory. The Engineer shall be given 24 hours advance notice of performing test.

C. Leakage Test: A leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to 200-psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula: $L = 0.0001351(N)(D)(\text{square root of } P)$ in which L equals the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in psi gauge. Should any test of pipe disclose leakage greater than that specified, the defective joints shall be located, repaired, and the section retested until the leakage is within the specified allowance. The Engineer shall be given 24 hours advance notice of performing test.

D. Time for Making Test: Except where concrete reaction backing necessitates a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after installation.

E. Concurrent Hydrostatic Tests: Hydrostatic tests using either or both of the following procedures may be used:

1. Pressure test and leakage test may be conducted concurrently.

2. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be re-accomplished. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair, or retesting shall be accomplished at no additional cost to Owner

3.4 DISINFECTION

A. Before acceptance of the potable water line, the completed water line shall be disinfected up to the next valve beyond the work area as specified herein. After pressure tests have been made, the line to be disinfected shall be thoroughly flushed with water (at a velocity of at least 2.5 feet per second) until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall provide a dosage of not less than 50 parts per million (ppm) and shall be introduced into the water line in an approved manner. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to AWWA B 300 or B 301. The treated water shall be retained in the pipe long enough to destroy all non-sporeforming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of chlorine throughout the line at the end of the retention period. The line shall then be flushed with clean potable water until the residual chlorine is reduced to less than 1.0 ppm. The Engineer will take samples of water in properly sterilized containers for bacterial examination. The disinfection shall be repeated until tests indicate the absence of total bacteria for at least 2 full days. The water line will not be accepted until satisfactory bacteriological results have been obtained.

3.5 CLEANUP

A. Upon completion of the installation of the water lines and appurtenances, all debris and surplus materials resulting from the work shall be removed and trench areas left in a condition ready to receive the surface treatment called for on the drawings.

END OF SECTION

SECTION 02665

POTABLE WATER HYDROPNEUMATIC TANKS

PART 1 GENERAL

1.1 WORK DESCRIPTION

A. The work includes furnishing all labor materials and equipment necessary to install and construct the potable water hydropneumatic tanks.

B. Standard Products. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment must essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

C. Verification of Dimensions. The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Engineer of any discrepancy before performing any work.

D. Code. All plumbing work shall be in accordance with applicable state and national codes.

1.2 SUBMITTALS

A. General: The following shall be submitted in accordance with SECTION 01340.

1. All descriptive data for equipment and materials specified in this section.

2. The lists of materials and equipment supported by sufficient descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements; catalog numbers alone will not be acceptable. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. The manufacturer's recommendations for each material or procedure to be utilized should also be submitted as part of the shop drawings.

3. Operation and Maintenance Manuals. The operation and maintenance manuals shall be in accordance with SECTION 01730.

PART 2 PRODUCTS

2.1 HYDROPNEUMATIC TANKS

A. Hydropneumatic tanks shall be pre-charged industrial bladder type tanks sized as indicated on the Drawings and designed for operation between 40 and 60 psi. Tanks shall have pressure ratings as noted on the Drawings.

B. Tanks shall be constructed with carbon steel and stamped in accordance with Section VIII of the ASME pressure vessel code.

C. Tanks shall be epoxy lined and approved for use with potable water.

D. Bladders shall be replaceable and constructed with heavy duty FDA approved butyl rubber, and rated for a maximum temperature of 240 deg F.

E. Approved Manufacturers:

1. AA Tank
2. AO Smith
3. Roy E Hanson, Jr. Manufacturing

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Hydropneumatic tanks shall be installed in strict compliance with the manufacturer’s recommendations.

3.2 TESTS, FLUSHING, AND STERILIZATION

A. Tanks shall be flushed and sterilized in accordance with Section 02660.

END OF SECTION

SECTION 02710

SUBSURFACE DRAINAGE MATERIALS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all labor, materials and equipment necessary to install and construct the subsurface drainage system called for on the Drawings and as specified herein.

B. This section covers construction of subsurface drainage systems.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM).

ASTM C117-95	Standard Test Method for Materials Finer than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C136-962	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
ASTM D1785-91	Standard Specification for Poly (Vinyl Chloride) (PVC) Pipe, Schedules 40, 80, and 120.
ASTM D2466 REV A-90	Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
ASTM D 2564 REV A-91	Standard Specifications for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
ASTM D3034-89	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
ASTM D3212-92	Standard Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

1.3 SUBMITTALS

A. Material certification or manufacturer's design data for rock materials, collection pipe, fittings, joint materials, manholes and seepage rings shall be submitted in accordance with SECTION 01340.

PART 2 PRODUCTS

2.1 PERFORATED DRAIN

A. Subsurface Drainage Pipe. Drainage pipes shall be 6" diameter perforated PVC pipe conforming to ASTM D1785, Schedule 40. The distal ends of the lateral pipes shall be provided with threaded caps. Joints shall be bell and spigot conforming to ASTM D3139 or ASTM D2564.

2.2 DRAINAGE MEDIA

A. Drainage media shall consist of clean washed gravel, clean crushed rock, or other approved media. When gravel or crushed rock is used it shall have a minimum size of three quarters (3/4) inches and a maximum size of two and one-half (2-1/2) inches. The material shall be durable and inert so that it will maintain its integrity and not collapse or disintegrate with time and shall not be detrimental to the system.

2.3 GEOTEXTILE

A. Geotextile shall conform with the specifications in SECTION 02200

2.4 DISCHARGE PIPE

A. Discharge pipe shall conform with the specifications in paragraph 2.1 in SECTION 02730.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Trench Excavation

1. Trench excavation shall be performed in accordance with SECTION 02221 requirements. Trenches shall be excavated with banks as vertical as allowable under OSHA regulations and to the lines and grades as shown. Where trench widths are not indicated, they shall be excavated to a width to permit proper pipe laying and jointing. Such grading shall be done as may

be necessary to prevent surface water from flowing into trenches and any water accumulating therein shall be removed by methods described in the accepted dewatering plan. Over-excavation made inadvertently or without approval shall be restored to grade by backfilling with pipe bedding material, using compaction requirements specified below.

B. Trench Backfill

1. Trench backfill shall conform to the requirements specified in SECTION 02221.

3.2 INSTALLATION

A. Handling

1. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of non-plastic pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Materials found to be defective before or after laying shall be replaced with sound material. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

B. Cutting of Pipe

1. Cutting of pipe shall be done without damage to the pipe. Unless otherwise recommended by the manufacturer and also approved cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable. Plastic pipe shall be cut with a hand saw or hack saw with the assistance of a square in a sawing vise, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

C. Pipe Joint Deflections

1. Degree of joint deflections are not to exceed the pipe manufacturer's recommendations.

D. Pipe Laying

1. Piping shall be installed to the lines and grades indicated on the Drawings. Unless otherwise indicated, pipe laying shall proceed upgrade with the spigot ends pointing in the direction of flow. The bottom of the trench shall be shaped using a template to give substantially uniform circumferential

support to the lower quadrant of each pipe. As the work progresses, the interior of the drainage pipe shall be cleared of all materials. Trenches shall be kept free from water until the pipe-jointing operation is complete and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no trench water, earth, or other substance will enter the pipe or fittings.

E. Rubber Gaskets

1. Rubber gasket joints shall be made by thoroughly cleaning the bell and spigot, carefully placing and lubricating the rubber gasket, and forcing the joints home. Applicable manufacturer's recommendations shall be adhered to.

F. Excavation for Collection Trench

1. General: Excavation shall be performed to the lines and grades shown or as indicated. Overdepth excavation shall be backfilled. Water accumulating in excavations shall be removed.

2. Trenches: Trenches shall be excavated with vertical sidewalls. Drainage pipe trenches shall be of sufficient width to permit proper laying and jointing of pipe. Trench bottoms for drainage pipes shall be shaped to provide uniform bearing for the pipe.

G. Installation of Subsurface Collection Piping

1. Distribution Piping: Each pipe shall be laid true to line and grade. Joints shall be solvent-welded or have flexible elastomeric seals. Pipe shall be firmly bedded. Perforated plastic pipe and fittings shall be placed on the drainage media. There shall be a minimum of three inches of clean drainage media below the distribution laterals. The remainder of the drain media shall be placed over the pipe without disturbing the alignment or grade. Ends of pipe shall be closed when work is not in progress to prevent entry of water, earth, or other debris.

H. Backfilling of Collection Trenches

1. Backfill over the drainage media shall not be performed until acceptance by the Engineer. Prior to backfilling, the drain media shall be covered with synthetic filter fabric. Backfill shall be constructed in 12-inch lifts and made firm by pressing the bucket against the loose material. No other compactions shall be performed on the lateral trench backfill. Material shall be mounded over the trench to a depth of 10 percent of the backfill height above the gravel.

I. Cleanup

1. Upon initial completion of the work, all surplus construction materials and debris shall be removed.

END OF SECTION

SECTION 02730

SANITARY SEWAGE SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Work includes furnishing all labor, materials and equipment necessary to install and construct the sanitary sewage systems called for on the Drawings and as specified herein.

B. This section covers construction of the sanitary sewer line outside of the structures including excavation, bedding, backfill, manhole, pipe plugging, service connections, final cleanup, and testing.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM).

ASTM C117-95	Standard Test Method for Materials Finer than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C136-962	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
ASTM C478-96	Standard Specification for Precast Reinforced Concrete Manhole Sections.
ASTM D1785-91	Standard Specification for Poly (Vinyl Chloride) (PVC) Pipe, Schedules 40, 80, and 120.
ASTM D2466 REV A-90	Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
ASTM D 2564 REV A-91	Standard Specifications for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
ASTM D3034-89	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

ASTM D3212-92	Standard Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

1.3 SUBMITTALS

A. Material certification or manufacturer's design data for filter fabric, sewer pipe, fittings, joint materials, manholes and seepage rings. Shall be submitted in accordance with SECTION 01340.

PART 2 PRODUCTS

2.1 PIPE

A. Plastic Pipe and Fittings for Gravity Sewers

1. Plastic (PVC) pipe for gravity sewers shall conform to ASTM D3034, Type PSM with a maximum SDR 35 with flexible elastomeric seal joint.

2. Joints for plastic (PVC) pipe for gravity sewers shall be slip-ring, tite-seal type. Rubber gaskets shall conform to the chemical and physical requirement of ASTM D3212.

3. Fittings for plastic (PVC) pipe for gravity sewers shall have rubber gasket joints and strength characteristics identical to that of the pipe.

2.2 BEDDING AND BACKFILL

A. Pipe Bedding

1. Pipe bedding shall conform to the requirements specified in SECTION 02221.

B. Trench Backfill

1. Trench backfill shall conform to the requirements specified in SECTION 02221.

C. General Select Backfill. General select backfill material shall conform to the requirements specified in SECTION 02221.

2.3 REINFORCED CONCRETE

A. Cast-in Place reinforced concrete shall conform to the requirements of SECTIONS 03200 and 03300.

2.4 SEPTIC TANKS

A. General

1. Septic tanks shall be 1,000 gallon precast concrete that have been designed by a registered engineer and approved by the local regulatory agencies. The manufacturer shall provide the structural design and certification to the Engineer for review. The design shall be in accordance with accepted engineering practice and the requirements of SECTION 03400.

2. The tanks shall be designed for the following loading conditions:

   Top-400 psf; Lateral Loads-62.4 pcf

3. All tanks shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of delivery to the project. Manufacturer's signed guarantee shall accompany bids.

4. Tanks shall be manufactured and furnished with access opening 18 -inches in diameter and of the configuration shown.

5. Inlet plumbing shall penetrate 18 -inches into the liquid from the inlet flow line.

6. Tanks shall be capable of successfully withstanding an aboveground static hydraulic test and shall be individually tested.

7. All tanks shall be installed in strict accordance with the manufacturers' recommended installation instructions.

B. Preformed Tank

1. Walls, bottom and top of reinforced concrete tanks shall be designed across the shortest dimension using one-way slab analysis. Stresses in each face of monolithically constructed tanks may be determined by analyzing the tank cross-section as a continuous fixed frame.

2. If a precast concrete tank is used the walls and bottom slab shall be poured monolithically and all materials shall conform to SECTION 03400.

3. Precast tanks shall be protected by applying a heavy cement-base waterproof coating (Thoroseal or equal), on both inside and outside surfaces, in compliance with Council of American Building Officials (CABO) report #NRB-168; 6181, however the tank must be watertight without the addition of seal coatings.

4. Form release used on tank molds shall be Nox-Crete or equal. Diesel or other petroleum products are not acceptable.

5. Tanks shall not be moved from the manufacturing site to the job site until the tank has cured for seven (7) days or has reached two-thirds of the design strength.

6. In order to demonstrate water-tightness, tanks shall be tested twice prior to acceptance. Each tank shall be tested at the factory, prior to shipping, by filling with water to the soffit and letting stand. After 24 hours, the tank shall be refilled to the soffit and the exfilteration rate shall be determined by measuring the water loss during the next two hours. Any leakage shall be cause for rejection. After installation is completed, each tank shall be filled with water to a point two inches into the access riser and retested as previously described. Backfill of a depth equal to the water height in the riser must be in place over the tank to prevent damage due to hydrostatic uplift.

2.4 RISERS & LIDS

A. Inlet Risers. Shall be provided on all septic tanks and shall be ribbed PVC as manufactured by Orenco Systems, Inc. or approved equal. The material shall PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. Risers shall extend to two inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 21-inches.

B. Outlet Risers. Shall be provided on all septic tanks and pumping chambers and shall be ribbed PVC as manufactured by Orenco Systems, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. Risers shall be at least 12-inches high, shall have a minimum nominal diameter of 24-inches.

1. When bonding to concrete or fiberglass grooves, a two-part epoxy consisting of an acrylic reactive cement component and an organic peroxide solution component shall be used. One pint is required per 21-inch or 24-inch diameter riser and one quart is required per 30-inch diameter riser. When bonding to a flanged riser tank adapter, a two-part epoxy consisting of an inhibited methacrylate ester component and an organic peroxide solution component shall be used.

2. Lids. One Lid shall be furnished with each access riser. Lids shall be Orenco Systems, Inc. Model FL21g, FL24g, or FL30g or approved equal, as appropriate, fiberglass with green non-skid finish, and provided with urethane gasket, stainless steel bolts, and wrench. The riser and lid combination shall be able to support a 2500 lb. wheel load. (Note: this is not to imply that PVC risers are intended for traffic areas.)

3. Insulation. Rigid closed-cell foam insulation of 2" or 4" thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The insulation shall have an R-value of no less than 10 per 2" increment.

4. Riser Installation. Shall be accomplished according to the manufacturer's instructions.

2.5 DRAINFIELD MATERIALS

A. All materials shall be new and unused and as specified herein as follows:

1. Drainfield Piping. The central manifold pipe shall be PVC pipe conforming to ASTM D1785, Schedule 40. Lateral pipes shall be perforated PVC pipe conforming to ASTM D1785, Schedule 40. Fabricated orifice shields made from 6-inch PVC pipe conforming to ASTM D1785, Schedule 40, or approved equal shall be used. Orifices shall have a diameter of 1/8-inch and spacing as shown. The lateral pipes will be laid with the orifices in the 12 o'clock position (pointing upward). The distal ends of the lateral pipes shall be provided with threaded caps. Joints shall be bell and spigot conforming to ASTM D3139 or ASTM D2564.

2. Drain Media. Drain media shall consist of clean washed gravel, clean crushed rock, or other approved media. When gravel or crushed rock is used it shall have a minimum size of three quarters (3/4) inches and a maximum size of two and one-half (2-1/2) inches. The material shall be durable and inert so that it will maintain its integrity and not collapse or disintegrate with time and shall not be detrimental to the system.

3. PVC Joint Cement and Primer. PVC joint cement and primer shall be a solvent welding type conforming to ASTM D2564 or as specified by pipe manufacturer.

4. Filter Fabric. Filter fabric shall be made of synthetic material. Untreated building paper shall not be used. Filter fabric shall meet the following specifications:

a. Material synthetic fabric, either spun-bonded or woven.

b Burst Strength, psi - not less than 25 psi.

c. Air Permeability, cfm per sq. ft. - not less than 500.

d. Water Flow Rate - not less than 500 gpm per sq. ft. at 3-inches of head.

e. Surface Reaction to Water - Hydrophilic.

f. Equivalent Opening Size - 70 to 100 sieve.

g. Chemical Properties:

1. Non-biodegradable.

2. Resistant to acids and alkalies within a pH range of 4 to 10.

3. Resistant to common solvents.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Trench Excavation

1. Trench excavation shall be performed in accordance with the requirements of SECTION 02221. Trenches shall be excavated with banks as vertical as allowable under OSHA regulations and to the lines and grades as shown. Where trench widths are not indicated, they shall be excavated to a width to permit proper pipe laying and jointing. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches and any water accumulating therein shall be removed by approved methods. Over-excavation made inadvertently or without approval shall be restored to grade by backfilling with pipe bedding material, using compaction requirements specified below.

B. Pipe Bedding

1. Pipe bedding shall be installed in conformance with the requirements specified in SECTION 02221.

C. Trench Backfill

1. Trench backfill shall be installed in conformance with the requirements specified in SECTION 02221.

D. Structural Excavation and Backfill

1. Excavation and backfill for septic tanks and appurtenances shall comply with SECTION 02220.

3.2 INSTALLATION

A. Handling

1. Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair shall be made. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of non-plastic pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Materials found to be defective before or after laying shall be replaced with sound material. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

B. Cutting of Pipe

1. Cutting of pipe shall be done without damage to the pipe. Unless otherwise recommended by the manufacturer and also approved cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable. Plastic pipe shall be cut with a hand saw or hack saw with the assistance of a square in a sawing vise, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

C. Pipe Joint Deflections

1. Degree of joint deflections are not to exceed the pipe manufacturer's recommendations.

D. Pipe Laying

1. Piping shall be installed to the lines and grades indicated on the drawings. Unless otherwise indicated, pipe laying shall proceed upgrade with the spigot ends pointing in the direction of flow. The bottom of the trench shall be shaped using a template to give substantially uniform circumferential support to the lower quadrant of each pipe. As the work progresses, the interior of the sewer shall be cleared of all materials. Trenches shall be kept free from water until the pipe-jointing operation is complete and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and closed to the satisfaction of the Engineer so that no trench water, earth, or other substance will enter the pipe or fittings.

E. Cleanouts and Concrete Manholes

1. Pipe connections to manholes and cleanouts shall be grouted with an approved non-shrink grout. Pipe joints shall be placed within 1 foot of the inlet and outlet of the structure for seismic protection.

F. Service Connections

1. Service connections as shown shall be made. Connections between different types of pipe and accessories shall be made with approved transition fittings.

G. Rubber Gaskets

1. Rubber gasket joints shall be made by thoroughly cleaning the bell and spigot, carefully placing and lubricating the rubber gasket, and forcing the joints home. Applicable manufacturer's recommendations shall be adhered to.

H. Excavation for Drainfield

1. General: Excavation shall be performed to the lines and grades shown or as indicated. Overdepth excavation shall be backfilled. Water accumulating in excavations shall be removed.

2. Trenches: Trenches shall be excavated with vertical sidewalls. Distribution pipe trenches shall be of sufficient width to permit proper laying and jointing of pipe. The trench length for the laterals shall be a least 6 -inches longer but not more than 18 -inches longer that the laterals. Trench bottoms for distribution pipes shall be shaped to provide uniform bearing for the pipe.

I. Installation of Drainfield

1. Distribution Piping: Each pipe shall be laid true to line and grade. Joints shall be solvent-welded or have flexible elastomeric seals. Pipe laying shall proceed with the spigot end pointed in the direction of flow. Ends of pipe shall be closed when work is not in progress to prevent entry of water, earth, or other debris.
2. Drainfield Piping: Prior to placing drain media the trench sidewalls shall be raked. Lateral pipe shall be placed at zero percent slope. Pipe shall be firmly bedded. Perforated plastic pipe and fittings shall be placed on the drain media. There shall be a minimum of three inches of clean drain media below the distribution laterals. The remainder of the drain media shall be placed over the pipe without disturbing the alignment or grade.

J. Backfilling of Drainfield

1. Backfill over the drain media shall not be performed until acceptance of the pipe and gravel installation by the appropriate permitting agency and the Engineer. Prior to backfilling, the drain media shall be covered with synthetic filter fabric. Backfilling shall consist of drainfield soil exclusive of roots, trash, debris, and stones in excess of 2 inches in diameter. Backfill shall be constructed in 12-inch lifts and made firm by pressing the bucket against the loose material. No other compactions shall be performed on the lateral trench backfill. Material shall be mounded over the trench to a depth of 10 percent of the backfill height above the gravel.

K. Cleanup

1. Upon initial completion of the work, all surplus construction materials and debris shall be removed.

3.3 TESTING FOR SEWER

A. General

1. Where any section of a force main or drainfield is provided with concrete thrust blocking for fittings, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. All testing equipment, gauges, pumps, water, power and required temporary blocking must be provided by the Contractor.

B. Pressure Test

1. After the pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved or plugged section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 50 psi or 150 percent of the working pressure, whichever is greater. Exposed pipe, joints, fittings and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this pressure test shall be removed and replaced, and the test shall be repeated until the test results are satisfactory. Prior to the pressure test, an orifice shield must be placed next to each upward-facing orifice on the laterals. After approval of the pressure test, the shields shall be shifted so that they cover the orifices. The Engineer shall be given 24 hours advance notice of performing the test.

C. Leakage Test

1. Leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and

during the test the force main shall be subjected to 50 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or plugged section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

L = ND P/K Where:
L = Allowable leakage in gallons per hour.
N = Number of joints in length of pipeline tested.
D = Nominal diameter of the pipe in inches.
P = Square root of the test pressure in psig.
K = 7,400 for pipe materials.

D. At the conclusion of the test, the amount of water remaining in the container shall be measured and the result recorded in the test report.

E. Retesting

1. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances.

F. Time for Making Test

1. Except for joint material setting or where concrete reaction backing necessitates a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after installation.

G. Concurrent Hydrostatic Tests

1. Pressure test and leakage test may be conducted concurrently, at option. Regardless of the sequence of tests employed, the results of pressure tests and leakage tests shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished.

END OF SECTION

SECTION 02821

SEEDING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Preparation of subsoil.

B. Placing topsoil.

C. Hydroseeding.

D. Maintenance.

1.2 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

B. United States Department of Agriculture – Forest Service. Forest Service Handbook 2509.22 – Soil and Water Conservation Practices Handbook (USFS 2509.22)

1.3 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass and any other plant material identified as weeds by local, state or federal agencies.

1.4 MAINTENANCE DATA

A. Submit under provisions of SECTION 01730.

B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.5 QUALITY ASSURANCE

A. Provide seed mixture in new sealed containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. All seed mixture for sites within the jurisdictional boundaries of the U.S. Forest Service shall conform to USFS 2509.22.

C. Gross seed mix shall allow for a minimum of 100 pounds of seed per acre or as specified by the County Extension Office or the Forest service which ever is greater.

1.6 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from U.S. Forest Service indicating approval of seed mixture.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of SECTION 01600.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.1 SEED SUPPLIERS

A. Reference: SECTION 01340 – Submittals.

B. Contractor to submit to the Engineer a list of proposed suppliers for review and acceptance.

C. Substitutions: Under provisions of SECTION 01600.

2.2 SEED MIXTURE

A. All seed mixture for sites within the jurisdictional boundaries of the U.S. Forest Service shall conform to USFS 2509.22 and/or County Extension Office.

2.3 SOIL MATERIALS

A. Topsoil: As specified in SECTION 02200.

2.4 ACCESSORIES

A. Mulching Material: Per Section 02270.

B. Fertilizer: Per Section 02270.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Erosion Fabric: Per Section 02270.

E. Herbicide: Not to be used in riparian areas extending to 200 feet from anadromous fish bearing streams. Approved only by specific submittal to the Engineer on a case by case basis.

F. Stakes: Softwood lumber, chisel pointed.

G. String: Inorganic fiber.

2.5 TESTS

A. Provide analysis of topsoil fill under provisions of SECTION 02200.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil [and prior to roller compaction].

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.5 SEEDING

Not used

3.6 HYDROSEEDING

A. Apply seeded slurry with a hydraulic seeder at a rate of 50 lbs per acre or as specified by the County Extension Office or Forest Service which ever is greater evenly in two intersecting directions.

B. Do not hydroseed area in excess of that which can be mulched on same day.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inches or 2000 lbs. per acre. Maintain clear of shrubs and trees.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.7 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 18 inches. Space stakes at 120 inches.

3.8 MAINTENANCE

A. Water to prevent grass and soil from drying out.

B. Immediately reseed areas which show bare spots.

C. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 02830

FENCING AND GATES

PART 1 GENERAL

1.1 GENERAL INFORMATION

A. The section covers all work required for replacing existing fence and new installation of wire mesh fencing and replacing damaged chain link fencing post, barbed wire, extension arms, and gates. Wire mesh fencing shall be installed to the lines and grades shown and as specified.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM).

ASTM A116	Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A121 REV A-91	Standard Specification for Coated (Galvanized) Steel Barbed Wire.
ASTM A153-82	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A570/A570M-92	Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled Structural Quality.
ASTM A702-89	Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought.
ASTM C94 REV A-92	Standard Specification for Ready-Mixed Concrete.

1.3 SUBMITTALS

A. The following shall be submitted in accordance with SECTION 01340.

1. Shop drawings and product data including spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

2. Working drawings, catalog cuts, and data, prior to installation, describing each item and giving evidence that each item complies with the specified requirements. The Contractor's working drawings shall include all dimensions and finish details.

3. Manufacturer's installation instructions.

4. Double swing, chain link gate plan.

PART 2 PRODUCTS

2.1 MATERIALS

A. General

1. All fencing materials to be installed on sites within the jurisdictional boundaries of the U.S. Forest Service shall be covered with a standard, UV resistant green PVC coating.

B. Wire Fence Material

1. Wire Mesh: Wire mesh shall conform to the requirements of ASTM A116 and shall consist of seven horizontal wires with vertical stays spaced 6 inches apart. The top and bottom wires shall be 10 gauge and the intermediate wires and vertical stays shall be 12 ½ gauge. The mesh shall have a total width of 26 inches. Galvanizing shall be Class 2. The zinc-coated wire as represented by test specimens shall be capable of being wrapped in a close helix at a rate of not exceeding 15 turns per minute around a cylindrical steel mandrel having a diameter the same as the specimen being tested, without cracking or flaking the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers.

2. Vertical Cinch Stays: Vertical cinch stays shall be 9 1/2-inch gauge galvanized wire meeting the requirements of AASHTO M279-90 except that the minimum weight of zinc coating shall be 0.3 ounces per square foot of uncoated wire surface.

3. Barbed Wire: The barbed wire shall be galvanized steel conforming to the requirements of ASTM A121 and shall consist of two-strand 12 1/2-gauge wire with tightly wrapped, shop four-point barbs formed of 14-gauge wire spaced evenly at not more than 5-inch intervals. Galvanizing shall be class 3.

4. Fence Posts: Fence posts shall be tubular with cap, tee, channel, or U-bar shaped and shall be formed of structural steel, hot-rolled carbon steel, or hot-rolled rail steel having a minimum yield strength of 40,000 psi and a minimum ultimate strength of 70,000 psi. Posts shall be either galvanized in accordance with ASTM A123 or painted with weather-resistant paint specifically designated for steel or painted with enamel which has been shop or factory baked. Shapes shall conform to Type I, Style I of Table 3.2.1.3.1 "Cross-Sectional Dimensions" of ASTM A702-89. Lengths shall be as called for on the plans. Posts shall be equipped with corrugations, knobs, notches, holes, or studs designed to engage all line wires. Punched tabs will not be permitted.

5. Fence Hardware: Fence hardware shall be steel, galvanized in accordance with ASTM A153-82.

B. Concrete

1. Concrete for the footings shall be provided and cured according to ASTM C94, using ¾-inch maximum-size aggregate, and having minimum compressive strength of 3,000 psi at 28 days.

C. Specials

1. Materials for all special hinges, flanges, brackets, and other non-standard fittings and fasteners shall be zinc-galvanized in accordance with ASTM A153-82.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. The fence and gates shall be installed on previously prepared surfaces to lines and grades indicated. Fence installation shall be as specified and in accordance with the fence manufacturer's written installation instructions. The Contractor shall submit gate plan for acceptance by Engineer prior to installation. All posts to be installed shall be thoroughly cleaned of rust, dirt, and grit.

B. Clearing and Grubbing

1. The fence lines shall be cleared, grubbed, and otherwise prepared by the Contractor. All brush, flat rock, and other such obstacles, which occur along the fence line and which interfere with proper fence construction shall

be removed. Irregularities in the ground surface less than quarter the panel length or less than 2 feet in height which would interfere with maintaining the specified clearance of the bottom wire above the ground surface shall be removed by cutting or filling with earth or rock.

C. Excavation

1. Excavation for posts shall be of the dimensions indicated except in bedrock. If bedrock is encountered before reaching the required depth, the excavation shall be continued to the depth indicated or 18 inches into the bedrock, whichever is less, and shall be a minimum of 2 inches larger than the outside diameter of the post. Post holes shall be cleared of loose materials. Waste material shall be spread where directed.

D. Post Setting

1. Posts shall be set plumb and in alignment. Concrete shall be thoroughly compacted so as to be free of voids and finished in a dome. In bedrock, posts shall be set with a minimum of 1 inch of grout around each post. Concrete shall be cured a minimum of 72 hours before any further work is done on the posts. Wire fence line posts shall be driven or have post holes excavated, the post placed, and backfilled with the excavated material. When line posts are set in dug holes, the backfilling shall be in 6-inch layers, each layer being separately and thoroughly tamped and compacted to a density at least equal to the undisturbed material around the hole. The height of posts above ground shall not exceed the design height by more than 3 inches.

E. Barbed Wire

1. Barbed wire shall be installed on extension arms above fence posts and extended ends of gate frames. Each strand shall be pulled taut and securely fastened to each supporting arm and extended member. The method of securing wires shall be positive and complete.

F. Gate Stops

1. Gate stop posts shall be located in the field. After the posts are set and plumbed to line and grade, the hole shall be concreted. The concrete shall be thoroughly worked into the hole so as to leave no voids and crowned to shed water. Post shall be capped.

G. Grounding

1. The fence shall be grounded at each gate post and at 200-foot intervals. At each grounding location a 5/8-inch by 6-foot copper clad steel ground rod

shall be connected to the fence post by No. 2 AWG bare copper wire utilizing pressure type connectors, burndy type GAR or equal. The copper wire to ground rod connection shall be molded powdered exothermic metal weld. The ground wire shall be buried a minimum of 1 foot. Grounding rod shall be installed vertically and shall be drilled and grouted if in rock.

H. Placing Wire Fence Materials

1. In general, wire fence materials shall be placed on that side of the post which faces the uphill side. In final position, barbed wire and wire mesh shall be free from warp and sags. Barbed wire and wire mesh shall be attached to each post in accordance with recognized standard practice for fence construction and in conformance to the plans and the following provisions:

   a. Barbed wire shall terminate at each end post, pull post, and corner post set in the line of the new fence and each line of barbed wire shall be wrapped around the post and shall be spliced to itself with at least four turns.

   b. Where existing fences intersect the new fence, the existing fence materials shall be cut or new materials spliced thereto as may be necessary, basically in kind, and each line of barbed wire and wire mesh shall be fastened to the new end post.

   c. At each line post, each line of barbed wire and wire mesh shall be fastened to the post. Fasteners for metal posts shall be galvanized 16 gauge wire ties or clamps. Splices of separate lines of wire between posts will be permitted provided that not more than two such separate wire splices, spaced at least 50 feet apart, shall occur in any one run of the fence. Splicing shall be neat and so done as to develop the full strength of the wire.

   d. If, because of depressions or irregularities in the ground surface, the bottom line of the fence as normally constructed leaves an unfenced opening beneath it exceeding 20 inches in height, an additional wire between line posts shall be provided across said opening so that no point alone the fence will there be bottom openings exceeded 20 inches in dimension.

   e. In crossing waterways the lower wire or wires of the fence, as normally constructed at the site shall provide a fenced closure of the waterway so that at no point will there be unfenced bottom openings exceeding 30 inches in dimension when the waterway is conveying its lightest flow or is dry as the case may be.

3.2 CLEANUP

A. Upon completion of the specified work, all waste material resulting from the operations shall be satisfactorily removed from the work area as directed. All natural ground surfaces or slopes damaged or displaced by the Contractor's operations shall be satisfactorily replaced, restored, seeded, or otherwise dressed to the condition existing prior to erection of the fence and gates.

END OF SECTION