SPECIFICATIONS

FOR

CITY OF PENDLETON, OREGON

DIGESTER REHABILITATION - PHASE I

2022

RENEWS 12-31-22
SIGNED: 2-4-2022

ANDERSON PERRY & ASSOCIATES, INC.

La Grande, Redmond, and Hermiston, Oregon
Walla Walla, Washington

Job No. 77-51

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GENERAL REQUIREMENTS

A. SUMMARY OF WORK

The Work for this Contract involves the rehabilitation of the City of Pendleton's existing sludge drying beds and the installation of additional drying bed capacity, together with all other Work required to complete the Project as shown on the Drawings and specified herein.

B. ABBREVIATIONS

The following abbreviations of Associations, units of measurement, and miscellaneous items are defined as they may be used in these Contract Documents or on the Drawings. This list may not be all-inclusive.

Associations

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CRSI	Concrete Reinforcing Steel Institute
DFPA	Douglas Fir Plywood Association
DIPRA	Ductile Iron Pipe Research Association
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IPC	International Plumbing Code
IPCEA	Insulated Power Cable Engineers Association
ITE	Institute of Transportation Engineers
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
SAE	Society of Automotive Engineers
SDI	Steel Door Institute
SSPC	Steel Structures Painting Council
WWPA	Western Wood Products Association

GENERAL REQUIREMENTS

Codes and Acts

MUTCD	Manual on Uniform Traffic Control Devices
NEPA	National Environmental Policy Act
OAR	Oregon Administrative Rules
SEPA	State Environmental Policy Act
UL	Underwriters Laboratories, Inc.
WAC	Washington Administrative Code

Federal Agencies

BLM	Bureau of Land Management
BOR	Bureau of Reclamation
FHWA	Federal Highway Administration
LCDC	Land Conservation and Development Commission
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
OSHA	Occupational Safety and Health Administration
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

State Agencies

DEQ	Oregon Department of Environmental Quality
DSL	Oregon Department of State Lands
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OWRD	Oregon Water Resources Department

Units of Measurement and Abbreviation (Partial Listing)

AC	Asphalt Concrete
ACP	Asphalt Concrete Pavement
CL	Centerline
C.O.	Clean Out
Cl.	Class
Conc.	Concrete
Culv.	Culvert
CY, C.Y., or Cu.Yd.	Cubic Yard(s)
DI	Ductile Iron

Dia.	Diameter
Ea.	Each
Elev., EL, or El.	Elevation
Est.	Estimate or Estimated
Extg.	Existing
F	Fahrenheit
F.F.	Finished Floor
FLG	Flange
fps	Feet Per Second
Ft.	Foot or Feet
gpm	Gallons Per Minute
HDPE	High Density Polyethylene
HMAC	Hot-Mix Asphalt Concrete
Hp	Horsepower
I.D.	Inside Diameter
In.	Inch or Inches
Inv.El.	Invert Elevation
Irr	Irrigation
L	Liter
Lb.	Pound(s)
L.F. or Lin.Ft.	Linear Foot (Feet)
LS or L.S.	Lump Sum
Max.	Maximum
MH	Manhole
MJ	Mechanical Joint
Min.	Minimum
N.T.S.	Not to Scale
O.C.	On Center
O.D.	Outside Diameter
PL	Plate
PVC	Polyvinyl Chloride
psi	Pounds Per Square Inch
Q	Flow Rate
R	Radius
REQD.	Required
RPM	Revolutions Per Minute
R/W	Right-of-Way
S	Sanitary Sewer
SCH	Schedule
SD	Storm Drain
SF, S.F., or Sq.Ft.	Square Foot
Sht.	Sheet
Stl.	Steel
SY, S.Y., or Sq.Yd.	Square Yard

TDH	Total Dynamic Head
Typ.	Typical
W	Water
WS	Wood Stave

C. CONSTRUCTION SEQUENCING AND TIMING OF WORK

The proper sequencing and timing of the construction elements of the Project is vital in meeting the intent of the Project schedule and to continue successful, uninterrupted wastewater treatment plant (WWTP) operations during construction. The sequencing efforts shall be carefully and thoroughly coordinated between the Contractor, the Engineer, and the Owner to ensure the Project schedule is met successfully with minimal disruption to WWTP operations.

During the construction period, the Owner shall be primarily responsible for the operation of the WWTP and sludge drying beds. The Contractor shall coordinate all Work that affects the operation of these facilities with the Owner. The Contractor shall provide and allow the Owner free access to these facilities for operation and shall assist the Owner in the operation of the facilities where necessary. The Contractor shall be responsible for maintaining all Project improvements under the direction of the Owner, until receipt of the Notice of Acceptability of Work.

The construction activities must be sequenced in a carefully coordinated manner to ensure an unbroken transition for the existing facilities to the new facilities, and to allow the Owner to continue to provide uninterrupted wastewater treatment and solids handling for their customers.

The construction sequence shall be at the option of the Contractor, in keeping with good construction practices, time restrictions, continued system operation requirements, and the schedule as outlined herein, all costs of which shall be included in the various bid amounts. The Contractor shall conduct the order of Work to allow existing facilities to remain operational, to the extent possible, during the construction of the Project and shall coordinate all activities through the Engineer and Owner.

The following summary of the construction sequencing and timing of Work elements shall be used as a general guideline for outlining the detailed Project schedule and work plan. The outlined Work elements may be completed in a different order than listed herein, including performance of two or more tasks concurrently, provided uninterrupted treatment of wastewater and sludge dewatering can be maintained.

1. Construction of drying beds 7 through 9 and all associated piping, structures, and appurtenances shall be completed prior to taking any of drying beds 1 through 4 off line. Construction of the new septage receiving station is recommended to occur concurrently with construction of drying beds 7 through 9.

2. Construction of the drying beds 1 through 4 improvements and all associated piping, structures, and appurtenances shall be completed prior to the constructing drying beds 5 and 6.

3. All phasing shall be carefully coordinated with the Owner to ensure that treatment of wastewater and sludge dewatering are not interrupted.

D. PROJECT WORK PLAN

The Contractor shall prepare and submit to the Engineer, prior to beginning of construction, a Project Work Plan. The Project Work Plan shall detail safety provisions, equipment, work crews, methods of performing the Work, submittal schedule, detailed construction schedule and sequencing of Work, quality control, and any other pertinent information requested by the Engineer or necessary to properly complete the Work.

E. PROJECT WORK MEETINGS/PROCORE

1. The Contractor and/or their superintendent shall meet with the Owner and Engineer on a regular basis to review the progress of the Work, Work schedule, Project concerns, etc., as may be appropriate. The intent of this meeting will be to keep communication channels open and to keep all parties informed as to the status of the Work. Generally, the meeting shall be held weekly; however, it may be scheduled at other times if needed. In addition to these meetings, the Contractor and resident Project Representative shall meet monthly, in a Record Drawing Review meeting, prior to submitting the monthly Application for Payment. This meeting will be used to review Record Drawings being kept on the Project by the Contractor.

2. The Contractor, Owner, and Engineer shall use the Engineer's electronic project document software (Procore) to manage construction documentation. Failure to use this software system shall be considered cause for suspension of Work.

   Procore is a web-based software application and does not require the Contractor to purchase or install any software. The Contractor shall be required to log in and upload all information for submission to the Owner or the Engineer.

   The Contractor, the Owner, and the Engineer shall use this program as the main communication and data storage for the Project.

   The following items shall be tracked using the Procore software including, but not limited to:

   a. Submittals

   b. Meeting Notifications and Minutes

   c. Request for Information (RFI)

d. Contract Schedules

e. Memos

f. Work Change Directives

Documents shall be uploaded in PDF format, unless otherwise approved by the Engineer. Weekly meeting documents shall be distributed through the Procore system to all attendees. The Engineer shall be responsible for preparing and distributing meeting agendas and minutes.

F. ENVIRONMENTAL REQUIREMENTS

The Contractor shall be responsible for obtaining an National Pollutant Discharge Elimination System Permit 1200-C for erosion and sedimentation control during construction if this permit is required. A copy of the permit shall be provided to the Engineer and Owner prior to the start of construction.

G. MOBILIZATION/DEMOBILIZATION

1. Mobilization shall consist of preparatory work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the Project Site for the establishment of offices, buildings, and other facilities necessary for Work on the Project, for premiums on bond and insurance for the Project, special fees, and for other work and operations which the Contractor must perform or costs the Contractor must incur before beginning Work on the Project.

2. Demobilization shall consist of work and operations including, but not limited to, those necessary for the movement of personnel, equipment, and incidentals from the Project Site, as well as preparation of operation and maintenance (O&M) materials and Record Drawings, Project photos, Project closeout, etc.

H. PROJECT SAFETY

1. The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work, including excavation safety. The Contractor shall comply with all applicable Laws and Regulations, ordinances, rules, and orders of any public body having jurisdiction as it relates to Project and Work safety. See applicable provisions of the General Conditions, as well as all other provisions of the Contract relative to Project and Work safety.

2. The Contractor shall maintain local access to area residents and emergency traffic throughout the life of the Project and coordinate construction activities closely with area residents to keep them informed of operations that may impact their use of any streets or roadways.

3. All signs, barricades, barriers, lights, cones, trench boxes, shoring/bracing, and other such "devices" required to warn, protect, or direct the public and workmen during the life of the Contract shall be furnished, installed, moved, and removed by the Contractor. When conditions warrant their use, flagpersons shall also be provided by the Contractor. The determination of what measures are required, in addition to those specifically called for by the Drawings and Specifications, shall be solely the responsibility of the Contractor.

4. The Engineer and Owner are not responsible for determining whether proper safety precautions, etc., are being utilized. Should the Contractor fail to furnish the necessary protective measures, the Owner or Engineer may, but shall not be required to, bring to the Contractor's attention by written notice of such failure and the Contractor shall undertake such corrective measures as is proper.

5. All construction Work shall be performed in accordance with the provisions of the Occupational Safety and Health Regulations of the Oregon Occupational Safety and Health Division, and other applicable regulations. It shall be the Contractor's responsibility to meet all requirements of Chapter 437 of the State of Oregon Administrative Rules. In addition, Oregon Revised Statutes (ORS) 757.542 through 757.562 and Oregon Administrative Rules (OAR) 860-024-0007 administered by the Oregon Public Utilities Commission shall apply.

6. The materials used for and the installation of all warning and traffic control devices shall conform to the applicable provisions of the Oregon Standard Specifications for Construction - current edition, Sections 00220 and 00225, and the Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration, current edition.

7. It shall be the Contractor's sole responsibility to provide a "competent person" as defined in the regulations to be on the Project Site during all trenching operations. The "competent person" appointed by the Contractor shall fulfill all requirements of the regulations.

8. Prior to opening an excavation, the Contractor shall arrange for field location of utility installations such as sewer, telephone, fuel, electric, gas, water lines, or any other underground installations that reasonably may be expected to be encountered during the excavation work. When excavation operations approach the estimated location of underground installations, the Contractor shall determine the exact location of the installations by safe and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard workers.

9. The Contractor shall ensure that structural ramps that are used by workers as a means of access or egress from an excavation shall be designed by a competent person, in accordance with all requirements of the regulations.

10. Workers exposed to public vehicular traffic shall be provided with and shall wear warning vests or other suitable garments marked with, or made of, reflectorized or highly visible material. No worker shall be permitted underneath loads handled by lifting or digging equipment. Workers shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped in accordance with the regulations to provide adequate protection for the operator during loading and unloading operations.

11. The Contractor shall take adequate precautions, in accordance with the regulations, to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions. These precautions include providing proper respiratory protection or ventilation and, when controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, the Contractor shall provide testing as often as necessary to ensure that the atmosphere remains safe. The Contractor shall provide emergency rescue equipment, such as breathing apparatus, safety harness, etc., where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

12. The Contractor shall not allow work in excavations in which there is accumulated water or in excavations where water is accumulating, unless adequate precautions have been taken to protect workers against the hazards posed by water accumulations. The precautions necessary to protect workers adequately vary with each situation, but include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and life line. If the Contractor is controlling water or preventing it from accumulating by the use of water removal equipment, the water removal equipment and operation shall be monitored by a competent person to ensure proper operation. If excavation work interrupts the natural drainage of surface water, such as streams, then diversion ditches, dikes or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

13. In situations where the Contractor feels their trench operations pose a risk to the stability of adjoining buildings, walls, or other structures, the Contractor shall notify the Engineer and shall provide adequate support systems per the requirements of the regulations. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to workers shall not be permitted except when the Contractor has retained a Registered Professional Engineer and said Registered Professional Engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity, or said Registered Professional Engineer has approved the determination that such excavation will not pose a hazard to workers.

14. Sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or other method of protection is provided to protect workers from the possible collapse of such structures. The Contractor shall provide adequate protection to all persons from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. The Contractor shall also provide protection by placing and keeping excavated materials or equipment at least two feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations or by a combination of both, if necessary.

15. The Contractor shall ensure that daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person appointed by the Contractor for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of Work and as needed throughout the shift. Inspection shall also be made after every rain storm or other hazard increasing occurrence. These inspections are only required when worker exposure can be reasonably anticipated. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, the Contractor shall remove workers from the hazardous area until the necessary precautions have been taken to ensure their safety.

16. It shall be the Contractor's responsibility to provide all physical barrier protection at all excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Further, no trenches shall be left open at any time unless guarded with adequate barricades, warning lamps, and signs. Proper traffic and pedestrian control shall be provided by the Contractor.

17. The Contractor shall ensure that each worker in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with the regulations.

18. It shall be the Contractor's responsibility to design the sloping and benching systems for trench excavation in accordance with the requirements of the regulations stated herein. Where the Contractor takes the option to not utilize one of the standard tables or trench excavation designs contained in OAR Chapter 437, then it is the Contractor's responsibility to retain a Registered Professional Engineer to design said sloping and benching system. When the Contractor chooses this option, the design shall be in written form and shall include at least the following information:

    a. The magnitude of the slopes that were determined to be safe for the particular Project.

    b. The configurations that would determine to be safe for the particular Project.

c. The stamp and signature of the Registered Professional Engineer approving the design.

19. At least one copy of the design shall be maintained at the Job Site while the slope is being constructed. After that time the design need not be at the Job Site, but a copy shall be made available to the Owner upon request.

20. Where the design of a support system, shield system, or other protective system is required, it shall be the Contractor's responsibility to meet all requirements of the regulations. It shall be the Contractor's responsibility to have on site at least one copy of the manufacturer's tabulated data which identifies the Registered Professional Engineer who approved the data or, when a support system or shield system or other protective system is not a standard manufactured item but is designed by a Registered Professional Engineer, at least one copy of the design shall be maintained at the Job Site during construction of the protective system. After that time, the design may be stored off the Job Site, but a copy of the design shall be made available upon request.

I. SHOP DRAWINGS

1. The Contractor shall submit Shop Drawings or manufacturer's data sheets in accordance with the Schedule of Shop Drawings and Sample submittals as listed hereafter and on the Project Procore site. It should be noted that the Engineer may require Shop Drawings for other items as may be deemed necessary. The Contractor should review the requirements for Shop Drawings in Section 7.16 of the General Conditions. A minimum of four paper copies of each item shall be submitted, unless approved otherwise by the Engineer.

2. All submittals or resubmittals shall be accompanied by and furnished in accordance with the "Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance" form provided at the end of these General Requirements. All submittals shall be submitted at a time sufficiently early to allow review of same by the Engineer and to accommodate the rate of construction progress required under this Contract.

3. The Engineer will return two prints of each Shop Drawing to the Contractor, with comments noted thereon, within 15 calendar days following their receipt at the Engineer's office. The Contractor shall make any corrections required by the Engineer and shall return the required number of corrected copies of Shop Drawings and resubmit new Samples for review. The Contractor shall direct specific attention in writing to revisions other than the corrections called for by the Engineer on previous submittals. It is considered reasonable that the Contractor shall make a complete and acceptable submittal to the Engineer by the second submission of the Drawing. The Owner reserves the right to withhold monies due the Contractor to cover additional costs of the Engineer's review beyond the second submission.

a. If Shop Drawings are returned to the Contractor marked "NO EXCEPTIONS NOTED," formal revision and resubmittal of said Shop Drawings will not be required.

b. If Shop Drawings are returned to the Contractor marked "NO EXCEPTIONS, PROVIDED THE FOLLOWING CONDITIONS ARE MET," formal revision and resubmittal of said Shop Drawings will not be required.

c. If Shop Drawings are returned to the Contractor marked "MAKE CORRECTIONS NOTED," formal revision and resubmittal of said Shop Drawings will not be required.

d. If Shop Drawings are returned to the Contractor marked "REVISE AND RESUBMIT," the Contractor shall revise said Shop Drawings and shall resubmit four copies of said revised Shop Drawings to the Engineer.

e. If Shop Drawings are returned to the Contractor marked "REJECTED," the Contractor shall revise said Shop Drawings and resubmit four copies of said revised Shop Drawings to the Engineer.

f. If Shop Drawings are returned to the Contractor marked "SUBMIT SPECIFIED ITEM," the Contractor shall submit material requested but shall not be required to resubmit all previous material.

4. For each resubmittal necessary, an additional 15 calendar days shall be allowed for review. The Contractor shall include copies of all approved submittal information in the Contractor's Record Drawings and O&M Manual. A copy of each Shop Drawing and Sample shall also be kept in good order by the Contractor at the job Site and shall be available to the Engineer.

Shop Drawings requirements shall include, but are not limited to:

a. Pipes, pipe supports, etc.

b. Fittings, couplings, valves, etc.

c. Pressure gauges and related appurtenances

d. Aggregate materials (base rock, etc.)

e. Concrete mix design and reinforcing steel

f. Asphalt concrete mix design

J. QUALITY CONTROL

1. The Contractor shall be responsible for providing their own construction monitoring and quality control program. The Contractor shall provide and maintain a quality control

program that will ensure the quality of the Work and materials incorporated into the Project. The Contractor shall also perform all tests required by Laws and Regulations, ordinances, and orders of public authorities. The Contractor shall provide appropriate quality control personnel and testing facilities and certified testing personnel to perform the Work. A written quality control program shall be provided to the Engineer for their review prior to any Work being performed. The plan shall describe testing facilities, qualifications of quality control and testing personnel, testing frequency, and reporting schedule. Copies of all test results shall be provided to the Engineer for their review as soon as the test has been performed. This includes copies of daily worksheets. Materials, equipment, or Work which fails to meet the Contract requirements shall not be used in the Work.

2. The Engineer and their representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating federal or state agency shall be permitted to review all Work, materials, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any review or testing thereof. The Contractor shall notify testing personnel, including testing personnel provided by the Owner or Engineer, at least 24 hours in advance of operations to allow for personnel assignments and test scheduling. All materials to be tested shall be provided by the Contractor at their expense. After tests are completed, the Contractor shall be responsible for repairing test areas to match original conditions. The Contractor shall pay for all additional reviews and retesting required because of defective Work or ill-timed notices.

3. The Contractor shall submit Samples of the material to be utilized on the Project to the Engineer for their review. The Engineer or their representative may take additional Samples and provide check tests on material being incorporated into the Work to verify compliance with the requirements of the Contract Documents. Materials or workmanship found to be outside of the specification limits shall be replaced with suitable material at no expense to the Owner.

4. Tests or reviews by the Engineer or others shall not relieve the Contractor from their obligations to perform the Work in accordance with the requirements of the Contract Documents and does not make the Engineer, or others, an insurer of the Contractor's Work.

5. When tests are required, the technician or technicians performing any testing shall possess valid Western Alliance for Quality Transportation Construction (WAQTC) recognized certifications, Oregon Department of Transportation (ODOT) recognized certifications, or American Concrete Institute (ACI) recognized certifications in the following disciplines:

    - Aggregate Testing Technician (AgTT)
    - Asphalt Testing Technician (AsTT)
    - Concrete Testing Technician (CTT)

- Embankment and Base Testing Technician (EBTT)
- Density Testing Technician (DTT)
- ACI Concrete Strength Testing Technician (CSTT)
- ACI Concrete Field Testing Technician (CTT)
- Certified Aggregate Technician (CAgT) (WAQTC = AgTT)
- Certified Embankment and Base Technician (CEBT) (WAQTC = EBTT)
- Certified Density Technician (CDT) (WAQTC = DTT)
- Certified Asphalt Technician I (CAT-I) (WAQTC = AsTT)
- Certified Asphalt Technician II (CAT-II)
- Certified Mix Design Technician (CMDT)
- Quality Control Technician (QCT)
- Concrete Control Technician (CCT)
- Concrete Strength Technician (CST)
- Concrete Laboratory Testing Technician (CLTT)

6. Following are the minimum required tests and testing frequency that shall be included in the Contractor's quality control program for the materials listed. See the Technical Specifications for other testing and quality control requirements. If the Contractor fails to provide all or any part of the required quality control testing and corresponding reports for the Project after the Engineer has requested the Contractor to do so in writing, the Owner may elect to have the quality control work performed by others and withhold the actual cost of quality work plus $100 for each test performed from payments owed the Contractor on the Project.

   a. Trench Backfill Materials

      A minimum of one ASTM D1557 laboratory density test will be performed for each testable material used as trench backfill, providing the maximum theoretical density and optimum moisture content of the material. A minimum of one nuclear gauge density test (ASTM D6938) will be performed every 300 feet along the trench line on each lift of material to show required density is being achieved. Once an acceptable compaction method is established and verified with field density tests, the testing interval can be reduced to 600 feet along the trench line. If backfill material or compaction equipment changes, compaction testing shall immediately be performed to verify that density is being achieved and shall continue at 300-foot intervals until a new compaction method is verified.

   b. Earthwork

      A minimum of one AASHTO T 180 laboratory density test will be performed for each testable material used as embankment material, providing the maximum theoretical density and optimum moisture content of the material can be determined. A minimum of one nuclear gauge density test (ASTM D6938) will be

performed every 800 square yards on each lift of material to show required density is being achieved. Once an acceptable compaction method is established and verified with field density tests, the testing interval can be reduced to one test each 1,600 square yards on each lift. If backfill material or compaction equipment changes, compaction testing shall immediately be performed to verify that density is being achieved and shall continue at 800 square yard intervals until a new compaction method is verified.

c. Base Rock

1) Testing required to qualify material source prior to production as outlined in Technical Specifications - "Surface Restoration."

2) Quality control testing required during production consists of the following:

Gradation	AASHTO T 27	Start of production and one test every 1,000 tons (three tests minimum)
Fracture Face	AASHTO T 335	Start of production and one test every 3,000 tons (three tests minimum)
Sand Equivalent	AASHTO T 176	Start of production and one test every 3,000 tons (three tests minimum)

3) Compliance of base rock produced and stockpiled before the Award Date or Notice to Proceed of this Contract will be determined by the following:

a) Provide all production records for testing that was performed during production.

b) If production records are not available, provide post testing of the stockpile per AASHTO T 2 as follows:

Gradation	AASHTO T 27	One test every 1,000 tons in stockpile (three tests minimum)
Fracture Face	AASHTO T 335	One test every 3,000 tons in stockpile (three tests minimum)
Sand Equivalent	AASHTO T 176	One test every 3,000 tons in stockpile (three tests minimum)

4) Compliance of base rock delivered to the Project Site will be determined by the following:

Gradation	AASHTO T 27	One test every 1,000 tons (three tests minimum)

Fracture Face	AASHTO T 335	One test every 3,000 tons (three tests minimum)
Sand Equivalent	AASHTO T 176	One test every 3,000 tons (three tests minimum)

5) A minimum of one AASHTO T 180 laboratory density test will be performed on base rock material, providing the maximum theoretical density and optimum moisture content of the material can be determined. A minimum of one nuclear gauge density test (ASTM D6938 or AASHTO T 310) will be performed every 800 square yards on each lift of base rock to show required density is being achieved. Once an acceptable compaction method is established and verified with field density tests, the testing interval can be reduced to one test each 1,600 square yards on each lift. If base rock material or compaction equipment changes, compaction testing shall immediately be performed to verify that density is being achieved and shall continue at 800 square yard intervals until a new compaction method is verified.

d. Aggregate Base Rock

1) Testing required to qualify material source prior to production as outlined in Technical Specifications - "Surface Restoration."

2) Compliance of aggregate base rock delivered to the Project Site will be determined by visual inspection by the Engineer.

e. Hot-Mix Asphalt Concrete (HMAC) Pavement

1) Testing required to qualify HMAC aggregate material source prior to production consists of the following (current ODOT certification of the material source can be substituted for this testing):

Soundness	AASHTO T 104
Abrasion	AASHTO T 96
Degradation	ODOT TM T-208
Lightweight Pieces	AASHTO T 113
Plastic Index	AASHTO T 103
Friable Particles	AASHTO T 112

2) Quality control testing required on HMAC aggregate during production consists of the following:

Gradation	AASHTO T 27	Start of production and one test every 1,000 tons (three tests minimum)
Sand Equivalent	AASHTO T 176	Start of production and one test every 3,000 tons (three tests minimum)
Fracture Face	AASHTO T 335	Start of production and one test every 3,000 tons (three tests minimum)
Wood Particles	ODOT TM T-225	Start of production and one test every 3,000 tons (three tests minimum)
Elongated Pieces	ODOT TM T-229	Start of production and one test every 3,000 tons (three tests minimum)
Dust or Clay Coating	ODOT TM T-226	Start of production and one test every 3,000 tons (three tests minimum)

3) Compliance of HMAC aggregates produced and stockpiled before the Award Date or Notice to Proceed of this Contract will be determined by the following:

a) Provide all production records for testing that was performed during production.

b) If production records are not available, provide post testing of the stockpile per AASHTO T 2 as follows:

Gradation	AASHTO T 27	One test every 1,000 tons in stockpile (three tests minimum)
Sand Equivalent	AASHTO T 176	One test every 3,000 tons in stockpile (three tests minimum)
Fracture Face	AASHTO T 335	One test every 3,000 tons in stockpile (three tests minimum)
Wood Particles	ODOT TM T-225	One test every 3,000 tons in stockpile (three tests minimum)
Elongated Pieces	ODOT TM T-229	One test every 3,000 tons in stockpile (three tests minimum)
Dust or Clay Coating	ODOT TM T-226	One test every 3,000 tons in stockpile (three tests minimum)

4) Quality control testing of hot-mix asphalt concrete pavement mixture required during placement is as follows:

Asphalt Content	AASHTO T 308	One test every 1,000 tons, one test per day minimum
Gradation	AASHTO T 30	One test every 1,000 tons, one test per day minimum
Maximum Specific Gravity	AASHTO T 209	One test every 1,000 tons, one test per day minimum
Compaction	WAQTC TM 8	5 tests every 1,000 tons
Percent Hydrated Lime	ODOT TM T-321	One test every 1,000 tons

Asphalt content, gradation, and maximum specific gravity testing will be performed at the start of production to verify the hot-mix asphalt mix design.

f. Portland Cement Concrete (PCC)

Aggregate testing is required to be completed with the mix design. Should additional testing of aggregate for PCC be deemed necessary by the Engineer, testing shall be performed by the Contractor as specified by ASTM C33. Samples shall be selected at random from the stockpile and tested for conformance with the Specifications. The decision to perform aggregate testing and testing frequencies shall be left to the Engineer.

Quality control testing of PCC during and following placement is as follows:

Air Content	AASHTO T 152	One test per each set of cylinders
Slump	AASHTO T 119	One test per each set of cylinders
Concrete Temperature	AASHTO T 309 ASTM C1064	One test per each set of cylinders
Strength	ASTM C31 AND ASTM C39	One set of three cylinders per 25 cubic yards (minimum one set per day or placement.) Test one cylinder at seven days and two cylinders at 28 days.

K. REVIEW OF WORK

It is not the intent of the Owner or Engineer to provide continuous or full-time observation of all Work. When required by the Engineer, the Contractor shall provide the Engineer a daily report of their Work progress and proposed Work schedule for the next two days. This daily communication shall be a requirement of the Contract.

L. REQUEST FOR INTERPRETATION (RFI)

The Contractor may request information or seek clarification concerning the Work from the Engineer utilizing the "Request for Interpretation" form in the Contract Forms section of the Contract Documents. The Engineer will provide a written response to the RFI utilizing the form within 10 days of receipt of the RFI. If a change in the Contract requirements is necessary, the procedures in Article 11 of the General Conditions shall be followed.

M. COOPERATION WITH OTHERS

The Contractor shall cooperate with the residents and business owners in the area to provide good access to private property whenever possible. Sidewalks shall be kept clear at all times of any construction materials. Barricades, traffic cones, blinkers, and signing shall be used to direct the public through the Work area safely.

N. CONSTRUCTION STAKING

1. The Contractor shall carefully preserve benchmarks, reference points, and stakes set by others. In the case of willful or careless destruction by the Contractor, the Contractor shall be charged with the resulting expense of replacement and shall be responsible for any mistakes or liability that may be caused by the loss or disturbance.

2. Any additional staking requested by the Contractor, replacement of stakes or hubs lost or disturbed by the Contractor or due to vandalism or other reasons, or re-staking required because of improper construction will be done by the Engineer at the Contractor's expense or by a licensed professional land surveyor hired by the Contractor. The Engineer requires two business days' notice (excluding weekends and holidays) prior to the time the staking is required. The Contractor shall secure the Work area and protect all construction staking.

3. The Contractor shall utilize the existing drying beds finish floor elevations shown on the Drawings as benchmarks and reference points.

O. EXISTING SURVEY MONUMENTATION

1. The Contractor shall be responsible for the protection and perpetuation of existing land survey, property, or construction monuments shown on the Drawings, which are marked or are clearly visible on the ground.

2. The Contractor shall give the Engineer a minimum of 48 hours' notice prior to working in the vicinity of any such monument that the Contractor may disturb so the Owner can arrange for such monuments to be referenced. When proper notice is provided, the Owner shall have any disturbed monuments restored following construction. Should the Contractor fail to provide adequate notice to the Engineer, the Contractor shall be responsible for the expense of having the disturbed monument restored by a qualified surveyor.

P. EXISTING UTILITIES

1. Contact treatment plant personnel to coordinate tie-ins and conflicts with existing utilities.

2. Known utilities and structures expected to be adjacent to or encountered in the Work are shown on the Drawings. Information on existing utilities may be provided by others and existing records may not be complete or accurate. It is expected there may be discrepancies and omissions in the location, size, and quantities of utilities and structures shown. Those shown are for convenience of the Contractor only, and no responsibility is assumed by either the Owner or Engineer for their accuracy. The Contractor shall work closely with the owner of any utilities or structures affected by the Work to avoid any damage.

3. The Contractor shall be responsible for the actual locating and protecting of existing utilities. The Contractor, prior to commencement of Work, shall contact existing Utility Companies such as water, sewer, power, telephone, gas, etc., to have the Utility Companies locate all utilities which will be affected by the Work to be performed. The Contractor shall give notification at least two business days but not more than 10 business days before commencing excavation in accordance with ORS 757-557. The "call before you dig" number is 811 or 1-800-332-2344. The Contractor shall perform all necessary coordination work with the Utility Companies in performing the Work and shall be fully responsible for any damage to existing utilities caused by the Contractor's operations. The Contractor shall make any advance exploration necessary to protect all existing utilities and to properly plan the installation of pipelines or other work to the design line and grade. No payment shall be made for this work for up to two hours of advanced backhoe excavation work necessary to locate each existing utility at each specific site. The Work shall include all labor, equipment, etc., necessary to perform the location work. These costs shall be understood to be included in the Contract Prices. Should the Contractor be unable to locate the existing utility after its location has been marked by the appropriate utility company and diligent effort made by the Contractor to locate the utility including up to two hours of backhoe excavation work for each utility at each location site, the Contractor may be entitled to additional compensation as outlined hereafter. When prior notice has been given to the Engineer and the Engineer gives approval, the Contractor shall be paid for all additional backhoe excavation work required to locate the utility on an hourly basis under the bid item "Additional Potholing" when listed in the Bid Schedule or through an approved Change Order. Any additional potholing work performed by the Contractor without prior written approval of the Engineer will not be paid for.

4. If a conflict develops between the design line and grade of a pipeline or Project improvement and an existing utility, the Engineer may adjust the pipeline grade or have the existing utility relocated. The existing utility may be relocated by the owner of the utility or its designated representative or by the Contractor upon the approval of the

utility owner and the Engineer. The Contractor shall perform all relocation work required by the Engineer. If the Contractor performs the relocation work, a Change Order shall be negotiated prior to any actual work unless payment for the work is specified otherwise.

5. The owner of the utilities shall normally be responsible for taking the utility out of service if necessary for the performance of the Work; i.e., shutting valves, etc. In the case of water valves, the owner of the water system may operate the valves or request the Contractor to do so. When the Contractor is requested to do so, the Contractor shall operate water valves as a normal part of the Work at no additional cost to the Owner. All water valves shall be operated as instructed by the owner of the valves. It can be expected that some valves may not fully operate properly which may require that additional valves be operated. This situation shall be considered a normal requirement of the Work.

6. The Contractor shall receive prior approval from the appropriate authority or utility owner before any public or private utility service is interrupted.

   a. The Contractor shall give a minimum of four hours' notice to all utility customers who will be affected by the Contractor's operations. No utility service shall be disconnected or interrupted for more than nine hours or as required by the utility owner, whichever is less, in any 24-hour period. When disruption of service will be longer than nine hours in any one day, the Contractor shall provide safe and appropriate temporary service. All temporary service shall be coordinated with the utility owner.

   b. When regular utility service interruption is required during the course of the Work, the Contractor shall submit a written plan to the Engineer and utility owner which details proposed Work plan notification procedures, and estimated extent of service interruption. The Contractor must obtain written approval of their plan from the utility owner prior to interrupting the utility service. As a minimum, notification shall include door hangers and public notification in the newspaper and radio, as appropriate. Personal contact shall be made where practical.

   c. The Contractor shall make every effort possible to provide continuous utility service to all utility customers. When special conditions exist where an interruption of utility service would create an extra hardship on the utility customer or create a hazardous condition, the Contractor shall provide continuous service. Particular care and planning must be arranged to provide continuous service of existing services or temporary services as approved by the utility owner and the Engineer.

   d. If the Contractor inadvertently damages or interrupts an existing utility, the Contractor shall immediately notify the affected utility company, Owner,

Engineer, and utility users and make arrangements to provide temporary service to the parties affected.

e. The Contractor shall, as requested by the Engineer, either immediately arrange for the utility company to make the needed repairs or immediately make the repair to the damaged utility.

f. The Contractor shall pay the full cost of repair and damages when the utility was previously located and was within four feet on either side of the marked location as required by the Call Before You Dig notification system, or where negligence of the Contractor occurred.

g. The Contractor will be paid for the cost of repair and damages when existing utilities encountered during the performance of the Work were not previously located by the utility as required by the Call Before You Dig notification system, where existing utilities were farther than four feet away on either side of the marked location, and where damage to the utilities occurred due to no negligence of the Contractor.

h. If the Contractor fails to make immediate repairs and provide service as required, the Owner may have said Work performed by others and deduct the cost of said Work from payment to the Contractor.

7. The Contractor shall support and otherwise protect all pipes, conduits, cables, poles, and other existing services where they cross the trench or are otherwise undermined or affected by their Work. The Contractor shall restore the support of an undermined existing utility using select backfill compacted to 95 percent maximum density as determined by ASTM D698.

Q. PROGRESS OF THE WORK - CLEANUP

1. The Contractor shall arrange their work schedule such that all phases of Work, once started, shall be diligently pursued until completed. The intent is that the work area shall not be disturbed for undue periods of time. Work shall not be left uncompleted. If the Engineer determines that Work is not being diligently completed, the Engineer shall request the Contractor to complete said Work.

2. Cleaning up shall be a continuing process from the start of the Work to final acceptance of the Project. The Contractor shall, at all times, at their own expense and without further order, keep property on which Work is in progress free from accumulations of waste material or rubbish caused by employees or by the Work, and at all times during the construction period shall maintain structure sites, rights-of-way, easements, adjacent property, and the surfaces of streets and roads on which Work is being done in a safe condition for the Contractor's workers and the public.

a. Accumulations of waste materials that might constitute a fire hazard will not be permitted.

b. Spillage from the Contractor's hauling vehicles on traveled public or private roads shall be promptly cleaned up. The Contractor shall take appropriate action to control dust caused by their operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the construction Project.

c. Upon completion of the Work, the Contractor shall, at their own expense, remove all temporary structures, rubbish, waste material, equipment, and supplies resulting from their operations. They shall leave such lands in a neat and orderly condition that is at least as good as the condition in which they found them prior to their operations.

d. Should the Contractor fail to provide said cleanup upon 24-hour written notice, the Owner shall have the right to perform such Work at the expense of the Contractor and withhold the cost from the Contractor's payments.

3. The Contractor shall replace or restore, equivalent to their original condition, all surfaces or existing facilities disturbed by their Work, whether within or outside of the Work areas. Restoration work will include, but is not limited to, roadways, utilities, structures, landscaping, etc.

R. EXISTING EQUIPMENT REMOVAL AND SALVAGE

Existing equipment or materials removed by the Contractor during the course of the Work, which the Owner requests to be salvaged, shall remain the property of the Owner. The equipment and materials shall be removed with care to prevent unnecessary damage and shall be neatly stored at a location directed by the Engineer. Equipment or materials not to be salvaged as requested by the Owner shall be salvaged or recycled by the Contractor in accordance with ORS 279C.510(1) if feasible and cost effective.

S. STARTUP AND TRAINING

It shall be the Contractor's responsibility to install all system components in accordance with the manufacturer's recommendations. All equipment shall be lubricated and adjusted as components prior to testing the system as a whole. The Contractor shall arrange with the Engineer to witness a test of the system and equipment after installation is completed. The Contractor shall provide the services of manufacturers' representatives to assist with the startup of major components and to provide training to the Owner's personnel. These tests shall demonstrate the complete facility operates in accordance with the Drawings and Specifications and the required functions. It is anticipated that minor adjustments may occur after the system has been started up. The Contractor shall make adjustments and correct deficiencies as required so the system can be kept in operation once it is placed into service.

These adjustments, etc., shall be completed before final acceptance. The Contractor shall pay all costs associated with manufacturer's representatives and startup work.

As part of this Work, the Contractor shall provide startup training to the Owner and Engineer in sufficient detail so the Owner and Engineer are fully familiar with the proper operation and maintenance of Project components and systems. The startup training shall occur after the construction Work is complete and properly functioning.

T. RECORD DRAWINGS

1. The Contractor shall maintain on the Job Site an up-to-date, complete, and accurate set of Record Drawings. These Drawings shall include all Work performed by the Contractor and shall note any changes or deviations made from the details shown on the Construction Drawings. Such deviations would include, but not be limited to, dimensional changes, location, grade changes, elevation changes, material type, configuration, etc. All changes shall be neatly and accurately shown on the Record Drawings. The Record Drawings shall also include all required job photos. The Engineer will provide one full-size set of prints for use by the Contractor in preparing the Record Drawings.

2. The Contractor shall provide ties to all buried service line taps from an above-ground reference point such as a valve, manhole, etc. At least two swing tie references shall be provided for all service line stubouts which will not be connected to an active service. Swing tie measurements shall be from some permanent reference point, i.e., house corner, fire hydrant, power pole, etc. All ties shall be provided in such a way that the buried service line can be accurately located after construction Work is complete. All buried improvements shall be described in detail including location, type, size, depth, brand name, model numbers, etc. Buried improvements shall include valves, fittings, repair clamps, connections to existing lines, etc. All offsets shall be appropriately noted on the Drawings.

3. A clear color digital photo shall be taken of each improvement that will be permanently buried on the Project, such as connections to existing lines, fittings, repairs, valve configurations, etc. These photos shall become a part of the Project Record Drawings. The intent is that the Contractor shall provide good photo documentation of underground improvements that can be used in future years for maintenance or service of the buried improvement. Failure on the part of the Contractor to properly document these improvements will result in deductions described in this section. The Contractor shall provide two typical photos of repetitive type underground work such as manhole connections, cleanouts, water/sewer service connections, water meter installations, etc. Individual photos shall be taken for non-typical installations. A scale, survey rod, or similar reference device shall be included in the photo to provide a size reference when appropriate. Only digital photos will be allowed. Digital photos are to be used so the quality of the photo can be verified prior to the covering of the underground improvement. If an acceptable photo is not obtained with the first photograph, the

Contractor shall take additional photos until an acceptable quality photo(s) has been obtained. A system shall be set up linking the photo with a log describing the date the photo was taken, the location of the photo, applicable Drawing sheet references, plus any appropriate information relative to what is being shown. The photo shall clearly document the underground improvement being shown, such as size of pipe fittings, etc. All details shall be clearly observable. The Contractor shall print and clearly index in a three-ring loose-leaf notebook all of the required job photos with all labels and information required for each photo next to the appropriate photo. Two color copies of the notebook shall be provided in addition to the original color photo notebook.

4. The Contractor shall also note the locations, types, size, depth, etc., of any existing utilities encountered during the performance of the Work. The Record Drawings shall be available for inspection during the Project by the Owner and Engineer. The Contractor shall keep the Record Drawings current each day to avoid loss of critical or important information.

5. Prior to submitting the monthly Application for Payment, the Contractor shall meet with the Project Representative to review, in detail, the Record Drawings and job photos prepared by the Contractor for the Project. The Contractor shall demonstrate to the Project Representative that current, up to date, accurate, and complete Record Drawings have been prepared for the Work performed to date. The Contractor and Project Representative shall compare Record Drawing information being kept by each to be sure there is consistency in the information being collected. Monthly Application for Payment requests will not be approved or processed until this meeting is held and the Contractor demonstrates that acceptable Record Drawings have been prepared by the Contractor. The Contractor shall also certify, by signing the Application for Payment, that their Record Drawings and job photos are up to date, accurate, and complete.

6. Prior to the Contractor submitting the Contractor's Notice of Substantial Completion, the Contractor shall give the Record Drawings and photographs to the Engineer.

7. IT IS INTENDED THAT THE RECORD DRAWINGS BE COMPLETE AND DETAILED. EXAMPLES OF ACCEPTABLE RECORD DRAWINGS ARE AVAILABLE FOR INSPECTION AT THE ENGINEER'S OFFICE. CONSIDERABLE EFFORT SHALL BE EXPENDED IN PREPARING THE RECORD DRAWINGS.

U. OPERATION AND MAINTENANCE MANUAL

1. Three copies of an O&M Manual shall be submitted to the Engineer prior to the Contractor submitting the Contractor's Notice of Substantial Completion. The material shall be bound in a three-ring loose-leaf notebook with the Project name, Owner's name, Engineer's name, and Contractor's name printed on the cover. The material shall also be clearly indexed and grouped by the various systems in the Project. This data shall be supplied for all materials, equipment, and devices and components which will require maintenance, replacement of parts, and knowledge of operation. The information

furnished shall pertain specifically to the materials and equipment furnished. Manufacturers' O&M manuals that deal with more than one product line shall have the non-relevant information crossed or blocked out. Also, in addition to the three bound copies due prior to final completion of the Project, the Contractor shall furnish one copy of O&M material to the Engineer for all major equipment when it arrives on the Job Site. The Contractor shall furnish a complete listing of all equipment supplied and each respective Supplier's name, address, and telephone number. The O&M data furnished shall include detailed manufacturer's O&M information on each component, function description of operation, a complete parts list, and a separate parts list for parts not readily available.

2. For all electrical systems, in addition to other requirements listed herein, Record Drawing one-line diagrams and wiring diagrams properly labeled shall be submitted. The Contractor shall also furnish the Engineer with copies of the appropriate plan sheets marked up with "Record Drawing" locations of conduits underground, under or in concrete slabs, locations of installed equipment, and the name, address, and phone number of the electrician who installed the system.

3. For mechanical systems, in addition to other requirements listed herein, where appropriate, lubrication schedules shall be furnished or clearly identified in the manufacturer's O&M Manual.

4. For painting systems, the Contractor shall provide either fresh labels from paint cans with a list of places used or a written description of the painting systems, locations used and application requirements, and Supplier's name, address, and phone number.

5. IT IS INTENDED THAT THE O&M MANUAL BE COMPLETE AND DETAILED. EXAMPLES OF ACCEPTABLE O&M MANUALS ARE AVAILABLE FOR INSPECTION AT THE ENGINEER'S OFFICE. CONSIDERABLE EFFORT SHALL BE EXPENDED IN PREPARING THE O&M MANUAL.

6. Included hereafter is a partial listing of items for which manufacturer's data should be included in the O&M Manual. Information such as manufacturer's name, equipment model number, size, type, instructions for installation, calibration, operation, service and parts, etc., should be indicated for the specific items that have been incorporated into the Project. Non-relevant information shall be crossed or blocked out.

   a. Pipe - Type and Pressure Rating
   b. Fittings
   c. Valves
   d. Valve Boxes
   e. Couplings
   f. Check Valve
   g. Manufacturer's Guarantee on Materials Furnished

END OF SECTION

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE				DATE	NO.
SECTION 1 – REQUEST REVIEW OF THE FOLLOWING ITEMS *(This section will be initiated by the Contractor)*					
TO ENGINEER:		FROM CONTRACTOR:		PROJECT	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL
ITEM No.	DESCRIPTION OF ITEM SUBMITTED *(Type, size, model number, etc.)*	MFR. OR CONTR. CAT. CURVE DRAWING OR BROCHURE NO.	No. OF COPIES	CONTRACT REFERENCE DOCUMENT SPEC. SECTION NO. / DRAWING SHEET NO.	COMMENTS
REMARKS NOTE: Contractor shall note any variations from requirements of the Contract Documents.				I certify that the above-submitted items have been reviewed in detail as required by the Contract Documents (see General Conditions 7.16) and have been approved by the Contractor. NAME AND SIGNATURE OF CONTRACTOR	

TECHNICAL SPECIFICATIONS

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Technical Specifications

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SECTION 1

EXCAVATION AND BACKFILL OF TRENCHES

TECHNICAL SPECIFICATIONS

SECTION 1

EXCAVATION AND BACKFILL OF TRENCHES

PART 1 - GENERAL

1.1 Summary

These Specifications cover the excavation and backfill of trenches for the installation of storm sewer, sanitary sewer, water lines, service lines, pressure sewer lines, and other underground utilities.

1.2 Definitions

A. Foundation material or stabilization fabric will only be required when standard bedding requirements will not adequately support the pipe.

B. Backfill is the filling of the trench to the existing ground level or the finish grade line shown on the Drawings.

C. General trench excavation shall include whatever materials that are encountered (except solid rock) to the depths shown on the Drawings or as required to properly install the pipe.

D. Solid Rock

1. Solid rock is defined as being rock formations other than cemented gravels that require hard ripping, jackhammering, blasting, or other extra work beyond the capability of heavy-duty trench excavating equipment such as a Caterpillar 235 or 345B Excavator.

2. Cemented gravel excavation may be included as "Rock Excavation" when said excavation requires hard ripping, jackhammering, or blasting and ONLY when, in the opinion of the Engineer, such conditions were unforeseen and are beyond the capability of heavy duty trench excavating equipment such as a Caterpillar 235 or 345B Excavator.

1.3 Safety

A. See requirements for Project safety in the General Conditions and General Requirements.

B. The determination of the safe trench width is the sole responsibility of the Contractor.

1.4 Existing Utilities

See the General Conditions and General Requirements for Contract requirements for existing utilities and for preservation of survey monumentation.

1.5 Dust and Mud Control

A. The Contractor shall take appropriate action to control dust and mud caused by their operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the construction Project.

B. No measurement or payment shall be made for this Work.

1.6 Soil and Groundwater Conditions

A. Soils data and groundwater conditions, when shown on the Drawings, are provided for the Contractor's information, may not be relied upon, and are a general description only. This information may or may not be shown. The Engineer assumes no responsibility for actual soil conditions.

B. Soils data and groundwater conditions, when shown, shall not relieve the Contractor from the responsibility of making additional investigations. The Contractor shall perform investigations as they deem necessary to acquaint themselves with actual conditions to be encountered in performing the Work. Groundwater conditions in particular should be carefully considered and are subject to change.

PART 2 - MATERIALS

2.1 Foundation Material

Foundation material shall be well-graded 2-1/2"-0 or 1-1/2"-0 crushed rock.

2.2 Bedding and Select Backfill

Bedding and select backfill shall be well-graded 3/4"-0 crushed rock or approved equal. All bedding and select backfill materials shall be subject to the approval of the Engineer.

2.3 General Backfill

A. General backfill will consist of material excavated from the trench, or material imported by the Contractor. General backfill material shall be free of vegetative matter, boulders (6-inch plus), frozen material and any other unsuitable material, and shall have a

moisture content that will allow for the required compaction of the general backfill material unless approved otherwise by the Engineer. Use of backfill material containing consolidated masses 6 inches in diameter or greater is prohibited.

B. When necessary, the Contractor shall selectively separate suitable general backfill material from unsuitable general backfill material.

C. When the Engineer determines that the native material excavated from the trench is unsuitable or unacceptable for use as general backfill, the Engineer may require the Contractor to remove the unsuitable material from the Project Site and import suitable general backfill material. Suitable material shall be similar in nature to native soils as approved by the Engineer. When imported general backfill must be placed in or below the groundwater, the imported general backfill shall be free draining granular material with less than 20 percent passing a No. 4 sieve and less than 3 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 Clearing and Grubbing

A. Contractor shall do all clearing and grubbing and removal of structures, etc. necessary to permit proper installation of the pipeline and to eliminate the possibility of stumps, logs, brush, or rubbish being mixed with the backfill material. A sufficient amount of all stumps and stump roots shall be removed so that any future removal of any remaining parts of the stumps and/or roots will not damage the pipeline. All stumps, roots, logs, brush and rubbish shall be removed and disposed of in conformance with the requirements of local authorities controlling air pollution, and solid waste disposal.

B. Should the area in which construction takes place be served by rural mail carrier service, the Contractor shall cooperate with the mail service and re-install, in a convenient location, any rural mail boxes which will have to be removed or be blocked by construction operations. As soon as the Work is completed, all mail boxes removed shall be replaced undamaged in their original location.

C. As soon as the Work is completed, all signs, guardrails, utility poles, fences, etc., that were moved for the construction operation shall be replaced undamaged in their original location. Damaged items shall be replaced by the Contractor with new items of equal quality.

3.2 Cutting of Asphalt Pavement and Concrete Sidewalks, Curbs and Driveways

A. Where the excavation is made in a paved street, the asphalt surface shall be cut on each side of the trench prior to excavation, to provide a vertical joint in the surface. Cutting of the asphalt will be made with a saw designed for the cutting of asphalt.

B. The use of a jackhammer, wheel cutter, or other similar tool may be allowed by the Engineer only where the Contractor can demonstrate that the alternate method provides a neat straight edge.

C. Prior to excavating across a concrete structure such as a curb, sidewalk, or driveway, the Contractor shall cut and remove a section of the structure to provide for their excavation. The dimensions of the removed section shall be such that the Contractor's excavation will not result in undermining of the remaining structure.

D. The Contractor shall cut the concrete structure with a diamond saw or other equipment designed for that purpose such that a neat, straight, vertical edge is left on the remaining concrete structure. The Contractor shall similarly cut and remove any such concrete structure undermined or damaged by their construction work.

E. Following proper backfill and compaction of their excavation, as specified herein, the Contractor shall repair streets, replace the curbs, sidewalks, or driveways in conformance with the Drawings, or, if no Drawing is provided, equal to the condition prior to removal.

3.3 Trench Excavation

A. General

When solid rock is encountered in trench excavation, the Engineer shall be notified.

B. Trench Width

1. The maximum trench width in the pipe zone shall be 2 feet plus the O.D. of the pipe and the minimum trench width in the pipe zone shall be 1 foot plus the O.D. of the pipe. This width shall be maintained to the top of the pipe.

2. The maximum clear width above the top of the pipe will not be limited except in cases where excess width of excavation would cause damage to adjacent structures or utilities.

C. Exploratory Work

Contractor shall perform appropriate exploratory work to locate utilities when they are known to exist but the specific location is unknown or not marked accurately. Appropriate exploratory work shall be performed in these situations.

3.4 Shoring, Sheeting, and Bracing of Trenches

A. The Contractor shall adequately sheet and brace the trench during excavation whenever necessary to satisfy trench safety standards, prevent cave-ins, or to protect adjacent structures or property. Where sheeting and bracing are used, the Contractor shall increase trench widths for the bracing material accordingly.

B. The sheeting must be kept in place until the pipe has been placed, backfilled at the pipe zone, tested for defects, and repaired if necessary. All sheeting, shoring, and bracing of trenches shall conform to the requirements of the public agency having jurisdiction.

3.5 Dewatering Excavated Areas

A. All groundwater, seepage, or stormwater that may occur or accumulate in the excavation during the progress of the Work shall be removed. In areas where the nature of soil and hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the dewatering operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench.

B. All excavations shall be kept free of water during the construction or until otherwise requested by the Engineer.

C. Contractor shall dispose of all waste and water removed from the trench. Disposal shall be in accordance with all state and local regulations.

3.6 Location of Excavated Materials

A. During trench excavation, the excavated material shall be located within the construction easement or right-of-way so that the excavated material will not obstruct any private or public traveled roadways or streets, or cause undue damage to the streets.

B. Contractor shall provide means of containing overly saturated soils, i.e., muck, or remove the muck from the Work area as it is excavated, if such soils are encountered in the excavation. The intent is to prevent excessive damage or disruption to street rights-

of-way or easement beyond what would normally occur during such Work. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least two feet from the edge of the trench. It shall be the Contractor's responsibility, however, to determine the safe loading of all trenches.

3.7 Disposal of Excavated Materials

Contractor shall dispose of all excavated material, which is not required for, or is unsuitable for, backfill. The Contractor's method of disposal shall comply with regulations of the governing body having jurisdiction.

3.8 Trench Backfill

A. All backfill material shall be placed into the trench so that free fall of the materials into the trench is prevented until at least two feet of cover is provided over the pipe. Under no circumstances shall sharp or heavy pieces of material be allowed to drop directly onto the pipe. Methods of backfilling, other than as specified herein, shall be used only upon the approval of the Engineer.

B. Bedding and Select Backfill

1. A minimum 4-inch depth of bedding shall be placed on the trench bottom, compacted to 95 percent of the maximum density as determined by ASTM D698 and smoothed to provide uniform bedding so the pipe is supported along its full length and not by the bells. Bell holes at each joint shall be provided to ensure support along the entire pipe length.

2. It shall be understood that the 4-inch depth is a minimum depth only, not an average depth, and does not preclude the Contractor at their option from placing additional depth of bedding to facilitate their Work. Once the pipe is properly installed, the bedding material shall be brought up to the spring line of the pipe in 4-inch lifts and compacted to 95 percent density. Care shall be used to ensure that the bedding material is properly worked under the haunch of the pipe for its full length. No additional payment will be made to the Contractor should they elect to use additional bedding material for their convenience. Payment for any additional bedding material used as foundation material must be approved by the Owner prior to any Work being performed.

3. Select backfill shall then be brought up from the spring line to the minimum distance above the top of the pipe shown on the Drawings, leveled and compacted to 95 percent of ASTM D698 density. Compaction of the bedding and

select backfill by hand tamping will be allowed if the 95 percent density is achieved; otherwise, mechanical tamping will be required.

4. When an open-graded material is used for bedding or foundation material to facilitate trench dewatering, the open graded material shall be placed to the spring line of the pipe. The Contractor shall make provisions to ensure that fines from the select backfill do not migrate into the open graded bedding or foundation material. To prevent soil migration the Contractor may use any of the following:

   a. Provide a properly graded select backfill approved by the Engineer;

   b. Provide an approved fiber/fabric between the open graded bedding material and select backfill;

   c. Hydraulically jet select backfill fines into open graded bedding material after dewatering is complete and before general backfill is placed; or

   d. Provide an alternative approved by the Engineer.

C. All general backfill material shall be pushed first onto the slope of the backfill previously placed and allowed to roll down into the trench. The Contractor shall not push the backfill material directly into the trench until at least two feet of cover is provided over the pipe.

D. Compaction

1. In roadways, driveways, under curbs and sidewalks, as shown on the Drawings, or as required by the Engineer, general backfill shall be placed in horizontal lifts not to exceed 12 inches in depth and compacted to 95 percent of the laboratory density as determined by ASTM D1557.The method of compaction shall be selected by the Contractor.

2. The Contractor shall exercise extreme care to avoid damage to the pipe during compaction of the trench. Where materials consist of cobbles and coarse gravels, compaction of each lift shall be accomplished by at least five passes of an appropriate vibrating type compactor. When materials are such that meaningful in place density test cannot be run, then the Contractor and Engineer will agree on a method of compaction which will provide adequate compaction.

3. In sections where specific compaction requirements are not specified or required by the Engineer, general backfill shall be compacted, as a minimum, to a density

equal to that of the natural ground adjacent to the trench. All trenches shall be maintained for a period of one year after final acceptance of the Project. Any settlement of the trenches during the one-year guarantee period shall be remedied promptly at the request of the Engineer and at no additional cost to the Owner.

3.9 Execution of Dust and Mud Control

If the Contractor fails to properly control the dust and mud, the Engineer may request them to do so in writing. If, after 24 hours from this request, the Contractor has not corrected the dust or mud problem, the Owner may elect to have the corrective work performed and withhold the cost from the Contractor's payments.

3.10 Restoration, Finishing, and Cleanup

A. The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures and fences, or other existing facilities disturbed by their Work unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed.

B. All surplus material and temporary structures as well as excess excavation shall be removed by the Contractor and the entire Site of Contractor operations shall be left in a neat and clean condition.

C. Surface restoration shall be performed in accordance with Technical Specifications - "Surface Restoration." All other existing facilities shall be replaced or restored equal to their original condition.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis of Measurement and Payment

A. Unless specifically listed in the Bid Schedule, there will be no measurement or payment made for general trench excavation, shoring, and backfill of trenches, including bedding and select backfill. All costs shall be included in other appropriate bid items listed in the Bid Schedule. See Technical Specifications - "Measurement and Payment" for a description of the bid items for this Project.

B. The Contractor shall make allowance in their Bid for importing up to 10 percent of the general backfill material required on the Project and shall perform this Work when, in the opinion of the Engineer, native soil conditions require removal and replacement of unsuitable material. The Engineer and the Contractor shall document all general backfill

quantities removed using neat line average trench section areas and lengths to compute quantities. Should the quantity which is removed and replaced exceed 10 percent of the total general backfill required on the Project, the amount of general backfill imported over 10 percent shall be paid for under a negotiated Change Order or under the bid item for "Imported General Trench Backfill" when included in the Bid Schedule. Material called for removal and replacement with defined material, specifically on the Drawings, shall not be considered as a part of the import allowance.

C. Unless specifically listed in the Bid Schedule, there will be no measurement or payment made for general trench excavation, backfill of trenches, including bedding and select backfill. All costs shall be included in other appropriate bid items listed in the Bid Schedule.

D. When specific repair work is not listed in the Bid Schedule, required repair work will be paid for by an approved Change Order. There shall be no payment for damaged water lines or sewer lines that have been marked by the Owner prior to excavation and are within the four feet specified. When rock excavation is required to complete the Work and unit prices for rock excavation are not included in the Bid Schedule, rock excavation shall be performed by Change Order.

4.2 Surface Restoration

The Contractor should note the pay limits of gravel and asphalt restoration listed under Technical Specifications - "Surface Restoration."

4.3 Additional Excavation

All such additional excavating work shall be performed by Change Order, unless previously shown on the Drawings and/or called for in the Bid Schedule or identified in other portions of the Specifications. This provision applies also to manhole and vault foundations.

4.4 Shoring, Sheeting, and Bracing

Unless provided for in the Bid Schedule, no additional payment will be made for shoring, sheeting, or bracing of trenches.

END OF SECTION

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SECTION 2

SITE WORK

TECHNICAL SPECIFICATIONS

SECTION 2

SITE WORK

PART 1 - GENERAL

1.1 Scope

These Specifications cover the Site improvements, including earthwork, excavation and backfill, road work, curbs and sidewalks, asphalt pavement, landscaping, etc. Work shall include furnishing all equipment, materials, labor, etc., as required to complete the required improvements. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections herein, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

1.2 Earthwork

A. Earthwork Quantities

The approximate quantities, shown on the Drawings, of material required for the embankment construction and the quantity available from the excavation have been made based on the ground elevations shown on the Drawings. Estimated quantities may vary because the actual ground surface elevations shown may vary and the shrinkage factor of the soil may vary. The Work shall be performed on a lump sum, all required basis. No field measurements of quantities will be made. The Contractor shall make their own determination of the actual quantity of earthwork required to complete the Work as shown on the Drawings.

B. Clearing and Grubbing

Clearing and grubbing shall include the removal and disposal of any unwanted items, such as existing curbs, sidewalks, pavement, culverts, fences, etc., and organic material such as trees, tree stumps, brush, hedges, vegetation, roots, rubbish, posts, fences, sod, and topsoil, and any other obstacles or materials in the construction area which would prevent completing the Project, and which are unsuitable for site work construction.

C. Excavation

Excavation shall consist of the excavation, haul, placement and/or satisfactory disposal of all materials taken from within the work area for the construction of embankments, subgrade, ditches, entrances, approaches, structures, curbs, sidewalks, and incidental work to the lines, grades, and cross sections shown on the Drawings.

D. Balancing Earthwork

Any imbalance in the actual earthwork which may occur shall be adjusted by either of the following methods. When sufficient material is not available from the excavation areas to construct the embankments, the Contractor shall arrange for and obtain borrow material to complete the Work, unless borrow areas are designated on the Drawings. When excess or unsuitable material exists beyond that required to complete the embankments, the Contractor shall dispose of the excess material at a location selected by the Contractor outside of the Project boundaries, unless a waste site has been designated on the Drawings or by the Owner. Balancing the earthwork shall be incidental to the Work performed.

E. Construction Stakes

See the General Requirements for staking requirements.

1.3 Submittals

A. Asphalt Concrete

The Contractor shall submit for review by the Engineer data on the asphalt concrete mix to be used. Data shall include aggregates, gradation and tolerances, aggregate suitability, asphalt concrete, mix proportions and tolerances, etc.

B. Site Drainage System

The site drainage work consists of furnishing and installing the site drainage pipes, building drainage pipes, catch basins, and appurtenances as required. The Work includes, unless otherwise specified, furnishing all labor, materials, tools, equipment, and incidentals required to construct a complete drainage system ready for service as outlined in the Drawings and Specifications.

1.4 Materials Certification and Testing

A. General

All testing shall be performed as per the requirements of the Drawings and Technical Specifications. Materials and work which fail to meet Contract requirements shall not be incorporated in the Work.

B. Owner's Responsibility

The Owner may provide routine testing services on materials and Work incorporated on the Project. These tests may include, but are not limited to, spot gradation checks, in-place densities, concrete air, slump and compression test, extraction/gradations, etc. All routine testing services performed by the Engineer or Owner are provided for the Owner's information and in no way relieves the Contractor's responsibility to comply fully with the Contract requirements.

C. Contractor's Responsibilities

1. The Contractor shall provide, at their expense, all preliminary testing needed to determine if materials are suitable for the Project.

   a. If aggregates are crushed for use on this Project, the Contractor shall be responsible for providing adequate quality control tests to document that the materials conform to these Specifications.

   b. All tests required by Laws and Regulations shall also be the responsibility of the Contractor.

   c. The results of all tests performed on materials to be used on the Project by the Contractor shall be submitted to the Engineer, prior to the use of any of these materials.

2. The Contractor shall cooperate with testing personnel and shall provide access to the work area and to manufacturer's operations.

   a. The Contractor shall notify testing and inspection personnel at least 24 hours in advance of operations to allow for personnel assignments and test scheduling.

   b. All materials to be tested shall be provided by the Contractor at their expense. After tests are completed, the Contractor shall be responsible for repairing test areas to match original conditions.

   c. The Contractor shall remove all defective material from the Site at their expense. The Contractor shall pay for re-inspection and retesting required because of defective work or ill-timed notices.

1.5 Construction Staking

Refer to the General Requirements for construction staking.

PART 2 - MATERIALS

2.1 Earthwork

A. Backfill Material

Suitable backfill material, unless shown otherwise on the Drawings, shall be the material excavated at the Site or crushed rock as approved by the Engineer. Backfill material shall be free from sod, roots, trash, large cobbles, or other debris, etc., and shall be at a proper moisture content to achieve compaction.

B. Borrow Material

Borrow material shall be equal to or better than the on-site backfill material.

C. Water for Compaction

The Owner will allow the Contractor to use water from the existing water system at no cost when such a water system exists, provided the Contractor follows the requirements set forth by the Owner.

2.2 Aggregate Materials

A. General

All aggregate materials for aggregate base rock, base rock, or surface rock, unless called for otherwise, shall meet the following requirements:

Percent Wear (AASHTO T 96)	40% Maximum
Durability Index Coarse and Fine	35% Maximum

B. Aggregate Base Rock

The aggregate base rock shall be a well-graded 4"-0 crushed or uncrushed basalt material with the fraction passing the #200 sieve not greater than 8 percent of the total aggregate weight. Other materials may be considered by the Engineer; however, Samples must be submitted for review.

C. Base Rock

Base Rock shall substantially conform to current Oregon "Standard Specifications for Construction" for base aggregate materials, Section 02630, or as otherwise approved by the Engineer. The Contractor shall have the option of using 1-1/2"-0, 1"-0, or 3/4"-0 base rock unless designated otherwise on the Drawings.

D. Surface Rock

1. The surface rock shall be crushed stone or gravel meeting the following requirements:

Liquid Limit (AASHTO T 89)		35 Maximum
Plasticity Index (AASHTO T 90)		2-9 Maximum
Dust Ratio	% Passing No. 200	2/3 Maximum
	% Passing No. 30	

2. Grading Requirements (AASHTO T 11 and T 27)

Sieve	Percent Passing
1"	100
3/4"	70-98
#4	36-60
#8	25-47
#30	12-31
#200	8-15

3. Surface rock shall have at least 70 percent by weight of the particles retained on the #4 sieve and shall have at least two fractured faces.

2.3 Concrete

Concrete for curbs and sidewalks shall comply with the requirements of Technical Specifications - "Reinforced Concrete."

2.4 Hot-Mix Asphalt Concrete Pavement Materials

A. Asphalt Concrete

Asphalt concrete shall be an approved commercial mix generally conforming to the applicable provisions of the current "Oregon Standard Specifications for Construction" for asphalt concrete pavement. Unless approved otherwise, the mix shall generally conform to Section 00744 for a 1/2-inch dense Level 2 mix. The Contractor shall submit for review by the Engineer data on the asphalt concrete mix to be used. Data shall include aggregates, gradation and tolerances, aggregate suitability, asphalt concrete, mix proportions and tolerances, etc.

B. Tack Coat

The material can be an asphalt cement of the same grade as the asphalt concrete, or CRS-1 or CSS-1 emulsified asphalt.

C. Asphalt Seal Coat

Asphalt seal coat shall consist of CSS-1 emulsified asphalt mixed with water at a rate of 1 to 1.

2.5 Area Drains

A. Area Drains

1. Area drains shall be precast units manufactured in accordance with ASTM C139 and C913. Basin type shall be Oregon Department of Transportation standard G-2 inlet base appropriate precast concrete adapter to match frame and grade, or approved equal.

2. Concrete shall have a compressive strength of 3,000 psi.

3. Reinforcement in precast structures shall be rebar meeting ASTM A615, Grade 60 or welded wire meeting ASTM A497. Reinforcement shall not be required for cast-in-place structures.

4. Precast bases shall be furnished with cutouts or knockouts. Knockouts for pipes shall have a wall thickness of 2 inches minimum and may be located on all four sides.

B. Frames and Grates

1. Catch basin and area drain grates shall be metal castings conforming to the requirements of ASTM A48, Class 30. Castings shall be tough, close-grained, gray iron free from blowholes, shrinkage, and cold sheets. Castings shall be smooth, sound, clean, and free from blisters and defects. Castings shall be planed and ground when necessary to ensure flat and true surfaces.

2. Catch basin frame and grate shall be East Jordan Iron Works 7035 with M6 vane grate, or approved equal.

3. Field inlet frames and grates shall be hot-dip galvanized flat bar A36 steel as shown on the Drawings, or approved equal.

C. Pipe Connection to Area Drains

1. All pipe connections to precast units shall be watertight.

2. For solid wall polyvinyl chloride (PVC) and ductile iron pipe, a 1/2-inch pipe gasket stretched over the pipe shall be used in combination with a non-shrink grout to provide a watertight seal.

3. The profile wall PVC and high density polyethylene pipe connection shall utilize gaskets or fittings in combination with a non-shrink grout to provide a watertight seal and shall be approved by the Engineer.

PART 3 - EXECUTION

3.1 Earthwork

A. Clearing and Grubbing

1. All vegetation, rubbish, and debris shall be removed and disposed of by the Contractor in conformance with the requirements of local authorities controlling air pollution and solid waste disposal.

2. When topsoil at the Site is to be saved and reused, it shall be stripped and stored clear of the construction area. Take reasonable care to prevent the topsoil from becoming mixed with subsoil and other debris, etc.

3. The Contractor shall exercise care to minimize disturbing the natural ground or vegetation outside the limits of the construction area.

B. Excavation

1. Prior to any excavation, the area to be excavated shall be cleared and grubbed.

2. Allow for forms, working space, granular base, and finish topsoil as shown or required. Do not carry excavation for footings and slabs deeper than the elevation shown. All over-excavated areas shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

C. Backfilling

The Contractor shall exercise care during backfilling operations to prevent damage to footings, pipes, or other structural elements. The Contractor shall also pay particular attention to compaction around footings to avoid settlement of floor slabs or steel floors at the footing-floor connection points. All fill material shall be compacted to 95 percent of ASTM D1557 laboratory density.

D. Subgrade Cut Areas

In subgrade cut areas, the subgrade material shall be compacted to 90 percent of maximum density as determined by ASTM D1557 for a minimum of 6 inches below the top of the subgrade. Depending on the type of material encountered, the Contractor may have to scarify, aerate or add water, over-excavate, or take other actions as necessary to achieve the required compaction.

E. Trenching for Underground Improvements

Trenching for underground improvements shall comply with the applicable provisions of the Technical Specifications - "Excavation and Backfill of Trenches."

F. Roadway and Site Subgrades

1. All grading and subgrade preparation and other excavations and embankments shall be trimmed accurately to the lines, grades and cross sections as shown on the Drawings and established by the Engineer and shall be finished in a thoroughly workmanlike manner to within plus or minus 0.05 foot of the required grade.

2. The grade shall be in a neat and well-finished condition at the time the Project is completed. The entire right-of-way area shall be cleaned up and made free of debris and foreign matter of all kinds. Accumulations of dirt and/or other materials shall be disposed of in a manner satisfactory to the Engineer.

3. Upon completion of the subgrade and prior to placement of any geotextile fabric, if required, and aggregate materials, the Contractor shall load test the finished subgrade surface. The load test shall consist of slowly driving a loaded dump truck over the subgrade surface. The dump truck shall have a minimum capacity of 10 cubic yards. The Engineer and Contractor shall note any soft areas.

4. The Contractor shall excavate and either replace unsuitable material or properly compact all soft areas in order to provide a firm base that conforms to the Specifications. Any soft areas that occur as part of the Project because of overwatering, improper compaction, weather, etc., shall be replaced at no cost to the Owner. If the soft areas are due to existing condition beyond the Contractor's control, such as existing water lines leaking, swampy areas, springs, etc., then the Contractor will be additionally compensated either by utilizing established unit prices, or by approved Change Order.

G. Water for Compaction

The Contractor shall be responsible for obtaining, transporting and the application of the water.

H. Shoring, Sheeting, Bracing, and Sloping

Install and maintain shoring, sheeting, bracing, and sloping necessary to support the sides of the excavation, to keep and to prevent any movement which may damage adjacent pavements, utilities, or structures, damage or delay the Work, or endanger life and health. Install and maintain shoring, sheeting, bracing, and sloping as required by OSHA, and other applicable governmental regulations and agencies.

3.2 Placement of Aggregate Materials

A. The construction procedure described herein shall be understood to apply to each of the courses and/or layers of aggregate materials of which the Site is to be constructed.

1. After the subgrade is brought to the proper line, cross section and compaction, the aggregate materials shall be spread and shaped as required.

2. The spreading and shaping of the aggregate materials shall be so performed as to prevent separation of the coarser material from the finer materials including the use of adequate water.

3. The aggregate materials shall be brought to proper moisture content as required for compaction and compacted to 95 percent of maximum density as determined by ASTM D1557.

4. The finished surface when tested with a 10-foot straightedge shall not vary from the testing edge by more than 0.05 foot at any point.

5. Following construction of each lift, the Contractor shall do such blading, brooming, watering and other work as necessary to prevent raveling and rutting.

6. These operations are to be continued as required until the lift is covered by a following lift or until all Work to be done under the Contract is completed.

7. If the required compacted depth of any lift exceeds 6 inches, it shall be constructed in two or more lifts, each lift not exceeding 6 inches in depth.

B. Upon completion of the aggregate materials placement, the Contractor shall load test the finished surface. The load test shall consist of slowly driving a loaded minimum 10 yard dump truck over the road surface.

C. All soft areas shall be noted. The Contractor shall excavate and/or compact all soft areas in order to provide a firm base that conforms to the requirements of the Technical Specifications. This shall be done at the Contractor's expense.

3.3 Concrete Curbs/Sidewalks

A. General

Concrete curbs and sidewalks shall be constructed in accordance with these Technical Specifications and the lines, grades and cross-sections shown on the Drawings. Curbs may be constructed with forms or with a curbing machine meeting the requirements of these Technical Specifications. Curbs located on vertical or horizontal curves shall be constructed to result in a uniform and smooth curve appearance.

B. Curbing Machine

The machine for extruding Portland Cement concrete curb, if used, shall be of the self-propelled type equipped with a material hopper, distributing screw and adjustable curb forming devices capable of placing and compacting Portland Cement concrete to the lines, grades, and cross-sections as shown in an even homogeneous manner. A grade line gauge or pointer shall be attached to the machine in such a manner that a continual

comparison can be made between the curb being placed and the established curb grade as indicated by the offset guideline.

C. Placement and Finishing

1. The top and face of finished curbs shall be true and straight and the top surface of curb shall be of uniform width free from humps, sage, honeycombs or other irregularities. When a straight edge 6 feet long is laid on the top face of the curb or on the surface of gutter, the surface shall not vary more than 0.02 foot from the edge of the straight edge except at grade changes or vertical curves. The Contractor shall construct all curb and gutter within 0.02 foot of true line, within 0.02 foot of established surface grade, cross-section and slope and within 0.02 foot of specified thickness.

2. When the curbing machine is used, the Contractor shall feed the concrete into the extruding machine at a uniform rate and operate the machine under sufficient restraint in a forward motion to produce a well compacted mass of concrete. All exposed surfaces of the curb shall be floated, followed by a light brush finish.

3. If forms are used, they shall be removed after the concrete has taken its initial set and while the concrete is still green enough to finish. Minor defects shall be repaired with mortar containing one part Portland Cement and two parts sand.

4. Honeycombed, slumped, and other structurally defective concrete shall be removed and replaced at no expense to the Owner.

5. All exposed formed surfaces shall receive a rubbed finish utilizing a Carborundum brick or other abrasive until a uniform color and texture is produced.

D. Joints

1. Expansion Joints

a. Expansion joints shall be provided opposite abutting expansion joints, at the end of curved sections, at connections to existing curbs or sidewalks, and adjacent to any structure.

b. The width of joints and thicknesses of filler shall match those of the joints and abutting or underlying concrete; elsewhere the filler thickness shall be 1/2 inch.

c. Each expansion joint shall be at right angles to the structure alignment, vertical to the structure surface, and shall provide complete separation of new cement concrete.

2. Transverse Contraction Joints

a. Transverse contraction joints of the weakened plane or dummy type shall be formed in the exposed surfaces opposite contraction joints in abutting Portland Cement concrete and at other locations in the new curb or sidewalk as required to confine the contraction joint spacing to a maximum of 10 feet.

b. The joints shall be formed by grooving, by insertion and removal of plates or other devices, by insertion and leaving in place of preformed bituminous filler, or by sawing.

c. Contraction joints shall be 3/16 inch in width and a minimum depth of 1/4 of the thickness of the concrete.

d. The edges of joints shall be tooled, unfilled grooves and shall be clean and neat, and joint filler shall be even and flush with the surface of the concrete. If the joints are constructed by sawing the sawing shall be performed as soon as practical after pouring and prior to the occurrence of any shrinkage cracking.

3.4 Hot-Mix Asphalt Concrete Pavement

A. General

1. After completion of the base and application of the soil sterilant or preparation of the existing mat, the Contractor shall place and compact one or more lifts of hot-mix asphalt concrete to the lines, grades, thicknesses, and cross-sections shown on the Drawings and as established by the Engineer. The asphalt concrete shall consist of a hot mixture of asphalt cement, well graded high quality aggregate, mineral filler and adhesive as required. It shall be plant mixed into a uniformly coated mass, hot laid on a prepared foundation and compacted to the specified density.

2. At least one week before paving is scheduled to begin, the Contractor will set up a pre-paving meeting between the Contractor and the Engineer. If a paving Subcontractor is being used they shall also be present. The intent of the meeting

is to allow the Engineer and the Contractor to jointly review the proposed method of operation, equipment, personnel, mix, schedule, etc., along with the Project Specifications.

B. Placement

1. Weather Limitations

a. Asphalt concrete plant mix shall be placed on properly prepared surfaces. The air temperature and the surface temperature shall be no less than those specified in the following table.

Surface Temperature Limitations		
Compacted Thickness of Individual Courses	Wearing Course	Leveling and Base Course
Less than 1-1/2"	60°F	55° F
1-1/2" to 2"	50°F	45°F
Over 2-1/2"	40°F	35°F

b. Placement during rain or other adverse weather conditions normally will not be permitted, except when approved by the Engineer and only when the mix is in transit at the time these adverse conditions occur. Under these conditions the mix may be laid if the mix is at a proper temperature, if the mix has been covered during transit, and if the mix is to be placed on a foundation free from pools or flow of water. Should the Contractor proceed with their paving operation knowing that adverse weather is predicted the Contractor will proceed at their own risk and shall assume all losses associated with the Work stoppage due to improper weather.

C. Hauling Equipment

1. Vehicles used for hauling asphalt concrete mixes shall have tight clean smooth metal beds which have been thinly coated with a minimum amount of paraffin oil, lime solution, soapy water, or other approved material to prevent the mixture from adhering to the beds.

2. Vehicles which cause excessive segregation, which leak badly, which are contaminated with material other than asphalt cement, or which delay normal operations shall not be used.

3. All hauling vehicles shall be supplied with canvas tarps to cover the mix. All asphalt concrete loads shall be covered during transport, unless otherwise approved by the Engineer.

D. Asphalt Concrete Pavers

1. Asphalt concrete pavers shall be self-contained, power propelled units provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing lifts of asphalt concrete plant mix material in lane widths applicable to the specified typical sections and to required thicknesses, lines, grades, and cross-sections. The paver shall be equipped with a receiving and distribution system of sufficient capacity for a uniform spreading operation and shall be capable of placing the mixture uniformly in front of the screed without segregating the materials.

2. The paver shall be designed to compensate for minor irregularities of the base on which it is supported that such will not be reflected immediately in the surface of the lift being placed. The weight of the paver shall be supported on tracks or wheels, none of which shall contact the mixture being laid.

3. The contact area of the screed or strike-off assembly shall be uniform over the entire width of the mixture being placed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.

E. Compactors

1. Rollers shall be steel-wheeled, pneumatic tired, vibratory, or a combination of these types, as the Contractor may elect. They shall be in good condition capable of reversing without backlash and shall be operated at speeds slow enough to avoid displacement of the asphalt concrete mixture. Weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

2. As a minimum, steel wheel rollers must weigh a minimum of 10 tons and must be capable of at least 250 pounds per lineal inch of width on the drive or compression wheel, on the surface asphalt.

3. Pneumatic rollers must be capable of exerting a minimum pressure 80 pounds per square inch of tire surface on the asphalt surface.

4. Vibratory rollers must weigh a minimum of 6 tons and shall be equipped with amplitude and frequency controls specially designed for compaction of asphalt mixtures.

F. Existing Structures

1. All edges of manholes, valve boxes, curbs, existing pavement, etc., that are to be in contact with the new asphalt concrete shall be cleaned and painted or sprayed with a thin tack coat.

2. This tack coat is to be applied only far enough in advance as is appropriate to ensure a tacky, sticky condition at the time the asphalt concrete comes in contact with the structure. The application of the tack coat shall be done in a neat, workmanlike fashion. Any material inadvertently applied to surfaces away from the paving, such as on sidewalks, exposed sections of curbs, etc., shall be cleaned by the Contractor at no expense to the Owner.

G. Hauling, Spreading, Finishing, and Temperature Control

1. The temperature of the mixture at the time it is spread into final position shall be within the tolerances set by the mix design, but in no case less than 250°F.

2. The mixture shall be laid in strips of such widths as to hold to a practical minimum the number of longitudinal joints required. Longitudinal joints in any course shall not occur within the area or width of a traffic or auxiliary lane. On shoulder areas such joints shall occur only at points of change in the transverse slopes as shown on the Drawings. Longitudinal joints in one layer shall offset those in the lift immediately below by a minimum of 6 inches. The maximum compacted thickness for any lift shall be 3 inches, unless otherwise approved by the Engineer.

3. Except for unavoidable delay or breakdown, delivery of hot asphalt cement mixture to the paving machine shall be at a rate sufficient to provide as nearly continuous an operation of the paving machine as possible. Segregation of materials, slumping loads, non-uniform texture, boils, slicks, fouled surfaces, and other defects in material and workmanship shall be corrected by the Contractor at their own expense.

4. The internal temperature of the mixture shall not be less than 180°F upon achieving density requirements in accordance with the applicable Specifications.

Vibratory rollers shall not be used under any circumstances when the internal temperature of the mixture is below 175°F.

H. Compaction

1. Immediately after the asphalt concrete mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted to a minimum of 91 percent of the maximum density as determined by ASTM D2041. The completed course shall be free from ridges, ruts, humps, depressions, objectionable marks or irregularities and in reasonable conformance with line, grade, and cross section as shown in the Drawings or as established by the Engineer.

2. Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking or shoving occurs. All compaction equipment units shall be operated at the speed, within specification limits, that will produce the required compaction. Areas inaccessible to specified compaction equipment shall be compacted by mechanical or hand tampers. Any asphalt concrete that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced at no additional cost with fresh hot mix which shall be immediately compacted to conform with the surrounding area.

3. Final rolling shall be performed with tandem steel wheel rollers. Rollers shall move at a slow but uniform speed with the drive rollers or wheels nearest the paver. Normally rolling shall begin at the sides and proceed longitudinally parallel to the lift being placed. When paving against a previously placed layer, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. Rollers shall not make sharp turns on the course being compacted and then shall not be parked on the hot asphalt mixture. Alternate trips of a roller shall terminate in stops at least 5 feet distant longitudinally from the adjacent preceding stops.

4. When using static steel-wheeled or pneumatic-tired rollers to roll longitudinal joints, only 4 to 6 inches of the roller width shall ride on the newly-placed lane on the first pass. The bulk of the width shall ride on the previously compacted side of the joint. In each subsequent pass, more and more of the roller width shall be allowed onto the fresh mat, until the entire width is on the new mixture. With vibratory rollers, the roller drums shall be extended only 4 to 6 inches onto the previously compacted lane with the rest of the drum width riding on the

newly placed mixture. The roller shall continue to move along this line until a thoroughly compacted, neat joint is obtained.

I. Transverse Joints

1. Placing of the asphalt concrete mixture shall be as continuous as possible. Rollers shall not pass over the unprotected end of freshly laid mixture unless the end will be subjected to traffic. In that case the end shall be made to or left at a bevel of approximately 50:1 (horizontal to vertical).

2. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the lift.

3. An asphalt tack coat shall be applied on contact surfaces just before fresh mixture is placed against the previously rolled mixture.

4. At ends of other rigid type structures, compacting shall be in transverse direction as well as longitudinally.

J. Longitudinal Joints

1. The Contractor shall take special precautions when constructing longitudinal joints to ensure that the two mats are properly bonded together and a smooth surface is provided. If possible, the Contractor shall schedule their operations so that all longitudinal joints are constructed when the mats are still hot (above 180°F).

2. When the adjacent mat is allowed to cool, the Contractor shall clean the joints and provide a tack coat of asphalt cement or CRS-1 or CSS-1 emulsified asphalt. The paving screed should be set to overlap the first mat by 1 to 2 inches and the elevation set to equal the amount of roll down expected during compaction of the new mat. The coarser aggregate shall be raked away from the joint, allowing the finer material to be compacted into the joint.

K. Surface Tolerances

The top surface of each lift shall closely parallel that specified for the top surface of the finished pavements. The surface of each lift shall be tested by the Engineer for trueness to specified grade and transverse slope at selected locations. Testing, if done, will be with a 10-foot straightedge. Variation of the surface from the testing edge of the straightedge between any two contact points with the surface shall at no point exceed 0.05 foot on an underlying lift and 0.03 foot on the top lift.

L. Special Protection under Traffic

No traffic or equipment shall come in contact with the compacted mixture until it has cooled and set sufficiently to prevent marking; edges shall be protected from being broken down.

M. Compaction and Testing of Hot-Mix Asphalt Concrete Pavement

1. Compaction Density Requirements

The Engineer may utilize a nuclear gauge and test strip to establish a target density for quality control. A description of the procedure to establish target density is described hereafter. A minimum of five random nuclear gauge tests shall be run on a maximum 400 sq. yd. test lot. The average of these tests shall be at least 98 percent of the target density as determined on a test strip, with none of the tests less than 95 percent. The Contractor will cooperate with the Engineer during the initial startup of the paving operation to set up the test strip used in determining the target density.

2. Control Strip - Target Density Method Compaction Control of Bituminous Pavements With Nuclear Density Gauge

a. The following is a field test method, whose purpose is to obtain a "Target Density" which will act as the basis for the control of density in compaction of bituminous pavements. The Target Density will be determined by the Engineer. This procedure will be utilized, at the option of the Engineer.

1) Establish a control strip that is approximately 400 square yards in area. It should be located within and become a portion of the completed paved area. The location of the control strip should be typical of the area for which it will act as the control.

2) Select an initial test point that is a random spot within the control strip. This point should be located so that it is near the center of a normal roller pass and shall be no closer than 2 feet from the edge of the placed mat. The point should be no closer than 25 feet from either end of the control strip. The thickness of the mat at this initial point should be at least the specified depth required.

3) Random test points shall be selected at random within the control strip and should be located so they represent the entire area of the strip. Normally they should be no closer than 2 feet from the panel edge and no closer than 10 feet to the ends of the control strip. Usually 10 of these random points should be designated.

4) The rollers used for compaction of the bituminous material on the control test strip must meet the requirements of the Technical Specifications. Rolling of the control strip shall be performed using a standard rolling pattern in a like manner as will be done on the entire Project.

5) After each roller pass over the Initial Point, a density test is to be performed using a nuclear density gauge. To determine the density select a smooth roller surface area, use a fine sand to fill open surface pores and seat the gauge firmly. A 15 second count is run on backscatter and the wet density recorded. A second 15 second count is then run at the same location. Turn the gauge 90° and run two additional tests for 15 seconds. The density is the average of the four readings. Record the temperature of the A.C. at the time of the density after each roller pass. The temperature should be taken at the midpoint of the mat.

6) The standard rolling pattern is to be repeated covering the entire control strip area and the density tests repeated after each roller pass over the initial point until such time as no further compaction can be obtained as determined by the testing.

7) When no more compaction or densification of the bituminous mat can be obtained as indicated by the density readings at the initial point, the rolling shall be discontinued. Density tests shall immediately be made on all of the random test points and an average density shall be determined. The average density of the random test points shall be considered to be the Target Density providing it meets the following criteria:

   a) The average density of the random test points must be at least 98 percent of or greater than the maximum density of the Initial Point.

b) No single density of any random test point shall be less than 95 percent of the maximum density of the Initial Point.

8) If the average density of the random test points meets the above criteria, then it is considered to be the Target Density. If the criteria is not met, then another Control Test Strip must be established and the entire sequence repeated.

b. A new Target Density should be established if:

1) A change in mix design is made.

2) A change in depth of the mat being placed is made.

3) There is a change in aggregate source or character of the material.

4) More than a 10-day run has been made. A change in the character of the roadway subgrade, base, etc. which indicates a changed condition has occurred.

5) A substantial change in weather or other conditions which could change the current target value, but with the changed conditions being within allowable specified limits.

N. Asphalt Seal Coat

1. After the construction of the asphalt concrete, the Contractor shall apply a fog seal consisting of an asphalt seal coat and applied at a rate to be determined by the Engineer. It is anticipated that this rate will be between 0.05 to 0.20 (0.03 to 0.10 residual) gallons per square yard.

2. The areas to be sealed shall be dry and free of dirt, dust, leaves, or other foreign matter at the time of placement. After application and initial cure of the emulsified asphalt the Contractor shall apply a light coat of clean fine sand. The sand shall be applied evenly and then broomed across the pavement surface. After approximately 5 days the Contractor shall sweep the street and remove the excess loose sand.

O. Adjustment of Utility Covers To Grade

The Contractor shall adjust the tops of all manholes, valve boxes and other utility covers as required to bring the covers or gratings of the structures to the grade required by the improvement involved. The Contractor shall repair any of these structures which are damaged during performance of the Work at no cost to the Owner.

3.5 Area Drains

A. Area drains shall be constructed to the line, grade, and detail as shown on the Drawings and as approved by the Engineer.

B. Excavation and backfill shall be performed in the same manner as specified in Technical Specifications - "Excavation and Backfill of Trenches," where applicable. Backfill shall be brought up evenly on all sides of the area drains.

C. All area drains are to be watertight, including all connections and joints, and any leakage shall be corrected in an approved manner.

D. New Connections

1. All connections shall match the grade and alignment of the pipe entering and exiting each unit. Pipe connections shall be constructed so flow is not restricted in any way.

2. All holes shall be located to provide the design flow line and direction of any pipe entering the catch basin, area drain, or field inlet. After the pipe connection is made and set to grade, the annular space between the pre-cast unit and the pipe shall be cement grouted to permanently set the flow line of the pipe. Non-shrink cement grout shall be used.

3.6 Site Cleanup

The Site shall be left in a clean, neat, and presentable condition. All debris, construction materials, unsightly rocks, tree roots, or other material which detracts from the appearance of the Site shall be disposed of in a satisfactory manner.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis

See Technical Specifications - "Measurement and Payment" for a description of the basis of measurement and payment for Work performed under this Contract.

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SURFACE RESTORATION

PART 1 - GENERAL

1.1 Scope

A. The Contractor shall perform all Work and furnish all materials to restore the work area including any gravel, asphalt, concrete, lawn, fences, or any other surfaces or items damaged or disturbed by their construction operation. Surface restoration shall follow as closely as possible the backfill and compaction of excavations.

B. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

PART 2 - MATERIALS

2.1 Base Rock

Base rock shall substantially conform to current Oregon Standard Specifications for Construction for base aggregate materials, or as otherwise approved by the Engineer. The intent is to specify a base rock which is suitable for use in the restoration of areas disturbed by the Contractor's Work. Base rock required shall generally be 1"-0, or 3/4"-0, unless otherwise specified or approved. The Contractor shall submit to the Engineer Samples of the base rock proposed for use on the Project.

2.2 Asphalt Concrete

Asphalt concrete shall be an approved commercial mix generally conforming to the applicable provisions of the current Oregon Standard Specifications for Construction for asphalt concrete pavement. Unless approved otherwise, the gradation of the mix shall generally conform to a 1/2-inch dense mix. The Contractor shall submit for review by the Engineer data on the asphalt concrete mix to be used. Data shall include aggregates, gradation and tolerances, aggregate suitability, asphalt concrete, mix proportions and tolerances, etc.

2.3 Surface Aggregate

A. The surface aggregate shall be crushed stone, slag, or gravel meeting the following requirements:

Liquid Limit (AASHTO T 89)		35 Maximum
Plasticity Index (AASHTO T 90)		2 to 9 Maximum
Dust Ratio	% Passing No. 200 / % Passing No. 30	2/3 Maximum

Grading Requirements (AASHTO T 11 and T 27)	
Sieve	**Percent Passing**
1"	100
3/4"	70-98
#4	36-60
#8	25-47
#30	12-31
#200	8-15

B. At least 70 percent by weight of the particles retained on the #4 sieve shall have at least two fractured faces.

2.4 Portland Cement Concrete

A. The Portland Cement concrete used for this Work shall be an approved commercial transit mix. The exact proportions of all the materials entering into the concrete shall be as established by an approved laboratory mix design and shall be changed only as directed by the Engineer or laboratory when necessary to obtain the specified strength, desired density, uniformity, or workability. Previously prepared mix designs will be allowed provided adequate test data is available to document the suitability of the mix and the Contractor can document that the same materials are being used.

B. The mix shall have a maximum water-cement ratio of 0.45, a minimum 28-day compressive strength of 4,000 psi, a minimum of 564 pounds of cement per cubic yard of mix, and an air content of 4 to 7 percent. The maximum allowable slump shall be 4 inches for all structures covered under this section of the Specifications.

2.5 Topsoil

Topsoil shall be native to the area and shall be approved by the Engineer prior to use.

Furnish topsoil containing no substance detrimental to the growth of plants, that is free of plants designated by the Oregon Department of Agriculture as Type "A" or Type "B" weeds, and that is free of quack grass or crabgrass species.

Furnish topsoil that is from the fertile part of a soil profile, commonly referred to as the "A" horizon, typically ranging in depth from 3 inches to 12 inches below original ground surface. Do not take material for topsoil from a depth greater than 12 inches below original ground surface.

2.6 Hot Asphalt-Rubber Joint Sealant

Hot asphalt-rubber joint sealant shall be Roadsaver 221 as manufactured by Crafco, Inc., or equal.

PART 3 - EXECUTION

3.1 Gravel Surface Restoration

A. During trench and general excavation, the Contractor shall minimize the disturbance of adjacent gravel surfaces.

B. Backfill of trenches and other work areas shall be in accordance with Technical Specifications - "Excavation and Backfill of Trenches," or other applicable requirements.

C. In gravel streets, parking areas or driveways disturbed by the Work, the Contractor shall resurface the areas with base rock, as required on the Drawings.

D. In gravel streets, shoulders, parking strips and driveways, a 4-inch minimum compacted depth shall be required or a compacted depth equal to the existing depth of gravel plus the depth of granular subbase, if any, whichever is greater, unless otherwise specified on the Drawings or in these Specifications.

E. The resurfacing aggregate shall be compacted to 95 percent of laboratory density as determined by ASTM D1557.

3.2 Asphalt Street Restoration and Asphalt Parking-Driveway Restoration

A. Existing asphalt surfaces shall be cut on each side of the trench prior to excavation to provide a vertical, neat, straight-line joint in the surface. Should any asphalt surface be undermined or damaged during construction, the undermined or damaged asphalt shall be similarly cut and removed prior to backfill. This work shall be performed along neat, continuously straight lines to provide a pleasing finished appearance. Irregular lines will not be allowed.

B. Backfill shall be made in accordance with Technical Specifications - "Excavation and Backfill of Trenches."

C. The base rock under the asphalt pavement shall be replaced to a compacted depth equal to the existing base rock depth plus the depth of granular subbase, if any, or 8 inches, whichever is greater, unless specified otherwise on the Drawings or in these

Specifications. The base rock shall be compacted to 95 percent of the laboratory density as determined by ASTM D1557.

D. Immediately following backfill and compaction of the trench, and until the asphalt concrete is replaced, the base rock course shall be placed and compacted flush with the existing asphalt surface and maintained in a good condition.

E. In areas of heavy traffic, highway crossings, etc., a temporary cold-mix patch shall be placed and maintained until asphalt surface restoration is accomplished. The cold-mix asphalt concrete delivered to the Project shall be fresh and workable.

F. Just prior to placing the asphalt concrete, the base rock course and any temporary patch shall be excavated to the depth equal to that of the asphalt concrete to be placed.

G. Placement of Asphalt Concrete

1. Asphalt concrete for all areas, except in the State Highway, shall be 2 inches in depth after compaction or a depth equal to the existing pavement, whichever is greater, unless specified otherwise on the Drawings or in the Specifications.

2. The restoration of asphalt concrete pavement in the State Highway shall be performed as described on State Highway Crossing Permits.

3. Asphalt concrete shall be compacted with an 8-ton minimum steel-wheeled roller and compacted to a minimum of 91 percent of the maximum density as determined by ASTM D2041.

4. Prior to placing the asphalt concrete, an asphalt tack coat shall be applied to the edges of the existing asphalt. An asphalt tack coat shall also be used between lifts should the Contractor elect to patch with multiple lifts. The Contractor shall utilize a paving machine, spreader box, or other approved mechanical equipment to place the asphalt concrete material. No lift of asphalt placed shall have a compacted thickness of less than 1/2 inch or greater than 3 inches. The finished asphalt surface shall be flush with the existing surface, uniform in appearance equal to or better than the existing pavement, and shall provide a smooth ride.

5. Installation shall conform to the applicable provisions of the current Oregon Standard Specifications for Construction, Sections 00495 and 00744. Asphalt Concrete for temporary patches shall conform to Section 00745.50 of the Oregon Standard Specifications for Construction.

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3.3 Concrete Sidewalk and Curb Restoration

A. Existing concrete surfaces shall be saw cut on each side of the trench prior to excavation to provide a vertical, straight-line joint in the surface. Should any concrete surface be undermined or damaged during construction, the undermined or damaged concrete shall be similarly cut and removed prior to backfill. This work shall be performed along neat lines to provide a pleasing finished appearance. Irregular lines will not be allowed.

B. Backfill shall be made in accordance with Technical Specifications - "Excavation and Backfill of Trenches."

C. A 2-inch compacted depth leveling course of base rock shall be placed on the prepared subgrade. The base rock shall be compacted to 95 percent of the laboratory density as determined by ASTM D698.

D. Any forms used shall be wood or metal and shall be straight. They shall be suitably braced to prevent movement during placement. Joints shall be placed to match existing or as directed by the Engineer. The placement and curing of the concrete shall follow good concrete placement practices. The concrete thickness, section, finish, configuration, etc., shall match the existing structure as closely as possible.

3.4 General Surface Restoration

A. General

1. The Contractor shall replace or restore, equivalent to their original condition, all surfaces, trees and shrubbery, lawns, agricultural areas, pastures and fences, or other existing facilities disturbed by their Work unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed. Surface restoration shall be completed as soon as possible after the underground work is complete.

2. All surplus material, rock and debris, and temporary structures, as well as excess excavation, shall be removed by the Contractor and the entire Site of Contractor's operations shall be left in a neat and clean condition.

3. Lawns and pastures in private easement shall be restored to a smooth condition and reseeded with a like mixture of grass unless specified otherwise on the Drawings, in the Specifications, or in the easement documents. When backfilling trenches in private easements, unless otherwise specified, Contractor shall replace topsoil to minimum 1-foot depth or to a depth equal to the original

depth, whichever is less. Lawn sod shall be utilized where called for on the Drawings or where required by the Engineer.

B. Natural Areas

1. Where called for on the Drawings, the existing top soils in the excavation area shall be removed and stockpiled at a separate location from the general trench excavation material. This topsoil shall not be mixed or contaminated with any other materials.

2. Upon completion of the trench backfill and after all rocks and unsuitable material have been removed from the work area, the stockpiled topsoil shall be replaced and graded to match the existing ground. The depth of topsoil restoration shall be as shown on the Drawings.

3.5 Cleanup

A. Cleaning up shall be a continuing process from the start of the work to final acceptance of the Project. The Contractor shall, at all times, keep the area on which work is in progress free from accumulations of waste material or rubbish.

B. Spillage from the Contractor's hauling vehicles on traveled public or private roads shall be promptly cleaned up. Upon completion of the work the Contractor shall remove all temporary structures, rubbish, and waste material, equipment and supplies, resulting from the Contractor's operations. The Contractor shall leave such lands in a neat and orderly condition which is at least as good as the condition in which the Contractor found them prior to the Contractor's operations. See specific conditions in the General Requirements.

C. In roadways and traffic areas, the Contractor shall be responsible for maintaining a road surface suitable for travel by the public from the time of excavation until the road surface has been restored. Such work includes dust control, temporary patching, signing, grading, and filling of potholes on temporary street surfaces, etc. The Contractor shall be responsible for all Claims and damages resulting from their failure to maintain a suitable surface.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis

See Technical Specifications - "Measurement and Payment" for the description of the basis of measurement and payment for the Work performed under this Contract.

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SECTION 4

REINFORCED CONCRETE

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SECTION 4

REINFORCED CONCRETE

PART 1 - GENERAL

1.1 Scope

This section covers the mixing, placing, finishing, curing, and repairing of reinforced concrete. Portland cement concrete shall be composed of cement, aggregates, water, admixtures, etc., as specified or approved. The required proportions shall be assembled, well mixed, transported, placed, consolidated, finished, and cured as hereinafter specified. Concrete shall be uniformly dense and sound, free from faults, cracks, voids, honeycomb, and other imperfections.

A. Concrete shall conform to the requirements of these Specifications and to the latest issue of the "Building Code Requirements for Reinforced Concrete" (ACI 318), "Specifications for Structural Concrete for Buildings" (ACI 301), and "Standard Specification for Ready Mixed Concrete" (ASTM C94) except as modified below.

B. The Specifications in this section are general in nature and, therefore, some of the items outlined may not apply to the Work required. All applicable sections, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

1.2 Delivery, Handling, and Storage

A. All cement shall be stored in a suitable, weather-tight building in such a manner as to protect the cement from dampness and to permit easy access for proper inspection. Storage bins for bulk cement shall be weather-tight and constructed so that there will be no dead storage. If there is reason to believe that dead storage exists, the bins shall be emptied completely at least every four months.

B. Fine and coarse aggregates shall be stored and measured separately. Aggregates shall be protected from contamination with dust, dirt or other foreign materials.

C. Steel reinforcement not placed in the Work shall be stored under cover to prevent rusting, and shall be placed on blocking such that no steel touches any ground surface.

1.3 Submittals

A. Reinforcing Steel

1. Before ordering reinforcing steel, the Contractor shall submit all order lists and bending diagrams for review by the Engineer.

2. Review of order lists and bending diagrams by the Engineer shall in no way relieve the Contractor of the responsibility for correctness of such lists and diagrams.

3. Any expense incidental to the revision of materials furnished according to such lists and diagrams to make the material comply with the Drawings shall be borne by the Contractor.

B. Concrete Mix Designs

Before placement of any new concrete, the Contractor shall submit the proposed concrete mix designs for review by the Engineer.

PART 2 - MATERIALS

2.1 Portland Cement

Portland cement shall conform to the requirements of ASTM C150, for Type I - II cement. The Engineer may direct the use of Portland cement of a type other than that specified in the Contract Documents, in which case the Owner will pay the additional cost, if any, for the cement required over the cost of that specified, or shall receive appropriate credit for any cement required of a lesser cost than that specified.

2.2 Aggregates

A. General

1. All aggregates for concrete shall conform to the Specification for "Concrete Aggregates" (ASTM C33). No aggregate shall be incorporated into the Work until and unless the aggregates are approved by the Engineer.

2. The decision to perform any or all tests on aggregates shall be left to the Engineer. Should testing of the aggregates be deemed necessary, Samples shall be selected at random from the stockpile and tested for conformance with the Specifications.

3. When the aggregates have been approved by the Engineer, the source shall not be changed without the written approval of the Engineer.

B. Fine Aggregate

Fine aggregate shall consist of natural sand, having hard, strong, and durable particles and which does not contain more than 2 percent by weight of such deleterious substances as clay lumps, shale, schist, alkali, mica coated grains, or soft and flaky particles. The grading of fine aggregate shall range uniformly from coarse to fine within the limits specified in ASTM C33.

C. Coarse Aggregate

1. Coarse aggregate shall consist of clean, hard, fine grained, sound crushed rock, or washed gravel which does not contain in excess of 5 percent by weight of flat, chip-like, thin, elongated, friable or laminated pieces, or more than 2 percent by weight of shale or cherty material.

2. Any piece having a major dimension in excess of 2-1/2 times the average thickness shall be considered to be flat and/or elongated.

3. The maximum size of coarse aggregate shall not exceed 1-1/2 inches, nor 1/5 of the narrowest dimension between the forms, nor 3/4 of the clear spacing between reinforcing bars.

4. The minimum size of coarse aggregate shall be 3/4-inch unless approved otherwise.

5. Coarse aggregate shall be uniformly graded from coarse to fine within the limits specified in ASTM C33.

2.3 Water

Water for mixing shall be clean, fresh, and free from injurious amounts of oil, acid, chlorides, sulfates, alkali, organic matter, or other deleterious substances.

2.4 Concrete Admixtures

A. General

1. The use of admixtures will be allowed only when included in the mix design or as specified.

2. Admixtures used will be considered as a means of improving workability and/or placement of the concrete.

3. Admixtures shall conform to the following:

Parameter	Reference
Air-entraining	ASTM C260
Water Reducer	ASTM C494, Type A
Set Retarding	ASTM C494, Type B
Water Reducing/Set Retarding	ASTM C494, Type D
High Range Water Reducing (Super Plasticizer)	ASTM C494, Type F and G
Pozzolanic	ASTM C618, Type F

4. Admixtures shall be non-toxic after 30 days and shall contain no chlorides. Calcium chloride will not be permitted to be used in concrete.

B. Air-Entraining Admixtures

Provide air-entraining admixture in all concrete. Furnish manufacturer's compliance statement for these requirements.

C. Water Reducing Admixture

1. When water-reducing and/or super plasticizer admixtures are used, with the agreement of the Engineer, it shall be compatible with the air-entraining admixtures.

2. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations.

3. Furnish a compliance statement that the admixture used satisfies all requirements of this Specification.

2.5 Proportioning of Concrete Mix

A. General

The exact proportions of all materials entering into the concrete shall be as established by an approved laboratory mix design and shall be changed only as directed by the Engineer or Laboratory when necessary to obtain specified strength or desired density, uniformity, and workability. This requirement may be waived when adequate test data

is available on mixes currently being used to verify the suitability of a given mix for the job, or as approved by the Engineer.

B. Mix Design

1. The mix shall meet the following requirements unless otherwise specified or approved:

Parameter	Class A
Minimum compressive strength (at 28-day test)	4,000 psi
Maximum water-cement ratio (by weight)	0.45
Minimum cement content (per cubic yard of concrete)	630 lbs
Air Content Range	4-7%

2. All concrete shall have a maximum water soluble chloride ion content of 0.06 percent of mix design cement weight.

3. All concrete used in the Work shall meet the requirements of Class A.

4. Water Content and Slump Test

a. In calculating the total water content in any mix, the amount of free moisture (excess of saturated surface dry) carried on the surface of the aggregate particles shall be included. The amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity, and workability.

b. For the type of construction indicated, the slump shall be within the range indicated below unless approved otherwise:

Allowable Slump		
Location/Type of Construction	Slump in Inches[1]	
	Maximum	Minimum
Reinforced foundation walls and footings	4	2
Unreinforced footings and substructure walls	3	1
Reinforced slabs, beams and walls	4	2

Allowable Slump		
Location/Type of Construction	Slump in Inches[1]	
	Maximum	Minimum
Building columns	4	3
Sidewalks, driveways, and slabs on ground	4	2
Heavy mass construction	2	1
Light weight concrete	3	1

[1]Slump listed in the table is the maximum slump allowed prior to the addition of water reducing or high range water reducing admixtures. Maximum allowable slump after the addition of admixtures is 8 inches.

2.6 Reinforcing Steel Bars

Steel reinforcing bars shall be grade 60 billet steel, unless otherwise specified and shall conform to ASTM A615. Bars shall be deformed in accordance with ASTM A305. When called for on the Drawings, epoxy coated reinforcing bars shall conform to ASTM A775.

2.7 Grout

A. Nonshrink Grout

1. Grout shall be fluid grout capable of satisfactorily meeting the baseplate test and shall be non-metallic, unless specified for special use hereinafter. The grout shall be a non-gas-liberating type, cement base product, premixed, requiring only the addition of water for the required consistency. All components shall be inorganic.

2. The grout product shall satisfy all of the above requirements even though the Project use calls for a dry pack consistency and use.

3. The following listed grouts meet these requirements and are acceptable for use: UPCON High Flow, the UPCO Company, Cleveland, Ohio; Master Flow 713, The Master Builders Co., Cleveland, Ohio; or approved equal. Grout type and procedure shall be as recommended by the manufacturer for the specific application.

4. The grout used shall be cured with a curing compound sprayed on, or as recommended by the grout manufacturer.

B. Neat Cement Grout for Horizontal Construction Joints

Grout for horizontal construction joints in walls and columns shall be flowable and shall consist of concrete sand, water, and a maximum water:cement ratio of 0.5. Proportions by weight: Two parts cement, three parts sand, and one part water.

2.8 Concrete Bonding Agent/Admixture

For bonding new concrete to old and as an admixture for concrete finish work, use Burke Acrylic Bond-Crete or equal.

2.9 Curing Compounds

A. Curing compounds shall conform to the requirements of ACI 308 and ASTM C309 and shall be compatible with required finishes and/or coatings.

B. The compound shall be approved Type 2, Class B white or gray pigmented or Type 1-D clear compound with fugitive dye.

C. Manufacturer's literature shall state quantity or coverage required to meet or exceed tests and method of application.

2.10 Bond Breaker

Bond breaker shall be Dayton Superior Clean Strip J1EF or approved equal. Bond breaker shall not leave a soapy residue.

2.11 Surface Hardener

Surface hardener shall be MasterKure HD300WB as manufactured by Master Builders (BASF), or approved equal. Surface hardener shall result in a deposit of a hard, wear-resistant compound in the pores of the wearing surface to reduce absorption and arrest dusting.

2.12 Mortar for Sack Rubbing

Mortar for sack rubbing shall consist of one part cement, two parts mortar sand by volume, a concrete bonding admixture, and enough water to obtain a mortar consistency of thick cream. The sand shall pass a No. 40 screen.

2.13 Construction, Contraction, and Expansion Joints

Construction, contraction, and expansion joints are as follows or as approved by the Engineer:

A. Pre-molded Joint Filler for Expansion Joints

Bituminous type conforming to ASTM D994 or D1751, unless otherwise shown or specified.

B. Pourable Joint Fillers

1. Rubber Asphalt Filler: The specific gravity of the in-place filler after curing shall be greater than 1.0. Filler shall be No. 164.

2. Polymeric sealing compound, hot pour, or Hi-Spec Polymeric joint sealing, hot pour compound, as manufactured by W. R. Meadows, Inc., Elgin, IL; or No-Track two-component materials (Code 2323), cold applied, self-leveling filler as manufactured by A. C. Horn, Inc., North Bergen, NJ; or Gardox, two-component, cold applied compound filler, as manufactured by W. R. Meadows, Elgin, IL.

3. On sloping joints, use Gun Grade material of the above products or similar non-sag material; submit product information for approval.

C. Roofing Felt for Expansion Joints

Thirty-pound asphalt-saturated roofing felt conforming to ASTM D226, Type II; or a tar-saturated roofing felt of equal quality at the option of the Contractor.

2.14 Waterstops and Sealants

A. PVC Waterstop

1. Center bulb type, as shown on Drawings, extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride (PVC). The size shall be as shown. Specific gravity shall be approximately 1.37 and the shore durometer Type A hardness, approximately 80. No reclaimed PVC shall be used in the compound.

2. Waterstop shall have a constant thickness from the edge of the bulb to the outside edge. All waterstops shall have a number of parallel ribs or protrusion on each side of the center of the strip. Corrugated type waterstops are not acceptable.

3. The minimum weight per foot for waterstop shall be 0.90 pound for 3/16-inch x 6-inch, 1.62 pounds for 3/8-inch x 6-inch, and 2.30 pounds for 3/8-inch x 9-inch.

4. Certain approved manufacturers and Suppliers are listed below. Other products shall not be used without prior agreement by the Engineer.

   a. Greenstreak Plastic Products
   b. Vinylex Corporation
   c. Vulcan Metal Products, Inc.

B. Surface-Applied Waterstop

Surface-applied waterstop shall be Adeka Ultraseal® MC-2010MN, or approved equal.

C. Hydrophilic Caulk

Hydrophilic caulk shall be Adeka P-201 caulking, or approved equal.

D. Synthetic Rubber Sealant

1. Sealant for concrete structures shall be synthetic rubber sealing compound (polyurethane) as manufactured by Polymeric Systems, Inc., PSI 270 or PSI 270 SL; Pacific Polymers, Garden Grove, CA, Elastothane 227R, or equal.

2. The material shall be multi-part polyurethane designed for continuous submerged condition in water or sewage and exposed to direct sunlight in dry condition. A compound shall be provided to cure at room temperature to firm, highly resilient rubber, and shall comply with FS TT-S-00227e, Type I, pourable grade, and Type II, non-sag, Class A, having the following properties determined at 75°F and 50 percent humidity:

Property	Test Method	Value
Solids	---	> 97 percent
Application Time	---	> 2 hours
Cure Time	---	< 3 days
Tack Free	---	24 hours
Ultimate Hardness	Shore A	35 ± 5
Tensile Strength	ASTM D412	300 psi min.
Ultimate Elongation	ASTM D412	> 550 percent
Tear Resistance	ASTM D624 Die C	> 85 lbs/in.

3. Color and temperature service range: Gray to match concrete, unless otherwise indicated on the Drawings. Temperature service range: 50 to 200°F.

PART 3 - EXECUTION

3.1 General

All manufactured articles, materials, and equipment specified in this section shall be applied, installed, connected, erected, used, cleaned, and conditioned as recommended by the manufacturer and approved by the Engineer.

3.2 Forming

A. General

1. The Contractor shall be responsible for the design, engineering and construction of formwork. Formwork shall conform to applicable requirements of "Recommended Practices for Concrete Formwork" (ACI 347).

2. Forms shall be used, whenever necessary, to confine the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. Forms may be of wood, metal or other material, and shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines.

3. The surface of all forms in contact with the concrete shall be smoothly finished and free from defects that might adversely affect the appearance of concrete formed against it.

4. All forms, whether prefabricated or custom made, shall be assembled and connected in such a manner that only minor mortar seepage through the joints will occur during vibration of the concrete.

B. Form Surface Preparation

1. All dirt, chips, sawdust, mud, water, and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused.

2. All wood surfaces in contact with the concrete shall be coated with an effective release agent prior to form installation. The release agent shall be non-staining and non-toxic after 30 days.

3. Mill scale, rust, and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface of steel forms. All steel forms shall have the contact surfaces coated with a release agent. The release agent shall be effective in preventing discoloration of the concrete from rust, and shall be non-toxic after 30 days.

4. Proprietary panels shall be free of surface cracks, spalls, gouging, splitting or other surface damage. Patching of forms is not acceptable. Any repairs must include complete surface recondition.

C. Beveled Edges and Corners (Chamfers and Fillets)

1. Exposed sharp edges shall be eliminated from finished concrete work by means of 3/4-inch triangular fillets or chamfer strips placed in the forms.

2. Where called for on the Drawings, horizontal corners shall be tooled with a 1/2-inch radius tool.

D. Form Removal

1. All forms shall be removed before backfilling is begun.

2. Forms shall be so constructed that they can be removed without hammering on or prying against the concrete and shall be removed in such a manner as to prevent damage to the concrete and to ensure the complete safety of all parts of the structure.

3. The Contractor shall determine the time of removal of forms and shall be responsible for any damages due to early or improper form removal. In general the following periods, exclusive of days when the temperature is below 40°F, for removal of forms may be used as a guide.

Time Period for Removal of Forms	
Location	**Time Period**
Support Under Beams	14 days
Supported Floor Slabs	14 days

Walls	24 hours
Columns	7 days
Side of Beams and Other Parts	24 hours

3.3 Placement of Reinforcement Steel

A. General

1. Mild steel reinforcing bars shall be furnished, cut, cold bent, tagged, marked, shipped, and placed as indicated on Drawings and in accordance with the current edition of the "Manual of Standard Practice" by the Concrete Reinforcing Steel Institute. Field bending or straightening shall be accomplished so that the steel will not be damaged. Kinked bars shall not be used.

2. Reinforcing bars shall be in position before concrete placement is begun. All reinforcing bars shall be tied together and supported in such a manner that displacement during placing of concrete will not occur. Conform to the requirements of "Placing Reinforcing Bars" published by the Concrete Reinforcing Steel Institute.

B. Minimum Bar Spacing

The clear distance between parallel bars shall not be less than 1.5 times the nominal diameter for round bars, but in no case shall the clear distance be less than 1-1/2 inches nor less than 1.33 times the maximum size aggregate.

C. Concrete Cover

1. At the time of placing concrete, all reinforcement shall be free from dirt, loose mill scale, detrimental rust, grease, oil, paint, or other foreign substances which might destroy or reduce its bond with concrete.

2. Unless stated otherwise on the Drawings, the following minimum concrete cover over reinforcement steel shall apply.

   a. All formed surfaces exposed to water, ground, or weather shall have a minimum cover over the reinforcement steel of 2 inches.

   b. All formed surfaces not exposed to water, ground, or weather shall have a minimum cover over the reinforcement steel of 1-1/2 inches.

c. All surfaces cast against and permanently exposed to earth shall have a minimum cover over the steel of 3 inches.

D. Splicing

1. Splices at the points of maximum stress shall be avoided.

2. Bars in horizontal members shall have a minimum lap at splices sufficient to develop the strength of the bars. Whenever possible, splices of adjacent bars shall be staggered.

3. Deformed bars shall be lapped the minimum splice length as listed in the table below, or as shown on the Drawings, whichever is greater.

4. Furnish full length reinforcing bars the specified length or the calculated length, and for those designated "full length."

5. Splice bars with designated splice locations at those locations or fabricate bars full length.

6. In absence of other directions, including bars designated "continuous," furnish reinforcing bars to provide the minimum practical number of bars and splices. In lapped splices, place bars in contact and fastened together with at least three ties.

Reinforcing Bar Splice Length Table

for 4,000 psi Concrete and Grade 60 Non-Coated[1] Reinforcing Bars

Bar Size (No.)		3	4	5	6	7	8	9	10	11
Bar Orientation	Vertical and Horizontal	1'-7"	2'-1"	2'-7"	3'-1"	4'-6"	5'-2"	5'-10"	6'-7"	7'-3"
	Horizontal Top Bars	2'-1"	2'-9"	3'-5"	4'-1"	5'-11"	6'-9"	7'-7"	8'-6"	9'-6"

[1]For epoxy coated bars, increase the listed splice lengths by 50 percent.

E. Supports and Ties

1. All reinforcement shall be retained in place, true to indicated lines and grades, by the use of approved galvanized metal or concrete supports, spacers, or ties. They must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.

2. Concrete blocks used to support reinforcement shall have a compressive strength of not less than the specified 28-day compressive strength of the concrete being placed. Rocks, clay bricks, masonry blocks, etc., or parts thereof, shall not be used to support reinforcement.

3. Tie bars in the top mats of footings and slabs at all intersections. Tie all other bars at all intersections except where spacing of the bars is less than 12 inches in each direction, then alternate intersections shall be tied.

4. Tie coated reinforcement with nonmetallic coated ties. Precast concrete blocks that support coated reinforcement shall have nonmetallic ties.

F. Reinforcement Around Opening

Where reinforcing steel has to be cut to permit passage of pipe or openings and should no detail be shown for extra reinforcing in such areas, at least an equivalent area of steel cut must be placed around all four sides of pipe or opening. This steel shall be extended at least 2'-0" beyond opening.

G. Inspection

The Engineer shall be notified when the reinforcing is ready for review with sufficient time for this review to occur prior to placement of the concrete.

3.4 Mixing

A. Batch Plant

1. Adequate equipment and facilities shall be provided for accurate control and measurement of all materials within specified proportions and tolerances, and for readily changing the proportions of materials as may be necessary to meet varying conditions of the Work in order to produce concrete of the required strength, durability and workability.

2. Batch plant equipment shall be in complete working order and equipment shall conform to the requirements of Section 00540.20 of Oregon Standard Specifications for Construction, current edition.

B. Mixers

1. General

a. Concrete shall be mixed in batch plant mixers or in a revolving drum type truck mixer.

b. Concrete mixed in a batch plant mixer shall be hauled to the Project Site in a truck mixer.

c. Mixers shall be equipped with a metal plate on which the manufacturer has marked the mixing and agitation speeds of the drum and the maximum mixing capacity.

2. Batch Plant Mixing

Refer to Specifications for truck mixing.

3. Truck Mixing

a. Truck mixers shall be the revolving drum type, watertight, and constructed and maintained within tolerances of the manufacturer's specifications. Truck mixers shall be equipped and operated with a tank for carrying mixing water, a device to measure mixing water added to the mix and a device to indicate the number of drum revolutions.

b. Before placing materials for the concrete into the mixer, empty the drum of water and reset the drum revolution counter to zero or record the counter number on the batch ticket. The total revolution on any load shall not exceed 300. The concrete in the truck mixer shall not exceed the manufacturer's maximum rated capacity. All materials of a batch shall be simultaneously and continuously fed into the mixer.

c. Mixing shall commence as soon as the cement is added to the aggregate. Continue mixing before leaving the plant for not less than 70 nor more than 100 revolutions of the drum at the manufacturer's rated mixing speed. If water or additives are added to the batch at the Project Site, the concrete shall be mixed an additional 40 revolutions or more at the manufacturer's mixing speed, but the total revolution shall not exceed 300.

d. All mixers, when fully loaded, shall mix the ingredients into a uniform mass within the required time. Only truck mixers that properly mix the concrete and are capable of discharging the concrete at a steady rate shall be used on the Project Site.

e. During transport of the concrete, the truck mixer shall turn continuously at the rated agitation speed.

3.5 Placing Concrete

A. Conveyance

1. Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position.

2. There shall be no free vertical drop greater than 6 feet, except when starting a vertical pour in which case the free vertical drop of concrete shall not be more than 2 feet.

3. In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs.

B. Placement

1. Concrete shall be placed before initial set has occurred and unless otherwise authorized by the Engineer, before it has contained its water content for more than 1-1/2 hours at 85°F. This time period may be extended provided Contractor can satisfy the Engineer that admixtures in sufficient quantity can extend the setting time of the concrete without adverse effects to the strength and quality of the concrete.

2. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces free from running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved tamping or other compaction so that ultimate settlement has occurred.

3. Concrete shall not be placed in water nor shall water be allowed to rise over freshly placed concrete until the concrete has set sufficiently to prevent damage unless otherwise approved by the Engineer.

4. Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position, and until the form ties at construction joints have been retightened, all sleeves, hangers, pipe, bolts, waterstop, and any other items required to be embedded in the concrete have been placed and anchored.

5. Concrete shall be placed generally in horizontal layers not more than 12 inches thick except as otherwise specified. When a monolithic layer cannot be completed in one operation, it shall be terminated with a vertical bulkhead. Feathering out to less than 6 inches will not be permitted.

6. All top surfaces not covered by forms, and which are to be covered by additional concrete or backfill, shall be carried slightly above grade, struck off and given specified finish.

C. Vibration

1. Concrete shall be placed with the aid of approved mechanical vibrating equipment. Vibration shall be transmitted directly to the concrete; in no case shall it be transmitted through the forms. Vibrators shall be applied at uniformly spaced points not farther apart than the visible effectiveness of the machine.

2. The vibrator shall at all times be inserted through the newly placed layer into the next lower course, to ensure a proper integration of one course to another, and shall then be pulled up slowly, the speed of which is dependent upon mix design and type of vibrator. The vibrator operator shall vibrate the concrete systematically from one point to another without skipping any areas or without having to move backwards and forwards in any one single pass. Particular care to vibrating concrete shall be given at horizontal and vertical construction joints to eliminate any possibility of honeycomb. Extreme care shall be exercised in using vibrators around waterstops to avoid damage to the waterstop. Every effort shall be made to avoid any contact of vibrator to reinforcing steel. At all times, the intensity and duration of vibration shall be sufficient to accomplish thorough and uniform compaction.

3. Vibrators shall not be used to flow or transport concrete inside of forms. Where necessary, vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

4. Only high frequency internal vibrators with operating speeds of preferably 21,000 vpm but not less than 14,000 vpm shall be used unless otherwise approved in writing by the Engineer. The number of vibrators employed shall be ample to consolidate the incoming concrete to the proper degree within 5 minutes after it is deposited. The number of vibrators will be predicated by the nature of the job and the ability to sufficiently consolidate the concrete within the specified time.

3.6 Restrictions Due to Weather

A. Cold Weather

1. Concrete placement in cold weather, i.e., 40°F or less, will be permitted only under conditions which shall meet the approval of the Engineer.

2. In general, cold weather placing shall conform to "Recommended Practice for Cold Weather Concreting" (ACI 306).

3. Salts, chemicals, or other foreign materials shall not be mixed with the concrete to prevent freezing, unless such use is authorized by the Engineer in writing.

4. All concrete shall be effectively protected from frost action for a period of 5 days after placing, during which the temperature of the concrete does not fall below 40°F. Upon written notice from the Engineer, all concrete which may have become damaged by frost action shall be replaced by the Contractor at their own expense.

B. Hot Weather

1. For concrete placed during extremely hot weather (air temperature exceeding 95°F), the aggregate shall be cooled by frequent spraying in such a manner as to utilize the cooling effect of evaporation. During such periods, the placement schedule shall be arranged, as approved, in such a manner as to provide time for the temperature of the previously placed concrete to begin to recede.

2. The mixing water shall be the coolest available at the Site insofar as is practicable. At no time shall the temperature of the concrete mix exceed 90°F prior to placement.

C. Low Humidity

1. Placing of concrete during periods of low humidity (below 50 percent) should be avoided when feasible and economically possible, particularly when large surface areas need to be finished.

2. In any event, finished surfaces exposed to the drying wind shall be covered up immediately with polyethylene sheets and be water cured continuously as soon as the concrete has set up.

3. Curing compounds, in lieu of water, may not be used.

3.7 Bonding Concrete

A. Bonding to New Concrete

1. Roughen the surface of the hardened concrete. Thoroughly clean and saturate with water and apply a concrete bonding agent.

2. Cover the horizontal surfaces with at least a 12-inch lift of superplasticized concrete (6-inch to 8-inch slump) and thoroughly vibrate the mix.

3. New concrete is defined as less than 60 days old.

B. Bonding to Old Concrete

1. Mechanically roughen the existing concrete surfaces to 1/4-inch amplitude using chipping guns or bushhammers, thoroughly clean, and then coat the contact surfaces with a concrete bonding agent.

2. The method of preparation and application of the bonding agent shall conform to the manufacturer's printed instructions and recommendations for specific application for this Project.

3. Obtain this recommendation in writing from the manufacturer's representative.

4. Cover horizontal surfaces with a lift of superplasticized concrete (6-inch to 8-inch slump) and thoroughly vibrate the mix.

3.8 Finishing

A. Slabs

1. Screeding

a. Concrete shall be deposited in the slab from a wheelbarrow, buggy, bucket, chute, conveyor, or pump hose without segregation of coarse and fine aggregates.

b. Spreading of the concrete shall be performed with a square end shovel.

c. The concrete shall then be screeded or struck off before any excess moisture or bleed water is present on the surface.

d. If a vibrating screed is used, it shall be moved forward as rapidly as possible to avoid excess mortar being brought to the surface.

2. Bull Floating

a. The purpose of bull floating is to smooth the surface and to eliminate high and low spots.

b. Bull floating shall occur immediately after screeding or strike off and before bleed water accumulates on the surface, and shall be done in such a manner that the surface is not sealed.

c. Bull floating shall be done with a wood or magnesium float.

d. Do not overwork the surface.

3. Waiting Period

Upon completion of the bull floating, the concrete shall be allowed to sit until the bleeding has stopped and the water sheen disappears, and after the concrete is firm enough to permit a person to walk on the surface leaving a foot print no greater than 1/4 inch in depth.

4. Edging and Jointing

After the bleeding has stopped, sidewalks, driveways, steps, and other slabs as directed shall be edged and jointed.

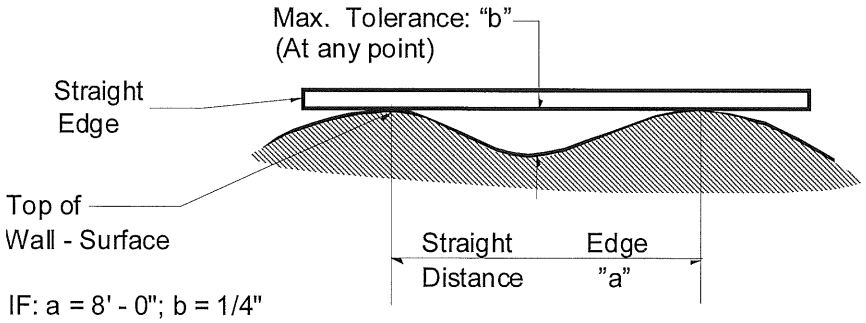
5. Floating

   a. The purpose of floating is to embed the large aggregate just beneath the surface of the mortar; to remove slight imperfections, bumps and voids; and to compact the concrete and consolidate mortar at the surface in preparation for final finishing.

   b. After the waiting period defined above, the Contractor shall float the concrete surface using wood or magnesium hand floats or a troweling machine equipped with float shoes.

6. Surface Tolerance

   The surface of all slabs shall conform to the following surface tolerance:



   IF: a = 8' - 0"; b = 1/4"

   IF: a = 2' - 0"; b = 1/8"

   IF: a = 1' - 0"; b = 1/16"

7. Surface Hardener

   a. Surface hardener shall be applied to concrete floors in all rooms containing mechanical equipment or corrosive interior materials and as indicated on the Drawings.

   b. Do not apply surface hardeners to floors designated to receive vinyl floor coverings.

8. Broom Finish

   a. After completion of floating and after the concrete has hardened sufficiently, all stair treads, interior and exterior, and all exterior slabs including sidewalks, driveways, etc., shall receive a broom finish unless otherwise specified.

b. The broom shall be a stiff fiber or steel tined broom that will mark the finished concrete to a depth not to exceed 1/8th of an inch. Markings or corrugations shall be transverse to the direction of travel.

B. Unformed Surfaces

Unformed surfaces that will not be exposed in the complete Work shall be brought to required finished elevations and left smooth and regular. Sufficient screeds shall be installed to ensure an even concrete surface, true to grade and elevation, without unacceptable local depressions.

C. Formed Surfaces

1. Class C Finish

a. Forms shall be removed as soon as permissible and immediately thereafter, snap tie holes, rock pockets, air pockets over 1/2-inch depth, and other defects shall be chipped, sandblasted, or wire brushed to expose sound aggregate and mortar and then shall be pointed and thoroughly tamped with dry pack grout.

b. Surfaces that have been pointed shall be kept moist for a period of not less than 24 hours. If after the pointing sets and is rubbed, dusting occurs, the surface shall be refinished.

c. Finished surfaces shall be free from sand streaks or other voids.

d. All formed concrete surfaces that will not be exposed to view shall receive a Class C surface finish unless otherwise indicated.

2. Class B Finish

a. Class B finish shall consist of a smooth finish such as can be achieved by means of plywood forms, steel forms, or form liners.

b. After the forms are removed, the concrete surface shall first receive a Class C finish, with air pockets over 1/4-inch depth chipped, sandblasted, or wire brushed to expose sound aggregate and mortar, then pointed and thoroughly tamped with dry pack grout. The surface shall then be additionally finished as necessary to produce a smooth and even surface with uniform texture, lines, and appearance, free of bulges, fins, lips,

undulations, depressions, or other imperfections. Chipping, grinding, or other methods may be necessary to achieve a smooth surface.

c. All exposed formed concrete surfaces shall receive a Class B Finish unless otherwise indicated. Surfaces below water shall be considered exposed.

3.9 Protection

Every reasonable precaution shall be taken to protect finished surfaces from abrasions or other damage. Concrete surfaces or edges likely to be injured during the construction period shall be protected by leaving the forms in place or by erecting satisfactory covers. No fire shall be permitted in direct contact with concrete at any time. Concrete shall be adequately protected from drying action by sun and wind.

3.10 Curing

A. General

1. All Portland cement concrete shall be cured by maintenance of proper moisture content and temperature for the development of desired concrete strength and durability. Curing shall be commenced immediately after placement of the concrete and initial finishing has been completed.

2. There are two systems of maintaining satisfactory moisture content:

a. Water curing by the continuous or frequent application of water through ponding or immersion, fog spraying or sprinkling or a saturated cover of heavy quilted cotton mats or rugs, or multiple layers of burlap.

b. Surface sealing for the prevention of excessive loss of water from concrete slabs by use of 4-mil polyethylene sheet or reinforced bituminous kraft paper (ASTM C171); and for exterior slabs only by the application of a liquid membrane-forming curing compound to the freshly placed concrete, and for walls by leaving water proof forms in place with periodic soaking.

B. Cure Time

All concrete shall be cured for a period of not less than 7 days after placement. If during the cure time the surrounding temperature falls below 45°F, the cure time shall be extended for the number of hours the temperature is below 45°F.

C. Walls

The acceptable methods of curing concrete walls are:

1. Concrete forms for walls shall be left in place and kept damp at all times during the required cure time; the wall forms may be loosened after 24 hours following the concrete placement, but water shall be flowed periodically into the space between the concrete and the form to add moisture. During the cure time, the tops of walls shall be covered with a continuously water saturated covering such as burlap or cotton mats.

2. The Contractor may remove the wall forms not less than 24 hours following the concrete placement. Curing shall then be accomplished by draping continuously water saturated heavy quilted cotton mats or rugs over the concrete walls. The water saturated coverings shall be secured to the wall to prevent air from circulating between the covering and the concrete surface.

3. After 24 hours of water cure, except as specified below, concrete curing of formed surfaces may be completed using a curing compound. However, a curing compound shall not be used on concrete surfaces that will be Class A or Class B finished, painted, waterproofed, or where other coatings or coverings are to be bonded to the surface, unless the curing compound is compatible with the final finish or the curing compound is removed by sandblasting.

D. Slabs

The entire surface of a newly placed concrete slab shall receive one of the water curing or sealing methods described above, or a combination thereof, beginning after finishing operations have been completed and as soon as marring of the concrete will not occur.

E. Curing Compounds

1. Curing Compound shall not be used on concrete surfaces to be painted, waterproofed, moisture-proofed, Class A sack rubbed surface finished, or where other coverings are to be bonded, unless the curing compound is compatible with the final finish covering or it is to be removed by sandblasting prior to covering.

2. Generally, use of curing compounds is limited to use on concrete sidewalks, curbs, landings, driveways, catch basins, and other minor structures. Curing compound shall not be used on interior floor slabs.

3. Liquid membrane curing compounds shall be applied after finishing and as soon as the free water on the surface has disappeared and no water sheen is visible but the surface is still moist. The compound shall be applied at a uniform rate, not greater than 200 square feet per gallon using two applications (100 square feet per gallon each) at right angles to each other.

F. Curing and Protection in Cold Weather

Curing and protection in cold weather shall conform to ACI 306. Repair or replace concrete changed by cold weather.

3.11 Construction, Contraction, and Expansion Joints

A. General

Joints in concrete shall be horizontal level or vertical and shall be of the type and location as shown on the Drawings, or as approved by the Engineer. Joints shall be accurately located and constructed to produce straight joints. The concrete pour shall not commence until after the joint preparation has been reviewed by the Engineer.

B. Installation of Waterstops

1. Join waterstops at all intersections so that a continuous seal is provided. Center the waterstop on the joint. Secure waterstop in the correct position. In the event of damage to the waterstop or improper installation of waterstop, repair the waterstop in an acceptable manner to provide a water tight seal.

2. Vibrate concrete to obtain impervious concrete in the vicinity of all joints. Make a visual inspection of the entire waterstop area during concrete placement. Limit concrete placement to top of waterstop in first pass, vibrate the concrete under the waterstop, lift the waterstop to confirm full consolidation without voids, then place remaining concrete to full height.

C. Construction Joints

1. Construction joints, including keyways when required, shall be made as shown on the Drawings or as approved by the Engineer.

2. For construction joints without keyways, prior to placing the abutting concrete for all construction joints, the contact surface shall be cleaned by sandblasting or other approved means to remove all laitance, expose the aggregate, and roughen surface to a minimum of 1/4-inch amplitude.

3. For all joints, the exposed portion of the reinforcing steel shall be cleaned and surface roughening of all concrete. The cleaning and surface roughening method shall be conducted so as not to damage the waterstop, if one is present.

4. The surface of the hardened concrete may be roughened by one of the following methods:

   a. Sandblasting the foundation and reinforcing dowels after the concrete has fully cured to remove all laitance and spillage, and to expose sound aggregate.

   b. Water blasting the foundation and reinforcing dowels after the concrete has partially cured to remove all laitance and spillage, and to expose sound aggregate.

5. Horizontal Construction Joints

   a. For all horizontal construction joints with waterstop, prior to placement of the abutting concrete, thoroughly clean the concrete, exposed waterstop, reinforcing steel, etc., saturate with water, and immediately place concrete.

   b. Limit the first concrete lift to 12 inches and thoroughly vibrate to provide a good connection to underlying concrete.

   c. For all horizontal construction joints without waterstops and all vertical construction joints, thoroughly clean and saturate the hardened concrete surface with water prior to placement of the new abutting concrete.

D. Sawed Contraction Joints

When called for on the Drawings, the Contractor shall make saw cut contraction joints at the location, spacing, and layout shown on the Drawings. Joints shall be sawed as soon as the concrete is hard enough not to be torn or damaged by the blade. Joints shall be sawed approximately 1/8-inch in width to a depth of one-quarter of the slab thickness. When called for on the Drawings, saw cut joints shall be filled with pourable or gun grade joint filler.

E. Formed Contraction Joint

When called for on the Drawings, the Contractor shall make contraction joints as detailed including keyways, waterstop, dowels, reinforcement, sealants, etc. Prior to

placement of the new concrete, a bond breaker shall be applied to the existing hardened concrete. Bond breakers shall not be applied to waterstop material.

F. Expansion Joints

1. General

a. Expansion joints shall be made as shown on the Drawings and as approved by the Engineer. The pre-molded joint filler shall be of sufficient width to completely fill the joint space.

b. If a waterstop is in the joint, the pre-molded joint filler shall be accurately cut to butt tightly against the waterstop and the side forms.

c. At locations where joint sealant or filler is to be applied, the pre-molded joint filler shall be precut to the required depth, see details on Drawings.

d. Cavities for joint sealant shall be formed with either precut, pre-molded joint filler; or smooth, accurately-shaped material that can be removed.

e. Concrete shall be thoroughly vibrated along the joint form to produce a dense, smooth surface. Surface irregularities along the joint sealant cavity, due to improper concrete consolidation or faulty form removal, shall be repaired with an approved compound compatible with the joint sealant in a manner that is satisfactory to the sealant manufacturer.

2. Bituminous Type Pre-molded Joint Filler

Drive nails at about 1 foot on centers through the filler to provide anchors into the concrete when it is placed. Place pre-molded joint filler in forms in the proper position before concrete is poured. Install pre-molded joint filler in all sidewalks to provide expansion and contraction joints at not more than 25-foot intervals.

3. Pourable Joint Filler

a. Install pourable joint fillers in accordance with the manufacturer's instructions, except the entire joint above the waterstop shall be filled with filler as shown.

b. Thoroughly clean joints by mechanically roughening and cleaning, using a motorized wire brush or other motorized device, the concrete surfaces of

each side of the joint from the plastic waterstop to the top of the joint, dry the joint, and remove all dust and foreign materials using clean and dry high pressure air; prime before pouring the filler. Avoid damaging the waterstop. Primer shall be compatible with filler material.

3.12 Pumped Concrete

A. General

Pumping of concrete will be permitted only with the Engineer's agreement. If, in the Engineer's opinion, the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment

1. The Contractor shall have a standby pump, conveyor system, crane and concrete bucket, or other system acceptable to the Engineer, on the Site during pumping, in order to provide adequate redundancy to assure completion of the concrete placement without cold joints in the event of breakdown of the primary placing equipment.

2. The minimum diameter of the hose (conduit) shall be 4 inches. Pumping equipment and hoses (conduits) that, in the opinion of the Engineer, are not functioning properly, shall be replaced.

3. Aluminum conduits for conveying the concrete shall not be used.

4. A cement-water slurry shall be pumped through the lines and hoses before starting the concrete mix through the pump. The pump shall be operated in a manner that produces a continuous stream of concrete without air pockets or segregation.

C. Concrete Samples

Concrete samples for slump and test cylinders will be taken at the placement (discharge) end of the line.

3.13 Tolerances

A. General

Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in these Specifications, permissible deviations will be in accordance with ACI 347. Notations on the Drawings of specific maximum and minimum tolerances shall govern if in conflict with these Specifications.

B. Permissible Tolerance

Unless otherwise indicated, all columns, beams, slabs, openings, reinforcing bars, waterstops, etc., shall be accurately located to within 1/4 inch. The permissible tolerance of the inside and outside wall surface shall be 3/16-inch plus or minus for linear walls and 3/8-inch plus or minus for circular walls. The tolerance of alignment as to the actual position of inside and outside surface is 3/8-inch plus or minus. All transitions from plus to minus shall be gradual, even and smooth, and without abrupt changes in the surfaces.

C. Failed Tolerances

Should the completed Work fail to meet the tolerances specified herein, the Contractor shall bear the expense of any remedial work required to repair or replace the defected, as directed by the Engineer. Surface defects and irregularities are defined as finished and are to be distinguished from tolerances.

3.14 Testing and Quality Control

A. General

All testing shall be performed as per the requirements of the Drawings and Specifications. Materials that fail to meet Contract requirements shall not be incorporated in the Work.

1. Owner's Responsibilities

Refer to the General Requirements.

2. Contractor's Responsibilities

Refer to the General Requirements.

B. Structural Concrete

1. Cement Content

The cement content shall be tested in accordance with ASTM C85 and shall meet the requirements specified above in "Proportioning of Concrete Mix."

2. Fine and Coarse Aggregate

Aggregate size shall meet the requirements of ASTM C33.

3. Slump

Concrete shall be tested for slump in accordance with ASTM C143.

4. Air Content

Air content shall be tested in accordance with ASTM C231 and shall meet the requirements specified above in "Proportioning of Concrete Mix."

5. Compressive Strength

a. See the General Requirements.

b. All cylinders shall be prepared and cured in accordance with ASTM C31 and tested in accordance with ASTM C39. One cylinder shall be tested at the age of 7 days and two at the age of 28 days. Each strength test result shall be the average of the two cylinders from the same Sample tested at 28 days.

c. The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the required minimum compressive strength and no individual strength test result falls below the required minimum compressive strength by more than 500 psi.

6. Concrete Core Samples

a. Samples shall be taken according to ASTM C42. Three cores shall be taken for each unsatisfactory strength test. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60° to 85°, relative humidity less than 60 percent) for 7 days before test

and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.

b. Concrete in the area represented by the core tests may be considered structurally adequate if the average of the three cores is equal to at least 85 percent of the minimum compressive strength and if no single core is less than 75 percent of the minimum compressive strength. The decision as to whether the concrete is structurally adequate shall be at the sole discretion of the Engineer. A cost adjustment may be required as a condition of acceptance.

7. Admixtures

Admixtures shall meet the requirements listed under Part 2 - Materials, "Concrete Admixtures."

8. Visual Inspection

The concrete shall be free of rock pockets, cracks, and other structural and water holding defects. Any defective concrete shall be repaired as approved by the Engineer. Any defective concrete with exposed reinforcing steel shall either be repaired or demolished and replaced at the sole discretion of the Engineer.

C. Defective Concrete

1. For each unsatisfactory strength test, concrete core samples shall be taken according to ASTM C42. A minimum of three cores shall be taken for each unsatisfactory strength test. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60° to 85°, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.

2. Concrete in the area represented by the core tests may be considered structurally adequate if the average of the three cores is equal to at least 85 percent of the minimum compressive strength and if no single core is less than 75 percent of the minimum compressive strength. The Engineer may require additional core tests to determine the limits of the defective concrete. The cost of core tests shall be borne by the Contractor. The decision as to

whether the concrete is structurally adequate shall be at the sole discretion of the Engineer. A cost adjustment may be required as a condition of acceptance.

D. Visual Inspection

All concrete shall be free of rock pockets, cracks, and other structural and water holding defects. Any defective concrete shall be repaired as approved by the Engineer. Any defective concrete with exposed reinforcing steel shall either be repaired or demolished and replaced at the sole discretion of the Engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis

See Technical Specifications - "Measurement and Payment" for a description of the basis of measurement and payment for Work performed under this Contract.

END OF SECTION

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SECTION 5

PIPE, FITTINGS, AND VALVES

TECHNICAL SPECIFICATIONS

SECTION 5

PIPE, FITTINGS, AND VALVES

PART 1 - GENERAL

1.1 Scope

A. These Specifications cover the furnishing and installation of all pipe, valves, and associated fittings for the drying bed improvements. The Work includes, unless otherwise specified, furnishing all labor, materials, tools, equipment, and incidentals required to construct the drying bed improvements as shown on the Drawings and outlined in these Specifications. For additional requirements and related work, refer to other Technical Specifications.

B. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

C. The Contractor shall furnish and install pressure sewer lines of the size called for on the Drawings and the type and class indicated in these Specifications, unless otherwise noted on the Drawings. These Specifications cover all buried pressurized sewer lines.

1.2 Specification References

Specification references made herein for manufactured materials such as pipe, fittings, valves, etc., refer to designations for the American Public Works Association (APWA), the American Water Works Association (AWWA), or the ASTM effective on the bid date.

1.3 Submittals

Catalog information on all materials and/or equipment to be installed shall be submitted to the Engineer for review prior to installation.

1.4 Care and Handling of Materials

A. Adequate precautions shall be taken to prevent damage to pipes, fittings, manhole components, and all other materials used in construction of a sewerage system. During transport, pipe and other materials shall be secured individually by use of wood spacer blocks or wood rates, or otherwise protected to prevent collision of individual pieces and the possible subsequent damage.

B. All pipe, fittings, manhole components, and valves shall be loaded and unloaded in a manner to prevent shock or damage. Under no circumstances shall such material be dropped. All materials on the ground shall be protected from damage. All pipe, fittings, valves, and all other materials used in the construction of the sewerage system shall be

carefully inspected by the Contractor prior to installation. All defective materials shall be rejected. All materials that are delivered considerably in advance of their installation shall be stored in a satisfactory manner. The Contractor will not receive payment for materials on hand not protected.

C. Proper materials, tools, and equipment shall be used by the Contractor for safe and convenient execution of the Work. All pipe, fittings, etc., shall be carefully lowered into the trench piece by piece in such a manner to prevent any damage to the materials. Under no circumstances shall sewerage system materials be dropped or dumped into the trenches.

1.5 Slide Gates

A. General requirements and descriptions for slide gates are presented below. The Contractor shall provide a slide gate design per these Specifications and as shown on the Drawings for approval by the Engineer.

B. Submittals

The Contractor shall provide the following information to confirm compliance with these Specifications, in addition to the submittal requirements specified herein as applicable to the slide gates and associated components.

1. Complete description of all materials, including material thickness of all structural components, frame, and slide.

2. Installation drawings showing all details of construction, details required for installation, dimensions, and anchor bolt locations.

3. Maximum bending stress and deflection of the slide under the maximum design head.

C. The Contractor shall provide the name of the manufacturing company, the location of the company headquarters, and the location of the principal manufacturing facility.

PART 2 - MATERIALS

2.1 Pipe

A. General

Pipe shall be of the type called for on the Drawings and shall conform to the following Specifications. Pipe substitutions may be made only with prior approval of the Engineer.

B. Ductile Iron Pipe

1. Ductile iron pipe and fittings shall conform to AWWA C150, AWWA C115, AWWA C151, and AWWA C110 and shall be minimum special Class 350, unless specified otherwise. All ductile iron pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104. All joints for buried service, unless otherwise specified, shall be push-on rubber gasket joints conforming to AWWA C111. When required for fittings, mechanical joints shall conform to AWWA C111.

2. When flanged pipe is required, the Contractor shall provide the ductile iron pipe class required by the flange manufacturer to ensure the pipe and flange units are compatible. These data shall be provided to the Engineer for review prior to ordering these materials. Flanges for couplings and fittings shall conform to ANSI B16.1, 125-pound bolt hole template.

C. PVC Pipe - Diameter 2-inch or Smaller

PVC pipe shall be the size and type called for on the Drawings and shall conform to the following applicable ASTM Standards:

1. D1784, PVC and CPVC plastic compounds

2. D1785, Schedule 40, 80, and 120 PVC pipe

D. PVC Pipe - Diameter Greater than 2 Inches

PVC pipe with a diameter greater than 2 inches shall conform to AWWA C900-16, DR 18 (235 psi pipe), or as otherwise specified. The pipe shall have flexible rubber gasketed joints conforming to ASTM D3139 and ASTM F477. Pipe color shall be green.

E. Miscellaneous Pipe

Miscellaneous small pipe, not otherwise specified, shall be of first class material and suitable for the intended service.

2.2 Fittings

A. Fittings for Iron

1. Unless specified otherwise, all fittings such as elbows, tees, crosses, etc., for buried pipe shall be mechanical joint short-bodied compact ductile iron fittings conforming to AWWA C153, Class 350.

2. When called for, flanged cast iron fittings shall conform to AWWA C110 with ANSI B16.1, 125-pound bolt hole template.

3. All fittings shall be cement mortar lined in accordance with AWWA C104.

4. Gaskets shall be either ring or full faced, 1/8-inch thick conforming to AWWA C111, Appendix B.

B. Sleeve Type Straight Couplings

Sleeve type couplings shall be ductile iron or fabricated steel as manufactured by Dresser, Ford, Romac, or approved equal conforming to AWWA C219. The Contractor shall provide the appropriate coupling and gaskets as required to match the pipe types and sizes being utilized. Couplings shall be rated for the working pressure of the pipe main for which they will be utilized.

C. Restrained Joint Pipe and Fittings

1. Where called for on the Drawings, restrained joint pipe and fittings shall be:

a. Restrained Push-on Joint Pipe

When restrained joint ductile iron pipe is required, the pipe shall be the same class and type as the ductile iron pipe specified herein. Joints shall be Tyton Joint with Field Lok 350 gaskets, or approved equal. The restraint shall be boltless, integral restraining system, rated for 350 psi in accordance with the performance requirements of ANSI/AWWA C111/A21.11.

b. Restrained Fittings

All mechanical joint fittings called out to be restrained shall be equipped with a MEGALUG Series 1100 mechanical joint restraint system as manufactured by EBAA Iron, Inc., or approved equal.

D. Flexible Couplings

Reinforced rubber sleeve couplings for use on the suction and discharge piping of pumps shall be the style specified on the Drawings, as manufactured by Proco, Metraflex, or approved equal. Flexible couplings shall have a method of restraint to prevent linear movement of the pipe when pressurized.

E. PVC Fittings

PVC fittings shall be the size and type called for on the Drawings and shall conform to the following applicable ASTM standards:

1. D2467, Socket-type Schedule 80 PVC fittings

2. D2564, PVC solvent cements

2.3 Valves

A. General

Valves shall be of the type called for on the Drawings and shall conform to the following Specifications:

B. Plug Valves

1. All plug valves shall conform to AWWA C504. The valve body shall be constructed of cast iron (semi-steel) conforming to ASTM A126 Class B and shall be protected with a factory-applied fusion-bonded coating meeting AWWA C550.

2. The shaft and plug shall be integrally constructed of cast iron (semi-steel) and shall be 100 percent encapsulated with Buna-N rubber.

3. The stem seals shall be Buna-N multiple "V" ring stem packing seals. The valve seat surface shall be raised welded-in overlay of not less than 90 percent nickel.

4. Flange dimensions, facing, and drilling shall conform to ANSI B16.1, Class 125.

5. Mechanical joints shall meet the requirements of AWWA C111/ANSI A21.11.

6. The valve shall have a 2-inch AWWA operator nut for buried services and handwheel operator for non-buried services or as called for on the Drawings.

7. Worm gear operators shall be furnished for all 4-inch or larger valves.

8. The interior of the valve bodies shall be covered with a Viton rubber coating with a minimum thickness of 1/8-inch.

9. Valves shall be Pratt Ballcentric plug valves.

C. Cast Iron Valve Box

1. All buried valves shall be equipped with an adjustable cast iron box of the sliding type with a base large enough to cover the top casing of the valve.

2. The diameter of the valve box shall be not less than 5 inches, and shall be of such length so as to provide the depth of cover over the pipe without full extension.

D. Flap Valves

Flap valves to be used on drain lines, as shown on the Drawings, shall be Neenah Series 5004 with flanged end, cast iron body with bronze hinge pin and seat. Bottom of seat shall be notched to allow small quantities of water to drain out.

E. Miscellaneous Valves

Miscellaneous valves not specified herein or in the General Requirements or on the Drawings shall be of first class construction and shall be suitable for the intended purpose.

F. Valve Labels

1. A valve label shall be provided for buried valves associated with pumping stations, reservoirs, etc.

2. The label shall be permanently cast into a concrete collar at each valve box.

3. The label shall note the valve number, if applicable, and valve function, as required by the Engineer.

2.4 Aluminum Decanting Slide Gate

A. General

1. Slide gates shall be as specified herein and have the characteristics and dimensions shown on the Drawings.

2. Handwheels shall be utilized and provide smooth, free operation from full open to close positions, be self-sealing with absence of head, and self-cleaning. The gates shall be installed to provide a smooth flow transition in the channel/pipe in which they are installed. The 2-inch operating nut tops shall be positioned below the top slab and within 6 inches of the bottom of the top slab to provide easy access.

3. Leakage shall not exceed 0.05 gallons per minute per foot of wetted seal perimeter in seating head and unseating head conditions.

4. The gate seals shall be either J, P, or self-adjusting.

5. All structural components of the frame and slide shall be fabricated of stainless steel or aluminum and shall have adequate strength to prevent distortion during normal handling, installation, and while in service. All other associated hardware shall consist of stainless steel, aluminum, and bronze components, unless otherwise noted. All other metal work, attachments, brackets, and hardware shall either be aluminum or hot-dipped galvanized, except where noted.

6. A stop nut shall be provided to limit the gate opening and prevent the slide from being removed from the frame.

7. All welds shall be performed by welders with American Welding Society certification.

8. Finish shall be mill finish on aluminum. Welds shall be sandblasted or physically de-scaled to remove weld burn and scale.

9. Materials:

Components	Materials
Frame Assembly and Retainers	Aluminum Alloy 6061, ASTM B209 or B308
Slide and Stiffeners	Aluminum Alloy 6061, ASTM B209 or B308
Stem	Stainless Steel, Type 304, ASTM A276
Fasteners, Nuts, and Bolts	Stainless Steel, Type 304, ASTM F593 and F594

Components	Materials
Seats/Seals and Facing	Ultra-High Molecular Weight (UHMW) Polyethylene ASTM D 4020
Lift Nuts	Bronze ASTM B584
Wall Brackets	Stainless Steel, Type 304L, ASTM A276

10. Stem guides shall be provided per manufacturer's recommendation. Stem guides shall have UHMW bushings.

11. The gate manufacturer shall provide the anchor bolts required for mounting the gates and appurtenances.

12. All dissimilar metals shall be galvanically insulated from each other.

2.5 Yard Hydrant

Yard hydrant shall be Woodford Manufacturing with cast iron head and bronze internal parts. Exterior hydrants shall be frost-free.

2.6 Structural Steel and Miscellaneous Metal Work

A. General

Unless otherwise noted on the Drawings, all rolled shapes, plates, and bars shall be carbon steel conforming to ASTM A36.

B. Aluminum

Aluminum bars, plates, and shapes shall be furnished in accordance with the Aluminum Standards and Data published by the Aluminum Association. Aluminum bars and plates shall be alloy 5086-H32, except that alloy 6061-T6 may be used for welded or bolted connection plates to aluminum structural shapes. Aluminum extruded shapes shall be alloy 6061-T6.

C. Pipe and Tube Columns

Pipe and tube columns shall be hot-formed welded or seamless carbon steel structural tubing conforming to ASTM A501.

D. Standard Railing, Stair Railing, and Toeboard

1. Standard railing shall consist of a top rail, intermediate rails, and posts. Rail height, post spacing, and pipe diameter shall be as shown on the Drawings, or as

required by applicable Safety or Building Codes. Railing assembly shall be able to withstand a load of 200 pounds applied in any direction at any point on the top rail.

2. Railing shall be fabricated from Schedule 40 aluminum alloy 6063-T6 extruded pipe, and shall be either a mechanical joint or a welded joint system, unless otherwise specified.

3. Mechanical joint system shall be ReynoRail II Aluminum Railing System supplied by Reynolds Metals Company, or an approved equal.

4. Toeboard shall be fabricated of 4-inch x 1/4-inch aluminum plate, unless otherwise specified.

E. Grating

1. Aluminum grating shall be Reliance Steel Products Company's Double-Lock Aluminum Grating Type IR4 or an approved equal, unless otherwise specified. Grating shall be sized as shown on the Drawings.

2. Grating shall have at least 1-1/4-inch x 3/16-inch bearing bars, or an equally strong I-bar, spaced 1-inch apart and cross bars 4 inches on center. Bearing bars shall span in the direction shown on the Drawings.

3. Walking surface shall be knurled or fluted to form a non-skid surface. Grating shall have a mill finish and all open edges shall be banded.

PART 3 - EXECUTION

3.1 Pipe Installation and Testing

A. General

Pipe shall be installed in accordance with good trade practice with respect to handling, joining, supporting, and testing. A calibrated torque wrench shall be provided and used where specific torque requirements are specified by the manufacturer.

B. Pipe Supports and Couplings

All pipe shall be rigidly secured in place by means of blocking, hangers, brackets, clamps, or by other approved methods, in such a manner to adequately support the pipe under all operating conditions, whether or not such supports are shown on the Drawings.

Sufficient unions and couplings shall be provided to facilitate the installation of any section of piping.

C. Testing

1. The Contractor shall furnish all necessary equipment and other apparatus, including gauges, necessary to properly perform the testing of pipelines as specified. Lines to be tested include mains and service lines. Each section of the lines before being tested and placed into service shall be isolated and slowly filled with water. Air should be expelled from the line through hydrants or taps made at the high points. The Engineer shall have the option of requiring the use of their own gauges.

2. The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the Engineer's representative. The Contractor shall coordinate the timing of this acceptance test with the Engineer's representative. The lines will not be accepted until the acceptance test has been witnessed and documented as passing. Forms for performing the various tests are included at the end of this Technical Specification for use and reference by the Contractor.

3. All lines shall be pressure tested at 150 psi gauge or 1.5 times the actual working pressure, whichever is greater, for one hour. Any cracked or defective pipe, joints or fittings shall be removed and replaced.

4. Each section of the line, after all backfill and compaction work has been completed and before being placed into service, shall be tested for leakage for a period of two hours at a minimum average gauge pressure of 100 psi. Leakage is defined as the quantity of water supplied into the section of line being tested, during and at the end of the test, that quantity being such that the pressure at the end of the test is equal to the pressure at the beginning of the test. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints until the leakage is within the specified allowance.

PVC Pipe: $L = \frac{ND\sqrt{P}}{7,400}$ DI Pipe: $L = \frac{SD\sqrt{P}}{133,200}$

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
N = Number of Joints or Connections
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

5. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints or pipe until the leakage is within the specified allowance. Prior to testing, potable water pipe and equipment shall be disinfected in accordance with Oregon Administrative Rules, Chapter 333, Public Water Systems, 1993, Section 333-61-050(10) "Disinfection of New Facilities" prepared by the DWS.

3.2 Painting

All pipes, valves, and fittings shall be painted in accordance with Technical Specifications - "Painting" and as shown on the Drawings.

3.3 Aluminum Decanting Slide Gate

A. Installation

1. It shall be the responsibility of the Contractor to handle, store, and install the equipment specified in these Specifications in strict accordance with the manufacturer's recommendations.

2. The Contractor shall review the installation drawings and installation instructions prior to installing the slide gates.

3. Slide gate assemblies shall be installed in a true vertical plane, square and plumb.

B. Field Testing

After installation, all slide gates shall be field-tested in the presence of the Engineer and the Owner to ensure all items of equipment are in full compliance with these Specifications. Each slide gate shall be cycled to confirm it operates without binding,

scraping, or distorting. Each slide gate shall be water tested by the Contractor, at the discretion of the Engineer and Owner, to confirm that leakage does not exceed the specified allowable leakage.

3.4 Structural Steel and Miscellaneous Metal Work

A. Fabrication and Erection

Fabrication and erection of structural steel and miscellaneous steel items shall be in accordance with the "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, where applicable. Structural steel and miscellaneous metal work shall be painted in accordance with Technical Specifications - "Painting."

B. Aluminum Welding

Aluminum shall be welded with gas metal arc (MIG) or gas tungsten arc (TIG) processes in accordance with the recommendations of the American Welding Society contained in the Welding Handbook, as last revised.

C. Standard Railing, Stair Railing, and Toeboard

1. Pipes shall have square and accurate pipe cuts for minimum joint gap. Joints with gaps in excess of 1/32 inch and all loose connections will be subject to rejection. All holes shall be drilled and countersunk the proper size, as required for a tight, flush fit of rivets.

2. The welded joint system shall consist of shop-welded sections field-connected with a mechanical joint system as specified above. The welded joint system shall have accurate joint makeup and high-quality welded joints. If welding is uniform and reasonably smooth, grinding of joints is not required. Shop-welded sections shall receive anodized coating after fabrication.

3. Contractor may propose, for Engineer's review and approval, a railing system that utilizes standard weight black pipe with corrosion resistant treatment coating.

4. Stair railing shall meet all the requirements of a standard railing. Rail height, post spacing, and pipe diameter shall be as shown on the Drawings, or as required by applicable Safety or Building Codes. Clearance between handrail and any object shall be a minimum of 3 inches.

5. Toeboard shall be securely fastened to railing posts, allowing for slippage due to expansion and contraction.

D. Minimum Embedment for Anchor Bolts

Minimum embedment for anchor bolts in concrete and masonry.

Bolt Size	Embedment Length
1/2-inch	4 inches
5/8-inch	5 inches
3/4-inch	5 inches
7/8-inch	6 inches
1-inch	7 inches

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis

See Technical Specifications - "Measurement and Payment" for a description of the basis of measurement and payment for Work performed under this Contract.

END OF SECTION

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SECTION 6

FENCES

TECHNICAL SPECIFICATIONS

SECTION 6

FENCES

PART 1 - GENERAL

1.1 Scope

A. These Specifications cover the construction of fences, gates, and gateways of chain link fabric to the lines and grades shown on the Drawings, or as established by the Engineer. The construction of the various types of fence shall include the assembly and erection of all component parts and materials complete in place at the locations shown on the Drawings as required by the fence manufacturer and as approved by the Engineer.

B. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

PART 2 - MATERIALS

2.1 General

All fencing materials (including gates) furnished and used in the construction of the fence shall be new material and shall be the products of recognized reputable manufacturers or producers. All fence fabric, barbed wire posts and fittings, and other appurtenances shall be properly labeled as to the manufacturer, weight and class of zinc, aluminum coating or aluminum alloy, and ASTM designation pertinent to the material. Any deviations from the requirements listed herein shall be submitted to the Engineer for review.

2.2 Chain Link Fence

A. General

1. Chain link fabric, post, braces, and appurtenances shall conform to the requirements of AASHTO M 181, as specified herein, and as shown on the Drawings.

2. Chain link fence may be of the following types as elected by the Contractor, provided that only one type is used in any one Project:

   a. Zinc-coated steel fabric, posts, hardware, and fittings;

   b. Aluminum-coated steel fabric and zinc-coated steel posts, hardware, and fittings; or

   c. Aluminum-alloy fabric, posts, hardware, and fittings.

3. Fabric and mounting systems may be interchanged but still shall be uniform throughout a Project.

4. All materials shall be of first class quality.

B. Tubular Members

1. All tubular members shall comply with provisions of ASTM A53 for weight and coating.

2. All structural shapes shall comply with provisions of ASTM A123 for galvanized coating.

C. Fabric

Fabric shall be heavily galvanized, with a minimum 1.2 oz. of zinc per square foot as per ASTM A392, Class 1 or aluminum coated with a minimum 0.40 oz. aluminum per square foot as per ASTM A491, Class 2. Hardware shall be galvanized in accordance with ASTM A153.

D. Aluminum Alloy Members

1. Aluminum alloy members shall conform to ASTM B241 or ASTM B221, alloy 6063-T6.

2. Miscellaneous aluminum alloy hardware shall conform to applicable ASTM standards.

E. Posts and Other Members

Posts and other members shall be of the size and weight as listed in the standard Drawings for fences. Alternate materials/size of members may be used if approved by the Engineer.

F. Gates

1. Gates shall be assembled by welding or with fittings riveted to ensure solid, rigid connections. Gates shall have the same height as the adjoining fence.

2. The Contractor shall furnish the following hardware for each gate.

a. Hinges shall be pressed steel or malleable iron to suit the gate size. They shall be non-lift off type and offset to permit 180° gate opening. One pair of hinges shall be provided for each gate leaf.

b. All latches shall be of the forked or plunger bar type to permit operation from either side of the gate. A padlock eye shall be provided as an integral part of each latch.

c. Heavy-duty brass padlocks shall be furnished by the Contractor. All locks on a Project shall be keyed alike.

d. A keeper shall be provided that automatically engages each gate leaf and holds it in the open position until manually released for all vehicle gates.

e. Gate stops shall be provided for all double gates to engage the center drop rod or plunger bar of the gate. They shall consist of mushroom type or flush plate with anchors and shall be set in concrete.

3. When required, the Contractor shall provide sliding gates. They shall have the manufacturer's standard heavy-duty track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and other accessories as required to complete an operational gate.

PART 3 - EXECUTION

3.1 Chain Link Fence

A. General

1. Installation of the chain link fence shall be performed in a first class manner in accordance with the manufacturer's instructions, the Drawings, and as approved by the Engineer.

2. Installation shall not begin prior to completion of final grading of the Site.

3. The end result shall be a sturdy, taut fence constructed to neat horizontal and vertical lines.

B. Post Installation

Post holes shall be excavated in firm, undisturbed, or compacted soil. Concrete is to be placed around the post in a continuous pour and tamped for consolidation. The top of

concrete footings shall be struck off, trowel finished, and sloped away from the posts. Each post when set shall be checked for vertical and top alignment. Concrete shall be cured for seven days before being stressed, unless approved otherwise by the Engineer. Keepers, stops, and sleeves shall be set in concrete.

C. Fabric Installation

Tension wires are to be installed before stretching the fabric and tied to each post with ties or clips. The fabric shall be pulled taut and tied to poles, rails, and tension wires. The fabric shall be installed on the security side of the fence and anchored to the framework so the fabric remains in tension after the pulling force is released. Stretcher bars should be threaded through the fabric and secured to the posts with metal bands with maximum band spacing of 15 inches.

D. Barbed Wire Installation

Three runs of barbed wire shall be installed on extension arms mounted on the security side of the fence, when shown on the Drawings. The wire shall be taut.

E. Gates

1. Gates shall be installed plumb level and secure for full 180° opening without interference.

2. All gate hardware shall be properly installed for smooth operation.

3. The fabric shall be installed taut and securely to the gate frame.

4. Hardware shall be attached by rivets or other means which will inhibit removal.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis

See Technical Specifications - "Measurement and Payment" for a description of the basis of measurement and payment for Work performed under this Contract.

4.2 Gateways

Gateways shall be included in the bid item for fence. No direct payment will be made for gateways.

END OF SECTION

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SECTION 7

PAINTING

TECHNICAL SPECIFICATIONS

SECTION 7

PAINTING

PART 1 - GENERAL

1.1 Scope

A. This Technical Specification covers the furnishing of labor, materials, and equipment necessary to provide surface preparation, coating application, and inspection for a complete coating system as specified.

B. As a general guideline, exposed improvements shall be painted unless specifically noted otherwise on the Drawings or Specifications. For piping systems above ground and in vaults, all pipe, valves, flowmeters, pumps, motors, etc., shall be painted.

C. In general, painting finishes are not required on the following, unless specifically noted otherwise on the Drawings or in the Specifications:

1. Stainless steel items of equipment, materials, and furniture having a factory finish, if the factory finish is in good condition.

2. Aluminum not in contact with concrete or masonry.

3. Galvanized fencing materials.

4. Manholes and covers.

5. Buried or concealed improvements.

6. Concrete structures.

D. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to every item of Work to be constructed. All applicable sections, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

1.2 Reference Standards

A. Protective coatings on potable water structures shall conform to applicable standards of the Oregon Health Authority - Drinking Water Services (DWS), AWWA, and ANSI/NSF.

B. Without limiting the general aspects of other requirements of these Specifications, all surface preparation, coating, and painting of interior and exterior surfaces shall conform to the applicable requirements of the National Association of Corrosion Engineers, the Steel Structures Painting Council, the DWS and the paint system manufacturer's printed instructions.

C. The below listed standards in Table 1 are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. Where standards of surface preparation are described by citing SSPC specification, numbered reference is made to the "Steel Structures Painting Manual," Volume 2, published by the Steel Structures Painting Council.

Table 1 - Reference Standards

Reference	Title
ANSI-NSF 61	Drinking Water System Components – Health Effects
SSPC-SP1	Specification for Solvent Cleaning
SSPC-SP2	Specification for Hand Tool Cleaning
SSPC-SP3	Specification for Power Tool Cleaning
SSPC-SP5	Specification for White Metal Blast Cleaning
SSPC-SP6	Specification for Commercial Blast Cleaning
SSPC-SP10	Specification for Near-White Metal Blast Cleaning
SSPC-PA2	Measurement of Dry Film Thickness with Magnetic Gages
ASTM D4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D2794	Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D4541	Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM F1249	Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
ASTM B117	Test Method of Salt Spray (Fog) Testing
ASTM D741	Method for Evaluating Degree of Blistering of Paints
ASTM D870	Practice for Testing Water Resistance of Coatings Using Water Immersion
ASTM D1014	Method of Conducting Exterior Exposure Tests of Paints on Steel
ASTM D1653	Test Method for Water Vapor Permeability of Organic Coating Films
ASTM D1654	Method of Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

Table 1 - Reference Standards	
Reference	**Title**
ASTM D4585	Practice for Testing the Water Resistance of Coatings Using Controlled Condensation
ASTM D5894	Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal (Alternating Exposure in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

1.3 Storage and Handling

A. Materials shall be brought to the Project Site in original sealed containers. The containers shall bear a legible product designation, batch number, and date of manufacture on the side of each container. They shall not be used until the Engineer has inspected contents and obtained data from information on containers or labels. Materials exceeding storage life recommended by the manufacturer shall be rejected. Submit paint receipts/invoices, upon request, to the Engineer.

B. Coating materials shall be handled and stored according to the manufacturer's latest published instructions, and shall be protected from damage, moisture, direct sunlight, and temperatures below 40°F or above 100°F. Flammable coatings and paints must be stored to conform with city, county, and state safety codes for flammable coating or paint materials. Water base coatings or paints shall be protected from freezing.

1.4 Submittals

A. Submit in accordance with the General Requirements in one complete package.

B. Prior to ordering material, submit a complete schedule of materials to be used. Include manufacturer's brand name, product name, and designation number for each coat of each system to be used. Include information indicating percent solids by volume, minimum recommended dry film thickness per coat, recommended surface preparation, recommended thinners, application instructions, and a statement indicating that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

C. Prior to commencing Work, submit a detailed list of all surfaces and equipment items upon which the Contractor intends to apply protective coatings.

D. Provide the following information on each paint product:

1. Abrasion resistance, ASTM D4060, 1 kg load at 1,000 cycles, CS-1 7 wheel

2. Impact resistance, ASTM D2794, direct and reverse

3. Moisture vapor transmission, ASTM Fl249

4. Adhesion, ASTM D4541

5. Salt fog, ASTM B117

6. QUV, ASTM G53 (exterior finish coat only)

7. Fresh water immersion, ASTM D870 (immersed coatings only)

8. Humidity, ASTM D4585

E. If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Engineer may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Owner. For substituted materials, provide a list of references, including contact person and phone number, where proposed substitute paint system has been used in similar exposures. Provide a minimum of five references (no duplicate owners or agencies).

F. Provide Material Safety Data Sheets (MSDSs) for all products.

G. Manufacturer's Certification: That products furnished meet applicable air quality regulations as to allowable VOC content for the place of application and use intended.

H. Submit to the Engineer a full range of the manufacturer's standard and let down finish colors for review and selection by the Owner. After final colors have been selected, submit two 8-1/2 by 11-inch Samples on cardboard of each color indexed as to manufacturer and color designation. Color chips 3/4-inch by 1-1/2-inch may be used for pipe color codes.

1.5 Quality Assurance

A. The Contractor shall submit to the Engineer a written detailed description of the painting Subcontractor's qualifications and experience relative to the application of the specified coating systems. Such description shall include the following minimum information:

1. Name of the company that will be performing the painting work.

2. Experience of the company on similar projects, including experience with sandblasting, preparation of steel structures, concrete, piping, buildings, equipment, etc., and use of the paint systems specified herein.

3. List of similar projects that the company has completed (five minimum).

4. List of contact persons and telephone numbers for each job reference.

5. Names of personnel who will be performing the Work on this Project and their experience.

6. Name of the on-the-job painting supervisor and their experience.

B. Coating Manufacturer's Qualifications

1. Protective coatings furnished under this section shall:

a. Be of a manufacturer who has been regularly engaged in the manufacture of protective coatings with a minimum of 10 years of successful experience.

b. Demonstrate to the satisfaction of the Engineer successful performance on comparable projects.

C. Applicator's Qualifications

Applicator shall be experienced in application of specified protective coatings for a minimum of 5 years, practical experience in application of the specified coatings, and successful completion of a minimum of five projects of similar size and complexity within the last 3 years.

D. Coating manufacturer's authorized representative shall provide a written statement attesting that the applicator has been instructed on proper preparation, mixing, and application procedures for coatings specified as well as the applicator's qualifications.

PART 2 - MATERIALS

2.1 General

A. TNEMEC products are listed as the basis of design and quality in terms of performance and characteristics. Other manufacturers' products will be considered subject to meeting the listed quality, performance, and characteristics of the standard/product(s)

for the particular application and compliance with the Specifications. Substantiating Technical Data are required. Submit requests for substitution in accordance with the General and Supplementary Conditions. Substitutions that decrease the film thickness, solids by volume, or number of coats will not be considered. Requests for substitutions shall include test reports that demonstrate the product(s) meets or exceeds the performance and characteristics of the listed standard/product(s).

B. The Contractor shall submit any proposed substitutions on Table 2 "Protective Coating - Substitution List" at the end of this section. Colors where not specified shall be approved by the Owner.

PART 3 - EXECUTION

3.1 Surface Preparation

A. General

Surfaces to be painted shall be prepared in accordance with the manufacturer's instructions in a professional manner with the objective of obtaining a smooth, clean, and dry surface. No painting shall be done before the prepared surfaces are approved by the Engineer.

B. Metal

1. Metal surfaces, including piping, not shop primed or painted shall be thoroughly cleaned by sandblasting, in accordance with the paint manufacturer's instructions, and as specified herein prior to painting. Any metal items with a paint incompatible with the specified finish shall be primed as recommended by the paint manufacturer.

2. Previously painted surfaces such as piping which are pitted, scaling, rusty, etc., or in otherwise poor condition shall have existing paint removed to bare metal or as approved by the Engineer. Oils, dirt, and other surface contaminants, shall be removed so that surfaces are properly prepared for painting. Priming and painting shall then be applied in accordance with these Specifications.

C. Wood

Wood surfaces exposed to view shall be sanded to remove any dirt or blemishes. Roof decking and beams need not be sanded if protected during construction such that no blemishes occur. Existing wood surfaces previously painted shall be scraped, sanded, and cleaned as required prior to painting.

3.2 Application

A. Paint shall be applied in a neat, professional manner. Finished surfaces shall be uniform and pleasing in appearance, free of runs, drips, sags, or variable texture. Defective painting shall be removed and replaced.

B. The painter shall apply each coating at the rate specified for application by the manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material.

C. Drying time shall be construed to mean "under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying time will be necessary. Additional coats of paint shall not be applied nor shall units be put into service until paints are thoroughly dry.

D. Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, shall be allowed, and all such thinning shall be done strictly in accordance with the manufacturer's instructions, as well as with the full knowledge and approval of the Engineer.

E. No paint shall be applied in fog, snow, rain, or to wet or damp surfaces, or when air temperatures are below 40°F and surface temperatures are below 35°F or when the relative humidity exceeds 85 percent. The Contractor shall provide heaters, fans, etc., when necessary to keep moisture off of piping to be painted.

F. Coating materials shall not be applied when the ambient air temperature, surface temperature, or humidity is outside the boundaries as stated on the product data sheets.

G. Materials shall be evenly applied to form a smooth, continuous, unbroken film.

H. Dirt, grease, oil, paint chalk, or any other contamination will not be permitted between coats.

I. Welds, bolt heads, nuts, rivets, and connections shall be stripe coated by brush with primer prior to applying full coat of primer.

J. Each application of protective coatings, with the exception of coal tars, shall be a different shade in color than the specified finish.

3.3 Painting Schedule

Painting schedule for the Work is given in Table 3 (end of section).

3.4 Inspection

A. Dry Film Thickness

After application of each coating in the specified system, the total dry film thickness shall be taken as follows:

1. Make five separate spot measurements spaced evenly over each section of 100 square feet in area per SSPC-PA 2. Measurements, as much as possible, should be taken at surfaces with dissimilar exposures, that is, at different angles, faces, bolts, etc., to ensure uniformity of the coatings.

2. No single spot measurement (average of three readings) in any section shall be less than 80 percent of the specified thicknesses.

B. Documentation

Applicator is to keep a log of ambient and surface temperature, humidity, dew point, and dry film thicknesses (paragraph 3.4.A.). These are to be logged every day at the beginning, middle, and end of each shift. This log is to be current and available at all times for the Owner, Engineer, and coatings manufacturer to verify.

3.5 Colors

A. General

Colors shall be as called for on the Drawings or as approved by the Owner and directed by the Engineer. The Contractor shall provide color charts to the Engineer when required.

B. Color Pipe Coding

1. To facilitate identification of piping in plants and pumping stations, the color scheme given in Table 4 (end of section) shall be utilized. Final color selection will be as approved by the Engineer.

2. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be

painted on one of the pipes at approximately 30-inch intervals. Identification labels shall also be painted on the pipe. Paint arrows indicating the direction of flow. For each pipe to be provided with labeling, the Engineer shall provide the Contractor with the list of identification labels.

3.6 Extra Paint

The Contractor shall provide a minimum of one gallon of extra paint for each major color and system used. A minimum of one quart of extra paint shall be provided for colors used as trim or for minor items as determined by the Engineer. The Contractor shall provide either fresh labels from paint cans with a list of places used, or a written description of painting systems, locations used, and applications requirements.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Basis

See Technical Specifications - "Measurement and Payment" for a description of the basis of measurement and payment for Work performed under this Contract.

Table 2 Protective Coatings – Substitution List			
	Specified Coating		Substitute Coating
System No.	Generic	Coating Name[1]	Manufacturer's Name, Generic, Performance, Percent Solids, Surface Preparation, No. Coats, Industrial Use, Standards
1	Modified Aromatic Polyurethane (Primer) Aliphatic Acrylic Polyurethane (Finish)	Series 1 Series 73	

[1] All listed coating names are TNEMEC products, except System No. 10.

TECHNICAL SPECIFICATIONS

SECTION 7

PAINTING

Table 3 - Painting Schedule			
Paint System No., Type, and Location	**Surface Preparation**	**Prime Coat ([1,2])**	**Intermediate/Finish Coat ([1,2])**
Ferrous Surfaces			
No. 1 - MC Polyurethane and Polyurethane Protective Coating - Exterior non-immersed ferrous surfaces such as exterior pipes, valves, supports, handrails, braces, covers, fabrications, etc.	**New** - Blast clean per SSPC-SP 6. Dry abrasive blasting performed with media that provides 1 to 2 mil anchor profile. **Touchup** - SSPC 1, 2, or 3	TNEMEC Series 1 Omnithane, 2.5 to 3.5 mils DFT	**Finish** - TNEMEC Series 73 Endurashield, 3 to 5 mils DFT

[1] – Prime and finish coats for touch-up or spot work shall be of the same system and dry film thickness (DFT) as the specified coating system.
[2] – DFT = dry film thickness

Table 4 - Color Pipe Coding	
Type of Pipe	**Color**
Water Lines	
Raw	Olive Green
Settled or Clarified	Aqua
Finished or Potable	Dark Blue
Chemical Lines	
Alum	Orange
Ammonia	White
Carbon Slurry	Black
Chlorine (Gas and Solution)	Yellow
Chlorine (Sample)	Light Yellow
Fluoride	Light Blue with Red Bands
Lime Slurry	Light Green
Potassium Permanganate	Violet
Sulfur Dioxide (Gas and Solution)	Green with Yellow Bands
Sulfur Dioxide (Sample)	Light Green with Yellow Bands
Waste Lines	
Backwash Waste	Light Brown
Sludge	Dark Brown
Sewer (Sanitary or Other)	Dark Gray
Other	
Compressed Air	Dark Green
Gas	Red
Other Lines	Light Gray

END OF SECTION

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SECTION 8

MEASUREMENT AND PAYMENT

TECHNICAL SPECIFICATIONS

SECTION 8

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 Scope

The basis for measurement and payment for all Work performed under this Contract shall be as listed in the "Bid Form." Unless the Work to be performed is specifically called out to be measured and paid for in the Bid Form, payment for such Work shall be included in other applicable items of the Bid Form. There shall be no separate measurement and payment for any such Work not specifically listed in the Bid Form.

1.2 Method of Payment

Items listed in the Bid Form as lump sum shall be on a lump sum all required basis. No direct measurement will be made for lump sum bid items. Bid items calling for unit prices show estimated quantities of Work to be performed. These quantities, although shown with as much accuracy as possible, are approximate only and are for bidding purposes only. The Owner reserves the right to increase or decrease the amount of these quantities as may be deemed necessary. Payment to the Contractor shall be made on the quantity of Work actually performed by the Contractor.

The summation of all bid items under the Bid Form shall equal all Work required by the Drawings and Specifications regardless of whether individual items of Work are described under bid item descriptions or not. Payment shall be made at the unit or lump sum prices listed in the Bid Form. The prices listed therein shall be payment in full for all labor, tools, equipment, materials, etc., required to construct respective bid items according to the Contract Documents, including all Work and materials incidental thereto.

1.3 Payment for Partially Completed Work

A. General

Payment for unit price bid items and lump sum bid items only partially completed at the end of monthly pay periods shall be based on a percentage of Work completed as determined by the Engineer. An example is the construction of pipelines where the unit bid item price includes the excavation and backfill of the trenches, installation of pipe, trench compaction, flushing, and testing, although the Contractor may have installed a certain footage of pipeline, yet has not completed the testing and/or restoration work. The actual payment for that bid item will be reduced to reflect the actual amount of Work completed.

B. Pipelines

For pipelines, partial payment for Work not complete will be as shown in the following table unless determined otherwise by the Engineer:

Partial Payment for Pipeline	
Description of Work	**Percentage of Linear Feet Installed**
Excavation, Backfill, and Compaction of Trench and Installation of Pipe	75%
Flushing, Pressure, and Leakage Testing and Disinfection of Pipeline when Required	15%
Surface Restoration Other than that Covered by Other Bid Items	10%
Total	100%

C. Valves, Meters, Manholes, Cleanouts, and Other Similar Work

For valves, meters, manholes, cleanouts, and other similar work items, the partial payment for Work not complete will be as shown in the following table unless otherwise determined by the Engineer.

Partial Payment for Valves, Meters, Manholes, Cleanouts, and Other Similar Work Items	
Description of Work	**Percentage of Each Installed**
Installation of Work Item	75%
Installation of Work Item to Finished Grade and Final Restoration	25%
Total	100%

1.4 Payment Items

A. Numbering

The numbering of the payment items listed below may not be the same as the numbering for bid items in the Bid Form.

B. Method of Payment

1. Mobilization/Demobilization

Measurement for payment for mobilization/demobilization shall be on a lump sum all required basis. The amount for mobilization/demobilization shall not exceed 5 percent of the total bid price. Payment shall be made at the lump sum price stated in the Bid Form for "Mobilization/Demobilization." Seventy-five percent of the bid amount for mobilization/demobilization will be made on the first payment request and the remaining 25 percent of the bid amount will be paid on the final payment request.

2. Demolition

Measurement for payment for demolition shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials for all demolition work, along with all costs required to haul all demolished materials to the Finley Butte Landfill in Morrow County, Oregon, as needed, as shown on the Drawings and specified in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "Demolition."

3. Asphalt Surface Restoration and Gravel Surface Restoration

Measurement for payment shall be on a square yard basis for these bid items. Area in square yards over pipelines shall be computed as the length along centerline of pipe times the allowable pay width of surface restoration. Area in square yards over excavations for concrete wall and structure excavations shall be computed as the length along the concrete wall times the allowable pay width of surface restoration. Areas that may overlap, either lengthwise or widthwise, will be included only once. Double payment for overlap areas will not be made. The pay width will be limited to the actual width restored or the pay limit listed in the following table, whichever is less, unless otherwise specifically shown on the Drawings or approved in writing by the Engineer.

Excavation Depth* (feet)	Pay Width Each Side of Pipe Centerline (feet)	Pay Width Distance from Footing (feet)
0 to 4	2	2
4 to 6	3-1/2	3-1/2
6 to 8	5-1/2	5-1/2
8 to 10	7-1/2	7-1/2
10 to 12	9-1/2	9-1/2

Excavation Depth* (feet)	Pay Width Each Side of Pipe Centerline (feet)	Pay Width Distance from Footing (feet)
12 to 14	11-1/2	11-1/2
14 to 16	13-1/2	13-1/2
16 to 18	15-1/2	15-1/2

* Trench depth is the depth from the ground surface to the invert of the pipe.

a. Any gravel and asphalt restoration necessary due to the Contractor's operation, but outside the specified pay widths, shall be done at the Contractor's own expense and at no cost to the Owner. The pay widths listed above shall in no way limit the width of the trench as required for safety. The above widths only define pay limits.

b. Payment shall be made at the unit price stated in the Bid Form for "Asphalt Surface Restoration" and "Gravel Surface Restoration." There will be no separate payment for asphalt concrete joint sealing, topsoil replacement, seeding, mulching, etc. These items shall be considered incidental to the Work. Unit prices in the Base Bid and Additive Alternative No. 1 shall be equal.

4. General Earthwork

Measurement for payment for general earthwork shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Earthwork shall include all clearing, grubbing, structure removal, excavation, embankment, borrow material, waste disposal, watering, scarifying, soft spot removal, compacting, and all grade control other than that performed by the Engineer, etc., as required to completely construct the drying beds up to the subgrade level as shown on the Drawings and called for in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "General Earthwork."

5. Drying Beds Walls

Measurement for payment for drying beds walls shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials for complete and finished drying beds walls as shown on the Drawings and specified in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "Drying Beds ___ Walls."

6. Drying Beds Base Rock

Measurement for payment for drying beds base rock shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Double payment for overlap areas will not be made. Payment shall be made at the lump sum price stated in the Bid Form for "Drying Beds ___ Base Rock."

7. Septage Receiving Station

Measurement for payment for septage receiving station shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials for a complete and finished septage receiving station, appurtenances, and all other items not specified for separate payment as shown on the Drawings and called for in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "Septage Receiving Station."

8. Riser Box, Type ____

Measurement for payment for riser boxes shall be on a per each basis. Work shall include all labor, equipment, and materials for construction of the riser boxes as shown on the Drawings and called for in the Technical Specifications. Payment shall be made at the unit price stated in the Bid Form for "Riser Box, Type _____," for the various types listed.

9. Decant Box

Measurement for payment for decant box shall be on a per each basis. Work shall include all labor, equipment, and materials for construction of the decant boxes as shown on the Drawings and called for in the Technical Specifications. Payment shall be made at the unit price stated in the Bid Form for "Decant Box."

10. Asphalt Overlay/Asphalt Surface and Access Ramps

Measurement for payment for asphalt overlay/asphalt surface and access ramps shall be on a per ton basis for the actual quantity used on the Project. The Contractor shall supply the Engineer with copies of all trip tickets listing the actual weight of material delivered on each truck to the Project. These tickets are to be delivered to the Project Site with each truck. Verification of the accuracy of the truck scales that will be used shall be supplied by the Contractor

prior to delivery of any mix. Payment shall be made at the unit price stated in the Bid Form for "Asphalt Overlay and Access Ramps" and "Asphalt Surface and Access Ramps."

11. 6-inch Ductile Iron Pipe

Measurement for payment for 6-inch ductile iron pipe shall be on a linear foot basis measured horizontally from center of area drain to center of area drain or from center of area drain to center of cleanout unless otherwise shown on the Drawings or described in the Technical Specifications. All fittings along a run of pipe shall be included in the pipe length and no additional payment will be made for such fittings unless called for specifically in the Bid Form. Payment shall be made at the unit price stated in the Bid Form for "6-inch Ductile Iron Pipe."

12. Plug Valves

Measurement for payment for plug valves shall be on a per each basis for each valve installed and shall include the valve and valve box as shown on the Drawings and as specified in the Technical Specifications. Payment shall be made at the unit price stated in the Bid Form for "6-inch Plug Valve."

13. Pressure Sewer Line Cleanout

Measurement for payment for pressure sewer line cleanout shall be on a per each basis. No separate payment will be made for varying cleanout depths. Payment shall be made at the unit price stated in the Bid Form for "Pressure Sewer Line Cleanout."

14. Connection to Existing Sewer Line

Measurement for payment for connection to existing sewer line shall be on a per each basis. Payment shall be made at the unit price stated in the Bid Form for "Connection to Existing Sewer Line."

15. Connection to Existing Primary Clarifier

Measurement for payment for connection to existing primary clarifier shall be on a per each basis. Payment shall be made at the unit price stated in the Bid Form for "Connection to Existing Primary Clarifier."

16. 2-inch Water Service

Measurement for payment for water service connection to existing water mains shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials for complete and finished 2-inch water service, including appurtenances, yard hydrant, hose rack, bollard, potholing to locate the existing water main, and all other items not specified for separate payment. Payment shall be made at the lump sum price stated in the Bid Form for "2-inch Water Service."

17. Chain Link Fence

Measurement for payment for fence shall be on a linear foot basis. Lengths of fence shall be determined by measuring along the centerline of the fence, from center of post to center of post along the line and grade of each separate run of fence. Work shall include, but not be limited to, the furnishing of all labor, materials, equipment, and the installation of the fence and associated gates as detailed on the Drawings. Payment shall be made at the unit price stated in the Bid Form for "Chain Link Fence."

18. Area Drain

Measurement for payment for area drain shall be on a per each basis. Work shall include all labor, equipment, and materials to install each area drain and associated appurtenances required for a complete and operable system. Payment shall be made at the unit price stated in the Bid Form for "Area Drain."

19. Ecology Block Wall

Measurement for payment for ecology block wall shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials for a complete and finished ecology block wall including appurtenances and all other items not specified for separate payment as shown on the Drawings and specified in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "Ecology Block Wall."

20. Concrete Curb

Measurement for payment for concrete curb shall be on a linear foot basis. Length shall be measured along the curb to the nearest foot. This measurement will include any drop section for driveway approaches, alleys, handicap ramps, etc. Payment shall be made at the unit price stated in the Bid Form for "Concrete Curb."

21. Relocate Existing Utility Pole

Measurement for payment for relocate existing utility pole shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials to relocate the existing utility pole and restore utility service, as needed, as shown on the Drawings and specified in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "Relocate Existing Utility Pole."

22. Asphalt Concrete Overlay

Measurement for payment for asphalt concrete overlay shall be on a per ton basis for the actual quantity used on the Project. The Contractor shall supply the Engineer with copies of all trip tickets listing the actual weight of material delivered on each truck to the Project. These tickets are to be delivered to the Project Site with each truck. Verification of the accuracy of the truck scales that will be used shall be supplied by the Contractor prior to delivery of any mix. Payment shall be made at the unit price stated in the Bid Form for "Asphalt Concrete Overlay."

23. Solids Storage Wall

Measurement for payment for solids storage wall shall be on a lump sum all required basis. There shall be no measurement of the Work for payment purposes. Work shall include all labor, equipment, and materials for complete and finished solids storage wall as shown on the Drawings and specified in the Technical Specifications. Payment shall be made at the lump sum price stated in the Bid Form for "Solid Storage Wall."

24. Solids Storage Base Rock

Measurement for payment for solids storage base rock shall be on a lump sum all required basis. There shall be no measurement of the Work for payment

purposes. Double payment for overlap areas will not be made. Payment shall be made at the lump sum price stated in the Bid Form for "Solids Storage Base Rock."

PART 2 - MATERIALS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION