Pierce County
Department of Public Works and Utilities

CHAMBERS CREEK REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

PROJECT NO. 7243

BID RECORD SUBMITTAL DESIGN PACKAGE 3

GREENFIELD PROCESS FACILITIES

VOLUME 9 OF 27

SPECIFICATIONS DIVISIONS 31-33

OCTOBER 2013

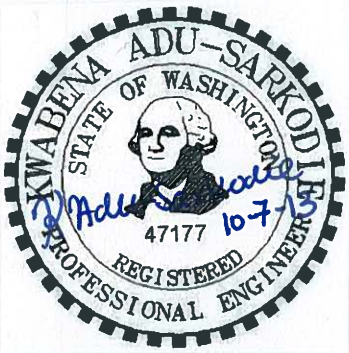
BROWN AND CALDWELL
AND ASSOCIATED FIRMS

CHAMBERS CREEK REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

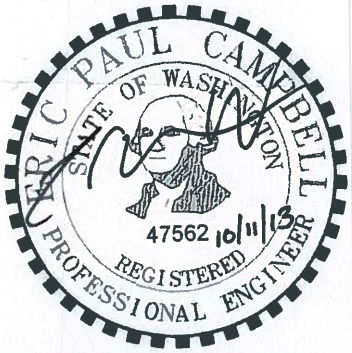
PROJECT NO. 7243
DESIGN PACKAGE 3
BID RECORD SUBMITTAL

GREENFIELD PROCESS FACILITIES

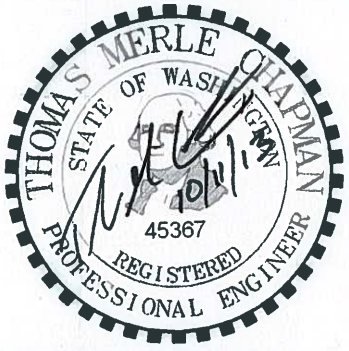
SPECIFICATION SEAL PAGE



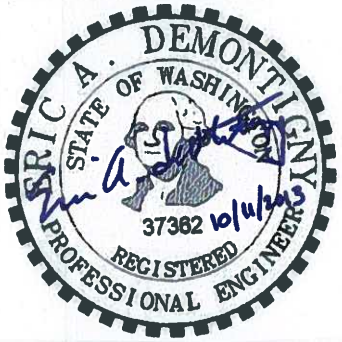
Responsible Sections - Please see TOC



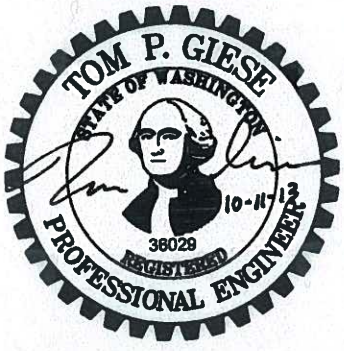
Responsible Sections - Please see TOC



Responsible Sections - Please see TOC



Responsible Sections - Please see TOC

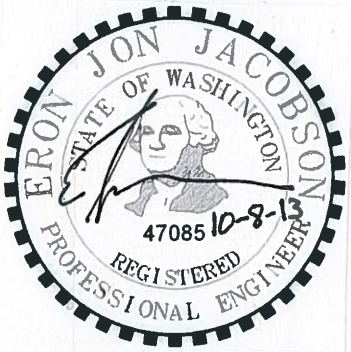


Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

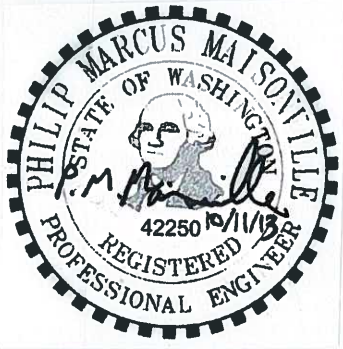


Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

Responsible Sections - Please see TOC



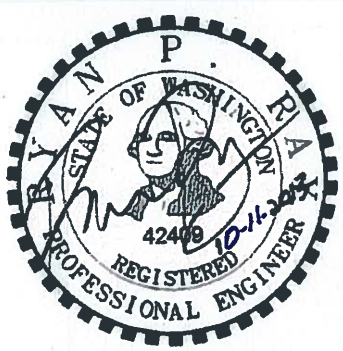
Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

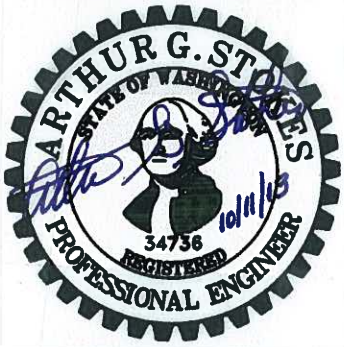
Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

Responsible Sections - Please see TOC



Responsible Sections - Please see TOC



Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

Responsible Sections - Please see TOC

CHAMBERS CREEK REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

PROJECT NO. 7243
DESIGN PACKAGE 3
BID RECPORD SUBMITTAL

GREENFIELD PROCESS FACILITIES

SPECIFICATIONS
TABLE OF CONTENTS

DIVISION 31 EARTHWORK		Responsible Engineer
31 10 00	Site Clearing	E. deMontigny
31 22 00	Grading	E. deMontigny
31 23 00	Excavation and Fill	E. deMontigny
31 23 19	Dewatering	E. deMontigny
31 50 00	Excavation Support Systems	E. deMontigny
31 60 00	Augercast Piles	D. McCleary

SECTION 31 10 00

SITE CLEARING

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies site clearing work (site preparation) which consists of clearing and grubbing.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued of otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Section
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications For Road, Bridge and Municipal Construction, 2012 edition.

1.03 PERFORMANCE REQUIREMENTS

A. PROTECTION:

1. Site preparation shall not damage structures, landscaping, or vegetation outside of the limits of the Work. The Contractor shall repair or replace any damaged improvements, including but not limited to structures, equipment, landscaping or vegetation, and road surfaces.

2. The Contractor shall construct and maintain temporary erosion and sedimentation controls on the site to protect adjacent surfaces and storm drain systems as specified in Section 01 57 13.

3. Prior to commencing clearing and grubbing work, the Contractor shall establish basic erosion control measures. The Contractor's proposed temporary haul roads, beyond those identified in the Contract Documents, shall be submitted to the Owner for approval.

4. The Contractor shall employ such measures as necessary to prevent surface runoff from entering excavations and trenches and re-establish and maintain erosion control measures as the work progresses.

5. The Contractor shall provide protection devices, including barricades, fencing, warning signs, lights, and other measures necessary to ensure the security of, and safety within, the project site during the duration of the Work.

6. The Plant historically has a nesting Canada goose population. Nests cannot be moved or disturbed during nesting season. The Contractor shall notify the Owner immediately upon any discovery of an existing nest for direction.

B. RESTORATION:

1. The Contractor shall restore any public or private improvement facility, structure, or land and landscaping within the limits of the Work that is damaged or injured directly or indirectly by or on account of an act, omission, or neglect in the execution of the Work. Restore to a condition substantially equivalent to that existing before such damage or injury occurred, by repairing, rebuilding, or otherwise affecting restoration thereof, or if this is not feasible, make a suitable settlement with the owner of the damaged property.

2. Restore and/or repair any property outside of the limits of the Work that is damaged during the course of Work. Use a restoration process that follows the same guidelines as those outlined for restoration of facilities within the limits of the Work.

3. Restoration of existing curbs, gutters, sidewalks, or paved areas will be in accordance with the Specifications, the applicable referenced Standard Specifications, the Standard Details, and the details shown on the Drawings. Restoration of these items shall be “in kind”, unless shown otherwise on the Drawings or directed by the Owner.

1.04 EXISTING CONDITIONS

A. The Contractor shall determine the actual condition of the site as it affects this portion of work.

1. Give minimum thirty (30) days notice to Owner to permit relocation of Plant personnel, equipment, materials, and operations. Refer to Division 01 for notification and coordination requirements.

2. Provide for the flow of sewers, drains, or water courses interrupted during the progress of the Work, and restore such drains or water courses as the work progresses.

PART 2--NOT USED

PART 3--EXECUTION

3.01 CLEARING AND GRUBBING

A. Grub or otherwise prepare areas, including areas to be cleared, to receive construction or other improvements.

B. The Contractor shall notify Owner 48 hours prior to commencing any clearing and grubbing activities, including that intended for survey or other site investigation work.

C. TREE AND BRUSH REMOVAL: Prior to grading and hauling operations the following shall be completed in each designated area:

1. Prior to beginning grading operations, trees and brush shall be removed from the site. Both merchantable and non-merchantable trees shall become the property of the Contractor and shall be disposed of offsite.

2. Stumps, root matter, heavy sod, boulders, stones larger than 6 inches in any dimension, broken or old concrete, pavement, and debris of any description shall be removed and disposed of offsite.

3. Where the Contractor employs chipping of brush and limbs, material shall not be discharged on the ground or stockpiled on the site. All wood chips shall be discharged to hoppers or trucks for disposal offsite.

4. Topsoil shall be stockpiled in an approved location and used to restore the site after construction. Topsoil and other overburden shall not be incorporated within new embankments or fill areas.

D. The Contractor shall notify the Owner when they are satisfied that clearing and grubbing operations have been completed and ready for site grading. The Owner shall examine the site for general acceptance of site conditions.

E. With the exception of surplus excavated material, material that is removed and is not to be incorporated in the Work shall be disposed of off the site by the Contractor.

F. Provide protection devices, including barricades, fencing, warning signs, lights, and other items necessary to ensure the security of, and safety within, the work site during this phase of the work.

G. Perform clearing and grubbing operations in accordance with Section 2-01.1 through 2-01.3 (inclusive) of the WSDOT Standard Specifications.

END OF SECTION

DIVISION 31 22 00

GRADING

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies requirements for grading necessary for proper completion of the Work.

PART 2--NOT USED

PART 3--EXECUTION

3.01 GENERAL

A. When the work is at an intermediate stage of completion, the lines and grades shall be as specified plus or minus 0.5 foot to provide adequate drainage.

3.02 ROUGH GRADING

A. Grading associated with earthmoving, cuts, excavations, and fills shall be in accordance with Section 31 23 00.

B. Ditches shall be cleaned, reshaped, and maintained in a satisfactory condition until final acceptance.

3.03 FINE AND FINISH GRADING

A. Finished surfaces shall be smooth, compacted, and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.

B. Finished grade shall be as specified by the contours plus or minus 0.10 foot except where a local change in elevation is required to match existing contours, sidewalks, curbs, manholes, and catch basins; or to ensure proper drainage; or allow for subbase and pavement thickness.

C. All surfaces including ditches shall be free draining with no standing water.

D. Allowance for topsoil and grass cover shall be made so that the specified thickness of topsoil can be applied to attain the finished grade. The finished grade shown on the Drawings shall be the top surface of the topsoil.

E. The Contractor shall conduct his operations in such a manner as to avoid damage to any previously constructed structures and facilities.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies materials and execution requirements for subgrade preparation, fills, embankments, bedding, backfilling, compaction, geotextile (for separation), cellular confinement system (for load support), unsuitable material removal, hauling, placement, and stockpiling and disposal of excess material required for construction of the Work. This Section also specifies requirements for "as-built" conditions of the final grading upon completion of Design Package 3.

B. DEFINITIONS: Terminology used in this Section conforms to the following definitions:

1. COEFFICIENT OF UNIFORMITY: Defined as the ratio of the particle diameters of 60 percent-finer to 10 percent finer in the particle-size distribution curve (Cu=D60/D10).

2. COMPACTION: Degree of compaction is specified as percent compaction. Maximum or relative densities refer to dry soil densities obtainable at optimum moisture content as determined by AASHTO T180/ASTM D1557.

3. DELETERIOUS MATERIAL: Any material comprised of wood, organic waste, coal, charcoal, debris, wash pond silt, or other extraneous or objectionable material.

4. EXCAVATION: Includes, without classification, the removal and disposal of all materials of whatever nature encountered, including water and all other obstructions that would interfere with the proper construction and completion of the required work.

5. EXCAVATION SLOPE: An inclined surface formed by removing material from below existing grade.

6. EMBANKMENT SLOPE: An inclined surface formed by placement of material above existing grade.

7. GLACIAL OUTWASH: Native, loosely compacted sand and gravel with a very low fines content.

8. GLACIAL TILL: Native highly compacted and well graded material with a moderate fines content.

9. OVERBURDEN: Soil above a defined grade line or soil which may not be suitable as backfill, such as grass cover, topsoil, or soils containing deleterious material.

10. UTILITIES: Buried and aboveground piping, conduits, wire, cable, ducts, manholes, vaults, services, appurtenances, pull boxes and the like, located in the vicinity of the project.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS: This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

1. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
AASHTO T 27 / ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 180 / ASTM D1557	Moisture-Density Relations of Soils Using a 10 in (4.54 kg) Rammer and an 18 in (457 mm) Drop (Modified Proctor Test)
AASHTO T 265 / ASTM D2216	Laboratory Determination of Moisture Content of Soils
AASHTO T 310 / ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
Chapter 296-62 WAC	WISHA General Occupational Health Standards
Chapter 296-155 WAC	WISHA Safety Standards for Construction
Chapter 296-155 WAC	Part N, Excavation, Trenching, and Shoring
RCW 49.17	Washington Industrial Safety and Health Act (WISHA)
RCW 39.04.180	Trench Safety Systems, Safety Systems Required
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition
WSDOT Materials Manual	Washington State Department of Transportation (WSDOT), Materials Manual, 2012 edition

1.03 SUBMITTALS

A. Procedures: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Product data for geotextiles.

3. Work plan for screening, preparing, or treating native excavated soils as required to meet the requirements of the specified materials. Submit laboratory test results demonstrating that the prepared material will meet the specification requirements.

4. TEST RESULTS ON NATIVE MATERIALS: Provide copies of laboratory test reports demonstrating that the proposed excavated and prepared native materials meet the specification requirements. Test reports shall be dated no more than 6 months prior to the date of submission. Submit maximum modified proctor densities and the optimum water content.

5. TEST RESULTS ON IMPORTED MATERIALS: Provide copies of laboratory test reports demonstrating that the proposed imported materials meet the specification requirements. Test reports shall be dated no more than 6 months prior to the date of submission. Submit maximum modified proctor densities and the optimum water content for all imported materials.

6. Provide laboratory tests reports certifying:

a. Moisture density relationships.

b. Gradation test reports.

c. Gradation curves.

d. Other tests as specified in the WSDOT Standard Specifications for each material type.

7. CELLULAR CONFINEMENT SYSTEM SUBMITTALS:

a. Product data and certifications.

b. Shop Drawings and manufacturer's calculations indicating cellular confinement system design suitability for H-20 loading.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. Field testing reports.

2. As-Built Survey consisting of the deliverables specified herein.

PART 2--MATERIALS

2.01 GENERAL

A. All earthwork materials used in the Work shall be free of deleterious material, and shall meet the referenced standards.

2.02 PIPE BEDDING AND PIPE ZONE MATERIALS

A. PIPE AND TUBING LESS THAN 4 INCHES IN DIAMETER:

1. Crushed Surfacing Top Course (CSTC) as specified herein. Locally available clean construction sand, free of deleterious material, may also be acceptable if approved by the Owner.

B. PIPE BEDDING MATERIAL:

1. Crushed Surfacing Top Course (CSTC) as specified herein.

C. PIPE BEDDING AND ZONE MATERIAL FOR PERFORATED DRAIN PIPES:

1. Gravel Backfill for Drains, WSDOT Standard Specifications Section 9-03.12(4).

D. SAND SHADING AND BEDDING FOR NGA PIPING:

1. Fine Aggregate for Portland Cement Concrete, Class 2, per WSDOT Standard Specifications Section 9-03.1(2).

2.03 TRENCH BACKFILL MATERIAL

A. Structural Fill as specified herein.

2.04 IMPORTED FILL

A. Locally available clean granular soil material, free of clods or rocks larger than 3 inches, with no more than 7 percent fines, defined as material passing the U.S. No. 200 sieve unless otherwise approved by the Owner.

2.05 STRUCTURAL FILL

A. Granular soil material that is free of deleterious material and rock fragments larger than 6 inches. Particle sizes larger than 3 inches shall be excluded from the top 2 feet of fill. Structural Fill shall contain no more than 7 percent fines, defined as material passing the U.S. No. 200 sieve, unless otherwise approved by the Owner.

2.06 WALL BACKFILL (FREE DRAINING GRAVEL BACKFILL)

A. Gravel Backfill for Walls, WSDOT Standard Specifications Section 9-03.12(2).

2.07 MSE RETAINING WALL FILL

A. Structural Fill as specified herein.

2.08 CONTROLLED LOW STRENGTH MATERIAL (CLSM) AND CONTROLLED DENSITY FILL (CDF)

A. WSDOT Standard Specifications Section 2-09.3(1)E.

2.09 SHOULDER BALLAST

A. Imported material conforming to WSDOT Standard Specifications for Permeable Ballast, Section 9-03.9(2).

2.10 CRUSHED ROCK

A. Crushed Surfacing Base Course (CSBC), WSDOT Standard Specifications Section 9-03.9(3).

2.11 CRUSHED SURFACING BASE COURSE (CSBC)

A. Imported material conforming to WSDOT Standard Specifications for Crushed Surfacing Base Course, Section 9-03.9(3).

2.12 CRUSHED SURFACING TOP COURSE (CSTC)

A. Imported material conforming to WSDOT Standard Specifications for Crushed Surfacing Top Course and Keystone, Section 9-03.9(3).

2.13 QUARRY SPALLS

A. Imported material conforming to WSDOT Standard Specifications 9-13 and Specification 9-13.6 (Quarry Spalls), except that material shall consist entirely of broken stones, not concrete.

2.14 RIPRAP

A. Imported material conforming to WSDOT Standard Specifications sections 9-13.1 and 9-13.1(2) for Light Loose Riprap, unless the D-50 size is shown otherwise on the Drawings.

2.15 GRAVEL BACKFILL FOR DRYWELLS

A. Imported material conforming to WSDOT Standard Specifications for Gravel Backfill for Drywells, Section 9-03.12(5).

2.16 CONSTRUCTION WATER

A. WSDOT Standard Specifications Section 9-25.

B. The water used shall be reasonably free of objectionable quantities of silt, oil, organic matter, alkali, salts, and other impurities. Water quality must be acceptable to the Owner.

2.17 BALLAST MATERIAL

A. Material conforming to WSDOT Standard Specifications for Ballast, Section 9-03.9(1).

2.18 GEOTEXTILE FOR SEPARATION

A. Non-woven geotextile for separation in accordance with WSDOT Standard Specifications Section 9-33, Table 3.

2.19 CELLULAR CONFINEMENT SYSTEM

A. BASE MATERIALS:

1. Polyethylene Stabilized with Carbon Black

a. Density shall be 58.4-60.2 lbs/ft^3 in accordance with ASTM D1505.

b. Environmental Stress Crack Resistance (ESCR) shall be >5,000 hours in accordance with ASTM D1693, or >400 hours in accordance with ASTM D5397.

c. Ultraviolet light stabilization with carbon black.

d. Carbon Black content shall be 1.5% to 2% by weight, through addition of a carrier with certified carbon black content.

B. CELL PROPERTIES:

1. Individual cells shall be uniform in shape and size when expanded.

2. Individual cell dimensions (nominal) shall be plus or minus 10%.

3. Nominal cell depth shall be 6 inches.

C. CELL SEAM STRENGTH TESTS: Provide written certification of the following minimum seam strengths:

1. SHORT-TERM SEAM PEEL-STRENGTH TEST:

a. Cell seam strength shall be uniform over full depth of cell.

b. Minimum seam peel strength shall be 480 lbf for 6-inch depth.

2. LONG-TERM SEAM PEEL-STRENGTH TEST:

a. Conditions: Minimum of 7 days in a temperature-controlled environment that undergoes change on a 1 hour cycle from 74 degrees F to 130 degrees F.

b. Test samples shall consist of two 4-inch wide strips welded together.

c. Test sample consisting of two carbon black stabilized strips shall support a 160-pound load for test period.

D. Cell infill material shall be CSBC.

E. ACCEPTABLE MANUFACTURERS:

1. Presto Geosystems.

2. Strata Systems.

3. Approved Equal.

2.20 BACKFILL FOR CAPILLARY BREAK

A. Material shall consist of a well-graded sand and gravel, or crushed rock, with a maximum particle size of ¾ inch and less than 5 percent fines, defined as material passing the U.S. No. 200 sieve.

PART 3--EXECUTION

3.01 EXISTING UNDERGROUND UTILITIES

A. The locations of existing utilities indicated on the Drawings are approximate. Physically verify the location and elevation of existing utilities prior to starting construction. Mark the ground surface where existing underground utilities are discovered.

3.02 DRAINAGE AND DEWATERING

A. So that construction operations progress successfully, completely drain the construction site during periods of construction to keep soil materials sufficiently dry. Throughout construction, grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary swales and other drainage features and equipment as required to maintain dry soils and prevent erosion. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented in the geotechnical report and the construction requirements in the plans and specifications and based on this assessment, to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

B. Groundwater flowing toward or into excavations shall be controlled with dewatering controls in accordance with Section 31 23 19 to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation, and to eliminate interference with orderly progress of construction. Dewatering controls shall be in place by the time excavation reaches the groundwater level. While excavation is open, the water level shall be maintained continuously at least 1 foot below the working level. French drains, sumps, ditches, or trenches will not be permitted within 3 feet of the foundation of any structure, except with written approval from the Owner.

3.03 EXCAVATION GENERAL REQUIREMENTS

A. Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the Work or shall be separately stockpiled if it cannot be readily placed. Suitable excess excavated material (fill) shall be disposed of as designated by the Owner or as shown on the Drawings.

B. Naturally occurring cobbles and boulders that exceed the maximum particle size for the aggregate class specified shall be stockpiled at an Owner designated location or location designated on Drawings.

C. Assume ownership of and dispose of all excavated debris offsite, including concrete; scrap pipes; scrap equipment from former mining and construction operations; and other materials determined by the Owner to be unsuitable for onsite placement. Comply with the applicable ordinances and environmental requirements for disposal.

D. Stockpile topsoil on site at locations indicated on the Drawings or as directed by the Owner for use in site restoration upon completion of Construction. Excess or unsuitable topsoil shall be disposed of on site at the respective locations shown on the Drawings.

E. Notify Owner immediately in the event that any suspected contaminated or hazardous material is encountered on site. Testing, handling, removal, and disposal of the contaminated or hazardous material shall be in accordance with Section 02 61 00, and applicable laws.

F. STORAGE OF MATERIAL: Neatly place excavated materials far enough from the excavation to prevent stability problems. Keep the materials segregated and shaped so as to cause the least possible interference with Plant operations, other construction activities, and drainage. Coordinate with Owner for storage site.

G. Wash Pond Silt may be encountered during some excavation work. Refer to Section 01 11 10 for geotechnical documents describing geotechnical investigations and subsurface soil conditions at the Plant. Wash Pond Silt material is unsuitable for use as backfill material. Stockpile Wash Pond Silt material separately from backfill materials and dispose of on site at the location shown on the Drawings.

H. OTHER UNSUITABLE SOILS:

1. Soils encountered at the site that are unsuitable for use as backfill due to excessive fines content shall be segregated and disposed of on site at the location shown on the Drawings.

2. Soils encountered at the site that are unsuitable due to excessive moisture content, but are otherwise satisfactory for use as fill or backfill shall be segregated and then dried or treated to restore to a useable condition. Coordinate with Owner for storage site.

3.04 SUPPORT OF EXCAVATIONS

A. Comply with Section 31 50 00.

B. The Contractor is responsible for selecting all excavation methods, monitoring slopes for safety and providing shoring, as required to protect personnel and property. All temporary cuts and fill slopes are required to be at a stable angle. Excavations must conform to Chapter 49.17 RCW and Chapter 296-155 WAC, Part N. All temporary cuts in excess of 4 feet in height shall be sloped appropriately or provided with shoring systems adequate to protect workers.

C. Adequately support all excavations to meet all applicable requirements in the current rules, laws, orders, and regulations. Excavations shall be adequately shored, braced, and sheeted so that the earth will not slide or settle and so that all existing and new structures, pipelines, conduits, and other facilities will be fully protected from damage or undercutting. Keep vehicles, equipment, and materials far enough from the excavation to prevent instability.

D. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, undercutting, or sliding soils resulting from high groundwater or the nature of the soil excavated.

E. The support for excavations shall remain in place until the installation of the pipeline, conduit, or structure has been completed. During the backfilling of the pipeline, conduit, or structure, the shoring, sheeting and bracing shall be carefully removed so that there shall be no voids created and no caving, lateral movement or flowing of the subsoils.

3.05 SLOPE STABILITY AND SETBACKS

A. MAXIMUM ALLOWABLE SLOPE FACES:

1. TEMPORARY SLOPES: No steeper than 1.5:1 (H:V), unless specifically noted otherwise on the Drawings.

2. PERMANENT SLOPES: As shown on the Drawings. No steeper than 2:1 (H:V) without retaining structures.

3. Permanent slope adjacent to roadway with no guardrail: No steeper than 4:1 (H:V).

B. All permanent slopes steeper than 3:1 shall be provided with terracing: one 6-foot-wide terrace for every 30 feet of vertical height.

C. SETBACKS FROM TOP OF SLOPE:

1. All stockpiles and travel ways shall be offset from top of slope by 1/3 the slope height, with a minimum required offset of 5 feet and a maximum of 40 feet.

2. All buildings shall be offset from top of slope a minimum of 10 feet. All buildings shall be set back from the toe of the slope a minimum of 10 feet or 1/5 of the height of the slope, whichever is greater up to 20 feet, unless shown otherwise on the Drawings.

3. If seepage is observed on the slope face, then slope offsets shall be increased as directed by the Owner.

D. SETBACKS FROM TOE OF SLOPE:

1. All stockpiles and travel ways shall be offset from toe of slope by 1/2 the slope height, with a minimum required offset of 5 feet and a maximum of 15 feet.

2. All buildings shall be set back from the toe of the slope a minimum of 10 feet or 1/5 of the height of the slope, whichever is greater up to 20 feet.

3. If seepage is observed on the slope face, then slope offsets shall be increased as directed by the Owner.

E. INTERCEPTOR SWALES AND DRAINS:

1. Provide interceptor swales at the top of slopes in excess of 3:1 (H:V) and with more than 20 feet of relief in accordance with King County Surface Water Design Manual Section D.3.6.1. Interceptor swales shall be sloped towards and discharge to catch basins or rip-rap spillways as specified and shown on the Drawings and Standard Details.

2. When a bench or roadway at the top of the slope is paved, provide an asphalt concrete raised edge or concrete curb to contain runoff on the pavement and direct it towards a catch basin.

3.06 COMPACTION REQUIREMENTS

A. GENERAL:

1. All earthwork materials shall be moisture conditioned, placed, and compacted as specified herein.

2. Compact each material to the percentages specified in the Material and Compaction Schedule or as indicated on the Drawings, whichever is more stringent.

3. Use compaction equipment appropriate for the use and material to achieve the specified level of compaction.

4. Compaction methods involving water flooding, ponding, or jetting shall NOT be used.

B. MOISTURE CONDITIONING:

1. ALL earthwork materials shall be properly moisture conditioned prior to compaction, without exception.

2. Add water to or dry the material as necessary to obtain moisture content that is no more than three (3) percent above or below optimum, unless otherwise approved by the Owner. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each lift being compacted.

C. MATERIAL PLACEMENT:

1. After the material has been moisture conditioned, place and spread the material using approved equipment in level uncompacted lifts of thicknesses not to exceed those specified in the Material and Compaction Schedule, except that uncompacted layer thickness shall not exceed 4 inches for hand-operated compaction devices in all cases.

D. If the backfill material becomes saturated from rains or any other source because it was not compacted to the specified density or was not backfilled and compacted to surface grade, through negligence or otherwise, remove the faulty material and replace it with suitable material compacted to the specified density.

E. When densities of compacted materials do not meet the requirements, remove and/or recompact the material and re-test until the requirements are met.

3.07 TESTING FREQUENCY

A. In-place compaction tests shall be made by the Owner's testing service using the frequency in the table below:

Compaction	
Embankment	1 per 2,500 CY
Pipe Bedding, Pipe Zone Material, and Trench Backfill	1 per 100 LF (per lift)
Cut Section	1 per 500 CY
Surfacing	1 per 1,000 SF (per lift)
General Backfill	1 per 500 CY
Structural Backfill	1 per 200 CY within 10 feet around the structure
Structural Base	1 per 200 SF (per layer), with no less than two per structure

3.08 MATERIAL AND COMPACTION SCHEDULES

MATERIAL AND COMPACTION SCHEDULE FOR PIPELINE AND CONDUIT TRENCHES

Description	Material	Max. Lift Thickness[1]	Min. Compaction[2]
Pipe bedding and pipe zone material	Pipe Bedding Material	4 inches	95%
Trench backfill (above the pipe zone to finished grade) in undeveloped areas that are 10 feet or greater from the edge of structures, vaults, footings, slabs, and roadways[3].	Structural Fill	12 inches	90%
Trench backfill (above the pipe zone to finished grade or roadway subgrade) within 10 feet horizontally of and beneath structures, vaults, footings, slabs, roadways[3], and the like.	Structural Fill	12 inches	95%

[1] Lift thickness measured before compaction.

[2] Relative Compaction: In-place density divided by the maximum dry density laboratory compaction as determined by AASHTO T 180 / ASTM D1557 expressed as percentage. Test method AASHTO T 310 / ASTM D6938

[3] Roadway: Paved, graveled, or unfinished surface intended for vehicular traffic as shown on the Drawings (including driveways, parking, and maneuvering areas).

MATERIAL AND COMPACTION SCHEDULE FOR STRUCTURES, SITEWORK, AND EARTHMOVING

Material or Description	Max. Lift Thickness[1]	Minimum Compaction[2]	Other Requirements
Crushed Surfacing Top Course	2 inches	95%	
Crushed Rock	8 inches	95%	
Crushed Surfacing Base Course	8 inches	95%	
Structural Fill			
Within 10 feet horizontally of and below foundations	8 inches	95%	
Below Slabs-on-grade	8 inches	95%	Proof roll
Within 10 feet horizontally of and below structures and vaults	8 inches	95%	
Prepared pavement and roadway subgrade[3]	12 inches	95%	Proof Roll
Other locations between structures	12 inches	95%	
Undeveloped areas that are 10 feet or greater from the edge of structures, vaults, footings, slabs, and roadways[3]	12 inches	90%	
Scarified native soil	6 inches	95%	

[1] Lift thickness measured before compaction.

[2] Relative Compaction: In-place density divided by the maximum dry density laboratory compaction as determined by AASHTO T 180 / ASTM D1557 expressed as percentage. Test method AASHTO T 310 / ASTM D6938.

[3] Roadway: Paved, graveled, or unfinished surface intended for vehicular traffic as shown on the Drawings (including driveways, parking, and maneuvering areas).

3.09 EXCAVATION AND PLACEMENT OF FILLS ASSOCIATED WITH ROUGH SITE GRADING, EMBANKMENT CONSTRUCTION, EARTHMOVING, AND ROADWAYS

A. Excavate to the lines, grades, and elevations shown on the Drawings.

B. Clear and grub the native and/or excavated surfaces in accordance with Section 31 10 00. The prepared surfaces shall not contain standing water and shall be free of loose material, foreign objects, and rocks greater than 6 inches in maximum dimension.

C. Immediately prior to placement of fill material, scarify subgrade to a depth of 6 inches, moisture condition, and recompact as specified herein. Scarify to greater depths or provide more stringent compaction requirements if shown on the Drawings.

D. The Owner shall test and favorably review the prepared subgrade prior to the placement of fills. Do not place any fill until receiving favorable review from the Owner.

E. A keyway shall be excavated along the length of the toe of all fill slopes steeper than 5:1 (H:V). The exposed soils along the key shall be scarified to a depth of at least 12 inches, moisture conditioned, and recompacted as specified herein. Provide more stringent compaction requirements if shown on the Drawings.

F. After the subgrade preparation has been completed, the Contractor shall promptly place and compact the first lift of fill on the subgrade to prevent loosening of the surface. If the subgrade surface is loosened, the Contractor shall remoisten and recompact the surface to the specified condition.

G. Construct fills as shown on the Drawings, true to line, grade, and cross-section.

H. Rough graded fills shall be constructed of Structural Fill, unless otherwise indicated on the Drawings.

I. Compaction of fill associated with rough site grading shall in accordance with Paragraph 3.08, Material and Compaction Schedule for Structures, Sitework, and Earthmoving, and referenced standards.

J. In any areas where materials become soft or yielding, such materials shall be removed, disposed of, and replaced with specified material.

K. The surface of the fill shall be maintained to permit travel of construction equipment. Ruts in the surface of any layer shall be filled and leveled before compacting.

L. When the fill material consists of large, rocky material, or hard lumps, such as hardpan or cemented gravel which cannot be broken readily, such material shall be well distributed throughout the fill. Place sufficient earth or other fine material around the larger material as it is deposited so as to fill the interstices and produce a dense, compact fill.

M. Fill shall be sloped at all times during construction so that water will drain.

N. The temporary differential elevation between any two adjoining zones of the fill due to construction operations shall not exceed 24 inches.

O. If the compacted surface of any layer of material is too smooth to bond properly with the succeeding layer, the surface shall be scarified. If required, moisture condition the surface before the succeeding lift is placed. Surface crust formed on a layer of fill material that has been dumped and spread shall be broken up by harrowing and, if required, the full depth of the affected layer shall be moisture conditioned immediately prior to rolling.

P. Where fills are to be made and compacted on sloping ground surfaces steeper than 5:1, such slopes shall be benched a minimum of 6 feet horizontally as the work is brought up. Recompact material thus removed by benching along with the new embankment material.

Q. It may be necessary to overbuild slopes and trim back to the compacted core to achieve adequate compaction of slope faces.

3.10 TRENCH EXCAVATION AND BACKFILL

A. GENERAL:

1. Excavation for pipe and other utilities such as duct banks shall be in open cut.

2. Should the Contractor desire to use other equivalent methods, he shall submit his method of construction to the Owner for favorable review prior to its use.

3. Provide ladders for access to the trench by construction and inspection personnel.

B. TRENCH DIMENSIONS:

1. Comply with the minimum and maximum trench widths shown on the Drawings and Standard Details. Notify the Owner for direction if the trench width exceeds the maximum allowable width for any reason.

2. The trench shall be as wide as necessary for sheeting and bracing and the proper performance of the work up to the maximum width permitted by the typical cross-sections shown on the Drawings.

3. The sides of the trenches shall be vertical in paved areas unless allowed otherwise by the Owner.

4. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings.

C. TRENCH BOTTOM GRADE:

1. Grade trenches such that the installed pipeline:

a. Is uniformly sloped between the pipe elevations shown on the Drawings, or;

b. Conforms to the piping profiles or elevations shown on the Drawings, or;

c. If no elevations or cover depths are shown on the Drawings, provide 3 feet of minimum cover unless otherwise specified elsewhere.

2. Accurately grade the bottom of the trenches and the specified Pipe Bedding Material to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints.

3. Dig bell holes and depressions for joints after the trench bottom has been graded and compacted. In order that the pipe rest on the bedding for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth and width as required for properly making the joint.

4. Remove stones to avoid point bearing on the pipeline.

D. OVEREXCAVATION:

1. Take care not to overexcavate, unless required to remove deleterious or otherwise unsuitable material.

2. Backfill and compact overexcavations with Ballast Material or Structural Fill as directed by the Owner.

3. If unsatisfactory material is encountered below the grades shown, remove the material as directed by the Owner and replace with Ballast Material or Structural Fill as directed by the Owner.

E. TRENCHES IN FILLED AREAS:

1. For all piping or conduits to be placed in any filled or excavated and backfilled areas, such as at manholes or for building connections, the specified backfill material shall be first compacted to a level at least 3 feet from the top of the piping or conduit elevation and then retrenched to pipe grade.

F. TRENCH BACKFILLING:

1. Backfill material shall not be placed over the pipe or conduit until after the joints have been completed, tested, and inspected by the Owner.

2. Place bedding and backfill materials true to the lines, grades, and cross-sections indicated on the Drawings. Compact each material to the degree specified or as shown on the Drawings, whichever is more stringent.

3. Place bedding and backfill materials in horizontal lifts as specified.

4. The difference in level on either side of a pipe shall not exceed 4 inches.

5. Compact by suitable hand methods under the haunches of the pipe and in areas not accessible to mechanical tampers unless otherwise specified or shown on the Drawings. The minimum level of compaction shall not be less than the specified amount.

G. PROTECT THE PIPE OR CONDUIT:

1. It shall be incumbent upon the Contractor to protect the pipe or conduit from damage during the construction period.

2. The Contractor shall bear responsibility to repair broken or damaged pipe at no extra cost to the Owner.

3. Carefully place backfill around and over the pipe and do not allow it to fall directly upon the pipe.

4. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers and other machines that will not injure or disturb the position of the pipe.

H. RESTORATION OF TRAFFIC:

1. Traffic (including construction traffic) shall not be allowed on the trench until the trench is properly backfilled and compacted as specified to the level equal to adjacent grade, and has been repaved (in paved areas).

2. Trench plating shall be provided for open trenches in roadways that are not immediately backfilled and repaved. The plates shall be recessed flush with the existing pavement on all sides within the public right-of-way. Fill gaps along the periphery of the plating with cold patch asphalt. Butt adjacent plates together flush and without gaps.

3.11 DRAINAGE CHANNEL, DITCH, AND SWALE CONSTRUCTION

A. SHAPING:

1. Clear and strip the proposed channel area as specified in Section 31 10 00.

2. Cut channels accurately to the cross sections, grades, and elevations shown on the Drawings. Channels shall be freely draining with continuous slopes and without sags, flat, or low spots. Where spot elevations are shown on the Drawings, channels shall be graded at a constant slope between those elevations.

3. When channels will be located within filled areas, the area shall first be filled to finish grade and compacted as specified, and then the channel cut to the lines and grades shown. For large channels, where it is not practical to fill to finish grade and re-cut the channel, the Contractor shall propose a method of construction to the Owner for review.

B. TOLERANCE:

1. In accordance with Section 31 22 00 for fine and finish grading.

2. When the invert of the channel is paved with concrete, shotcrete, or the like, the finished surface shall be within 0.04 foot (1/2-inch) of the grades or elevations shown on the Drawings.

C. ACCOMMODATE THICKNESS OF EROSION PROTECTION MATERIALS:

1. If rip-rap, concrete, or other material is shown for erosion protection, the finish grades, cross sections, and elevations shown on the Drawings shall indicate the finished surface of the material. The Contractor shall overexcavate the subgrade as appropriate to accommodate thickness of the material.

D. GRUBBING:

1. Grub all roots, stumps, or other vegetative matter greater than 3 inches in diameter from the sides and bottom of the channels to a depth of at least 6 inches.

2. Trim all roots and vegetative matter less than 3 inches in diameter flush with the channel bottom and sides.

3. Excavate and remove all boulders, rock, or other interfering objects.

E. OVEREXCAVATION:

1. Backfill excessive excavation, or fill voids (due to grubbing, removal of boulders, and the like), to grade with compacted Structural Fill.

F. UNSUITABLE MATERIAL:

1. If unsatisfactory material is encountered below the grades shown, remove the material and replace with compacted Structural Fill or Ballast Material as directed by the Owner.

G. COMPACTION:

1. Compact the channel embankments and bottoms with appropriate equipment such that they are firm and unyielding, and stand without sloughing. Compact in accordance with Paragraph 3.08.

2. The surfaces or subgrades of channel embankments and bottoms shall be smooth and neat in appearance.

H. EROSION PROTECTION:

1. Provide temporary erosion protection during construction in accordance with Section 01 57 13.

2. Provide permanent slope stabilization and erosion protection as indicated on the Drawings. Install the protection only after adjacent grading or construction activities that could disturb or injure the protection have been completed.

3.12 EXCAVATION AND BACKFILL FOR STRUCTURES

A. EXCAVATION DIMENSIONS:

1. All excavations for structures shall be done to the dimensions and levels indicated on the Drawings or specified herein.

2. Excavate to such width outside the lines of the structure to be constructed as may be required for proper working methods, sheeting, bracing, shoring, the erection of forms, and the protection of the work.

B. FOUNDATION EXCAVATION:

1. Prepare the subgrade of the foundation base layer as follows:

   a. Overexcavate the underlying material to a depth of 1 foot (minimum) below the subgrade of the base layer.

   b. Scarify and recompact the underlying material to a depth of 6 inches as specified.

   c. Backfill with Structural Fill and compact as specified to the grade of the base layer subgrade.

2. If the foundation base layer subgrade is shown or specified to be undisturbed, take care to preserve the material in an undisturbed condition. If the Contractor overexcavates or disturbs the material without written authorization of the Owner, it shall fill such overexcavations with Structural Fill and compact as specified.

C. EXAMINATION OF EXCAVATION:

1. The Owner will examine all structural foundation subgrades prior to subsequent work.

2. Notify the Owner when excavation for the structure is complete. No forms, reinforcing steel, concrete, or precast structure shall be placed until the excavation has been examined by the Owner.

D. UNSATISFACTORY FOUNDATION SUBGRADE MATERIAL:

1. Where unsatisfactory material is encountered below the grades shown for structural excavations, it shall be removed and replaced with Structural Fill as directed by the Owner and compacted as specified.

E. OVEREXCAVATION:

1. Backfill and compact overexcavations with Structural Fill.

F. FOUNDATION BASE LAYER AND CAPILLARY BREAK:

1. Place a base layer of compacted material meeting the requirements of Paragraph 2.20 under all cast-in-place and precast structures, slabs-on-grade, and foundations, regardless of whether shown or not on the Drawings.

2. The minimum compacted thickness of the base layer shall be 6 inches, unless shown otherwise on the Drawings.

G. BACKFILL ADJACENT TO STRUCTURES:

1. Backfill shall be Structural Fill and compacted as specified herein unless specifically shown otherwise shown on the Drawings. The entire excavation shall be backfilled with this material.

2. Do not place backfill against structures until the concrete has been patched and cured as required by Section 03 30 00.

3. Place backfill in uniform, level layers, not exceeding the thickness specified in the Material and Compaction Schedule. Bring backfill up uniformly on all sides of the structure, and on both sides of buried walls.

3.13 EARTHWORK WITHIN LANDSCAPED AREAS

A. Prepare landscaped area subgrade by excavating and backfilling to within 6 inches of final grade. Compact backfill in accordance with the Material and Compaction Schedule.

3.14 WET WEATHER EARTHWORK

A. The following measures shall be taken in wet weather or under wet conditions when proper control cannot be exercised over soil moisture content:

1. Prior to excavation all surface drainage shall be diverted to temporary sedimentation and erosion control facilities as approved by the Owner.

2. During excavation and earthwork operations, surface water shall be conveyed and handled using sloping, ditching, sumps, dewatering pumps, and piping as necessary to prevent sloughing of soils and to facilitate moisture control of materials in accordance with Sections 01 57 13 and 31 23 19.

3. Fill material shall contain no more than 5 percent fines (material passing the No. 200 sieve) by weight, based on wet sieving the material fraction passing a 3/4-inch sieve. Any fines present shall be non-plastic.

4. Earthwork shall be accomplished in small sections and carried through to completion to minimize exposure to wet weather. The size and type of equipment shall be limited to prevent soil disturbance.

5. No soil at the bottom of the excavation shall be left uncompacted so that it can soak up water. Soils which become too wet for compaction shall be removed and replaced with the specified fill material. The cost for such work shall be borne by the Contractor.

B. Excavation and fill placement operations will be observed by the Owner during wet conditions.

3.15 GEOTEXTILE FOR SEPARATION

A. Comply with the applicable requirements of WSDOT Standard Specifications Section 2-12, Paragraphs 2-12.1 through 2-12.3(2).

3.16 QUALITY CONTROL

A. SOURCE QUALITY CONTROL:

1. Test all import materials proposed for use to demonstrate that the materials conform to the specified requirements. Submit reports to the Owner for review.

B. FIELD QUALITY CONTROL:

1. The Owner shall take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill and embankment materials to check compliance with these specifications.

2. The Contractor shall remove surface material at locations designated by the Owner and provide such assistance as necessary for sampling and testing. The Owner may direct the Contractor to excavate inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these Specifications.

3. Costs for rework resulting from non-compliant tests shall be borne by the Contractor.

4. Tests made by the Owner do not relieve the Contractor of its responsibility to determine to its own satisfaction that its work meets the specifications.

5. Tests will be made in accordance with WSDOT Standard Specifications Section 1-06.2(1) and the following:

Test	Standard Procedure
Moisture content	AASHTO T 265 / ASTM D2216
Gradation	AASHTO T 27 / ASTM C136

Test	Standard Procedure
Density in-place	AASHTO T 310 / ASTM D6938
Moisture-density relationships	AASHTO T 180 / ASTM D1557

C. PROOF ROLLING:

1. Proof roll areas designated in the Material and Compaction Schedules and elsewhere in the Contract Documents or as directed by the Owner to detect soft zones.

2. Proof rolling shall be done on an exposed subgrade free of surface water (including wet conditions resulting from precipitation) which would promote degradation of an otherwise acceptable subgrade.

3. The Owner shall be present at all proof rolling tests. Notify the Owner at least 3 days prior to proof rolling test.

4. Proof roll by passing over all required areas with a loaded scraper, front-end loader with loaded bucket, or other heavy rubber tired vehicle with high tire pressure, in the presence of the Owner. Operate the proof rolling vehicle at speeds between 2-1/2 to 3-1/2 miles per hour.

5. The Owner shall determine what areas tested by proof rolling are soft zones that require corrective work.

6. Perform the following corrective work, unless otherwise specified:

   a. Remove all material within the Owner identified soft zones. Removed material shall be considered unsuitable for subsequent backfill, unless remedied to meet specifications for use as fill. Soils containing deleterious material shall not be used for backfill.

   b. Fill the resulting voids with moisture conditioned Structural Fill in maximum 8 inch uniform lifts and compact as specified.

3.17 AS-BUILT SURVEY

A. GENERAL: Submit an As-Built Survey of the finish grades, pipelines, and structures associated with Design Package 3. Work may need to be performed in phases as the work proceeds.

B. SURVEY CONTROL: Survey shall be based on vertical and horizontal controls shown on the Drawings. All units shall be in U.S. feet.

C. SCOPE OF SURVEY: The As-Built Survey shall include the following elements:

1. TOPOGRAPHIC SURFACE MAPPING AND MODELING: Provide a topographic surface map and three dimensional surface model of the finished grades of all grades altered in Design Package 3. Mapping results shall adhere to National Map Accuracy Standards. Ninety percent (90%) of contours shall be within 1/2 of the contour interval. Spot elevations shall be within 1/4 of the contour interval. The contour interval shall be one foot.

2. UTILITY AND STRUCTURE SURVEY: Provide a survey of the following elements installed in Design Package 3. The survey accuracy of elevations shall be plus or minus 0.01-foot of the actual elevation.

    a. Manhole rim elevations. Horizontal location shall be based on the center of the manhole cover. Where manholes are specified to be partially constructed, provide horizontal location based on the center of the manhole structure, diameter, and the elevation of the top-most riser section.

    b. Center of valve box covers.

    c. Invert elevation and orientation of all gravity pipelines and stub-outs at all connections to manholes, other structures, and existing pipelines.

    d. Top of pipe elevation of pressure pipelines at beginning and end points, connections to existing pipelines, horizontal angle points, vertical bend points, and at key vertical deflection points.

    e. Fire hydrants. Elevation shall be based on finish grade at the hydrant facing the adjacent roadway.

    f. Miscellaneous utility vaults and other yard structures.

D. DELIVERABLES: The As-Built Survey shall include the following deliverables:

1. Topographic three dimensional surface model in AutoCAD Civil 3D format, 2010 version compatible, (Civil 3D) on CD or DVD.

2. EARTHWORK QUANTITIES. Using the As-Built Survey information prepared at the completion of Design Package 2 as a basis for existing conditions, provide earthwork quantities for total cut and fill volumes associated with the final condition of Design Package 3.

3. Pipe networks in Civil 3D of all installed gravity and pressure pipelines based on the surveyed elevations and locations, including associated manholes, valves, and other structures. Pipe network and structure templates will be provided by the Owner.

4. Two dimensional base map survey information in Civil 3D of utilities, structures, valve boxes, hydrants, and other surface features,

5. Drawings on minimum 22 x 34-inch paper size showing topographic contours and base map information at a scale of 1" = 20'. Drawings shall be sealed by a Professional Surveyor registered in the State of Washington.

3.18 INSTALLATION OF CELLULAR CONFINEMENT SYSTEMS

A. Install cellular confinement systems in accordance with the manufacturer's instructions.

B. CELLULAR CONFINEMENT SYSTEM PLACEMENT AND CONNECTION:

1. Place cellular confinement system on graded, prepared surfaces as indicated on the Drawings.

2. Place cellular confinement system sections and verify all sections are expanded uniformly to required dimensions and that outer cells of each section are correctly aligned. Interleaf or overlap edges of adjacent sections. Ensure upper surfaces of adjoining sections are flush at joint and adjoining cells are fully aligned at the cell wall slot.

3. Connect cellular confinement system sections using manufacturer's recommended product(s) at each interleaf and end to end connection.

C. CELL INFILL MATERIAL PLACEMENT:

1. Place cell infill material with suitable material handling equipment.

2. Cell Infill material shall be free-flowing and not frozen when placed in the cellular confinement system sections.

3. Overfill cells with cell infill material. Limit drop height to 3 feet to avoid damage or displacement of cell wall.

4. Compact infill to a minimum 95 percent relative density.

5. Shape compacted surface to required elevations as indicated on the Drawings.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies the design, installation, operation, and maintenance of the systems necessary to dewater structure and trench excavations.

1. During excavation the Contractor may encounter perched water. The Contractor shall control groundwater seepage and surface run-off so as to prevent entry or collection of water in excavations.

2. The Contractor shall divert stormwater flow around the work area for the duration required to perform excavation, stockpiling, and backfill activities. Erosion control and water pollution control requirements are specified in Section 01 57 13.

3. All sediment laden groundwater produced from excavations and surface run-off entering excavations shall be collected and conveyed to an approved onsite location and dissipated (i.e., no offsite discharge is allowed).

B. DEFINITIONS: Terminology used in this Section conforms to the following definitions:

1. CONTROL OF WATER: General term referring to the management of groundwater and surface water inflow into excavations.

2. CONTROL OF WATER SYSTEM: General term referring the Dewatering Systems.

3. DEWATERING: General term referring to the process of removing accumulated water, including precipitation, water separated from excavated soils and seepage from the open excavation or from excavated soils.

4. DEWATERING SYSTEM: System to collect and remove said accumulated water from the open excavation or from excavated soils.

5. WATERTIGHT: Level of tightness required for installed barriers to minimize the groundwater seepage and inflow of water into excavations to accommodate design criteria.

6. GROUNDWATER SEEPAGE: Groundwater entering an excavation as inflow or seepage from exposed soils in the excavation and installed watertight systems.

7. PERCHED WATER: A layer of saturated soil that results when an underlying impermeable layer, restricts the downward movement of water. This water table is usually above the regional water table.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
King County SWDM	King County Surface Water Design Manual, 2009 edition
Chapter 173-160 WAC	Chapter 173-160 Washington Administrative Code, Minimum Standards for Construction and Maintenance of Wells

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. DEWATERING PLAN: Dewatering Plan, prepared, sealed, and signed by a professional engineer registered in the State of Washington, outlining the method and installation of the dewatering system, including details. The Plan shall include the following:

a. Indicate number and type of equipment and pipelines and other means of conveyance, including capacities.

b. Dewatering pit and sump locations and water discharge locations.

c. Dewatering well locations and water discharge locations.

d. Groundwater monitoring systems where necessary.

e. Filter systems and locations as necessary, and such other information to verify acceptable control and performance.

f. The Plan shall include the following excavation dewatering elements:

1) Details of methods to maintain the excavations in a dewatered and hydrostatically relieved condition.

2) Systems for control of groundwater inflow into excavations using watertight barriers, grouted soil masses, or other means.

3) Method for the measurement of inflow into excavations.

g. The Plan shall include the following surface water flow elements:

1) Method for prevention and removal of surface water flow entering the excavation.

3. CONTACT INFORMATION AND REPORTING:

a. The Contractor shall submit contact information for a designated emergency contact. The contact shall be a responsible individual available at all times.

b. The Contractor shall resubmit components of the drawings and design data if the systems or any part thereof is significantly modified during installation or operation.

c. Before dewatering commences, the Contractor shall obtain the acceptance of the Owner for the method, installation, and details of the dewatering system proposed for use.

C. Review by the Owner of the submitted Dewatering Plan shall not in any way relieve the Contractor from responsibility for errors therein or from the entire responsibility for a complete and adequate dewatering system. The Contractor shall bear sole responsibility for proper design, installation, operation, maintenance, and any failure of any component of the groundwater control system for the duration of this Contract.

1.04 PERFORMANCE REQUIREMENTS

A. Discharges of groundwater and surface water collected from excavations shall meet the discharge requirements of the King County SWDM, including discharges to infiltration facilities.

B. Comply with Chapter 173-160 WAC for the drilling, installation, construction, and abandonment of all dewatering wells, well points, monitoring wells.

PART 2--NOT USED

PART 3--EXECUTION

3.01 GENERAL

A. Furnish, install, operate, maintain, and remove all necessary equipment to keep excavations free from water during construction as needed to perform the excavations and to divert water around work areas. The withdrawal, removal, or disposal of the water shall not cause injury to public or private property or nuisance to the public.

B. Sufficient pumping and power equipment in good working condition shall be available at all times for all emergencies, including power outage, and competent workmen shall be available at all times for the operation of the dewatering and bypass system.

C. Systems shall not be shut down between shifts, on holidays, or weekends, or during work stoppages.

D. The Contractor has the option to install groundwater monitoring wells prior to excavating in order to verify adequacy of Contractor-designed dewatering system. However, if the system as designed is incapable of maintaining a dewatered excavation, the Contractor shall modify the system as required at no additional cost to the Owner. Any wells used for monitoring or dewatering shall be developed, drilled, and abandoned meeting the requirements of federal, state, and local codes.

3.02 DEWATERING SYSTEM OPERATION

A. The dewatering system shall be installed and operated so that the groundwater level outside the excavation or fill areas is not drawn down to the extent that would damage or endanger adjacent slopes, structure, underground installation, sidewalk, pavement, other improvement, or property.

B. Configuration and sizing of the dewatering system shall take into account run-off from areas adjacent to the Work where existing drainage patterns are interrupted.

C. During any backfill, filling, and compaction activities, control surface run-off so as to prevent entry or collection of water in excavations and fills. The static water level within excavations shall be drawn down a minimum of 1 foot below the bottom of the excavation so as to maintain the undisturbed state of the foundation soils and allow acceptable placement of any backfill to the required density.

D. Discharge of water from the dewatering of the excavations shall be in accordance with Section 01 57 13. The Contractor may consider use of the stormwater pipeline to the existing on-site presettling pond and infiltration basin as a component of the dewatering system with the following provisions:

1. The Contractor is responsible for verifying hydraulic requirements and capacity for coordination with the dewatering system.

2. Identification and provision of any temporary facilities needed to connect to the pipeline are the Contractor's responsibility.

3. Pipelines shall be cleaned and inspected, and the existing presettling pond shall be restored after dewatering system use.

E. Immediate steps shall be taken including but not limited to the modification of excavation and ground support procedures and ground permeability modifications, to reduce the inflow of water entering an excavation, where the volume or inflow rate is at risk of causing the following:

1. Drawdown of the groundwater level to an unacceptable level for the area outside the excavation.

2. Damage or has the potential of causing loss or damage to adjacent property or structures.

3. Adversely affects the performance of the work.

F. Excavations shall be kept free of water to the extent required to perform the Work during excavation. Excavations shall be kept free of water for backfill, slope construction, and compaction.

G. Control surface runoff so as to prevent entry or collection of water in excavations or in other isolated areas of the site.

H. DISCHARGE POINTS:

1. All water discharged shall be in accordance with Specification Section 01 57 13.

2. Dewater and dispose of the water so as not to cause injury to public, private, or other property, or to cause a nuisance or a hazard to the public.

3.03 ELECTRICAL SUPPLY FOR DEWATERING SYSTEM

A. Supply two separate electrical services or sources to be used for dewatering, stormwater bypass, and construction stormwater collection and conveyance that are separate from each other and all other Contractor electrical requirements.

3.04 DEWATERING SYSTEM PROTECTION

A. Take all reasonable precautions necessary to ensure continuous operation of the system.

B. Mark and signpost all pump and pipeline locations.

C. Standby pumps are to be fueled and on-line, isolated from the primary system by a valve at all times.

D. Test daily all standby pumps and generators to ensure their immediate availability.

E. Wherever vacuum headers or discharge lines are to be crossed for access and egress, use physical bridging devices such as a ramp to protect and separate the system from vehicular traffic.

1. Bridges shall be capable of supporting the heaviest equipment on site and shall provide at least 1 foot of clearance between the dewatering system element and the underside of the barrier.

2. Clearly identify with brightly colored or flagged 8-foot-high poles on each side of the access point for all vehicular access points to be used across the dewatering system.

3. All pipelines with vehicular crossing bridges, such as ramps, shall be equipped with valves on both sides of the ramp.

3.05 DAMAGES

A. Repair any damage to work in place that may result from inadequate or improper dewatering system installation, maintenance, and operation of the system, and any mechanical or electrical failure of the system. Work in place shall include but is not limited to:

1. Structures, pipelines, and utilities.

2. Other contractors' equipment.

3. The excavation, including damage to the bottom due to heave and removal of material and pumping out of the excavated area.

B. Immediately support any footings, slopes, foundations, basement or walls, concrete driveways, pipelines, utilities, or other structures that become unstable and vulnerable to settlement due to removal or disturbance of groundwater. Support shall include but not be limited to shoring, sheeting, bracing, grouting, underpinning, driving piles, excavation, backfilling, placing new structural concrete beneath or adjacent to the unstable structure, or other means necessary to rectify the particular problem involved.

C. Contractor is responsible for all loss or damage arising from removal or disturbance of groundwater including, but not limited to, subsidence damage or the loss of structural support that may occur in the prosecution of the Work.

3.06 SOIL AND GROUNDWATER DATA

A. Soil and groundwater data: Section 01 11 10.

B. Use of available information in no way relieves the Contractor from its responsibility for the operation of a properly functioning dewatering system.

END OF SECTION

SECTION 31 50 00

EXCAVATION SUPPORT SYSTEMS

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies requirements for excavation support systems for trenches and open excavations greater than 4 feet in depth and underpinning of existing structures. Where sheet piling, shoring, sheeting, bracing, or other supports are necessary, they shall be designed, furnished, placed, maintained and, unless shown or specified otherwise, removed by the Contractor.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
Chapter 49.17 RCW	Washington Industrial Safety and Health Act
Chapter 296-155 WAC	Part N, Excavation, Trenching, and Shoring

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. INFORMATIONAL SUBMITTAL ITEMS:

1. Detailed excavation support drawings and method of installation and removal of all sheeting, piling, shoring, and bracing, together with underpinning.

2. Design calculations and drawings for proposed sheeting or shoring systems. Calculations and drawings shall be prepared, sealed, and signed by a professional structural engineer registered in the State of Washington; shall utilize the criteria contained in the geotechnical report for this project; and shall comply with applicable requirements of the referenced codes and rules with respect to excavation and construction.

3. No excavations shall be started until the submittal is returned with a disposition of "Receipt Acknowledged." Review of the submittal will be for the Contractor's general compliance with the Construction Documents and shall not be construed as a detailed analysis for adequacy of the support system, nor shall any provisions of the above requirements be construed as relieving the Contractor of its overall sole responsibility and liability for the Work.

1.04 PERFORMANCE REQUIREMENTS

A. The design, planning, installation, and removal of all sheeting, shoring, piling, lagging, bracing, and underpinning shall be accomplished in such a manner as to maintain the required excavation or trench section and to maintain the undisturbed state of the soils below and adjacent to the excavation.

B. The excavation support system design shall meet the requirements of Chapter 296-155 WAC, Part N.

C. Horizontal struts below the barrel of a new pipe and the use of the pipe as trench support are not acceptable.

D. When the construction sequence of structures requires the transfer of bracing loads or forces to the completed portions of any new structure or to any existing structure, the Contractor shall provide the Owner with a complete design analysis of the expected impact of that bracing on the structure. This action shall in no way absolve the Contractor of responsibility of damage resulting from said bracing.

1.05 SAFETY RESPONSIBILITIES

A. The Contractor shall select, install, and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring such measures at a minimum: 1) comply with the requirements of the referenced documents and as specified herein, 2) provide necessary support to the sides of excavations, 3) provide safe access to the Owner's sampling and testing within the excavation, 4) provide safe access for backfill, compaction, and compaction testing, and 5) otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule.

PART 2--NOT USED

PART 3--EXECUTION

3.01 SUPPORT OF EXCAVATIONS

A. The construction of sheeting, shoring, and bracing shall not disturb the state of soil adjacent to the trench or excavation and below the excavation bottom or footings and utilities in the area. Sheeting, shoring, and bracing shall be removed after placement and compaction of initial backfill as necessary to allow excavation backfill to be placed and compacted against native excavation wall soils, except as noted otherwise.

B. Where sheeting, shoring, and bracing cannot be removed with the progression of backfill, it shall be designed in such a way that its removal shall not adversely affect the integrity of the pipeline or adjacent structures and the backfill shall be reconsolidated after final removal to the satisfaction of the Owner.

C. Where sheeting, shoring, or bracing cannot be removed without resulting in damage to the pipeline or adjacent structure, or where such sheeting, shoring, or bracing is specified or approved by the Owner to remain, it shall be removed to the maximum extent possible without resulting in damage to the pipeline or adjacent structure and removed from the site. Any shoring that remains shall be cut off a minimum of 4 feet below existing or finish grades, whichever is greater. All voids that exist behind any sheeting or shoring left in place and all voids created by removal of shoring shall be filled in a manner acceptable to the Owner. All timber associated with sheeting, shoring, or bracing that is proposed to remain shall be pressure treated with a wood preservative.

D. Provide support of existing structures where shown, specified, and at all other locations where the limit of excavation intersects a 1.5:1 (horizontal: vertical) slope extending from the bottom of the footing or adjacent structure being protected.

E. Be solely responsible for the adequacy of sheeting, shoring, bracing, and other support utilized in this project. Ensure that the integrity of the existing facilities is maintained and that appropriate construction techniques are employed at all times to protect existing structures and pipes.

F. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from high groundwater and/or the nature of the soil excavated.

G. Be responsible for maintaining a safe work site and shall protect workers and the public health and safety from the consequences of its operations.

3.02 EXISTING PIPING AND UTILITIES

A. Provide sheeting, shoring, and bracing to protect existing piping and utilities where excavation could expose and/or cause damage to the pipe or utility.

END OF SECTION

SECTION 31 60 00

AUGERCAST PILES

PART 1--GENERAL

1.01 SUMMARY

A. This section specifies augercast piles.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM C 33	Concrete Aggregates
ASTM C 150	Portland Cement
ASTM C 937	Grout Fluidifier for Preplaced-Aggregate Concrete

B. INSTALLER QUALIFICATIONS

1. Firm: Have demonstrated experience, not less than five years, in successful installation of augercast piles a minimum of the size indicated.

2. Supervision: Provide an experienced augercast pile installation supervisor at the job site at all times during progress of the work of this Section.

C. QUALITY CONTROL BY OWNER:

1. Special Inspection of augercast pile work will be performed by the Geotechnical Engineer under contract with the Owner and in conformance with IBC Chapter 17.

2. Notify the Owner at least seven days prior to starting pile injecting operations.

3. The Geotechnical Engineer will verify that approved procedures are used uniformly on production piles. The Geotechnical Engineer will keep a record for each pile placed. The record will give the pay length, location, type, calculated safe load and results of any test.

4. Cooperate with the Geotechnical Engineer to facilitate record keeping.

5. Owner provided testing provided in accordance with Section 01 45 23.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations.

2. EXPERIENCE: Augercast pile contractor shall submit evidence to the Owner that he has been engaged in the successful installation of augercast piles for at least five years and that his crane operators or "keymen" who give directions to the crane operators have at least two years of experience in the successful installation of augercast piles.

3. GROUT MIX DESIGN: Mix proportions and evidence that proposed mix provides adequate strength and uniform consistency of grout either from a currently prepared mix design for this Contract with documented 28-day breaks or from previous construction test records using the same concrete supplier and mix proportion.

4. SHOP DRAWINGS:

a. Indicate methods of augering and placing of grout and reinforcing steel.

b. Indicate predicted 7 and 28 day compressive strength of grout.

c. Indicate the size, number, and the installation sequence for each for the scheduled piles.

d. Reinforcing: in accordance with Section 03 20 00.

5. EQUIPMENT REVIEW AND WORKING DRAWINGS:

a. Complete list of the equipment proposed for use, including the manufacturer's description of the characteristics of each piece of equipment.

b. Working drawings of accessories showing compatibility with the size, configuration, handling, and requirements of the type of pile indicated.

1.04 PILING INSTALLATION RECORDS

A. Be responsible for keeping a record of piles installed, including abandoned piles.

B. Within 24 hours after each pile in a cluster has been installed, provide a written tabulation indicating the following information for augercast piles in that cluster:

1. Pile cluster location.

2. Pile number.

3. Pile diameter.

4. Elevation of top of pile (measured to nearest 0.01 foot).

5. Deviation from plan location (measured to nearest 0.01 foot).

6. Tip elevation.

7. Volume and strength of the grout material used in each pile.

8. Any unusual conditions encountered during pile installation.

C. Within two weeks after the completion of drilling all piles, provide the Owner with a certified plan showing the as drilled location of all piles installed within the structure to the tolerances indicated above.

1.05 COST OF ABANDONMENT AND REPLACEMENT PILES

A. Whenever a pile is rejected due to non compliance and necessitates structural redesign of the pile cluster, the cost of such redesign shall be deducted from the Contract Sum, via a Change Order Proposal, in accordance with Section 01 26 00.

B. Whenever a pile is rejected due to non compliance and necessitates structural redesign of the pile cap, and the redesigned pile cap requires greater quantities of concrete and reinforcing steel, the revised quantities shall be compared with the quantities required for the pile cap as originally designed, the cost of the additional quantities will be calculated on a time and material basis, and the additional cost, plus redesign cost, shall be deducted from the Contract Sum in accordance with Section 01 26 00.

PART 2--PRODUCTS

2.01 GROUT

A. Grout shall consist of a mixture of Portland cement, a pozzolanic material (when approved), fluidifier, sand, and water. This mixture will be proportioned and mixed to produce a grout capable of being pumped with a minimum compressive strength of 4,500 psi at 28 days when tested in accordance with the provisions of ASTM C109. Grout mix shall have a minimum of 940 lbs. of cement (10 bags) per cubic yard. Maximum water-cementitious materials ration by weight shall be 0.45. Other admixtures shall not be used.

B. PORTLAND CEMENT: conform to ASTM C 150.

C. POZZOLAN: per Section 03 30 00.

D. GROUT FLUIDIFIER: Grout fluidifier shall conform to ASTM C 937, except that expansion shall not exceed 4 percent. The fluidifier shall be a compound possessing characteristics that will increase the flowability of the mixture, assist in the dispersal of cement grains, and neutralize the setting shrinkage of the high-strength cement mortar.

E. WATER: Water shall be fresh, clean, and free from sewage, oil, acid, alkali, salts, or organic matter.

F. FINE AGGREGATE: meet the requirements of ASTM C 33. The sand shall consist of hard, dense, durable, uncoated rock particles and be free from injurious amounts of silt, loam, lumps, soft or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances. If washed, a washing method shall be used that will not remove desirable fines, and the sand shall subsequently be permitted to drain until the residual-free moisture is reasonably uniform and stable. The sand shall be well-graded from fine to coarse, with fineness modulus between 1.30 and 3.40. [The fineness modulus is defined as the total divided by 100 of the cumulative percentages retained on U.S. Standard Sieve Numbers 16, 30, 50, and 100.]

2.02 REINFORCEMENT

A. Materials, assembly, and placement of reinforcement shall conform to the requirements of Section 03 20 00.

2.03 REINFORCING STEEL

A. Preformed bars complying with Section 03 20 00.

2.04 EQUIPMENT

A. AUGERING:

1. General: Auger shafts for piles with continuous flight hollow shaft auger of sufficient length to drill shafts to indicated depths, of the type generally used for installation of auger placed, grout injected piling.

2. Injection:

a. Opening in the auger shaft: at the bottom of the auger head no more than 6 inches above the tip of the cutting teeth.

b. The minimum inside diameter of hollow shaft of auger flight: 3 inches.

c. Equipment provided with a mortar pressure gage in clear view of the equipment operator and the inspector.

B. PUMPING EQUIPMENT:

1. General: Remove all oil or other rust inhibitors and contaminants from mixing drums and grout pumps.

2. Pump:

a. Positive displacement type capable of developing and maintaining sufficient pressure to completely fill all voids.

b. Equipped with an in line grout pressure gage and stroke counter.

c. Provide a calibration of stroke count versus pumped grout volume performed within the previous 6 months prior to pile installation.

PART 3--EXECUTION

3.01 GENERAL

A. LOCATION:

1. Locate pile centers within 2 inches in any horizontal direction from location indicated at top of pile elevation.

2. Provide field engineering layout services and equipment to ensure accurate positioning of the piles immediately prior to drilling, and to control top of elevations.

3. Drill holes plumb and true to line continuously.

4. Piles shall be installed to a minimum of 15 feet embedment into very dense glacially consolidated soil layer with an estimated tip elevation of -3 feet per the geotechnical information listed in Section 01 11 10. Adjustments to final tip elevation may be made at the discretion of the Owner's Geotechnical Engineer.

5. Top of completed piles shall be within +1/2 inch of the elevation shown on the Drawings.

B. SPACING: Do not install adjacent piles closer than 8 feet center to center from previous piles until grout in the piles has set for a minimum of 12 hours.

C. DISTRIBUTION: Properly distribute concentrated loads from the pile placing equipment to prevent collapsing the hole as mortar is being injected.

D. METHOD OF CONSTRUCTING PILES:

1. Form each auger placed pile by rotation of a continuous auger flight hollow shaft auger into the ground.

2. Inject mortar through the auger shaft as the auger is being withdrawn, to exert upward pressure on the withdrawing earth filled auger as well as lateral pressure on the soil surrounding the mortar filled pile hole.

E. AUGER MOUNTING:

1. Mount the auger to ensure the accurate alignment of the auger flight at all times during augering operation.

2. Leads

a. Arrange leads in a manner that will prevent the twisting of the leads about the auger axis.

b. Provide at least 2 guides with the leads:

1) One is fixed at the lower end of the leads.

2) The other slides on the leads midway in the aboveground portion of the auger flight.

3.02 INSTALLATION

A. PILES: Drill auger holes in an acceptable manner without loss of ground and without endangering previously installed piles.

B. ALIGNMENT: Accurately plumb the auger over the pile location prior to the start of drilling and maintain at all times during drilling.

C. GROUT:

1. Measurement:

a. Measure all materials by volume or weight as they are fed into the mixer.

b. Measure shall be accurately and consistently.

c. Properly record measurement.

2. Mix materials to produce a homogeneous mortar of desired consistency.

3. If there is a lapse in the operation, recirculate the mortar through the pump.

4. The minimum volume of grout placed in the hole shall at least equal the volume of the augered hole.

5. Accomplish grout injection during withdrawal of the auger.

6. Maintain a minimum head of 5 feet of grout above the injection top during withdrawal of the auger to ensure lateral penetration and prevent hole collapse.

7. Withdraw the auger at a rate for the soil conditions and do not allow to exceed 8 feet per minute.

D. REINFORCEMENT:

1. When auger has been withdrawn and before mortar has set, place reinforcement in soft grout and place into position.

E. CONFLICT: In case of conflict with specified depth or in the event of unusual occurrences, notify the Owner immediately.

F. PILE ACCEPTANCE CRITERIA:

1. Pile fabrication and installation criteria in this Section shall be considered the minimum acceptable requirements.

2. The installation of the piling indicated on the Drawings may require additional measures beyond those specified. Accordingly, the Contractor is solely responsible for installing the piling so that it is acceptable.

3. Installed piling will be considered acceptable if:

a. Piling material is as specified.

b. Piling is installed to the minimum vertical capacity and embedment length.

c. Piling is installed at the locations indicated within the tolerance specified.

4. In the event that any piling does not meet the acceptance criteria, abandon that piling and replace with an acceptable piling.

3.04 ABANDONMENT AND REPLACEMENT PILES

A. GENERAL: In all cases, install and replace piles and provide other corrective measures as approved by the Owner.

B. OBSTRUCTIONS:

1. If obstructions are encountered during pile installation, it may be necessary to move the pile location.

2. In the event the pile cannot be installed, withdraw the auger from the pile hole to be abandoned and fill the shaft with grout.

3. The abandoned portion of the drilled pile will be paid for at the contract unit price per linear foot installed.

4. Relocate the pile as approved by the Owner.

5. If additional pile or piles are required to compensate for a rejected pile, payment will be based on the Contract unit price for each additional pile installed.

C. NON-COMPLIANCE:

1. Piles not installed in accordance with the provisions of the Construction Documents will be rejected at the sole discretion of the Owner.

2. Replace pile(s) in revised location and abandoned holes due to non compliance.

3.05 COMPLETION

A. Upon completion of pile installation, all equipment, excess materials and all miscellaneous materials not incorporated in the Work shall be removed so as to leave the site clean and free of debris.

END OF SECTION

DIVISION 32	EXTERIOR IMPROVEMENTS	Responsible Engineer
32 12 00	Flexible Paving	E. deMontigny
32 13 00	Reinforced Paving	E. deMontigny
32 16 00	Concrete Curbs and Sidewalks	E. deMontigny
32 17 23	Pavement Marking	E. deMontigny
32 31 00	Fences and Gates	E. deMontigny
32 32 20	Mechanically Stabilized Earth Retaining Wall (MSE Wall)	E. deMontigny

SECTION 32 12 00

FLEXIBLE PAVING

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies flexible paving systems consisting of an aggregate base, asphaltic concrete (hot mix asphalt, or HMA), and associated materials.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
AASHTO M 140	Emulsified Asphalt
AASHTO M 208	Cationic Emulsified Asphalt-HM-22
AASHTO M 320	Performance-Graded Asphalt Binder
ASTM D 977	Emulsified Asphalt
AASHTO T 209	Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)
AASHTO T 166	Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens ()
AASHTO T 180/ASTM D1557	Moisture-Density Relations of Soils Using a 10 in (4.54 kg) Rammer and an 18 in (457 mm) Drop (Modified Proctor Test)
ASTM D 2397	Cationic Emulsified Asphalt
ASTM D 2726	Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, Addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. MATERIAL DATA AND MIX DESIGN: Submit testing reports, mix designs, and other pertinent information to demonstrate to the satisfaction of the Owner that the proposed materials and installation methods meet the specified requirements.

3. CERTIFICATION: Certification that the materials used in the asphalt mix is from the same material manufacturer and gravel pit as those used in the trial batches to develop the mix design.

PART 2--PRODUCTS

2.01 SUITABILITY OF PROPOSED MATERIALS

A. Tests for conformance with the Specifications shall be performed prior to start of the Work. The samples shall be identified to show the name of the material, aggregate source, name of the supplier, contract number, and the segment of the Work where the material represented by the sample is to be used. Results of testing shall be submitted to the Owner. Materials to be tested include crushed surfacing base course, crushed surfacing top course, tack coat, asphalt binder, aggregate for HMA mixtures, and mineral filler.

2.02 CRUSHED SURFACING BASE COURSE

A. Imported material conforming to the Crushed Surfacing Base Course material as specified in Section 31 23 00.

2.03 CRUSHED SURFACING TOP COURSE (CSTC)

A. Imported material conforming to the Crushed Surfacing Top Course material as specified in Section 31 23 00.

2.04 TACK COAT

A. Tack coat shall be emulsified asphalt (Grade SS-1 or SS-1h, CSS-1 or CSS-1h diluted with one part water to one part emulsified asphalt). Emulsified asphalt shall comply with the requirements of AASHTO M 140 (ASTM D 977) or M 208 (ASTM D 2397).

2.05 ASPHALT BINDER

A. Asphalt binder shall be Performance Grade PG 64-22 complying with the requirements of AASHTO M 320.

2.06 HMA AGGREGATE

A. Imported material conforming to WSDOT Standard Specification 9-03.8, Class 1/2 inch.

2.07 HMA MIX DESIGN

A. HMA mix design shall comply with the requirements of WSDOT Standard Specification 5-04 with the 20-year design ESAL (in millions) being 0.3 to < 3.

B. The results of at least two tests shall be submitted for HMA mix designs. The tests shall be representative of the mix design to be used in the Work and shall be performed within the current production year. Materials used in the tests shall be from the same manufacturer as will be used in the final Work. Tests for aggregate material shall be from the same pit as those that will be used in the final HMA.

2.08 SOIL STERILANT

A. Soil sterilant or chemical weed control agent shall be a commercial product manufactured specifically to sterilize the subgrade soil to prevent the growth of weeds, plants, or any type of vegetation.

PART 3--EXECUTION

3.01 SUBGRADE PREPARATION

A. The subgrade shall be prepared in accordance with Section 31 23 00. The surface of the subgrade after compaction shall be hard, uniform, smooth, and true to grade and cross-section.

B. Subgrade for pavement shall not vary more than 0.02 foot from the indicated grade and cross section. Subgrade for base material shall not vary more than 0.04 foot from the indicated grade and cross section.

C. Apply soil sterilant or chemical weed control agent to the subgrade in strict compliance with manufacturer's dosages and application instructions, and any applicable laws, ordinances or regulations governing the use of such chemicals.

3.02 GRAVEL BASE AND CSTC

A. The indicated base materials shall be provided to the thickness indicated on the Drawings. Imported base material shall be delivered to the Plant as uniform mixtures and each layer shall be spread in one operation. Segregation shall be avoided and the base shall be free of pockets of coarse or fine material. The compacted surface of the finished aggregate shall be hard, uniform, smooth, and at any point shall not vary more than 0.02 foot from the indicated grade or cross-section.

3.03 TACK COAT

A. A tack coat shall be applied to existing paved surfaces where new asphalt concrete is to be placed on existing pavement. It shall also be applied to the contact surfaces of all cold pavement joints, curbs, gutters, and the like immediately before the adjoining HMA is placed. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new HMA. Diluted emulsified asphalt shall be applied at the rate of 0.05 to 0.15 gal/sq yd. Undiluted emulsified asphalt shall be applied at the rate of 0.025 to 0.075 gal/sq yd. Paving asphalt shall be applied at the rate of approximately 0.05 gal/sq yd.

3.04 HOT MIX ASPHALT (HMA)

A. HMA shall be transported to the Plant in vehicles previously cleaned of all foreign material. Each load shall be covered during cool and cloudy weather and at any time there is a probability of rain.

B. Temperature of HMA at the time of spreading shall be within the master range as established from the design mix plus or minus 30 degrees F. Any load or portion of load outside of this range shall be rejected.

C. HMA shall not be placed when the atmospheric temperature is below 40 degrees F or during unsuitable weather.

D. Placement of HMA shall be scheduled to coincide with favorable weather conditions. If rain or snow begins to fall during placement, transportation of HMA mixtures shall be terminated. HMA shall not be placed while rain or snow is falling or when there is water on the surface to be covered. Placement of HMA may resume once the rain or snow has stopped and water has been removed from the tacked surface to the satisfaction of the Owner and the temperature of the portion of the partially placed batch or the mixture caught in transit still meets the requirements as indicated above and the temperature is not below 40 degrees F.

E. The HMA shall be evenly spread upon the receiving surface to such a depth that, after rolling, it will be of the required cross section and grade of the course being constructed.

F. HMA shall be placed in layers as indicated. However, no single layer shall be laid such that it will have a final thickness of greater than 2 inches. Leveling course shall be placed after filling all depressions in the existing surface more than 1 inch deep by spot patching with leveling course mixture and then compacting thoroughly. Areas in which hand compaction is required shall not exceed 1-1/2 inches. No single layer of HMA shall be less than 1 inch thick.

G. The depositing, distributing, and spreading of HMA shall be accomplished in a single, continuous operation by means of a self-propelled mechanical spreading and finishing machine specially designed for that purpose. The machine shall be equipped with a screed or strike-off assembly capable of being accurately regulated and adjusted to distribute a layer of the material to a definite pre-determined thickness. When paving is of a size or in a location that use of a self-propelled machine is impractical, the Owner may waive the self-propelled requirement. Spreading, once commenced, shall be continued without interruption.

H. The mix shall be compacted immediately after placing. Initial rolling with a steel-wheeled tandem roller, steel three-wheeled roller, vibratory roller, or a pneumatic-tired roller shall follow the paver as closely as possible. If needed, intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall eliminate marks from previous rolling. In areas too small for the roller, a hand tamper or other satisfactory means shall be used to achieve thorough compaction.

I. Laying of HMA against cold transverse joints shall be made by cutting back on the previous run to expose the full depth of the mat.

J. Longitudinal joints of successive layers of HMA shall offset the joints of the underlying layer by at least 12 inches.

K. Upon completion the pavement shall be true to grade and cross-section. When a 10-foot straightedge is laid on the finished surface parallel to the center of the roadway, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at intersections or changes of grade. In the transverse direction, the surface shall not vary from the edge of the straightedge more than 1/4-inch.

L. The relative density after compaction shall be 96 percent of the density obtained by using ASTM D 1188 or D 2726. A properly calibrated nuclear asphalt testing device shall be used for determining the field density of compacted asphalt concrete, or slabs or cores may be laboratory tested in accordance with ASTM D 1188. Work shall not proceed on a subsequent layer of HMA until satisfactory compaction of the underlying layer is demonstrated.

END OF SECTION

SECTION 32 13 00

REINFORCED PAVING

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies reinforced paving for concrete driveways, ramps, and other concrete slabs subject to vehicular traffic, consisting of a pavement composed of Portland Cement Concrete on a prepared subgrade or base in conformity with the lines, grades, thicknesses, and typical cross-sections specified in the Drawings and Standard Details.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued of otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Section
WSDOT Standard Specifications	Section 2-01 Washington State Department of Transportation (WSDOT), Standard Specifications For Road, Bridge and Municipal Construction, 2012 edition.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Proposed mix design showing (a) the expected strength at 28 days, (b) corresponding slump before and after the introduction of high-range water-reducing admixtures, (c) water/cement ratios, (d) weights and test results of the ingredients, (e) aggregate gradation, (f) test results of mix design prepared by an independent testing laboratory, and (g) other physical properties necessary to review each mix design for conformance with these Specifications.

3. Product literature and technical data for aggregates, cement, and pozzolan.

4. Product literature, technical data, and dosage of all proposed admixtures including, but not limited to, air entraining, water reducing, and/or retarding admixtures and shrinkage reducing admixtures at liquid containing concrete.

5. Curing program description in sufficient detail to demonstrate acceptable strength, finish, and crack control as specified.

6. Product literature and technical data for curing and sealing compounds, and joint filler.

7. Concrete delivery truck tickets showing the information listed in ASTM C94, Section 14.

8. Mill certificates for all reinforcing.

9. Reinforcing steel shop drawings meeting requirements of Section 03 20 00.

PART 2--MATERIALS

2.01 REINFORCED PAVING MATERIALS

A. Materials shall meet the requirements of the following WSDOT Standard Specifications sections:

1.	Portland Cement:	Section 9-01
2.	Fine Aggregate:	Section 9-03
3.	Coarse Aggregate:	Section 9-03
4.	Combined Aggregate:	Section 9-03
5.	Joint Filler:	Section 9-04.1
6.	Joint Sealants:	Section 9-04.2
7.	Corrosion Resistant Dowel Bars:	Section 9-07.5(2)
8.	Tie Bars:	Section 9-07.6
9.	Concrete Patching Material:	Section 9-20

10. Curing Materials and Admixtures: Section 9-23

11. Water: Section 9-25

12. Epoxy Resins: Section 9-26

PART 3--EXECUTION

A. Comply with Chapter 5-05, WSDOT Standard Specifications.

END OF SECTION

SECTION 32 16 00

CONCRETE CURBS AND SIDEWALKS

PART 1--GENERAL

1.01 SUMMARY

A. Provide concrete curbs, curbs and gutters, gutters, sidewalks, and pedestrian ramps as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 Edition

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Proposed mix design showing (a) the expected strength at 28 days, (b) corresponding slump before and after the introduction of high-range water-reducing admixtures, (c) water/cement ratios, (d) weights and test results of the ingredients, (e) aggregate gradation, (f) test results of mix design prepared by an independent testing laboratory, and (g) other physical properties necessary to review each mix design for conformance with these Specifications.

3. Product literature and technical data for aggregates, cement, and pozzolan.

4. Product literature, technical data, and dosage of all proposed admixtures including, but not limited to, air entraining, water reducing, and/or retarding admixtures and shrinkage reducing admixtures at liquid containing concrete.

5. Curing program description in sufficient detail to demonstrate acceptable strength, finish, and crack control as specified.

6. Product literature and technical data for curing and sealing compounds, and joint filler.

7. Concrete delivery truck tickets showing the information listed in ASTM C94, section 14.

PART 2--PRODUCTS

2.01 CONCRETE CURBS AND GUTTERS

A. Materials shall meet the requirements of the following sections of the WSDOT Standard Specifications.

1.	Portland Cement:	Section 9-01
2.	Fine Aggregate:	Section 9-03
3.	Coarse Aggregate:	Section 9-03
4.	Combined Aggregate:	Section 9-03
5.	Joint Filler:	Section 9-04.1
6.	Joint Sealants:	Section 9-04.2
7.	Curing Materials and Admixtures:	Section 9-23
8.	Water:	Section 9-25

2.02 CONCRETE SIDEWALKS

A. Materials shall meet the requirements of the following sections of the WSDOT Standard Specifications.

1.	Portland Cement:	Section 9-01
2.	Fine Aggregate:	Section 9-03
3.	Coarse Aggregate:	Section 9-03
4.	Combined Aggregate:	Section 9-03

5.	Joint Filler:	Section 9-04.1
6.	Joint Sealants:	Section 9-04.2
7.	Curing Materials and Admixtures:	Section 9-23
8.	Water:	Section 9-25

PART 3--EXECUTION

3.01 INSTALLATION

A. CURB AND GUTTER: The requirements of Chapter 8-04 Curbs, Gutters, and Spillways of the WSDOT Specifications shall apply. Also comply with the applicable curb and gutter and barrier curb details as specified in the Drawings and Standard Details.

B. All concrete curb and gutter shall be water tested upon completion of installation to confirm free drainage with no standing or ponded water. Run water from a water truck or hydrant until the entire length of curb and gutter being tested becomes wetted. If the depth of any ponded water encountered exceeds 0.25 inch, the Contractor shall replace or modify the curb and gutter to provide drainage in a manner acceptable to the Owner.

C. SIDEWALKS: The requirements of Chapter 8-14 Cement Concrete Sidewalks of the WSDOT Standard Specifications shall apply. Comply with the sidewalk details specified in the Standard Details.

D. Unless shown otherwise on the Drawings, replace existing curbs, curbs and gutters, gutters, and sidewalks in kind.

E. Structures such as valve boxes, manhole frames and covers, catch basins, and vaults located physically in or within the influence of concrete sidewalk or curb and gutter shall be installed flush with the surface of the indicated finish grade of said curb and gutter or sidewalk as shown on the Drawings. “Flush” means no more than 0.125 inch of grade differential will be allowed. Warping the curb and gutter or sidewalk to meet the elevation of improperly installed structures will not be allowed. Such structures shall be reset to the appropriate grade and the adjacent curb and gutter or sidewalk reinstalled at no additional cost to the Owner.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKING

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: Provide pavement markings as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 Edition

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Product literature and technical data for pavement marking materials.

1.04 DELIVERY

A. Deliver pavement marking materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer.

PART 2--PRODUCTS

2.01 PAVEMENT MARKINGS

A. Materials shall meet the requirements of Chapter 9-34 of the WSDOT Standard Specifications for Low-VOC (volatile organic compound) Waterborne Paint.

B. All arrows, lettering, crosswalks, and stop bars shall be reflective pre-formed fused thermoplastic.

PART 3--EXECUTION

3.01 SURFACE PREPARATION

A. Prepare pavement surfaces according to the requirements of Chapter 8-22 of the WSDOT Standard Specifications.

3.02 INSTALLATION

A. Apply pavement marking paint to clean, dry surfaces, and unless otherwise approved, only when the air and pavement are above 40 degrees F. Install pavement markings to prepared pavement surfaces according to the requirements of Chapter 8-22 of the WSDOT Standard Specifications. Provide two applications of paint for each marking.

B. Equipment used in the application of pavement marking shall produce stripes and markings of uniform quality with clean and well-defined edges that conform to the details and dimensions indicated. Drips, improperly applied materials, and improper markings shall be immediately removed from the pavement surface by methods acceptable to the Owner.

END OF SECTION

SECTION 32 31 00

FENCES AND GATES

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies chain-link security fences, swing gates, slide gates, electrical gate operators, magnetic locks, access control hardware, override key switches, vehicle loop detector systems, and strobe detector switches.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A817	Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire
ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D668	Standard Test Methods of Measuring Dimensions of Rigid Rods and Tubes Used for Electrical Insulation
ASTM F567	Standard Practice for Installation of Chain-Link Fence
ASTM F626	Standard Specification for Fence Fittings
ASTM F900	Standard Specification for Industrial and Commercial Swing Gates

Reference	Title
ASTM F934	Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials
ASTM F1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
ASTM F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F1184	Standard Specification for Industrial and Commercial Horizontal Slide Gates
ASTM F1664	Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence
ASTM F1665	Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence
ASTM F2200	Standard Specification for Automated Vehicular Gate Construction
AWG	American wire gauge
CLFMI CLF 2445	Chain Link Fence Manufacturer's Institute (CLFMI) Product Manual, CLF 2445
CLFMI WLG 2445	Chain Link Fence Manufacturer's Institute (CLFMI) Product Manual, WLG 2445
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	National Electrical Safety Code (NESC) Standards
NETA ETT	International Electrical Testing Association, Standard for Certification of Electrical Testing Technicians
NFPA 70	National Electrical Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
OSHA	Occupational Safety and Health Administration
UL 325	Door, Drapery, Gate, Louver, and Window Operators and Systems
UL 467	Grounding and Bonding Equipment
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

2. UNIT RESPONSIBILITY: Assign unit responsibility, as specified in Section 46 05 13, to the Automated Gate manufacturer for all equipment associated with automated swing or slide gates (gates, gate operators, magnetic locks, access control hardware, key switches, loop detector systems, strobe switches, etc.) specified in this Section. This manufacturer is the unit responsibility manufacturer and has unit responsibility, as defined in Section 46 05 13, for the equipment specified in this Section. Provide a completed and signed certificate of unit responsibility (Section 01 31 30). Approved Manufacturer: Automated Gates and Equipment Company, 10847 E. Marginal Way S, Seattle, WA 98168; or approved equal.

3. INSTALLER QUALIFICATIONS:

    1. An experienced installer who has designed and constructed chain-link fences and gates control systems similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

        a. ENGINEERING RESPONSIBILITY: Preparation of data for chain-link fences and gates, gate control systems including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

4. TESTING AGENCY QUALIFICATIONS:

    1. An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

        a. TESTING AGENCY'S FIELD SUPERVISOR: Person currently certified according to NETA ETT, or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.

5. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES:

    1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

6. UL STANDARD:

    1. Provide gate operators that comply with UL 325.

7. EMERGENCY ACCESS REQUIREMENTS:

1. Contact and coordinate with the local authority having jurisdiction regarding emergency vehicle access requirements and requirements for gate devices, gate controllers, and control system. Comply with requirements of authority having jurisdiction for automatic gate operators serving as a required means of access.

8. PREINSTALLATION CONFERENCE:

1. Conduct conference at Project site in accordance with Section 01 31 19.

9. SPECIAL WARRANTY: Provide manufacturer's standard limited warranty covering slide gate and truck assembly against failure resulting from normal use for a period of 5 years from date of purchase. Failure is defined as any defect in manufacturing that prevents the gate from operating in a normal manner.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. PRODUCT DATA: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

a. Fence and gate posts, rails, and fittings.

b. Chain-link fabric, reinforcements, and attachments.

c. Gates and hardware.

d. Gate operators, Magnetic Locks, Access Control Hardware, Vehicle Detectors, and Key and Strobe Switches/Detectors, including operating instructions.

e. ACCESSORIES: Barbed wire.

f. MOTORS: Show nameplate data, electrical ratings, characteristics, and mounting arrangements.

3. SHOP DRAWINGS: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

    a. GATE OPERATOR: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.

    b. WIRING DIAGRAMS: Power and control wiring and signal access-control features for all gate controllers and gate operators. Diagrams shall show the interconnections of card readers, pin pads, gate operators, vehicle detector loops, magnetic locks, strobe and key switches, and master controller(s).

    c. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

4. SAMPLES FOR INITIAL SELECTION: Manufacturer's color charts or 6-inch lengths of actual units showing the full range of colors available for components with factory-applied color finishes.

5. PRODUCT CERTIFICATES: Strength test results for framing according to ASTM F1043, for each type of chain-link fence, operator, and gate, signed by product manufacturer.

6. Qualification data for installer.

7. Field quality-control test reports.

8. OPERATION AND MAINTENANCE DATA:

    a. Polymer finishes.

    b. Gate hardware.

    c. Gate operator.

    d. Magnetic lock.

    e. Access Control Hardware (Pin Pads, Key Card Readers, Intercoms, Controls Pedestals, Control Cabinets).

    f. Vehicle Detector Loops (Entry Controls/Free Entry Loops, Vehicle Presence Loops, Free Exit Loops).

g. Override Key Switch (Fire Department Access Switch).

h. Strobe Detector Switch.

1.04 PERFORMANCE REQUIREMENTS

A. STRUCTURAL PERFORMANCE:

1. Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

a. MINIMUM POST SIZE AND MAXIMUM SPACING FOR WIND VELOCITY PRESSURE: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:

1) Wind Speed: 85 mph.

2) Fence Height: As shown on the Drawings.

3) Line Post Group: IA, ASTM F1043, Schedule 40 steel pipe.

4) Wind Exposure Category: B.

B. ELECTRICAL PERFORMANCE:

1. The Contractor shall install, assemble, package, connect, etc., the security and gate operating systems to be a complete and operable system.

2. Comply with the applicable electrical specification sections.

PART 2--PRODUCTS

2.01 CHAIN-LINK FENCE FABRIC

A. GENERAL:

1. HEIGHT INDICATED ON DRAWINGS. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A392, CLFMI CLF 2445, and requirements indicated below:

a. STEEL WIRE FABRIC: Polymer-coated wire with a diameter of 0.148 inch.

1) MESH SIZE: 1-3/4 inches.

2) POLYMER COATING: ASTM D668, Class 2a or 2b over metallic-coated steel wire.

a) COLOR: Black, complying with ASTM F934.

b. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

2. SELVAGE:

a. SECURITY FENCE: Twisted top and knuckled bottom.

b. TRAIL FENCE: Knuckled top and bottom.

2.02 CHAIN-LINK FENCE FRAMING

A. POSTS AND RAILS:

1. Comply with ASTM F1043 for framing, ASTM F1083 for Group IC round pipe, and the following:

a. GROUP: IA, round steel pipe, Schedule 40.

b. FENCE HEIGHT:

1) SECURITY FENCE: 6 feet.

2) TRAIL FENCE: 4 feet and 6 feet.

c. STRENGTH REQUIREMENT: Heavy industrial according to ASTM F1043.

d. SECURITY FENCE POST DIAMETER AND THICKNESS: According to ASTM F1043.

1) BRACE AND TOP RAILS: 1 ¼ inches.

2) LINE POST: 2 inches.

3) END, CORNER, AND PULL POST: 2.5 inches.

e. COATING FOR STEEL FRAMING: Polymer coating over metallic coating.

1) COLOR: Black, complying with ASTM F1043.

2.03 TENSION WIRE

A. GENERAL:

1. Provide horizontal tension wire at the following locations:

a. LOCATION: Extended along top of barbed wire arms and top of fence fabric for supporting barbed tape.

b. LOCATION: As indicated.

B. METALLIC-COATED STEEL WIRE:

1. 0.177-inch- diameter, marcelled tension wire complying with ASTM A817, ASTM A824, and the following:

a. METALLIC COATING: Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:

1) Matching chain-link fabric coating weight.

2.04 SWING GATES

A. GENERAL:

1. Comply with ASTM F900 for single and double swing gate types. Automated gates shall also comply with ASTM F2200.

a. METAL PIPE AND TUBING: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings. Provide finish black-colored coatings as specified elsewhere herein on all components.

B. MANUFACTURER:

1. APPROVED MANUFACTURER: Automated Gates and Equipment Company, 10847 E. Marginal Way S, Seattle, WA 98168; or approved equal.

C. FRAMES AND BRACING:

1. Fabricate members from square, galvanized steel tubing with outside dimension and weight according to ASTM F900 and the following:

a. GATE HEIGHT: Match adjacent fence height.

b. LEAF WIDTH: As indicated.

c. FRAME MEMBERS:

1) TUBULAR STEEL: 2 inches square.

D. FRAME CORNER CONSTRUCTION:

1. Welded or assembled with corner fittings and 5/16-inch- diameter, adjustable truss rods for panels 5 feet wide or wider.

E. EXTENDED GATE POSTS AND FRAME MEMBERS:

1. Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches as indicated as required to attach barbed wire assemblies.

a. GATE POSTS: Steel pipe ASTM F1083 standard weight schedule 40; minimum yield strength of 25,000 psi

Gate leaf single width	Post size (round)	Weight
6 ft to 12 ft	4.00 in	9.11 lb/ft
12 ft to 19 ft	6.625 in	18.97 lb/ft

F. MANUAL GATE HARDWARE:

1. MANUAL GATE LATCHES: Forked type capable of retaining gate in closed position and have provision for padlock. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves. Latch shall permit operation from either side of gate.

2. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing at least 180 degrees inward or outward.

3. KEEPER: Provide for each gate leaf over 5 feet wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

4. DROP ROD: Provide to hold inactive leaf. Provide gate stop pipe to engage center drop rod.

5. BARBED WIRE TOP: Incorporate provisions for barbed extensions by extending vertical members 13 inches (380 mm) to accommodate three strands of barbed wire.

2.05 SLIDE GATES

A. GENERAL:

1. Comply with ASTM F1184 for single and double slide gate types. Automated gates shall also comply with ASTM F2200.

a. CLASSIFICATION: Type II Cantilever Slide, Class 2 with internal roller assemblies.

b. METAL PIPE AND TUBING: Aluminum.

B. MANUFACTURER:

1. APPROVED MANUFACTURER: Automated Gates and Equipment Company, 10847 E. Marginal Way S, Seattle, WA 98168; or approved equal.

C. GATE FRAMES:

1. Fabricate chain link cantilever slide gates in accordance with ASTM F1184, Type II, Class 2, using aluminum members conforming to ASTM B221, alloy and temper 6061-T6. Vertical members shall be 2-inch square aluminum, weighing 1.13 lb./ft., 2 inch x 4 inch aluminum bottom frame member weighing 1.73 lb./ft., and a one-piece aluminum track/frame member weighing a minimum of 4.621 lb./ft. The 2-inch square frame member of said track/frame shall have a wall thickness of not less than .250 inch on all four sides. Aluminum alloy used shall be 6061-T6 only. Internal uprights shall be 2-inch square aluminum spaced equally at no more than 6 feet on center subdividing the gate frame into panels. Weld all members together forming a rigid one-piece frame integral with top track. Provide two truck assemblies for each gate leaf, except as indicated for gates larger than 30 feet. Frame sizes over 27 feet in length shall be shipped in two parts and field spliced with special attachments provided by the manufacturer.

D. GATE FRAME FINISH:

1. Black, complying with ASTM F934.

E. CHAIN-LINK:

1. Finish to match Chain-Link Fence Fabric.

2. All Operated Chain-Link Cantilever slide gates will be filled across the entire length of the panel (including the back frame counterbalance) to satisfy UL325 and ASTM F2200 safe gate design guidelines.

3. Chain Link mesh size, and wire gauge to match that of Chain-Link Fence Fabric. Fabric shall be attached between each internal upright with hook bolts spaced no more than 15 inches on center as recommended by the manufacturer.

F. TRUSSING:

1. Each bay shall be cross-trussed by means of 1/4-inch cable with adjustable turnbuckles. Trusses will maintain the structural integrity of the gate while allowing for expansion and contraction of aluminum in varying weather conditions.

G. TOP TRACK/RAIL:

1. Enclosed combination one-piece track and rail, aluminum extrusion with weight of 4.62 lbs./ft. Top track/rail to be a single formed profile with integrated center stabilizing web without welding. All wall thicknesses to be 0.25 inch.

H. TRUCK ASSEMBLY:

1. Swivel type, zinc die coated steel, with 6 sealed lubricant ball bearing rollers, 2 inches in diameter by 9/16 inch in width, and two side-rolling wheels to ensure truck alignment in track. Mount trucks on post brackets using 7/8-inch diameter ball bolts with 5/8-inch shank. Truck assembly shall withstand same reaction load as track 2,000 #.

I. GATE HANGERS, BRACKETS, GUIDE ASSEMBLIES, RECEIVERS, AND LATCHES:

1. Malleable iron or steel, galvanized after fabrication. Operated cantilever gates are shipped without standard latching/locking hardware per ASTM F2200. If positive locking is required, a suitable electronic locking device should be employed.

J. BOTTOM GUIDE WHEEL ASSEMBLIES:

1. Each assembly shall consist of two, 3-inch diameter wheels, straddling bottom horizontal gate rail, allowing adjustment to maintain gate frame plumb and in proper alignment. Attach one assembly to each support post.

K. END PLUG:

1. After gate has been installed, both ends of the combination track/frame member shall be closed off with a shock absorbing plastic block that shall also serve as a stop bracket.

L. GATE POSTS:

1. Galvanized steel 4-inch OD schedule 40 pipe, ASTM F1083, weighing 9.1 lb./ft. Provide 1 latch post and 2 support posts for single slide gates and four support posts for double slide gates.

    a. FINISH: To match fence.

2.06 FENCE FITTINGS

A. GENERAL:

1. Comply with ASTM F626.

B. POST AND LINE CAPS:

1. Provide for each post. Line post caps with loop to receive tension wire or top rail.

C. RAIL AND BRACE ENDS:

1. Attach rails securely to each gate, corner, pull, and end post.

D. RAIL FITTINGS:

1. Provide the following:

a. TOP RAIL SLEEVES: Pressed-steel or round-steel tubing not less than 6 inches long.

b. RAIL CLAMPS: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. TENSION AND BRACE BANDS:

1. Pressed steel.

F. TENSION BARS:

1. Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. TRUSS ROD ASSEMBLIES:

1. Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. BARBED WIRE ARMS:

1. Pressed steel, with clips, slots, or other means for attaching strands of barbed wire, integral with post cap; for each post, unless otherwise indicated, and as follows:

a. Line posts with arms that accommodate top rail or tension wire.

b. Corner arms at fence corner posts, unless extended posts are indicated.

c. Type I, single slanted arm.

d. Type II, single vertical arm.

I. TIE WIRES, CLIPS, AND FASTENERS:

1. ACCORDING TO ASTM F626.

a. STANDARD ROUND WIRE TIES: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

1) HOT-DIP GALVANIZED STEEL: Diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

J. FINISH:

1. METALLIC COATING FOR PRESSED STEEL OR CAST IRON: Not less than 1.2 oz. /sq. ft. zinc.

2.07 BARBED WIRE

A. ZINC-COATED STEEL BARBED WIRE:

1. Comply with ASTM A121, Chain-Link Fence grade for the following two-strand barbed wire:

a. STANDARD SIZE AND CONSTRUCTION: 0.099-inch- diameter line wire with 0.080-inch- diameter, 2-point round barbs spaced not more than 4 inches o.c.

b. BARB SET: Manufacturer's standard.

2.08 AUTOMATIC GATE OPERATORS

A. GENERAL:

1. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Plant conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

a. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.

b. Provide operator with UL -approved components. Comply with UL-325.

c. Provide electronic components with built-in troubleshooting diagnostic feature.

d. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

e. Units shall be 120 volt.

f. Comply with NFPA 70.

B. SLIDE GATE OPERATOR:

1. APPROVED MANUFACTURER: Hysecurity; or approved equal.

2. PRODUCT: Hysecurity Slide Smart DC 15 Slide Gate operator with manual override and radio receiver for remote operation with up to 30 remotes.

C. SWING GATE OPERATOR:

1. APPROVED MANUFACTURER: Hysecurity; or approved equal.

2. PRODUCT: Hysecurity Swing Smart DC 20Swing Gate Operator with manual override and radio receiver with up to 30 remotes.

D. ACCESS CONTROL HARDWARE:

1. ENTRY/EXIT SYSTEM PEDESTALS:

a. Entry/Exit System Pedestals shall consist of a heavy-duty 2-inch steel pad-mount gooseneck and 304 NEMA 4X stainless steel enclosure. Gooseneck shall be black powder coated and suitable for outdoor exposure. Stainless steel enclosure shall be sufficiently sized for mounting the key card reader, pin pad, and intercom onto the gooseneck. Refer to the Automated Gate Schedule on the Drawings for features to be included at each automated gate.

b. KEY CARD READERS: In accordance with Section 28 13 19. Suitable for outdoor installation.

c. KEY (PIN) PADS: Integral with the Key Card Reader in accordance with Section 28 13 19, and suitable for outdoor installation.

d. INTERCOM: In accordance with Section 28 13 19 and suitable for outdoor installation.

2. CONTROL PANELS: Automated entry/exit system panel to interface with and control automated gate equipment operation. In accordance with Section 28 13 19.

E. OVERRIDE KEY SWITCH (FIRE DEPARTMENT ACCESS SWITCH):

1. Provide switches for all automated gates, both incoming and outgoing traffic directions.

2. APPROVED MANUFACTURER: Knox Company, 1601 W. Deer Valley Road, Phoenix, AZ, 85027; or equal. Product must be approved by the Fire Marshal.

3. PRODUCT: Single Switch Model 3502.

4. Install Fire Marshal-approved access lock for key switch.

F. VEHICLE DETECTOR LOOPS:

1. Provide Entry Controls/Free Entry Loops, Vehicle Presence Loops, Free Exit Loops as indicated on the Automated Gate Schedule.

2. PRODUCT: DSP-40 Vehicle Detector; or equal.

3. Provide loops consisting of multiple strands of wire. The number of turns, loop size, and method of placement at location shall be, as recommended in writing by detection system manufacturer for the function indicated.

a. LOOP: Wire, in size recommended for field assembly, for pave-over installation.

G. STROBE DETECTOR SWITCH:

1. Provide strobe switch/detector for automated gates as specified on the Drawings, both incoming and outgoing traffic directions.

2. APPROVED MANUFACTURER: Opticon; or approved equal. Product must be approved by the Fire Marshal.

H. EMERGENCY RELEASE MECHANISM:

1. Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control circuit power is disconnected during manual operation.

a. TYPE: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

b. TYPE: Mechanical device, key, or crank-activated release.

I. ACCESSORIES:

1. BATTERY BACKUP SYSTEM: Battery-powered drive and access control system. These features may be integrated with the electric gate operator.

a. FAIL SECURE: Gate cycles on battery power, then fails unlocked and remains unlocked when battery is discharged and power is not available.

2. MAGNETIC GATE LOCKS: Locking device for swing gate security. Manufacturer - Elite MG1300; or equal.

3. Provide Fire Marshal approved Knox Box fire department key access box for all manual vehicle and personnel gates.

4. INSTRUCTIONAL, SAFETY, AND WARNING LABELS AND SIGNS: According to UL 325 or Manufacturer's standard for components and features specified.

5. ELECTRIC DOOR STRIKES FOR PERSONNEL GATES: In accordance with Section 28 13 19. Equipment provided must be suitable for outdoor installation.

2.09 CAST-IN-PLACE CONCRETE

A. Class 3000 concrete in accordance with WSDOT Standard Specification Section 6-02.

2.10 GROUT AND ANCHORING CEMENT

A. NONSHRINK, NONMETALLIC GROUT:

1. Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. EROSION-RESISTANT ANCHORING CEMENT:

1. Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Plant to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.11 FENCE GROUNDING

A. CONDUCTORS:

1. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

a. MATERIAL ABOVE FINISHED GRADE: Copper.

b. MATERIAL ON OR BELOW FINISHED GRADE: Copper.

c. BONDING JUMPERS: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. CONNECTORS AND GROUNDING RODS:

1. Comply with UL 467.

a. CONNECTORS FOR BELOW-GRADE USE: Exothermic welded type.

b. GROUNDING RODS: Copper-clad steel.

1) SIZE: 5/8 by 96 inches.

2) QUANTITY: Two (2) spaced a minimum of 120 inches apart.

3) INSPECTION WELL: Provide 10-3/8-inch I.D. x 12-inch high traffic rated reinforced concrete ground inspection well with cast iron lid and ring seat in accessible location (National Lightning Protection Corporation #TR1 or approved equal).

2.12 POLYMER FINISHES

A. SUPPLEMENTAL COLOR COATING:

1. In addition to specified metallic coatings for steel, provide all fence and gate components with polymer coating.

B. METALLIC-COATED STEEL TENSION WIRE:

1. PVC-coated wire complying with ASTM F1664, Class 2a or 2b.

C. METALLIC-COATED STEEL BARBED WIRE:

1. PVC-coated wire complying with ASTM F1665, Class 2a or 2b.

D. METALLIC-COATED STEEL FRAMING AND FITTINGS:

1. Comply with ASTM F626 and ASTM F1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.

a. POLYMER COATING: Not less than 10-mil- thick PVC or 3-mil- thick polyester finish.

E. COLOR:

1. Black, complying with ASTM F934.

PART 3--EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by the Owner.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

3.04 CHAIN-LINK FENCE INSTALLATION

A. POST EXCAVATION:

1. Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. POST SETTING:

1. Set posts in concrete at indicated spacing into firm, undisturbed soil.

a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

b. CONCRETE FILL: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

1) EXPOSED CONCRETE: Extend 2 inches above grade; shape and smooth to shed water.

2) CONCEALED CONCRETE: Top 2 inches below grade to allow covering with surface material.

3) POSTS SET INTO CONCRETE IN SLEEVES: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

4) POSTS SET INTO VOIDS IN CONCRETE: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, non-metallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. TERMINAL (END) POSTS:

1. Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. LINE POSTS:

1. Space line posts uniformly at 10 feet maximum on center.

E. POST BRACING AND INTERMEDIATE RAILS:

1. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.

    a. Locate horizontal braces at mid-height of fabric 6 feet or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. TOP RAIL:

1. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. CHAIN-LINK FABRIC:

1. Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

H. TENSION OR STRETCHER BARS:

1. Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center.

I. TIE WIRES:

1. Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

    a. MAXIMUM SPACING: Tie fabric to line posts at 12 inches on center and to braces at 24 inches on center.

J. FASTENERS:

1. Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

K. BARBED WIRE:

1. Install barbed wire uniformly spaced. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

2. Extension arms shall angle toward the site exterior side of fence.

3.05 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 GATE OPERATOR INSTALLATION

A. GENERAL:

1. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. EXCAVATION FOR SUPPORT POSTS, PEDESTALS, OR CONCRETE BASES/PADS:

1. Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

C. CONCRETE BASES/PADS:

1. Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.

D. VEHICLE LOOP DETECTOR SYSTEM:

1. Locate, bury, and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. GROUNDING:

1. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.07 GROUNDING AND BONDING

A. FENCE GROUNDING:

1. Install at maximum intervals of 1,500 feet except as follows:

a. FENCES WITHIN 100 FEET OF BUILDINGS, STRUCTURES, WALKWAYS, AND ROADWAYS: Ground at maximum intervals of 750 feet.

1) GATES AND OTHER FENCE OPENINGS: Ground fence on each side of opening.

a) Bond metal gates to gate posts.

b) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. PROTECTION AT CROSSINGS OF OVERHEAD ELECTRICAL POWER LINES:

1. Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. FENCES ENCLOSING ELECTRICAL POWER DISTRIBUTION EQUIPMENT:

1. Ground as required by IEEE C2, unless otherwise indicated.

D. GROUNDING METHOD:

1. At each grounding location, drive the specified ground rod vertically until the top is 6 inches is below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

a. EACH BARBED WIRE STRAND: Make grounding connections to barbed wire with wire-to-wire connectors designed for this purpose.

b. EACH BARBED TAPE COIL: Make grounding connections to barbed tape with connectors designed for this purpose.

E. BONDING METHOD FOR GATES:

1. Connect bonding jumper between gate post and gate frame.

F. CONNECTIONS:

1. Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

b. Make connections with clean, bare metal at points of contact.

c. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. BONDING TO LIGHTNING PROTECTION SYSTEM:

1. If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.08 FIELD ADJUSTMENTS

A. GATE:

1. Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. AUTOMATIC GATE OPERATOR:

1. Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

a. OPERATIONAL TEST: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

b. TEST AND ADJUST CONTROLS. Equipment to be tested includes strobe switches/detectors, fire department key switch, gate operators, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operator, and other moving parts.

3.09 TRAINING SERVICES

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION

SECTION 32 32 20

MECHANICALLY STABILIZED EARTH RETAINING WALL (MSE WALL)

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: Section includes design and furnishing materials and placing mechanically stabilized earth (MSE) walls constructed in accordance with the Drawings and these Specifications. Contractor may select between block facing system (paragraph 2.02) or precast panel facing system (paragraph 2.03).

B. MSE WALL COMPONENTS INCLUDE:

1. Concrete leveling pad

2. Precast concrete face panels or precast concrete facing blocks

3. Soil reinforcement elements mechanically connected to each facing panel

4. Wall penetrations

5. Corrosion inspection elements

6. Guardrails.

1.02 QUALITY ASSURANCE

A. GENERAL: The MSE retaining wall system shall be designed in accordance with the following:

1. FHWA-NHI-00-043 Mechanically Stabilized Earth Walls Reinforced Soil Slopes Design & Construction Guidelines.

2. American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridge Seventeenth Edition, 2002.

B. REFERENCE STANDARDS:

Reference	Title
ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A123	Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

Reference	Title
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A1011	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM C140	C140 Sampling and Testing Concrete Masonry Units
ASTM C1372	Standard Specifications for Segmental Retaining Wall Units
ASTM D1505	Standard Test Method for Density of Plastics by the Density Gradient Technique
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
ASTM D4475	Standard Test Method for Apparent Horizontal Shear Strength of Pultruded Reinforced Plastic Rods By the Short-Beam Method
ASTM D4476	Standard Test Method for Flexural Properties of Fiber Reinforced Pultruded Plastic Rods
ASTM D4595	Standard Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method
ASTM D5262	Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics
ASTM D5818	Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics
ASTM D6637	Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi Rib Tensile Method
ASTM D6638	Standard Test Method for Determining Connection Strength between Geosynthetic Reinforcement and Segmental Concrete Units
ASTM D6706	Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil
ASTM D6916	Standard Test Method for Determining the Shear Strength between Segmental Concrete Units

C. FIELD QUALITY CONTROL

1. SOURCE QUALITY CONTROL: Test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent testing laboratory.

2. FIELD QUALITY MANAGEMENT FOR BACKFILL:

a. See Section 31 23 00.

3. PRECAST CONCRETE FACING PANEL TOLERANCES: All units shall be manufactured within the following tolerances with Contractor responsible for Quality Control:

   a. PANEL DIMENSIONS: Position panel connection devices within 1-inch, and all other dimensions within 3/16-inch.

   b. PANEL SQUARENESS: Squareness as determined by the difference between the two diagonals shall not exceed ½-inch.

   c. PANEL SURFACE FINISH: Surface defects on textured surface finish measured over a length of 5 feet shall not exceed shall not exceed 5/16-inch.

   d. WALL PLUMBNESS: Vertical and horizontal tolerance of ¾-inch when measured with 10 feet straight edge. Final overall vertical plumbness (batter) of less than ½-inch per 10 feet of wall height.

4. COMPRESSIVE STRENGTH: Acceptance of precast concrete facing panels with respect to compressive strength will be determined on the basis of production lots. A production lot is defined as a group of panels that will be represented by a single compressive strength sample and will consist of either 1,000 feet^2 of panel area or a single day's production, whichever is less. During the production of the concrete panels, the manufacturer will randomly sample the concrete in accordance with AASHTO T-141. A single compressive strength sample, consisting of a minimum of four cylinders, will be randomly selected for every production lot. The following shall be tested with Contractor responsible for Quality Control:

   a. COMPRESSION TESTS: AASHTO T-22 on samples prepared in accordance with AASHTO T-23 at 7 days and 28 days (minimum of two samples each).

   b. SLUMP TESTS: AASHTO T-119 determined at the beginning of each day's production, and at the same time, the compressive strength samples are taken.

   c. AIR CONTENT TESTS: AASHTO T-152 or AASHTO T-196 on samples taken at the beginning of each day's production and at the same time as compressive samples are taken.

5. REJECTION OF PRECAST CONCRETE FACING PANELS:

   a. Not meeting the specified minimum strength.

   b. Defects that indicate imperfect molding.

   c. Defects indicating honeycombing or open texture concrete.

   d. Cracked or severely chipped panels.

e. Color variation on front face of panel due to excess form oil or other reasons.

f. Not matching the Quality Control Sample.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. SHOP DRAWINGS:

a. Typical wall sections

b. Panel details

c. Coping detail

d. Guardrail detail

e. Traffic barrier detail

f. Panel joint details

g. Wall penetration details specific for this project

h. Soil reinforcement and connection details

i. Corrosion inspection elements

j. Samples of concrete finish of facing panels:

1) Provide two samples of two distinct panel types, which may be partial panels designated for use.

2) Mark both samples as “Quality Control Sample.”

k. Layout drawings, including plans and wall profiles showing, but not limited to, the following:

1) Finished grade in front of and behind walls.

2) Locations and dimensions of soil reinforcing, noting conformance with plan limitations of soil reinforcing on drawings

3) Location of geotextile filter fabric and impermeable membranes.

4) Location of leveling pads and details for changes in elevations.

5) Location of inspection elements.

l. Provide any additional details necessary to complete construction of the wall system, including the wall system's interface with the adjacent freestanding cast-in-place concrete wall at the south portal utilidor entrance.

2. Documented field construction manual describing in detail, with illustrations as necessary, the step-by-step construction sequence and the Contractor's quality control plan.

3. Precast Concrete Facing Panels or blocks Certificate of Compliance certifying that the materials conform to these Specifications.

4. Certified Mill Test results of metallic grid or geotextile reinforcing material and indicate the material specification, galvanizing specification, and thickness of galvanizing as appropriate.

5. Certificate of Compliance certifying MSE wall components meet contract specifications along with test results to assure contract compliance.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. Internal stability analysis and calculations in conformance with the AASHTO Standard Specifications and the FHWA-NHI-00-043 substantiating that the proposed design satisfies the design parameters in the contract drawings and as noted below, signed by a registered Civil Engineer in the State of Washington.

1.04 DESIGN REQUIREMENTS

A. MSE Wall shall be designed with the following criteria:

1. Reinforced Soil Unit Weight = 130 pcf

2. Reinforced Soil Angle of Internal Friction = 36°

3. Reinforced Soil Cohesion = 0 psf

4. Engineered / Retained Fill Unit Weight = 125 pcf

5. Engineered / Retained Fill Angle of Internal Friction = 32°

6. Engineered / Retained Fill Cohesion = 0 psf

7. Engineered / Retained Fill Allowable Bearing Pressure:

a. 3,000 psf

8. Seismic Loading meeting parameters shown on the Drawings.

9. Uniform surcharge load = 250 psf for both walls.

10. HS20 Load per AASHTO: Load to be 36 inches away from back face of the upper wall panels.

11. Traffic Barrier Load = Concentrated horizontal load of 10,000 pounds distributed over a barrier length of 60 inches applied perpendicular to top of traffic barrier for the upper MSE Wall.

12. Soil reinforcement shall not impinge upon neighboring storm drain, as shown on plan. Soil reinforcement shall not be placed in the top 2 feet of soil.

1.05 HANDLING, SHIPPING AND STORAGE

A. Handle, ship, and store all facing panel units in such a manner as to minimize the danger of chipping, cracks, fractures, and excessive bending stresses. Ship and store in stacks, front face down. Provide blocking or dunnage as required and of sufficient thickness to prevent the attachment devices from contacting the panel above.

PART 2--PRODUCTS

2.01 MECHANICALLY STABALIZED EARTH WALL SYSTEMS

A. Wall Systems shall use either facing blocks per Paragraph 2.02 or 2.03. Systems shall be complete and from one manufacturer or supplier. The system selected shall include a pedestrian guardrail meeting the requirements of Section 05 52 00 and shall accommodate the loading from the adjacent traffic barrier as shown in the Standard Details.

2.02 PRECAST CONCRETE FACING BLOCKS

A. Modular concrete units shall conform to the following architectural requirements:

1. Face color - concrete gray, unless otherwise specified. The Owner may specify standard manufacturers' color.

2. Face finish - sculptured rock face in angular tri-planer configuration. Other face finishes will not be allowed without written approval of Owner.

3. Bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.

4. Exposed surfaces of units shall be free of chips, cracks, or other imperfections when viewed from a distance of 10 feet under diffused lighting.

B. Modular concrete materials shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.

C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with ASTM C140 Sampling and Testing Concrete Masonry Units:

1. COMPRESSIVE STRENGTH: ≥ 3,000 psi;

2. ABSORPTION: 6 % for standard weight aggregates;

3. DIMENSIONAL TOLERANCES: ±1/8" from nominal unit dimensions not including rough split face, ±1/16" unit height - top and bottom planes;

4. UNIT SIZE: 8" (H) x 18" (W) x 18" (D) minimum;

5. UNIT WEIGHT: 100 lbs/unit minimum for standard weight aggregates.

D. Modular concrete units shall conform to the following performance testing:

1. Inter-unit shear strength in accordance with ASTM D6916 (NCMA SRWU-2): 1,500 plf minimum at 2 psi normal pressure;

2. Geogrid/unit peak connection strength in accordance with ASTM D6638 (NCMA SRWU-1): 900 plf minimum at 2-psi normal force.

E. Modular concrete units shall conform to the following constructability requirements:

1. VERTICAL SETBACK: 1/8 inch± per course (near vertical) or overall 1 inch + per course per the design

2. ALIGNMENT AND GRID POSITIONING MECHANISM: Fiberglass pins, two per unit minimum

3. Maximum horizontal gap between erected units shall be ≤ 1/2 inch.

F. Shear connectors shall be 1/2-inch diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units with the following requirements:

1. Flexural Strength in accordance with ASTM D4476: 128,000 psi minimum;

2. Short Beam Shear in accordance with ASTM D4475: 6,400 psi minimum.

G. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.03 PRECAST CONCRETE FACING PANELS

A. Minimum average compressive strength of 5,000 psi at 28 days. Concrete with lower compressive strength may be submitted for review with calculations signed and sealed by an Engineer licensed in the State of Washington.

B. Facing panel finish shall be Ashlar Stone by SSL, Ashlar Stone by Reinforced Earth Co., or approved equal.

C. Provide weep holes in precast concrete facing panels at a maximum spacing of 10 feet on center, 1'-0" above the lower grade elevation, and as further required by the engineered design in the shop drawings.

2.04 SOIL REINFORCING AND ATTCHMENT DEVICES FOR PANEL SYSTEMS

A. Provide one of the following soil reinforcing and attachment devices:

1. REINFORCING STRIPS: Hot rolled from bars to the required shape and dimensions with physical properties in accordance with ASTM A36 or ASTM A572 Grade 65 (AASHTO M-223).

2. REINFORCING MESH: Shop-fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A82 (AASHTO M-32) and welded into the finished mesh fabric in accordance with ASTM A185 (AASHTO M-55).

B. TIE STRIPS: Shop-fabricated hot rolled steel conforming to the minimum requirements of ASTM A1011, Grade 50.

C. GALVANIZATION: ASTM A123 (AASHTO M-111).

D. DESIGN LIFE: 100 years.

E. FASTENERS: Hexagonal cap screw bolts and nuts, which are galvanized and conform to the requirements of ASTM A325 (AASHTO M-164).

2.05 GEOGRID SOIL REINFORCEMENT FOR BLOCK SYSTEMS

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high-density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.

B. T_a, Long Term Allowable Tensile Design Load, of the geogrid material shall be determined as follows:

$T_a = T_{ult} / (RF_{cr} * RF_d * RF_{id} * FS)$

T_a shall be evaluated based on a 75-year design life.

1. T_{ult}, Short Term Ultimate Tensile Strength shall be determined in accordance with ASTM D4595 or ASTM D6637.

a. Tult is based on the minimum average roll values (MARV).

2. RF_{cr}, Reduction Factor for Long Term Tension Creep

a. RF_{cr} shall be determined from 10,000-hour creep testing performed in accordance with ASTM D5262. RF_{cr} = 1.45 minimum.

3. RF_d, Reduction Factor for Durability

a. RF_d shall be determined from polymer specific durability testing covering the range of expected soil environments. RF_d = 1.10 minimum.

4. RF_{id}, Reduction Factor for Installation Damage

a. RF_{id} shall be determined from product specific construction damage testing performed in accordance with ASTM D5818 (GRI-GG4). Test results shall be provided for each product to be used with project specific or more severe soil type. RF_{id} = 1.05 minimum.

5. FS, Overall Design Factor of Safety

a. FS shall be 1.5 unless otherwise noted for the maximum allowable working stress calculation.

C. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with ASTM D6638 Connection Strength between Geosynthetic Reinforcement and Segmental Concrete Units (NCMA SRWU-1).

D. SOIL INTERACTION COEFFICIENT, Ci

1. Values shall be determined per ASTM D6706 (GRI:GG5) at a maximum 0.75-inch displacement.

E. MANUFACTURING QUALITY CONTROL:

1. The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.

2. THE QC TESTING SHALL INCLUDE:

a. Tensile Strength Testing

b. Melt Flow Index (HDPE)

c. Molecular Weight (Polyester).

2.06 PRECAST CONCRETE FACING PANEL JOINTS

A. BEARING PADS: Provide in horizontal joints, preformed EPDM rubber pads conforming to ASTM D2000 for 4AA, 812 rubbers, neoprene elastomeric pads having a Durometer Hardness of 55±5, or high density polyethylene pads with a minimum density of 0.946 g/cm3 in accordance with ASTM D1505.

B. GEOTEXTILE FILTER FABRIC: In accordance with Section 31 23 00. Adhere to backside of facing panels at all joints. Extend a minimum of 6 inches on both sides of joint. Lap shall not be less than 6 inches.

2.07 GRANULAR BACKFILL MATERIAL

A. Provide Retained MSE Wall Fill per Section 31 23 00.

2.08 CONCRETE LEVELING PAD

A. As required by shop drawings, Type A Concrete in accordance with Section 03 30 00.

PART 3--EXECUTION

3.01 MSE WALLS

A. CONCRETE LEVELING PAD:

1. Provide concrete leveling pads as shown on the Shop Drawings.

2. Allow minimum curing in accordance with the requirements of Section 03 30 00 before commencing placement of precast concrete facing panels.

B. WALL ERECTION:

1. Place precast concrete panels so that their final position is vertical with no batter.

2. Place soil reinforcing normal to the face of the wall, unless otherwise shown.

C. PLACEMENT OF SOIL REINFORCING AND ATTACHMENT DEVICES:

1. Place in such manner to avoid damage or disturbance of the wall materials or misalignment of the facing panels or reinforcing element. Any wall materials that become damaged during backfill placement shall be removed and replaced at the Contractor's expense. Any misalignment or distortion of the wall facing panels due to placement of backfill outside the limits of this Specification shall be corrected at the Contractor's expense.

2. Prior to placement of the soil reinforcing, place backfill and compact it level to the height of the connection.

D. COMPACTION:

1. Compact in accordance with Section 31 23 00. Compaction density shall be consistent with Contractor's Design but shall be no less that 95% of maximum dry density.

E. Provide a representative of the MSE Wall manufacturer on site for training and technical assistance at:

1. The start of erection and available for two consecutive 8-hour days.

2. Near the completion of the MSE walls and available for one 8-hour day.

END OF SECTION

DIVISION 33 UTILITIES		Responsible Engineer
33 05 01.06	Ductile Iron Pipe	Z. Moore
33 05 01.07	High-Density Polyethylene Pipe	Z. Moore
33 05 26	Buried Utility Identification	E. deMontigny
33 05 26.14	Exposed Pipe Identification	Z. Moore
33 08 10	Commissioning of Water Utilities	E. deMontigny
33 08 30	Commissioning of Sanitary Sewerage Utilities	E. deMontigny
33 08 40	Commissioning of Storm Drainage Utilities	J. Paulson
33 11 00	Water Utility Distribution Piping	E. deMontigny
33 12 00	Water Utility Distribution Equipment	E. deMontigny
33 13 00	Disinfecting of Potable Water Utility Distribution	E. deMontigny
33 32 16	Packaged Sewage Grinder Pump Station	E. deMontigny
33 39 00	Sanitary Sewerage Utility Structures	E. deMontigny
33 41 00	Storm Drainage Piping	J. Paulson
33 49 00	Storm Drainage Structures	J. Paulson

SECTION 33 05 01.06

DUCTILE IRON PIPE

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE: This section specifies ductile iron pipe, fittings, end connections, and gaskets.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
ANSI B16.5	Pipe Flanges and Flanged Fittings
ASTM A449	Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, General Use, 120/105/90 psi Minimum Tensile Strength
ASTM A716	Ductile-Iron Culvert Pipe
ASTM C150	Portland Cement
AWWA C104 (ANSI A21.4)	Cement-Mortar Lining for Ductile- Iron and Gray-Iron Pipe
AWWA C105 (ANSI A21.5)	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110 (ANSI A21.10)	Ductile-Iron and Gray-Iron Fittings
AWWA C111 (ANSI A21.11)	Rubber-Gasket Joints for Ductile- Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115 (ANSI A21.15)	Flanged Ductile-Iron and Gray-Iron Pipe With Threaded Flanges
AWWA C150 (ANSI A21.50)	Thickness Design of Ductile-Iron Pipe

Reference	Title
AWWA C151 (ANSI A21.51)	Ductile-Iron Pipe, Centrifugally Cast
AWWA C153 (ANSI A21.53)	Ductile-Iron Compact Fittings
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	Grooved and Shouldered Type Joints

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS:

1. Manufacturer's product data, catalog cuts, dimensions and materials.

2. Indicate on the submittal each piping system where the product will be used.

3. Certifications indicated in the following documents:

a. ASTM A716, sworn statement of inspection and certification

b. AWWA C110, certification of inspection and testing

c. AWWA C111, record of specified tests

d. AWWA C115, affidavit of compliance

e. AWWA C151, manufacturer's statement and affidavit of compliance

f. AWWA C153, affidavit of compliance

g. AWWA C606, affidavit of compliance

PART 2--PRODUCTS

2.01 GENERAL

A. Ductile iron pipe design, materials, and manufacture shall comply with the following table:

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	AWWA C151
Gravity service pipe	ASTM A716

Item	Document
Joints	
Rubber gasket	AWWA C111
Threaded flange	AWWA C115
Grooved	AWWA C606
Fittings	AWWA C110/AWWA C153
Cement mortar lining	AWWA C104
Polyethylene encasement	AWWA C105

2.02 PIPE

A. Unless otherwise specified in Section 40 27 00, ductile iron pipe shall be Pressure Class 350 and have nominal laying lengths of 18 or 20 feet.

B. Pipe wall thickness for grooved-end pipe shall comply with AWWA C606.

C. Pipe wall thickness for glass lined pipe shall not be less than Thickness Class 53 for pipe diameters of 6 inches or greater. Four-inch glass lined pipe shall be Thickness Class 56. Bored or machined pipe shall be of a suitable wall thickness to ensure boring or machining will not impair minimum wall thickness required for Thickness Class 53.

2.03 FITTINGS

A. Unless otherwise specified on the Drawings, fittings shall conform to AWWA C110 or C153. Fitting ends shall be restrained joints unless otherwise specified in Section 40 27 00. Fitting end joint type shall match pipe end joint type. Long-radius elbows ($r \geq 2.5 \times D$) shall be provided where specified on the Drawings or in Section 40 27 00.

B. Grooved end fittings shall be furnished by the same manufacturer to assure uniformity and compatibility of piping components.

2.04 JOINTS

A. UNRESTRAINED JOINTS:

1. PUSH-ON JOINTS: Unrestrained joints shall be the rubber ring compression, push-on type joint suitable for buried service and shall conform to ANSI/AWWA A21.11/C111. This joint is not permitted on fittings or specials, unless otherwise specified in Section 40 27 00. Unless otherwise specified in the Section 40 27 00, push-on joints shall have an allowable deflection up to 5 degrees at specified pressures for pipe 30-inch diameter and less. Joint assembly and field cut joints shall be made in strict conformance with AWWA C600 and manufacturer's recommendations. Gaskets shall be as specified in ANSI/AWWA A21.11/C111. Candidate manufacturers and products include:

a. American Cast Iron Pipe Company Fastite

b. U.S. Pipe Tyton Joint

c. Approved Equal

2. MECHANICAL JOINTS: Where specified, mechanical joints for above or below ground service shall meet the requirements of ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.11/C111. Gaskets and bolts and nuts shall be as specified in ANSI/AWWA A21.11/C111.

B. RESTRAINED JOINTS:

1. GENERAL: Unless otherwise specified in Section 40 27 00, restrained joints are required for all exposed and buried piping. Unless otherwise specified, restrained joints shall be flanged or grooved end for exposed service and restrained push-on for buried service. Restrained Joints shall be restrained by the interference of metallic rings, bolts, locking segments or other interlocking components with flanges, lugs, beads, grooves or retainer rings that are integrally cast into or welded onto both ends of the joint. Restrained joints with retainer/follower glands and gripping wedges, or gripping gaskets, radial pads, or other devices that penetrate, grip, or embed in the pipe material to resist axial thrust loads are specifically prohibited.

2. RESTRAINED PUSH-ON JOINTS: Restrained push-on joints shall comply with ANSI/AWWA A21.11/C111 and shall be capable of being deflected after full assembly. Joint assembly shall be in strict conformance with AWWA C600 and manufacturer's recommendations. Unless otherwise specified in Section 40 27 00, push-on joints shall have an allowable deflection up to 5 degrees at specified pressures for pipe 12 inch diameter and less. No field cuts of restrained pipe are permitted without prior approval of the Owner. Gaskets shall be as specified in ANSI/AWWA A21.11/C111. Candidate manufacturers and products include:

a. American Cast Iron Pipe Company, Flex-Ring or Lok-Ring

b. U.S. Pipe, TR Flex or HP LOK

c. Approved Equal

3. FLANGE ASSEMBLIES:

a. Unless otherwise specified on the Drawings or in Section 40 27 00, flanges shall be ductile iron and shall be threaded-on flanges conforming to ANSI/AWWA A21.15/C115 or cast-on flanges conforming to ANSI/AWWA A21.10/C110.

b. Flanges shall be adequate for 250 psi working pressure. Bolt circle and bolt holes shall match those of ANSI B16.1, Class 125 flanges and ANSI B16.5, Class 150 flanges.

c. Flange faces shall either be flat flanges or convoluted ring flanges.

1) Flat face flanges: Where companion flanges are used, the flanges on pipe shall be refaced to be flush with the companion flange face. Plain faced flanges shall not be bolted to raised ace flanges.

2) Convoluted Ring Flanges: Convoluted ring flanges shall be ductile iron, designed to bear on hubs welded to the pipe and shall be as manufactured by Improved Piping Products. The Owner knows of no equal. The flange joints shall be rated for not less than 150 percent of the test pressures listed in Section 40 27 00 and shall conform to the requirements of ANSI B 16.5 and AWWA C207. The flange manufacturer shall be prepared to demonstrate, by certified pressure test that the flanges will meet these requirements.

d. Gasket material shall be as specified in 40 27 00.

e. Gaskets for plain faced flanges shall be the full face gaskets. Thickness shall be 1/16 inch for pipe 10 inches and less in diameter and 1/8 inch for pipe 12 inches and larger in diameter.

f. Gaskets for raised face flanges shall match the raised face and shall be 1/16 inch thick for pipe 3-1/2 inches and less in diameter and 1/8 inch thick for pipe 4 inches and larger.

g. Flange assembly bolts shall be ANSI B18.2.1 standard square or hexagon head bolts with ANSI B18.2.2 standard hexagon nuts. Threads shall be ANSI Bl.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5.

h. Except where high strength bolts are specified in Section 40 27 00, flange bolts for exposed flanges shall be carbon steel machined bolts with hot pressed hexagon nuts, ASTM A307, Grade B8. Where high strength bolts are specified in Section 40 27 00, flange bolts for exposed flanges shall be carbon steel hex cap screws, ASTM A449, Type1 or Type 3.

i. Flange bolts for buried flanges shall be made of noncorrosive high-strength, low-alloy steel, ASTM A 449, Type 3, Class C or Class D, having the metallurgy specified in ANSI/AWWA C111/A21, regardless of any other protective coating.

j. Where washers are required, they shall be of the same material as the associated bolts.

4. RESTRAINED MECHANICAL JOINTS: Where specified, restrained mechanical joints shall be fully restrained. Fully restrained mechanical joints for above or below ground service shall meet the requirements of ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.11/C111. Gaskets and bolts and nuts shall be as specified in ANSI/AWWA A21.11/C111. Where washers are required, they shall be of the same material as the associated bolts. Candidate manufacturers and products include:

   a. American Cast Iron Pipe Company, Mechanical Joint Coupled Joint

   b. U.S. Pipe, MJ HARNESS-LOK

   c. Approved Equal

5. GROOVED END COUPLINGS: Couplings and wall thickness for grooved end ductile iron pipe shall conform to AWWA C606. Unless otherwise specified in Section 40 27 00, grooved end couplings for ductile iron pipe shall be rigid joint for exposed service and flexible joint for buried service. Grooved End Couplings and gaskets on ductile iron pipe shall conform to AWWA C606. Bolts, and nuts for grooved end couplings shall conform to ASTM A183 or ASTM A449 as specified in AWWA C606.

6. GROOVED END FLANGE COUPLING ADAPTERS: Grooved end flanged coupling adapters candidate manufacturers are listed below:

   a. Victaulic Style 341

   b. Approved Equal

7. GROOVED END TRANSITION COUPLINGS: Grooved end transition couplings to steel pipe candidate manufacturers are listed below:

   a. Victaulic Style 307

   b. Approved Equal

C. BALL AND SOCKET FLEXIBLE JOINT PIPE: Ball and socket flexible joint pipe shall be the boltless type and shall allow a maximum joint deflection of 15 degrees. Each joint shall be provided with a retainer lock to prevent rotation after assembly. Candidate manufacturers include:

   a. American Cast Iron Pipe Company Flex-Lok Joint

   b. U.S. Pipe USIflex

   c. Approved Equal

2.05 PIPE COATING

A. Unless otherwise specified in Section 40 27 00, exposed pipe and fittings shall be furnished with a factory applied red oxide primer. Buried and encased pipe and fittings shall be coated with asphaltic material as specified in AWWA C151 and C110 unless otherwise specified in Section 40 27 00.

2.06 PIPE LINING

A. CEMENT MORTAR LINING: Interior surfaces of pipe and fittings shall be cement mortar lined in accordance with AWWA C104 unless alternate pipe lining requirements are specified on the Drawings or indicated in Section 40 27 00. Cement shall be ASTM C150, Type II or V, low alkali, containing less than 0.60 percent alkalis.

B. GLASS LINING:

1. Where specified in Section 40 27 00, provide glass lined pipe and fittings with a dual layer coating system of vitreous material to a minimum thickness of 10 mils. Glass lining shall provide continuous coverage as tested by a low voltage holiday detector with only isolated voids permitted due to casting anomalies. Voids, other than isolated pinholes, shall be cause for rejection.

2. Glass lined ductile iron pipe shall be bored, machined, or grit blasted to remove any voids, protrusions or surface irregularities to obtain a smooth continuous surface for glass lining. Pipe wall thickness for glass lined pipe shall be as specified in this Section. Fittings shall be ground or grit blasted to remove any voids, protrusions or surface irregularities.

3. Install end fitting grooves before applying glass lining.

4. Field cuts or field installation of grooved ends are not permitted.

5. Candidate manufacturers and products for glass lining are listed below:

a. Ferrock MEH-32

b. Vitco SG-14

c. Approved Equal.

2.07 POLYETHYLENE ENCASEMENT TUBING

A. MATERIALS: Where specified on the Drawings or in Section 40 27 00, ductile iron pipe and fittings shall be encased in polyethylene tubing. Polyethylene tubing shall be Anti-microbial, LDPE or HDPE as indicated in Section 40 27 00.

B. CERTIFICATION: Provide certification from an independent laboratory that polyethylene encasement meets the physical properties as listed in AWWA C105.

C. ANTI-MICROBIAL, LOW DENSITY POLYETHYLENE: 8-mil linear low density polyethylene film meeting the requirements of AWWA C105, impregnated with ½ percent NM-100 anti-microbial compound. Fulton Enterprises Biofilm, or Approved Equal.

D. HIGH DENSITY POLYETHYLENE: 4-mil high-density, cross-laminated polyethylene film meeting the requirements of AWWA C105.

PART 3--EXECUTION

3.01 INSTALLATION

A. GENERAL:

1. Follow piping routes specified on the drawings as closely as possible. Submit proposed deviations in accordance with Section 01 33 00.

2. Install pipe in accordance with AWWA C600.

3. Make connections to existing structures and manholes so that the finished work will conform as nearly as practicable to the requirements specified for the new manholes, including necessary concrete work, cutting and shaping. Shape concrete mortar within any structure and manhole as specified.

B. INSULATING SECTIONS: Where a metallic nonferrous pipe/appurtenance connects to ferrous pipe/appurtenance, provide an insulating section per Section 40 27 05.04

C. ANCHORAGE: Provide as specified on the Drawings.

3.02 COMPONENT TEST PHASE

A. Buried Piping: Test hydrostatic pressure in accordance with Section 5 of AWWA C600, using the test pressures and allowable leakage specified in Section 40 27 00.

B. Exposed and Concrete Encased Piping: Conduct hydrostatic pressure tests in accordance with Section 40 27 00.

3.03 POLYETHYLENE ENCASEMENT

A. Where specified, use polyethylene encasement for buried ductile iron pipe. Install polyethylene as specified in AWWA C105 and within this Section.

B. Potable Water Pipe: Single wrap, 4-mil high density polyethylene.

C. Wrapping:

1. Wrap buried pipe, fittings, valves, and couplings.

2. Prior to the placing of concrete, wrap fittings that require concrete backing.

3. Wrap the polyethylene tube seams and overlaps and hold in place by means of a 2-inch-wide plastic backed adhesive tape.

4. Tape:

   a. The tape shall be such that the adhesive shall bond securely to both metal surfaces and polyethylene film.

   b. Acceptable manufacturer:

      1) Polyken No. 900 (polyethylene).

      2) Scotchwrap No. 50 (polyvinyl).

      3) Approved Equal.

5. Bedding and initial backfill for polyethylene wrapped pipe shall be a well-graded granular material to avoid cutting or damaging the polyethylene tube during placement and backfilling.

END OF SECTION

SECTION 33 05 01.07

HIGH-DENSITY POLYETHYLENE PIPE

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE:

1. This Section specifies high-density polyethylene (HDPE) pipe, fittings, and appurtenances for general service.

2. This section also specifies HDPE pipe, fittings, and appurtenances for natural gas service piping, 12-inches and less, downstream of the utility meter.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

References	Title
ANSI/AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution
ASTM D2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2513	Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
ASTM D3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3350	Polyethylene Plastics Pipe and Fittings Material
ASTM F714	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F2164	Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure

References	Title
ASTM F1055	Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
ASTM F1290	Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F1473	Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins
ASTM F1668	Construction Procedures for Buried Plastic Pipe
ASTM F2620	Heat Fusion Joining of Polyethylene Pipe and Fittings
NFPA 54	National Fuel Gas Code
Plastic Pipe Institute (PPI)	Polyethylene (PE) Pipe Handbook

B. FACTORY TESTS:

1. Inspect and test HDPE materials, pipe and fittings in accordance with AWWA C906 (General Service Piping) or ASTM D2513 (Natural Gas), as applicable.

2. Affidavit of Compliance – General Service Piping: The manufacturer shall furnish an Affidavit of Compliance conforming to the requirements of AWWA C906, Section 6.3, affirming that the piping components comply with the requirements of AWWA C906 and this section. The affidavit shall be signed under penalty of perjury by a representative of the pipe manufacturer's company.

3. Affidavit of Compliance – Natural Gas Piping: The manufacturer shall furnish an Affidavit of Compliance confirming test the results and piping components comply with the requirements of ASTM D2513 and this Section. The affidavit shall be signed under penalty of perjury by representative of the pipe manufacturer's company.

C. SHIPMENT AND STORAGE: Sections of pipe with cuts, gouges, or scratches on the outside diameter surface that exceed 10 percent of the wall thickness of the pipe shall be removed completely and the ends of the pipeline rejoined. The inside diameter surface shall be free of cuts, gouges, and/or scratches.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations.

2. Manufacturer's product data, catalog cuts, dimensions and materials.

3. Shop drawings which show the type and location of all fittings, joints other than butt fusion heat welds, and connections to structures or manholes.

4. Signed Affidavits of Compliance.

1.04 PERFORMANCE REQUIREMENTS

A. General Service Piping shall conform to the following:

1. Dimension ratio (DR): 17, unless otherwise specified in Section 40 27 00.

2. Pressure class in accordance with AWWA C906: 125 psi, unless otherwise specified in this Section.

3. Maximum deflection in installed condition (buried pipelines), percent of the average inside diameter of the pipe: 4.2.

B. Natural Gas Piping shall conform to the following:

1. Dimension ratio (DR): 11, unless otherwise specified in Section 40 27 00.

2. Pressure class: 200 psi, unless otherwise specified.

3. Pipe shall have a yellow exterior or substantial yellow striping and marking in accordance with ASTM D2513.

PART 2--PRODUCTS

2.01 MATERIALS

A. HDPE piping components shall be manufactured from materials that meet or exceed the requirements of the Plastic Piping Institute designation PE4710 and that conform to the requirements of ASTM D3350 for a minimum cell classification of PE 445474C (black for natural gas piping).

B. FLANGE ENDS:

1. Flange End assemblies shall consist of HDPE stub end flange adapter and back up ring.

2. Furnish beveled flange adapters for disk clearance butterfly valve connections.

3. Stub end flange adapters shall be furnished with concentric ring convolutions on the flange face and radiused or chamfered outer diameter transition from pipe wall to stub end.

4. Back up ring shall be ductile iron encapsulated in polypropylene. Drilled for ANSI B 16.5, Class 150 or AWWA C207. Flange ring bore shall be chamfered or radiused to match transition on stub end flange adapter. Candidate product: Improved Piping Products - PPDI or Approved Equal.

C. BOLTS:

1. Flange assembly bolts shall be ANSI B18.2.1 standard square or hexagon head bolts with ANSI B18.2.2 standard hexagon nuts. Threads shall be ANSI BIB1.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5.

2. Except where high strength bolts are specified in the PIPESPEC, flange bolts for exposed flanges shall be carbon steel machined bolts with hot pressed hexagon nuts, ASTM A307, Grade B8. Where high strength bolts are specified in the PIPESPEC, flange bolts for exposed flanges shall be carbon steel hex cap screws, ASTM A449, Type1 or Type 3.

3. Bolts and nuts for exposed, corrosive applications shall be ASTM A276 Type 316 stainless steel.

4. Flange bolts for buried flanges shall be made of noncorrosive high-strength, low-alloy steel, ASTM A449, Type 3, Class C or Class D, having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating.

5. Where washers are required, they shall be of the same material as the associated bolts.

D. Provide drop-in or full-face gaskets for flange connections per Section 40 27 00.

2.02 FEATURES

A. PIPE: Having nominal IPS dimensions for the pipe size as specified on the Drawings and the specified DR. Dimensions and tolerances as specified in AWWA C906 or ASTM D2513, as applicable.

B. FITTINGS:

1. Conform to the applicable requirements of AWWA C906 and ASTM D2513, or F1055 for electrofusion fittings, as applicable, for the joining methods specified in this Section.

2. Long Radius Bends 14 inches and smaller: Where specified in Section 40 27 00, provide Arc™ sweep bends manufactured by Pipestar International, or Approved Equal. Bend radius three times the pipe diameter, measured to the center line of the bend.

3. Match pipe DR for long radius bends.

4. Increase wall thickness to next nominal pressure rating/next lower DR for mitered bends. Segment mitered bends according to the following table:

Degree of Bend	Minimum Number of Miter Segments
45 or less	2
Greater than 45	4

C. PIPE SUPPORTS FOR EXPOSED APPLICATIONS: Per Section 40 05 29, with the following additional requirements:

1. Supports cradle the bottom 120 degrees of arc of the pipe.

2. Supports have a length (measured parallel to the pipe axis) at least one half of pipe diameter.

3. Edges of the supports rounded or rolled to prevent cutting into the pipe.

4. Commercial pipe supports such as u-bolts, narrow strap-type hangers, and roller type supports are unsuitable unless modified for width and cradling.

PART 3--EXECUTION

3.01 INSTALLATION – BURIED APPLICATIONS

A. GENERAL SERVICE: Install in accordance with Chapter 7 of the Plastic Pipe Institute *PE Handbook*. ASTM D2321, AWWA C906 and the manufacturer's recommendations.

B. NATURAL GAS: Install in accordance with ASTM F2620, NFPA 54, and the local plumbing codes, as applicable. Transition HDPE piping to metallic piping in the ground, exterior to structures, in accordance with NFPA 54 requirements.

C. ALIGNMENT PROCEDURES: Pipe and fittings placed in the trench with the invert conforming to the elevations, slopes, and alignments specified on the Drawings.

D. JOINING:

1. Pipe and fittings: Joined into continuous lengths on the job site above ground. Unless otherwise specified, join by butt-fusion method performed in accordance with the pipe manufacturer's recommendations and ASTM D3261 or ASTM F1290 (electrofusion socket welds). Extrusion welding and hot gas welding shall not be used for buried field connections.

2. Consult pipe supplier to obtain machinery and expertise for the butt-fusion or electrofusion socket welding of HDPE pipe and fittings. No pipe or fittings shall be joined by fusion by any of the Contractor's personnel unless they are adequately trained and qualified in the techniques involved. Butt fusion joining shall yield a joint strength equal to or greater than the pipe tensile strength.

3. Flanged joining, or other mechanical joining methods shall be used to make connections to differing piping materials, to equipment, valves and other appurtenances, and where specified.

4. Internal beads at butt-fused joints: Cut out to produce a smooth interior surface across the joint where specified for select piping services in Section 40 27 00.

E. BEDDING AND BACKFILL: per Section 31 23 00. Blocking under pipe not permitted.

3.02 INSTALLATION – EXPOSED APPLICATIONS

A. GENERAL: Install in accordance with Chapter 8 of the Plastic Pipe Institute *PE Handbook*, ASTM F2620, AWWA C906 and the manufacturer's recommendations.

B. JOINING:

1. Pipe and fittings joined into continuous lengths on the job site. Unless otherwise specified, joining by the butt-fusion method performed in accordance with the pipe manufacturer's recommendations and ASTM D3261 or electrofusion socket welds. Extrusion welding and hot gas welding shall not be used for exposed field connections.

2. Consult with pipe supplier to obtain machinery and expertise for joining by butt-fusion for HDPE pipe and fittings. No pipe or fittings shall be joined by fusion by any of the Contractor's personnel unless they are adequately trained and qualified in the techniques involved. Butt fusion and/or electrofusion joints shall yield a joint strength equal to or greater than the tensile strength of the pipe.

3. Flanged joining, or other mechanical joining methods specified, may be used to make connections to differing piping materials, to equipment, valves and other appurtenances, and where specified.

4. Victaulic Style 995 couplings: installed where specified on the Drawings.

3.03 COMPONENT TEST PHASE

A. Hydrostatic pressure test per Section 40 27 00 with the following additional requirements:

1. Test buried pipelines prior to backfilling. Cover the pipe at intervals and/or at curves if necessary to hold the pipe in place during testing. Leave connections exposed for visual leak inspection.

2. After all free air is removed from the test section, raise pressure in the pipe at a steady rate to the required pressure. Measure pressure at the lowest point of the test section. Apply initial pressure and allow to stand without makeup pressure for 2 to 3 hours to allow for diametric expansion or pipe stretching to stabilize. After the equilibrium period, return the test section to the required test pressure and hold for 4 hours. Amounts of makeup water allowable for expansion during the pressure test shall be as listed in ASTM F2614. No visual leaks or pressure drops shall be observed during the final test period.

** END OF SECTION **

SECTION 33 05 26

BURIED UTILITY IDENTIFICATION

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies warning tape, tracer wire, and associated appurtenances for buried utilities.

1.02 SUBMITTALS

A. Procedures: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Warning tape product data:

a. Provide a full line product brochure showing available standard text and color coding options. Submit all custom text and color codings proposed for use.

b. Provide manufacturer's recommended installation instructions.

2. Tracer wire product data:

a. Provide product brochures and data sheets for wire and splice kits. Submit all wire colors proposed for use.

b. Submit proposed wire access box(es) for test leads. Submit electrical continuity test results upon completion.

3. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

4. Submit a Warning Tape Schedule, prepared by the Contractor in tabular format, which identifies the proposed tape color and text proposed for use with all new buried piping and utility systems in the yard.

C. Informational Submittal Items for this Section:

1. Electrical continuity test results.

1.03 PERFORMANCE REQUIREMENTS

A. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

PART 2--PRODUCTS

2.01 DETECTABLE WARNING TAPE

A. Three- (3-) inch wide plastic metallic type consisting of a color coded polyethylene or melinex film, a solid core aluminum detection layer and other layers recommended by the manufacturer to provide durability and longevity. The tape and ink shall be resistant to acids, alkalis, and other components likely to be encountered in soils.

B. MANUFACTURERS: Sentry Line Detectable Terra Tape by Reef Industries; Detectable Marking Tape by T. Christy Enterprises; or equal.

C. ELECTRICAL CONTINUITY CONNECTORS FOR END-TO-END AND BRANCH CONNECTIONS: Terra Clips by Reef Industries; or equivalent.

2.02 TRACER (LOCATE) WIRE

A. Direct burial rated, 12 gauge solid copper, 600-volt UF tracer wire with heavy-duty PVC insulation. Insulation shall be color-coded to match each utility service as designated in the Detectable Warning Tape Schedule.

B. SPLICES: Silicone-filled UL-Listed product specifically designed for waterproof direct bury splicing of tracer wire. 3M DBR-6; or equivalent.

C. WIRE ACCESS BOXES: Cast iron valve box top piece frame and cover set within a concrete ring cast flush with grade, as appropriate for the location in which it will be installed and for the traffic loading it may be subject to, and in accordance with the applicable elements of the Standard Detail for valve box installations. Lids shall be marked in raised or recessed lettering with the word “Test”. Submit all wire access boxes proposed for use to the Owner for review.

2.03 DETECTABLE WARNING TAPE SCHEDULE

A. Provide text and color coding appropriate for the utility or pipeline service as indicated in the Detectable Warning Tape Schedule. If the Contractor is unsure of the appropriate text or color coding for a certain pipeline service, obtain clarification from the Owner.

Pipeline Service Description	Color	Text[1]
Potable water and fire water pipelines	Blue	“Caution Water Line Buried Below”
Non-potable raw, plant, or process water pipelines	Yellow	“Caution Non-Potable Water Line Buried Below”
Gravity sewer, waste, and drain lines	Green	“Caution Sewer Line Buried Below”
Storm drain pipelines	Yellow	“Caution Storm Drain Line Buried Below”
Reclaimed water pipelines	Purple	“Caution Reclaimed Water Line Buried Below”
Pressure sewer force mains	Brown	“Caution Sewer Force Main Buried Below”
Sludge pipelines	Brown	“Caution Sludge Line Buried Below”

Pipeline Service Description	Color	Text[1]
Electric ducts, conduits, and cables	Red	"Caution Electric Line Buried Below"
Gas pipelines and services	Yellow	"Caution Gas Pipeline Buried Below"
Communication and fiber optic ducts, conduits, and cables	Orange	"Caution Communications Cable Buried Below"
Miscellaneous services not covered in the above categories and if approved on a case-by-case basis by the Owner	Yellow	"Caution Utility Line Buried Below"

[1] Text imprinted on the tape shall be as indicated or equivalent.

PART 3--EXECUTION

3.01 INSTALLATION OF DETECTABLE WARNING TAPE

A. Install a continuous ribbon of Warning Tape as specified for ALL buried pipelines, conduits, and direct-bury cables.

B. Multiple pipelines, tubing, and conduit less than 4 inches in diameter installed in a common trench may be provided with a single ribbon of tape per trench. If the total width of such utilities within the common trench exceeds 3 feet, provide two parallel ribbons of tape spaced equally.

C. All pipelines 4 inches and greater in size shall be provided with its own ribbon of tape.

D. Install the appropriate tape (color coding and text, as indicated in the Detectable Warning Tape Schedule) for the pipeline service or utility being installed.

E. Install the tape in accordance with manufacturer recommendations.

F. At end-to-end and branch connections, provide electrical continuity connectors for detectable tape to mechanically and electrically connect ends together as recommended by the manufacturer.

G. The burial depth of warning tape shall be as shown on the trench detail(s) on the Drawings, except that detectable warning tape shall not be buried greater than 24 inches below finished grade.

3.02 INSTALLATION OF TRACER WIRE

A. Install tracer wire for the following buried piping systems:

1. DGA

2. DRC

3. MLQ

4. NGA

5. PLY

B. Tracer wire shall be a continuous, fully functioning, and tested system to include all appurtenances including splices and wire access boxes at grade.

C. The color of the tracer wire insulation for each pipeline shall match the color of the corresponding warning tape based on the pipeline service (contents).

D. Tracer wire shall be laid along the top of the pipe prior to backfilling. Secure in place with tape every 20 feet. Where the pipe is encased or provided with concrete collars or cut-off walls, lay the wire on top of the encasement (do not encase the wire). Do not pull the wire taut; leave sufficient slack to allow for pipe movement and future repairs.

E. Splice tracer wire using the specified silicone-filled splice kits in accordance with manufacturer recommendations. Ensure the silicone fully encapsulates un-insulated wire ends and are made watertight.

F. Pull tracer wire up into all valve boxes, cleanout access boxes, and into all utility cabinets and meter boxes installed on the pipeline. For each wire end, provide an 18-inch long length of extra wire (coiled and tucked out of the way in an accessible location) for connection to utility locating equipment.

G. Where the pipeline enters structures, vaults, tanks, or buildings, provide a wire access box at grade outside adjacent to the structure or building for termination of the tracer wire. Provide an 18-inch long length of extra wire (coiled and tucked into the box) for connection to utility locating equipment. Also provide boxes at each pipeline branch, cross or tee, and at intermediate spacing along the pipeline not to exceed 1,000 feet (except where pipeline valves with valve boxes provide the required wire access at those locations and intervals).

H. Upon completion and backfill of the pipeline, the Contractor shall test and demonstrate electrical continuity of each segment of tracer wire. Submit test results to the Owner indicating the location of the tested segment. Testing shall be by the conductive method; inductive test methods are not acceptable. Repair all faulty work at no additional cost to the Owner until the system is functional and approved.

3.03 FIELD QUALITY CONTROL

A. The Contractor shall comply with manufacturer's handling and installation instructions.

B. The Contractor shall provide continuity testing of tracer wire as specified herein.

END OF SECTION

SECTION 33 05 26.14

EXPOSED PIPE IDENTIFICATION

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies labels and colors for exposed pipe.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI 13.1	Scheme for the Identification of Piping Systems
FS-595B	Colors used in Government Procurement

1.03 SUBMITTALS

A. PROCEDURES: 01 33 00.

B. ACTION SUBMITTAL ITEMS:

1. Pipe label drawings confirming letter height and directional arrow placement.

2. Color samples confirming the coating colors labels conform to the Federal Standard 595B color number.

3. A copy of this specification section, and addendum updates, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from specified requirements.

PART 2--PRODUCTS

2.01 PIPING IDENTIFICATION

A. Pipe labels consist of coatings applied over stenciled lettering. Pipe label shall be Coating System EU-1 per Section 09 90 00.

B. Pipe color and pipe label lettering color as specified in Table A of this Section (Pipe Paint and Label Schedule).

C. For each exposed pipe, labels shall identify the Service and Piping Service Designation as listed in the Pipe Paint and Label Schedule. Example: "<= MLQ – MIXED LIQUOR". Service name may be omitted from the pipe label for every other (alternating) pipe label. Align stenciled lettering and arrows sequentially along the longitudinal axis of the pipe.

D. Pipe labels to include uni- and bi-directional arrows, indicating flow direction, in the same sizes as the lettering for the pipe service designation. Directional arrows to be the same color as the pipe label lettering specified in the Pipe Paint and Label Schedule.

E. Where the Pipe Paint and Label Schedule indicates that the piping service is not painted, apply coating with the Pipe and/or Insulation Paint Color to the pipe as a background for the stenciled lettering and direction arrows of the pipe label. Background coating for pipe labels shall be a continuous radial band around the outside diameter of the pipe and extend longitudinally the length of the stenciled lettering and directional arrow(s) of the label.

F. Pipe labels bearing the Piping Service Designation and Service specified in the Pipe Paint and Label Schedule shall be provided in the following letter heights:

Nominal Pipe Diameter, Inches	Letter height, inches
Less than 2	1
2 through 3	2
4 through 8	3
Greater than 8	4

PART 3--EXECUTION

3.01 INSTALLATION

A. Pipe Labels and Flow Indication Arrows:

1. Locate at equipment connections, valves, branching fittings, and penetrations.

2. Install pipe labels at intervals not greater than 20 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.

3. Install pipe labels on exposed piping not normally in view, such as above suspended ceilings and in closets and cabinets.

4. Apply pipe labels only after painting in vicinity is complete.

5. Install in accordance with manufacturer's instructions.

3.02 COATINGS

A. PROCEDURES: Section 09 90 00.

B. COLOR SELECTION: Pipe/insulation paint color and pipe label lettering color shall be as specified in the Pipe Paint and Label Schedule. Colors shall conform to the following table:

Coating Color	Federal Standard 595B Paint Number(1)
Brown	20155
Gray	26373
Orange	22473
Tan	23717
Light Green	24190
Dark Green	24109
Light Blue	25540
Blue	25183
Red	21310
Yellow	23785
Purple	27160
White	27885

(1) First digit is paint sheen: 1=Gloss, 2=Semigloss, 3=Flat. Next 4 digits determine specific color.

C. PIPE LABELS AND LETTERING: Colors for each piping system are listed below:

Table A. Pipe Paint and Label Schedule

Piping Service Designation	Service	Painted Yes/No	Pipe and/or Insulation Paint Color	Pipe Label Lettering Color
BSL	Blended Sludge	Yes	Brown	White
CDR	Condensate Drain	Yes	Gray	White
CEN	Centrate (Centrifuge Liquids)	Yes	Gray	White
COA	Coagulant	Yes	White	Black
DGA	Digester Gas	Yes	Orange	Black

Piping Service Designation	Service	Painted Yes/No	Pipe and/or Insulation Paint Color	Pipe Label Lettering Color
DRC	Drain, Chemical or Condensate	Yes	Gray	White
DRP	Drain System, Pumped	Yes	Gray	White
DRS	Drain System	Yes	Gray	White
DRT	Tank Drainage	Yes	Gray	White
DSL	Digested Sludge	Yes	Brown	White
DSL(OF)	Digester Sludge Overflow	No	Brown	White
DSN	Drain, Sanitary Sewer	Yes	Gray	White
FIL	Filtrate	Yes	Gray	White
FLA	Foul Air	Yes	Tan	Black
FPW	Fire Protection Water	Yes	Red	White
FSW	Fire Sprinkler Water	Yes	Red	White
GLY	Glycol	Yes	Lt. Green	Black
HHR	Heating Hot Water Return	Yes	Lt. Green	Black
HHS	Heating Hot Water Supply	Yes	Lt. Green	Black
HHT	Heating Hot Water Treatment	Yes	Yellow	Black
HHW	Heating Hot Water System	Yes	Lt. Green	Black
HPA	High Pressure Air	Yes	Blue	White
HWP	Hot Water, Potable	Yes	Dark Green	White
IRR	Irrigation	No	Lt. Green	Black
LPA	Low Pressure Air	No	Light Blue	Black
LPR	Low Pressure Steam Return	Yes	Lt. Green	Black
LPS	Low Pressure Steam Supply	Yes	Lt. Green	Black
MES	Methanol Solution	Yes	Orange	Black
MET	Methanol	No	Orange	Black
MLQ	Mixed Liquor	Yes	Brown	White
NGA	Natural Gas	Yes	Yellow	Black
PAC	Polyaluminum Chloride	Yes	White	Black
PEF	Primary Effluent	Yes	Gray	White
PLY	Polymer System	Yes	White	Black
POT	Potable Water (City Water)	Yes	Dk. Green	White
PSL	Primary Sludge	Yes	Brown	White
PSM	Primary Scum	Yes	Brown	White

Piping Service Designation	Service	Painted Yes/No	Pipe and/or Insulation Paint Color	Pipe Label Lettering Color
RAS	Return Activated Sludge	Yes	Brown	White
PW1	Process Water - Not-Potable	Yes	Lt. Green	Black
PW2	Process Water - Reclaimed	Yes	Purple	Black
PW3	Process Water - Disinfected Effluent	Yes	Lt. Green	Black
PW4	Process Water - Non-Chlorinated	Yes	Lt. Green	Black
RAS	Return Activated Sludge	Yes	Brown	White
RCW	Reclaimed Water	Yes	Purple	Black
SEF	Secondary Effluent	Yes	Gray	White
SHC	Sodium Hypochlorite	Yes	Yellow	Black
SSE	Side Stream Effluent	Yes	Brown	White
SSL	Secondary Sludge	Yes	Brown	White
SSM	Secondary Scum	Yes	Brown	White
SSR	Side Stream (ANAMMOX) Reactor	No	Brown	White
SSS	Side Stream Solids	Yes	Brown	White
STD	Storm Drain	Yes	Gray	White
TEF	Tertiary Effluent	Yes	Lt. Green	Black
TSL	Thickened Sludge	Yes	Brown	White
TSM	Thickened Scum	Yes	Brown	White
VEX	Vent / Exhaust Gas Stack	No	None	None
WAS	Waste Activated Sludge	Yes	Brown	White

END OF SECTION

SECTION 33 08 10

COMMISSIONING OF WATER UTILITIES

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies commissioning of potable water utilities, including cleaning, testing, and inspection.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued of otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
NFPA 291	National Fire Protection Association (NFPA), Recommended Practice for Fire Flow Testing and Marking of Hydrants, 2013 Edition.
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. LEAKAGE TESTING PLAN: Identify proposed equipment and methods required for the hydrostatic pressure test. Pressure gauges and metering devices shall be of a type, accuracy, and calibration acceptable to the Owner, and certified as being correct within plus or minus 5 percent.

3. Equipment and methods proposed for use, including equipment certifications.

4. Leakage Test Results.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. Control Device Functionality Reports.

2. Hydrant Flow Test Reports.

PART 2--NOT USED

PART 3--EXECUTION

3.01 CLEANING

A. Prior to testing, the inside of the piping shall be thoroughly cleaned of all dirt, loose scale, sand, and other foreign material by flushing. Flushing shall be in accordance with WSDOT Standard Specification paragraph 7-09.3(24)A, Flushing.

B. All new, extended, or repaired lines shall be disinfected and successfully pass a bacteriological test before being placed into service. Disinfection and bacteriological testing shall be in accordance with Section 33 13 00.

3.02 TESTING GENERAL

A. All testing shall be performed in the presence of the Owner.

B. Leakage tests shall be performed on all potable water distribution piping and equipment.

C. Water utility facilities shall pass the specified leakage testing and be approved prior to placing them in service.

D. Perform test in accordance with approved Leakage Testing Plan.

E. All pumping, distribution, and disposal of water shall be accomplished by the Contractor. Water for testing is available at the Plant.

F. The Contractor shall disconnect instruments or other devices in the system that are not capable of withstanding testing pressures and these elements shall be tested at the rated pressure of said instruments or devices and reconnected after testing is complete.

G. All supports, anchors, and blocks shall be installed prior to pressure test of pipe and shall adequately withstand all forces imposed by test pressures. Concrete for thrust blocks and supports shall have developed full design compressive strength before testing.

H. Leakage testing shall be made after pipe is installed and backfilled, but prior to placing permanent resurfacing. The Contractor may conduct preliminary tests prior to backfill. Such tests will be considered to be for the Contractor's information and need not be performed in the presence of the Owner. If the Contractor elects to conduct preliminary tests, it shall provide any necessary temporary thrust restraint, and shall retest as set forth herein prior to surfacing placement.

I. CORRECTION OF DEFECTS: The complete and satisfactory test for each and every section of piping shall be a condition for final acceptance of the Work. If leakage exceeds the allowable amount, the installation shall be repaired or replaced and leakage tests shall be repeated until the leakage test requirements have been fulfilled. All detectable leaks shall be repaired, regardless of the test results.

J. REPORTING: Keep records of each test, including:

1. Description and identification of pipe segment tested.

2. Description of test procedure.

3. Test pressure.

4. Date of test.

5. Witnessing by Contractor and Owner.

6. Test evaluation.

7. Remarks, to include such items as:

a. Leaks (type, location).

b. Repairs made on leaks.

K. All test reports shall be submitted to the Owner.

3.03 TESTING SPECIFICS

A. HYDROSTATIC PRESSURE TESTING:

1. Perform hydrostatic pressure testing in accordance with WSDOT Standard Specifications paragraph 7-09.3(23), including the following subparagraphs:

a. Testing Extensions From Existing Mains, paragraph 7-09.3(23)A.

b. Testing Section with Hydrants Installed, paragraph 7-09.3(23)B.

c. Testing Hydrants Installed on Existing Mains, paragraph 7-09.3(23)C.

B. TESTING OF CONTROL DEVICES:

1. Perform all control device tests in accordance with the manufacturer's instructions and these Specifications.

2. After installation, all control devices shall be subjected to Hydrostatic Pressure Testing as specified. Should any defects in design, materials, or workmanship appear during these tests, the Contractor shall correct such defects to the satisfaction of the Owner.

3. After passing the Hydrostatic Pressure Testing, perform a functionality test to confirm that all control devices meet their intended functionality. Adjust settings as necessary until intended functionality is met. Test and adjust control devices within a flow range of 100 GPM to 1,600 GPM at 500 GPM increments. After final adjustment, provide the Owner with a Control Device Functionality Report noting control device functionality at each flow rate increment.

4. Functionality and testing of the following control devices shall be subject to additional requirements:

   a. Backflow Prevention Devices (BFP):

      1) Perform BFP testing and certification in accordance with Owner and Tacoma Water requirements.

   b. Pressure Reducing Valve (PRV):

      1) Adjust controls to provide pressure reduction as indicated in these Construction Documents.

C. TESTING OF HYDRANTS:

1. Perform all hydrant tests in accordance with the manufacturer's instructions and these Specifications.

2. After installation, fire hydrants, auxiliary gate valves, and other appurtenances thereto shall be subjected to Hydrostatic Pressure Testing as specified. Should any defects in design, materials, or workmanship appear during these tests, the Contractor shall correct such defects to the satisfaction of the Owner.

3. After installation and passing the Hydrostatic Pressure Testing, hydrants shall be subjected to a hydrant flow test. Perform hydrant flow test in accordance with NFPA 291. Submit hydrant flow test report to the Owner. Water discharged during flow testing shall be collected or routed to discharge to an onsite location. Offsite discharge of water is not permitted.

END OF SECTION

SECTION 33 08 30

COMMISSIONING OF SANITARY SEWERAGE UTILITIES

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies commissioning of sanitary sewerage utilities and similar gravity process pipeline systems, including cleaning, testing, and inspection. This Section is applicable to RCW and DRT gravity piping systems.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued of otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
Pierce County Sewer Utility, Sanitary Sewer Development Specifications	Pierce County Sewer Utility, Sanitary Sewer Development Specifications, 2012 edition.
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. LEAKAGE TESTING PLAN: Identify proposed equipment, materials, and methods required for the hydrostatic pressure test. Pressure gauges and metering devices shall be of a type, accuracy, and calibration acceptable to the Owner, and certified as being correct within plus or minus 5 percent.

3. Equipment and methods proposed for use, including equipment certifications.

4. Test Reports.

5. Video inspection reports.

PART 2--NOT USED

PART 3--EXECUTION

3.01 CLEANING

A. Prior to testing, the inside of each main pipeline, manhole, and lateral shall be thoroughly cleaned of all dirt, loose scale, sand, and other foreign material. Cleaning shall be by flushing with a high velocity water jet.

3.02 TESTING GENERAL

A. Leakage tests shall be performed on all sanitary sewer piping, similar process piping, associated manholes, and related facilities.

B. Perform testing is accordance with approved Leakage Testing Plan.

C. All testing shall be made in the presence of the Owner.

D. All pumping, distribution, and disposal of water shall be accomplished by the Contractor. Water is available at the Plant for testing.

E. The Contractor shall disconnect instruments or other devices in the system that are not capable of withstanding testing pressures and these elements shall be tested at the rated pressure of said instruments or devices and reconnected after testing is complete.

F. Leakage testing shall be made after pipe is installed and backfilled, but prior to placing permanent resurfacing. The Contractor may conduct preliminary tests prior to backfill. Such tests will be considered to be for the Contractor's information and need not be performed in the presence of the Owner. If the Contractor elects to conduct preliminary tests, it shall provide any necessary temporary thrust restraint, and shall retest as set forth herein prior to surfacing placement.

G. All supports, anchors and blocks shall be installed prior to pressure test of pipe and shall adequately withstand all forces imposed by test pressures. Concrete for thrust blocks and supports shall have developed full design compressive strength before testing.

H. CORRECTION OF DEFECTS: The complete and satisfactory test for each and every section of piping and each manhole shall be a condition for final acceptance of the work. If leakage or infiltration exceeds the allowable amount, the installation shall be repaired or replaced and leakage tests shall be repeated until test requirements have been fulfilled. All detectable leaks shall be repaired, regardless of the test results.

I. Sanitary sewerage utilities and similar gravity process pipeline systems shall pass the specified leakage testing and be approved prior to placing them in service.

J. REPORTING: Keep records of each piping and manhole test, including:

1. Description and identification of pipe segment or manhole tested.

2. Description of test procedure.

3. Date of test.

4. Witnessing by Contractor and Owner.

5. Test evaluation.

6. Remarks, to include such items as:

a. Leaks (type, location).

b. Repairs made on leaks.

K. All test reports shall be submitted to the Owner.

3.03 LEAKAGE TESTING OF GRAVITY PIPELINES

A. All gravity sewer and similar process pipelines, including laterals and drop structures shall be cleaned and tested after backfilling by the low pressure air method, unless otherwise directed by the Owner. The exfiltration method shall be permitted for lateral installations only. However, where the groundwater table is such as to preclude a proper exfiltration test, the Owner may require infiltration tests.

B. AIR TEST METHOD:

1. Pipelines shall be tested with low-pressure air by the pressure drop method. No pressure drop shall be permitted during the testing period. The test pressure shall be 4.0 psig.

2. SAFETY PROVISIONS. Plugs used to close the pipe for the air test must be securely braced to prevent the unintentional release of a plug which can become a high-velocity projectile. Gauges, air piping manifolds and valves shall be located above grade. Personnel shall not be permitted to enter a manhole where a plugged pipe is under pressure. Air testing apparatus shall be equipped with a pressure release device such as a rupture disk or a pressure relief valve designed to relieve pressure in the pipe under test at 6 psi.

3. All pressures shall be relieved from the pipe section being tested prior to removal of test plugs.

C. AIR TEST PROCEDURE:

1. After cleaning, each section of piping shall be tested between successive manholes, or in sections if favorably reviewed by the Owner, by plugging and bracing all openings in the mainline and the upper ends of all building and structure connections. Prior to any air pressure testing, all pipe plugs shall be checked with a soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated, and the test procedure started over again. The Contractor has the option of wetting the interior of the pipe prior to the test.

2. If the pipe to be tested is submerged in groundwater, insert a pipe probe, by boring or jetting, into the backfill material to the elevation of the pipe crown. Determine the pressure in the probe when air passes slowly through it. This is the back pressure due to groundwater submergence over the pipe crown. All gauge pressures in the test shall be increased by the groundwater back pressure.

3. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

4. Check exposed pipe and plugs for abnormal leakage by coating with a soapy water solution. If any failures are observed, bleed off air and make necessary repairs.

5. After an internal pressure of 4.0 psig is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressures.

6. After the 2-minute period, disconnect the air supply.

7. Start the stopwatch. Test time shall be in accordance with the following table. If the pipeline section fails the no loss air test, the Contractor shall be required to isolate and air test the lateral connections. The Contractor shall be required to retest pipeline after corrective measures are taken to repair leaks.

Specification Time Required for Pressure Test for Size and Length of Pipe

1 Pipe Diam. (in.)	2 Min. Time (min:sec)	3 Length for Min. Time (ft.)	4 Time for Longer Length (sec.)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190*L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427*L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760*L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187*L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709*L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671*L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846*L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235*L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837*L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17

D. EXFILTRATION TEST METHOD FOR LATERAL PIPELINES:

1. Prior to making exfiltration leakage tests, the Contractor shall fill the pipe with clear water. The leakage test shall be completed within 24 hours after filling the pipe.

2. The exfiltration testing time shall be 1 hour. The static head above the crown of the pipeline at the lower end of the test section shall be a minimum of 6 feet. No leakage shall be observed during the test duration. In the event that measurable leakage occurs, the Contractor shall make corrections as required and retest. The method of repair shall be approved by the Owner. Repair by chemical grouting will not be allowed.

3. Testing shall be made in the presence of the Owner.

3.04 VACUUM TESTING OF MANHOLES AND STRUCTURES

A. The method of testing shall be in accordance with ASTM C1244 and Pierce County Sewer Utility Sanitary Development Specifications, 2012 edition.

B. Testing of all manholes and vaults, including manholes partially constructed in Design Package 2 that are completed to finish grade in Design Package 3, shall be in accordance with the following:

1. INITIAL VACUUM TEST: 5 inches Hg (i.e. 34.92 inches Hg absolute).

2. TEST TIME: A vacuum of 5 inches of Hg shall be drawn and the vacuum pump shut off. With the valve closed, the time shall be measured for the vacuum to drop to 4-1/2 inches. The manhole shall pass if the time is greater than that shown on the following table.

Depth (ft.)	Time (sec.)					
	48" Diam.	54" Diam.	60" Diam.	72" Diam.	84" Diam.	96" Diam.
8	20	23	26	33	38	44
10	25	26	33	41	47	55
12	30	36	39	49	53	66
14	35	41	46	57	62	77
16	40	46	52	67	71	88
18	45	52	59	73	80	99
20	50	53	65	81	89	110
22	55	64	72	89	98	121
24	59	64	78	97	107	132
26	64	75	85	105	116	143
28	69	81	91	113	125	154
30	74	87	98	121	134	165
32	79	93	105	129	143	176
34	84	99	112	137	152	187
36	89	105	119	145	161	197
38	94	111	126	153	170	207
40	99	117	131	161	179	218

3. If the pressure drop exceeds 1/2-inch Hg in 2 minutes, the manhole shall be repaired and retested.

4. Joint repairs by parging are to be done on the inside of joint to ensure a permanent seal. Vacuum testing draws together the joint and applies high-pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to affect a repair.

3.05 TELEVISION INSPECTION

A. All completed pipelines shall be inspected using television equipment. Inspections will be conducted at times agreed upon by the Owner and the Contractor, and will be scheduled to coordinate with the project schedule.

B. The Contractor shall be responsible for flushing and cleaning the pipelines in preparation for television inspection.

C. If television inspections reveal areas where the construction is unsatisfactory, the Contractor shall repair/replace and retest all defective materials or workmanship. No repair shall be made until the repair method has been approved by the Owner. The satisfactory results of the television inspections shall be a condition for the final acceptance of the work.

D. The Owner will provide equipment and labor and will pay the cost of performing the initial television inspection. If the Contractor requests a television inspection and the inspection reveals construction deficiencies which must be corrected, the cost of re-inspection by television will be borne by the Contractor.

END OF SECTION

SECTION 33 08 40

COMMISSIONING OF STORM DRAINAGE UTILITIES

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies commissioning of storm drainage utilities, including cleaning, testing, and inspection.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
Pierce County	Pierce County Stormwater Management and Site Development Manual, 2008 edition.
King County Manual	King County Surface Water Design Manual, 2009 edition.
WSDOT Standard Specifications	Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Leakage Testing Plan: Identify proposed equipment and methods required for hydrostatic pressure test. Pressure gauges and metering devices shall be of a type, accuracy, and calibration acceptable to the Owner and certified as being correct within plus or minus 5 percent.

3. Equipment and methods proposed for use, including equipment certifications.

4. Test reports.

5. Video inspection reports.

PART 2--NOT USED

PART 3--EXECUTION

3.01 CLEANING

A. Prior to testing, the inside of each storm drainage pipeline and storm drainage manhole shall be thoroughly cleaned of all dirt, loose scale, sand and other foreign material. Cleaning shall be by flushing with a high velocity water jet.

3.02 TESTING GENERAL

A. Leakage tests shall be performed on all storm drainage piping and storm drainage manholes in this project.

1. Existing storm drainage manholes that are disassembled and reassembled or similarly disturbed shall be retested.

2. Storm drainage manholes that are constructed to the limits shown on the drawings but not completed to finish grade shall be tested in accordance with this section.

B. Perform testing in accordance with approved Leakage Testing Plan.

C. All testing shall be made in the presence of the Owner.

D. All pumping, distribution, and disposal of water or shall be accomplished by the Contractor. Water will be furnished by the Owner.

E. The Contractor shall disconnect instruments or other devices in the system that are not capable of withstanding testing pressures and these elements shall be tested at the rated pressure of said instruments or devices and reconnected after testing is complete.

F. Leakage testing shall be made after all pipe is installed and backfilled, but prior to placing permanent resurfacing. The Contractor may conduct preliminary tests prior to backfill. Such tests will be considered to be for the Contractor's information and need not be performed in the presence of the Owner. If the Contractor elects to conduct preliminary tests, it shall provide any necessary temporary thrust restraint, and shall retest as set forth herein prior to surfacing placement.

G All supports, anchors and blocks shall be installed prior to pressure test of pipe and shall adequately withstand all forces imposed by test pressures. Concrete for thrust blocks and supports shall have developed full design compressive strength before testing.

H. Correction of Defects: The complete and satisfactory test for each and every section of piping shall be a condition for final acceptance of the work. If leakage or infiltration exceeds the allowable, the installation shall be repaired or replaced and leakage tests shall be repeated as necessary until conformance test requirements specified herein have been fulfilled. All detectable leaks shall be repaired, regardless of the test results.

I. Storm drainage facilities shall pass the specified leakage testing and be approved prior to final inspection.

J. Reporting: Keep records of each storm drainage piping and storm drainage manhole test, including:

1. Description and identification of pipe segment or manhole tested.

2. Description of test procedure.

3. Date of test.

4. Witnessing by Contractor and Owner.

5. Test evaluation.

6. Remarks, to include such items as:

a. Leaks (type, location).

b. Repairs made on leaks.

7. Test reports shall be submitted to the Owner.

3.03 LEAKAGE TESTING OF STORM DRAINAGE PIPELINES

A. All storm drainage pipelines shall be cleaned and tested by the low pressure air method after backfilling, unless otherwise directed by the Owner. Storm drainage laterals to buildings shall be tested by the exfiltration method only. However, where the groundwater table is such as to preclude a proper exfiltration test, the Owner may require infiltration tests.

B. AIR TEST METHOD:

1. Pipelines shall be tested with low-pressure air by the pressure drop method. No pressure drop shall be permitted during the testing period. The test pressure shall be 4.0 psig.

2. Safety Provisions. Plugs used to close the storm drainage pipe for the air test must be securely braced to prevent the unintentional release of a plug which can become a high-velocity projectile. Gauges, air piping manifolds and valves shall be located above grade. Personnel shall not be permitted to enter a catch basin or manhole where a plugged pipe is under pressure. Air testing apparatus shall be equipped with a pressure release device such as a rupture disk or a pressure relief valve designed to relieve pressure in the pipe under test at 6 psi.

3. All pressures shall be relieved from the storm drainage section being tested prior to removal of test plugs.

C. AIR TEST PROCEDURE:

1. After cleaning, each section of storm drainage piping shall be tested between successive catch basins or manholes, or in sections if favorably reviewed by the Owner, by plugging and bracing all openings in the storm drainage piping and at the ends of storm drainage connections to the building or structures. Prior to any air pressure testing, all pipe plugs shall be checked with a soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated, and the test procedure started over again. The Contractor has the option of wetting the interior of the pipe prior to the test.

2. If the pipe to be tested is submerged in groundwater, insert a pipe probe, by boring or jetting, into the backfill material to the elevation of the pipe crown. Determine the pressure in the probe when air passes slowly through it. This is the back pressure due to groundwater submergence over the pipe crown. All gauge pressures in the test shall be increased by the groundwater back pressure.

3. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

4. Check exposed pipe and plugs for abnormal leakage by coating with a soapy water solution. If any failures are observed, bleed off air and make necessary repairs.

5. After an internal pressure of 4.0 psig is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain test pressures.

6. After the 2-minute period, disconnect the air supply.

7. Start the stopwatch. Test time shall be in accordance with the following table for air permeable pipe. Air permeable pipe includes concrete and vitrified clay. For non air permeable pipe, the time in seconds for pressure drop shall be equal to or greater than four times the time shown in the following table. If the pipeline section fails the no air loss air test, the Contractor shall be required to retest the pipeline after corrective measures are taken to repair leaks.

Time in Seconds for Pressure Drop

Pipe Dia. (in)	Pipe Length (ft)									
	50	100	150	200	250	300	350	400	450	500
4	5	9	14	18	22	27	31	36	40	45
6	10	20	30	40	50	60	70	80	85	85
8	18	36	54	71	89	107	114	114	114	114
10	28	56	84	111	139	142	142	142	143	159
12	40	80	120	160	170	170	170	183	206	228
15	63	125	188	213	213	214	250	286	320	360
18	90	180	255	255	257	310	360	410	460	520
21	123	245	298	298	350	420	490	560	630	700
24	160	320	340	370	460	550	640	730	830	920
27	203	390	390	460	580	700	810	930	1040	1160
30	250	430	430	570	720	860	1000	1140	1290	1430

D. EXFILTRATION TEST METHOD

1. Prior to making exfiltration leakage tests, the Contractor shall fill the pipe with clear water. The leakage test shall be completed within 24 hours after filling the pipe.

2. The exfiltration testing time shall be 1 hour. The static head above the crown of the storm drainage pipe at the upper end of the test section shall be a minimum of 6 feet. No leakage shall be observed throughout the duration of the test. In the event that measurable leakage occurs, the Contractor shall make corrections as required and retest. The method of repair shall be approved by the Owner. Repair by chemical grouting will not be allowed.

3. Provide a list of equipment and materials required for the exfiltration test as part of the Leaking Testing Plan. Testing shall be made in the presence of the Owner.

3.04 VACUUM TESTING OF STORM DRAINAGE MANHOLES

A. Not Used.

3.05 TELEVISION INSPECTION

A. All completed pipelines shall be inspected using television equipment. Inspections will be conducted at times agreed upon by the Owner and the Contractor, and will be scheduled to coordinate with the project progress schedule.

B. The Contractor shall be responsible for flushing and cleaning the pipelines in preparation for television inspection.

C. If television inspections reveal areas where the construction is unsatisfactory, the Contractor shall repair/replace and retest all defective materials or workmanship. No repair shall be made until the repair method has been approved by the Owner. The satisfactory results of the television inspections shall be a condition for the final acceptance of the work.

D. The Owner will provide all equipment and labor and will pay the cost of performing the initial television inspection. If the Contractor requests a television inspection and the inspection reveals construction deficiencies that must be corrected, the cost of re-inspection by television may be charged to the Contractor.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies piping materials and installation requirements for potable water (POT) piping systems as referenced in Section 33 05 01.06 and Section 40 27 00. Contractor shall provide all piping and ancillary devices as shown, specified and as required to provide a tested and fully functional system.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ANSI B18.2.2	Square and Hex Nuts
AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast for Water
AWWA C153	Ductile-Iron Compact Fittings for Water Service

Reference	Title
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

B. FACTORY TESTS:

1. The Contractor shall furnish manufacturer's test results for all products as required herein and by the Reference Standards.

2. No material shall be delivered until test results and certifications are submitted to and accepted by the Owner.

3. Joint tests are intended for qualification of joint design and shall be considered to be a qualification test to establish the adequacy of the manufacturer's joint design. The manufacturer shall certify that tests have been performed within the last year with pipes equivalent in size and design and that they have passed the test listed in the Specifications.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. For each piping system, submit manufacturers' product literature to be used for each pipe type and size category, including for each bend, coupling, fitting, bolt, gasket, or other items provided pursuant to the individual pipe specifications.

3. Piping layout drawings, for both exposed and buried piping systems, depicting supports, locations of support, fittings and restraints, seismic and thrust restraint provisions, and other pertinent information, including wall and floor penetrations, where applicable. Piping layout drawings shall clarify detailed connections to new and existing equipment, piping, and structures. Drawings shall be original layouts by the Contractor; photocopies of Contract Drawings are not acceptable.

4. The Contractor shall submit pipe manufacturer's test results which shall include a certification that pipe and ancillary materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the Specification requirements.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. Potholing Report: Verify by excavation, inspection, and survey/measurement of all installation conditions, including existing utilities and structures, for buried pipe before preparation of shop drawings. Submit field measurements, elevations, station locations, and photographs.

1.04 CONSTRUCTION SCHEDULING/SEQUENCING

A. Work provided under this Section will involve expansion and/or modification of an existing piping system which must continue to provide service during construction. The existing system provides potable and fire protection water to the existing Plant facilities and fire hydrants.

B. Connections and utilities modifications shall be coordinated to provide the least possible interruptions of service. Prior to any shutdown, all materials, fittings, supports, equipment, and tools shall be at the Plant and all necessary labor scheduled prior to starting any connection work. The Contractor shall notify the Owner in writing at least 7 days in advance of any required shutdowns so that shutdowns can be coordinated. If extended shutdowns are required, the Owner may require the Contractor to install temporary service to the affected facilities or devices. All temporary piping shall be cleaned, flushed, and disinfected in accordance with Sections 33 08 10 and 33 13 00 before being placed into service.

PART 2–PRODUCTS

2.01 GENERAL

A. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings, and coatings, shall be in accordance with this Section. All materials delivered to the Plant shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

B. Existing pipe material types may not be the same as material types specified for new piping. Contractor shall investigate and provide suitable connections, including electrical isolation, as necessary.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.

D. Where temporary piping is required, piping material and accessories shall be selected by the Contractor and submitted to the Owner for approval. Such piping shall be suitable for operation at the test pressure and capacity of the permanent piping system which the temporary piping is replacing. Temporary piping shall be supported at intervals to prevent sagging or liquid accumulation. Remove temporary piping when permanent water distribution systems are placed into service and temporary systems are no longer needed.

E. Fittings and coupling compatibility: To assure uniformity and compatibility of piping components, fittings and couplings shall be furnished by the same manufacturer(s).

F. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

2.02 DUCTILE IRON PIPE

A. GENERAL:

1. Pipe design, materials, and manufacture shall comply with the following documents:

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	
Water or other liquid	AWWA C151
Joints	
Rubber gasket	AWWA C111
Threaded flange	AWWA C115
Fittings	
Water or other liquid	AWWA C110/AWWA C153
Cement mortar lining	AWWA C104

B. PIPE:

1. Unless specifically indicated otherwise on the Drawings, ductile iron pipe shall be Pressure Class 350 pipe having nominal laying lengths of 18 or 20 feet.

C. FITTINGS:

1. Unless otherwise indicated, fittings shall conform to AWWA C110.

2. All fittings shall be rated for a minimum working pressure of 250 psi.

3. ENDS: flexible restrained push-on to suit the conditions specified.

4. AWWA C153 compact ductile iron fittings in sizes 3 through 12 inches are an acceptable substitute for standard fittings at the Contractor's option.

D. JOINTS:

1. RESTRAINED JOINTS:

a. Restrained joints are required for all pipe joints and fittings.

b. Restrained joints shall be flexible push-on for buried service, unless specifically shown otherwise on the Drawings.

2. FLEXIBLE PUSH-ON JOINTS:

a. Capable of being deflected after full assembly.

b. Joint assembly shall be in conformance with AWWA C600 and manufacturer's recommendations.

c. No field cuts of restrained pipe are permitted without prior approval of the Owner.

d. Candidate manufacturers:

1) American Cast Iron Pipe Company, Flex-Ring or Lok-Ring Joint.

2) U.S. Pipe, TR Flex Joint.

3) Approved equal.

e. Mechanical joints with restraining glands are acceptable only where specifically noted on the Drawings or approved by the Owner. Restraining glands shall be EBAA Iron Mega-Lug, Romac Industries RomaGrip, or equal.

3. FLANGE ASSEMBLIES:

a. Unless otherwise indicated, ductile iron, threaded-on flanges conforming to AWWA C115 or cast flanges conforming to AWWA C110.

b. Flanges shall be adequate for 250 psi working pressure.

c. Bolt circle and bolt holes shall match those of ANSI B16.1, Class 125 flanges and ANSI B16.5, Class 150 flanges.

d. Flanged joints shall not be used in buried pipe installations unless specified or noted on the Drawings.

e. Restrained flanged adapters for connecting plain end pipe to flanges for pipe sizes up to 12-inch diameter:

1) Body and follower ring: ductile iron per ASTM A536, fusion epoxy coated. Hardware: corrosion resistant high strength low alloy steel or Type 304 stainless steel. Gasket material: manufacturer's standard. Provide the appropriate gasket specified for the piping system.

2) NSF 61 listed.

3) Restraint system: Fully restrained system utilizing serrated gripping wedges or factory-installed anchor studs. Set screws are not acceptable.

4) Working pressure: 175 psi minimum.

5) Candidate manufacturers: Megaflange Series 2100 by EBAA Iron; Series 912 Flanged Coupling Adapter by Smith-Blair; or equal.

4. BOLTS, NUTS, AND OTHER HARDWARE:

a. Corrosion-resistant, high-strength, low-alloy steel as specified in AWWA C111.

b. Galvanized or cadmium-plated steel bolts and nuts are not acceptable substitutes.

c. Bolts shall be ANSI B18.2.1 standard square or hexagon head bolts with ANSI B18.2.2 standard hexagon nuts. Threads shall be ANSI B1.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be 2B. Bolt length shall conform to ANSI B16.5.

E. PIPE COATING:

1. Pipe and fittings shall be coated with asphaltic material as specified in AWWA C151.

F. PIPE LINING: CEMENT MORTAR LINING:

1. Interior surfaces of pipe and fittings shall be cement mortar lined in accordance with AWWA C104. Cement shall be ASTM C150, Type II or V, low alkali, containing less than 0.60 percent alkalis.

2.03 JOINT GASKETS

A. PUSH-ON:

1. AWWA C111, SBR or EPDM rubber.

B. FLANGE:

1. Compressed gasket consisting of organic fibers (Kevlar or aramid) and neoprene binder, Garlock Blue-Gard 3300 or equal.

PART 3--EXECUTION

3.01 INSTALLATION

A. GENERAL:

1. Comply with Section 40 27 00 as applicable.

B. STORAGE AND HANDLING:

1. Great care shall be exercised to prevent damage to the pipe during handling, transportation, or storage. Pipe shall not be stored on rough ground and rolling of the pipe on the coating will not be permitted. Any damaged pipe sections shall be repaired or replaced at the expense of the Contractor as satisfactory to the Owner.

2. The Contractor shall comply with the manufacturer's storage, handling, and installation instructions.

C. GRADE AND ALIGNMENT:

1. POTHOLING:

a. Determine horizontal and vertical location of existing buried utilities that may affect installation of water distribution piping through potholing.

b. Locations of potholes are not indicated on the Drawings. Contractor shall select locations of pothole excavations where interferences between existing and new utilities may exist.

c. Based on information obtained, modify alignment and depth of new piping from that indicated on the Drawings as necessary to avoid conflicts with existing utilities. Clearly identify modifications on piping layout drawings submitted for review and approval. Do not proceed with ordering pipeline materials for those areas where modifications are proposed until receiving approvals through submittal reviews.

2. Piping shall be provided as specified or shown on the Drawings except for adjustments to avoid existing utilities and shall be coordinated with electrical and other utility and process piping construction or as otherwise directed by the Owner. Unless otherwise indicated on Drawings, piping fitting angles and vertical and horizontal pipe locations shall be determined by Contractor and submitted to the Owner for favorable review prior to proceeding with the Work.

3. The Contractor shall verify the locations and establish the depth of the existing water mains at the points where connections are to be made prior to trenching for the pipelines. The profile shall be adjusted so no new high spots or low spots are created between the connection points to the existing water mains.

4. The minimum depth of cover for water mains shall be 36 inches over the top of the pipe unless otherwise indicated on the Drawings. Deeper excavation may be required due to localized breaks in grade, or to install the new piping under existing utilities where necessary. Where the profile of the pipeline and the ground surface is shown on the Plans, the pipeline shall be laid to the elevation shown.

D. PIPE INSTALLATION:

1. Bedding and backfill for buried piping shall be as specified per Section 31 23 00 and as shown on the Drawings.

2. Comply with the applicable paragraphs of the following WSDOT Specification sections, unless specified otherwise herein or in related sections:

   a. Section 7-08 General Pipe Installation Requirements.

   b. Section 7-09 Water Mains.

3. Install pipe in accordance with the manufacturer's instructions.

E. ALLOWANCE FOR DIFFERENTIAL SETTLEMENT:

1. Buried piping shall have restrained flexible connections where pipe passes through or connects to structures vaults, or encasements, regardless of whether shown or not on the Drawings.

2. The number and type of flexible connections and their location shall be as specified in Sections 03 48 01, 40 27 00, and 40 27 05.04 based on the type of structure, unless otherwise shown on the Drawings.

END OF SECTION

SECTION 33 12 00

WATER UTILITY DISTRIBUTION EQUIPMENT

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies material and installation requirements for potable water system distribution equipment within the Plant site and as referenced in Section 40 27 00, including water service connections, water utility distribution valves, tapping sleeves and valves, fire hydrants, air release and combination air valves, specialty and control valves, and related accessories as shown on the Drawings, described in the Specifications and as required to provide complete, tested, and fully operable systems.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM A536	Ductile Iron Castings
AWWA C509	Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C550	Protective Interior Coatings for Valves and Hydrants
NSF-61 (ANSI-61)	Drinking Water System Components – Health Effects
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

A. FACTORY TESTS:

1. The Contractor shall furnish manufacturer's test results for all products as required herein and by the reference specifications.

2. No material shall be delivered until test results and certifications are submitted to and accepted by the Owner.

3. Joint tests are intended for qualification of joint design and shall be considered to be a qualification test to establish the adequacy of the manufacturer's joint design. The manufacturer shall certify that tests have been performed within the last year with pipes equivalent in size and design and that they have passed the test listed in the Specifications.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Verify by inspection and measurement of all installation conditions, including existing utilities and structures, for all equipment before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings where exposed conditions are significantly different than indicated on the Drawings.

2. For each product, submit manufacturer's literature and other required data to demonstrate that the product conforms to all Specification requirements.

3. LAYOUTS AND SCHEMATICS: Submit detailed scaled installation drawings of all equipment showing dimensions. Coordinate installation drawings with vaults, adjacent utilities, and other installation conditions the equipment is subject to, to demonstrate the installed condition will conform to the Drawings and Specifications.

4. Submit proof of NSF-61 certification for each item submitted.

5. A copy of this Section, addendum updates included, with each paragraph check marked to indicate compliance or marked to indicate requested deviations from Section requirements.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. MANUALS: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:

a. Valves 3 inches and larger.

b. Air Release Valves.

c. Specialty Valves.

d. Strainers.

2. Field test reports as specified.

1.04 PERFORMANCE REQUIREMENTS

A. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

PART 2--PRODUCTS

2.01 GENERAL

A. PRODUCT UNIFORMITY: To assure uniformity, interchangeability, and compatibility of distribution equipment, all valves and other equipment furnished of the same type shall be by the same manufacturer(s).

2.02 GATE VALVES

A. GENERAL: Comply with the following:

1. Resilient wedge gate valves complying with AWWA C509 or C515. The seal shall be 100% drop-tight. Resilient wedge shall be fully encapsulated with EPDM rubber.

2. Valves shall be fusion-bonded epoxy coated on the inside and outside. The epoxy shall comply with AWWA C550. Interior epoxy shall be NSF-61 certified.

3. The body and bonnet of the valve shall be cast or ductile iron, with a full round port opening equal to or exceeding the diameter of the adjacent pipe.

4. The Contractor shall provide an affidavit of compliance stating that the valve furnished fully complies with AWWA C509 or AWWA C515.

5. MANUFACTURERS: U.S. Pipe Metroseal; Clow; or approved equal.

B. TYPE V121 GATE VALVES:

1. General: 3 through 12 inches for buried installations. Provide 2-inch square operating nut, low zinc bronze or stainless steel non-rising stem, and Type 304 or better stainless steel assembly hardware. 250 psi minimum working pressure rating.

2. End Connections: Restrained mechanical joint on both ends for line valves. Flanged by restrained mechanical joint for tapping sleeves and for fire hydrant services where shown on the Drawings and Standard Details.

C. TYPE V122 GATE VALVES:

1. General: 3 through 16 inches for exposed (vault or above-ground) installations. Outside stem and yoke (OS&Y) with rising stem, unless specifically noted otherwise. Provide handwheel and Type 304 or better stainless steel hardware. 200 psi minimum working pressure rating.

2. End Connections: Flanged.

D. TYPE V124 GATE VALVES:

1. General: 14 through 48 inches for buried installations per AWWA C515. Provide 2-inch square operating nut, low zinc bronze or stainless steel non-rising stem, and Type 304 or better stainless steel assembly hardware. 200 psi minimum working pressure rating.

2. End Connections: Restrained mechanical joint on both ends for line valves.

E. TYPE V125 GATE VALVES:

1. General: 14 through 36 inches for buried installations per AWWA C509. Provide 2-inch square operating nut, low zinc bronze or stainless steel non-rising stem, and Type 304 or better stainless steel assembly hardware. 150 psi minimum working pressure rating.

2. End Connections: Restrained mechanical joint on both ends for line valves.

F. TYPE V126 GATE VALVES:

1. General: 14 through 36 inches for exposed (vault or above-ground) installations per AWWA C509. Outside stem and yoke (OS&Y) with rising stem, unless specifically noted otherwise. Provide handwheel and Type 304 or better stainless steel hardware. 150 psi minimum working pressure rating.

2. End Connections: Flanged.

2.03 TAPPING SLEEVES AND VALVES

A. TAPPING VALVES:

1. Tapping valves shall be identical in construction to the specified gate valves. Tapping sleeves are considered an integral part of a tapping sleeve and valve assembly, with openings the same as the valve.

2. Tapping valves shall have ends and seat rings of sufficient size to permit the use of full size cutters of tapping machines. Tapping sleeve valves shall be flanged on one end to fit the tapping sleeve and a mechanical joint on the other.

3. The tapping valve shall have the discs and seat ring so constructed that the inside diameter of the rings shall be at least 3/16 inch larger than the nominal size of the valve.

B. TAPPING SLEEVES:

1. Tapping sleeves shall be of extra heavy construction to provide resistance to line pressures. The branch outlet shall have a flanged face for bolting to the tapping valve. The inside diameter of the outlet branch shall be sufficiently larger than the nominal size to provide clearance for the full size cutters of the tapping machine.

2. Tapping sleeves shall be cast or ductile iron or Type 304 stainless steel. Gaskets shall be SBR or other approved material. Assembly hardware shall be corrosion-resistant high strength low alloy steel or Type 304 stainless steel.

2.04 FIRE HYDRANT ASSEMBLIES

A. WSDOT Standard Specifications paragraph 9-30.5 and sub-paragraphs 9-30.5(1) through 9-30.5(5), inclusive.

B. Fire hydrants shall have a gloss yellow finish color coat.

C. Hydrants shall have two (2) 2-1/2-inch hose connection nozzles and a 4-1/2-inch pumper nozzle (Steamer Port). Provide a 5-inch Storz quick connect fitting on the pumper nozzle.

D. Submit hose thread standard. Coordinate with and provide hose threads that are compatible with West Pierce Fire and Rescue and Tacoma Public Utilities (Tacoma Water) requirements.

2.05 WATER SERVICE CONNECTIONS

A. APPLICABILITY: For service sizes 2 inches and smaller in diameter.

B. SADDLES: WSDOT Standard Specifications paragraph 9-30.6(1), except stainless steel saddles are not allowed.

C. SERVICE PIPING: Section 40 27 00, System 7.

D. SERVICE FITTINGS: WSDOT Standard Specifications paragraphs 9-30.6(4) and 9-30.6(6) for copper tubing.

E. INSULATING CORPORATION STOP: WSDOT Standard Specifications paragraph 9-30.6(2), except corporation stops shall incorporate a nylon insulator to prevent the flow of stray electrical currents.

F. POLYETHYLENE TUBE ENCASEMENT FOR COPPER SERVICES: ASTM D1248, minimum 6 mil thickness, blue in color.

2.06 AIR RELEASE VALVES (ARVs)

A. Releases accumulated air under pressure at pipeline high points.

B. AWWA C512, except as modified herein. Cast or ductile iron body; stainless steel float.

C. MANUFACTURERS: APCO model No. 50; equivalent model by Val-Matic; or equal.

D. AIR RELEASE VALVES (ARVs):

1. EQUIPMENT LIST:

Equipment Number:
P01POTARV001
P01POTARV002
P01POTARV003
P01POTARV004
P01POTARV005

2. Operating Pressure (psig): 60

3. Discharge Rate (CFM): 4.0

4. Minimum valve Inlet Size: 3/4 inch.

5. Orifice Size: 3/32 inch.

2.07 ACCESSORIES

A. VALVE BOXES FOR BURIED VALVES:

1. Valve boxes shall be installed on all buried valves. The box shall be of cast iron, two piece slip type standard design with a base corresponding to the size of the valve. Provide extensions as necessary if the depth exceeds the depth of the standard valve box. All valve boxes and covers shall be suitable for HS-44 AASHTO wheel loading. Each top and lid section shall be tested for accuracy of fit and marked in sets at the factory for delivery.

2. The box shall be coal tar painted by the manufacturer using its standard.

3. The cover shall have the word “WATER” cast in it.

4. MANUFACTURERS: Olympic Foundry Inc.; Clow; Mueller; or approved equal.

B. VALVE STEM EXTENSIONS:

1. Valve stem extensions shall have a 2-inch-square operating nut and self-centering rockplate support.

2. Provide stem extensions on all valves where required to raise the operating nut to within valves with an operating nut more than 4 feet below grade shall have a valve stem extension to raise the operating nut to within 24 inches of the ground surface. Provide centering rings.

PART 3--EXECUTION

3.01 GENERAL

A. Comply with WSDOT Standard Specifications paragraph 7-12.3, Construction Requirements. Disinfection and testing procedures shall be as specified in Sections 33 13 00 and 33 08 10.

B. Coat all buried valves in the field with two coats of coal tar epoxy or mastic.

C. Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.

D. Install valves and accessories such that all parts are easily accessible for maintenance and operation.

E. Connections between ferrous and non-ferrous piping, valves, accessories, or pipe supports shall be made using a dielectric coupling, union, or flange.

F. Store, handle, and install all valves and other distribution equipment in full conformance with the manufacturer's recommendations. Also comply with additional requirements stated in the following paragraphs.

3.02 FIRE HYDRANT INSTALLATION

A. WSDOT Standard Specifications paragraph 7-14.3, inclusive of all sub-paragraphs. Comply with the applicable Standard Details.

3.03 TAPPING SLEEVE INSTALLATION

A. Tapping sleeves shall be installed by competent crews experienced in the installation of tapping sleeves and valves.

B. Install tapping sleeves and valves in accordance with manufacturer recommendations and the applicable Standard Details. Install thrust blocking and valve support blocking and allow adequate cure time prior to boring.

C. SIZE-ON-SIZE INSTALLATIONS: Provide a same size branch and run tapping sleeve and valve; however, downsize the cutter bit by one standard pipe diameter size.

3.04 PRESSURE REDUCING VALVE INSTALLATION

A. Install and test in accordance with manufacturer recommendations.

3.05 WATER SERVICE INSTALLATION

A. Comply with the applicable Standard Details.

B. Comply with WSDOT Standard Specifications paragraph 7-15. Provide polyethylene tube encasement for copper service tubing for a minimum distance of 5 feet from the distribution main. Seal the end of the encasement around the insulating corporation stop at the service saddle with tape.

3.06 VALVE AND VALVE BOX INSTALLATION

A. Comply with the applicable Standard Details.

B. Comply with WSDOT Standard Specifications paragraph 7-12.3, except as modified below:

1. The lower casting shall be supported by both backfill and a Styrofoam collar cushion.

2. In paved areas, the frame and cover top piece shall be set flush with the surface of the finished pavement in accordance with the following procedure:

a. Prior to paving or overlaying the roadway, install the valve box riser and extensions, if necessary, to the required height. Do not install the slip top frame and cover piece or concrete collar at this time.

b. Survey or take other measurements to record the horizontal location of the center of each valve riser opening.

c. Temporarily cover the opening with heavy duty plywood or steel plate of no greater dimension than the outer diameter of the concrete collar shown on the applicable Standard Details.

d. Pave or overlay the roadway to the final course.

e. Mark the location of each valve box opening on the pavement based on the recorded horizontal locations. Using a jackhammer, excavate a circular hole in the pavement to the dimensions of the concrete collar shown on the applicable Standard Details. Remove the temporary cover from the riser opening.

f. Place the slip top piece over the riser. Pack sand or fill material beneath the flared bottom of the top piece to hold it to the correct elevation. The top piece shall be set flush with the adjacent finish pavement grade by using a straight screed bar bridging across the excavation, resting on the finished pavement surface on both sides. The top piece rim should touch the bottom of the screed bar.

g. Install the concrete collar in accordance with the applicable Standard Details. Screed the concrete flush with the asphalt and rim. Pressure wash concrete residue on the adjacent asphalt to prevent permanent discoloration. Do not allow traffic on the concrete ring until the concrete has developed sufficient compressive strength.

3. The top piece may be temporarily installed during construction while temporary or base courses of asphalt pavement are in place. However, the piece shall be removed and the above procedure carried out at the time the final course of pavement is installed.

END OF SECTION

SECTION 33 13 00

DISINFECTING OF POTABLE WATER UTILITY DISTRIBUTION

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies bacteriological disinfection and testing requirements for potable water utility distribution.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
AWWA C651	American Water Works Association (AWWA) Standard for Disinfecting Water Mains
WSDOT Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Submit a Disinfection Plan including the procedures, methods, materials, and schedules proposed for disinfecting and method of disposal of the disinfection solution.

PART 2--PRODUCTS

2.01 MATERIALS

A. DISINFECTION SOLUTION: Chlorine in accordance with WSDOT Standard Specifications paragraphs 7-09.24(C) through 7-09.24(G), inclusive.

PART 3--EXECUTION

3.01 PREPARATION

A. Disinfect pipelines and distribution equipment following successful pressure testing.

B. Prior to disinfecting, thoroughly clean and flush the pipeline and associated equipment and appurtenance interiors of dust, dirt, foreign matter, and deleterious substances in accordance with Section 33 08 10.

C. Schedule and coordinate the work with operating personnel. Once disinfection has been satisfactorily accomplished, no further work on the facilities will be allowed unless work must be made to perform repairs, in which case repeat disinfection on a localized basis at no additional cost to the Owner. The Contractor shall be responsible for maintaining integrity of the disinfected facilities.

D. Provide all necessary appurtenances required for the disinfection procedures including taps, temporary piping, connections, and shutoff valves. Submit data on appurtenances which will be permanently installed for review by the Owner.

3.02 APPLICATION

A. After completing pipeline installation activities, disinfect all surfaces that will come in contact with potable water in accordance with WSDOT Standard Specifications paragraph 7-09.3(24), inclusive of all sub-paragraphs.

3.03 FIELD QUALITY CONTROL

A. CHLORINE RESIDUAL TESTING: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified. Testing will be performed by the Owner.

B. BACTERIOLOGICAL ANALYSES OF WATER: In accordance with WSDOT Standard Specifications paragraph 7-09.3(24)N. Contractor shall provide the necessary means and access for the Owner to collect representative water samples for testing as required by the Owner. If bacteriological analyses do not satisfy the referenced requirements, then the Contractor shall repeat the disinfection procedure in accordance with WSDOT Standard Specifications paragraph 7-09.3(24)O until these requirements are met. Contractor shall be responsible for all costs of testing.

3.04 DISPOSAL OF DISINFECTION SOLUTION

A. Dispose of disinfection solution in accordance with WSDOT Standard Specifications paragraph 7-09.3(24)A and N, and in a manner acceptable to the Owner.

END OF SECTION

SECTION 33 32 16

PACKAGED SEWAGE GRINDER PUMP STATION

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies unit package sewage grinder pump station units; each unit consists of a grinder pump, polyethylene tank, pump removal harness, discharge assembly/shut-off valve, anti-siphon valve/check valve assembly, electrical alarm assembly, and all necessary packaged electrical components, wiring, controls, and panel.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued of otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT), Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition
Pierce County Sewer Utility	Sanitary Sewer Development Specifications, 2012 edition.

B. FACTORY TESTING:

1. Submit factory testing results prior to shipment.

2. Each grinder pump shall be submerged and operated for at least 1.5 minutes.

3. Test all ancillary components including the anti-siphon valve, check valve, discharge assembly, and each unit's dedicated level controls and motor controls. Test actual appurtenances and controls which will be installed in the field. A common set of appurtenances and controls for all pumps is not acceptable.

4. Submit certified test results showing the operation of each grinder pump at two different points on its curve. Provide validation testing of the integral level control performance, continuity to ground, and acoustic tests of the rotating components.

5. Leak test tank assemblies to assure the integrity of all joints, seams, and penetrations. All penetrations such as inlets, discharge fittings, and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).

C. SPECIAL WARRANTY:

1. The Manufacturer shall provide a parts and labor warranty on the complete station and accessories specified herein or otherwise supplied by the Manufacturer. The Guaranty period shall be for a minimum of 24 months after Substantial Completion, but no greater than 27 months after receipt of shipment. All manufacturing defects found during the warranty period shall be corrected at no cost to the Owner.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Detailed installation drawings of all equipment showing dimensions. Indicate the inlet sewer diameter, invert elevation, and finished grade elevation of each unit.

3. For each product, submit manufacturer's literature and other required data to demonstrate that the product conforms to all specified requirements.

4. Product submittals shall be transmitted to the Owner and approved prior to delivery of the materials to the site.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. MANUALS: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists.

2. Factory test reports as specified.

3. Field test reports as specified.

PART 2--PRODUCTS

2.01 ACCEPTABLE MANUFACTURER/PRODUCTS

A. Environment One Corporation (E-One) Model WH231 to match existing equipment currently installed at the facility. Owner will not consider substitutions.

B. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 10 years.

C. PRODUCT UNIFORMITY: To assure uniformity, interchangeability, and compatibility of components and equipment, all equipment furnished under this section shall be by the same manufacturer(s).

D. The complete assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc. The grinder pump shall also bear the seal of NSF International.

2.02 OPERATING CONDITIONS

A. Each unit shall be capable of meeting at a minimum the following pump performance requirements:

Design Point	Q (gpm)	Total Head (ft)
1	15	0
2	11	90
3	7.5	185

B. Each unit shall be capable of operating under negative head conditions without overloading the motor.

2.03 PUMP

A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal.

B. Provide double O-ring seals at all casting joints.

C. CASTINGS: CAST IRON: Epoxy coat inside and out to 8 to 10 mil nominal dry film thickness (DFT).

D. ROTOR: Polished, precipitation hardened stainless steel.

E. STATOR: Ethylene propylene synthetic elastomer suitable for domestic wastewater service. Buna-N is not acceptable.

2.04 GRINDER ASSEMBLY

A. The grinder assembly shall be designed to reduce all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, wipes, rubber, and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4-inch diameter stainless steel discharge piping.

B. The grinder shall be located immediately upstream of the pumping element and shall be direct-driven by the same (one piece) motor shaft as the pump.

C. The grinder impeller shall be securely fastened to the shaft by means of a threaded connection. Pins or keys are not acceptable.

D. GRINDER IMPELLER: One-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 to 60c for abrasion resistance.

E. SHREDDER RING: Stationary, cast iron, with teeth ground into the material to achieve effective grinding. Provide a staggered tooth pattern with only one edge engaged at a time, thus maximizing the cutting torque.

F. The assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures.

G. The grinder shall be constructed to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. As such, provide the following characteristics:

1. Flow into the grinder and pump shall be in an upward direction.

2. The maximum velocity through the cutting mechanism shall not exceed 4 feet per second.

3. The inlet shroud shall have a diameter of no less than 5 inches.

4. Maximum rotational speed: 1,800 rpm.

2.05 ELECTRIC MOTOR

A. CHARACTERISTICS: 1 HP, 1,725 RPM, 240 Volt 60 Hertz, 1-phase, capacitor start, ball bearing, air-cooled induction type. Oil-filled motors are not acceptable. The motor shall be press-fit into the casting.

B. INSULATION: Class F.

C. STARTING CURRENT: Not to exceed 30 amperes.

D. STARTING TORQUE: Minimum 8.4-foot-pounds.

E. MOTOR PROTECTION: UL listed automatic-reset, integral thermal overload switch.

F. MATERIALS: The wetted portion of the motor armature shall be 300 Series stainless steel.

2.06 BUCK-BOOST TRANSFORMER

A. GENERAL: Vendor package shall include a transformer in a NEMA 3R-rated enclosure to convert the available 208-volt single phase power supply to 240-volt single phase power.

2.07 MECHANICAL SEAL

A. Stationary ceramic seat, carbon rotating surface with faces precision lapped. Stainless steel spring.

2.08 TANK

A. MATERIAL: Polyethylene.

1. Rotational molded polyethylene with high environmental stress cracking resistance.

2. Thermal welded seams factory tested for leak tightness.

3. Tanks must be designed to withstand at least 150 percent of the maximum external pressure exerted by saturated soil loading at maximum burial depth.

B. BASIN CAPACITY: 230 gallons minimum. The largest diameter must be no less than 50 inches and no greater than 52 inches.

C. ACCESSWAY AND COVER:

1. Provide a lockable cover assembly with integral vent providing low profile mounting and watertight capability. The cover shall be high-density polyethylene, green in color, with a load rating of 150 lbs per square foot. The domed cover shall have an outside diameter of approximately 30 inches.

2. Provide an accessway of corrugated double-wall HDPE construction with the internal wall being generally smooth. Any incidental sections of a single-wall construction are to be a minimum .250-inch thick.

3. All seams created during tank construction are to be thermally welded. The accessway wall must be designed to withstand at least 150 percent of the maximum external pressure exerted by saturated soil loading at maximum burial depth.

4. The depth of each station furnished in this contract will vary. The height of the accessway shall be adjusted at the factory for each station such that field installation at the correct pipe invert elevation and finished grade elevations shown on the Drawings can be achieved. Accessway design shall also enable field adjustment in 3-inch increments.

D. PIPE CONNECTION:

1. The tank shall be furnished with EPDM grommet fitting(s) to accept the inlet gravity sewer piping. The quantity of pipes, pipe size, pipe material, location, and elevations of the pipe penetrations shall be as shown on the Drawings.

E. The tank, accessway, and factory pipe penetration fittings shall be factory tested and warranted by the manufacturer to be watertight.

2.09 DISCHARGE HOSE AND DISCONNECT VALVE

A. Discharge fittings and piping shall be constructed of polypropylene, EPDM or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

2.10 CHECK VALVE

A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve.

B. The check valve shall provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow.

C. Moving parts shall be made of stainless steel and fabric reinforced synthetic elastomer. A nonmetallic hinge shall be an integral part of the flapper assembly. The valve shall be designed to seat at low back pressure. The valve body shall be an injection molded thermoplastic resin.

D. The valve shall be rated for continuous operating pressure of 235 psi.

2.11 ANTI-SIPHON VALVE

A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve.

B. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

C. Moving parts shall be made of stainless steel and fabric-reinforced synthetic elastomer. A nonmetallic hinge shall be an integral part of the flapper assembly. The valve shall be designed to operate at low back pressure. The valve body shall be injection-molded thermoplastic resin.

2.12 CORE UNIT CONSTRUCTION

A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, motor controls, level sensor assembly, check valve, anti-siphon valve, electrical quick disconnect and wiring.

B. The watertight integrity of the core unit shall be factory tested at a minimum of 5 PSIG.

C. The core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy removal for maintenance.

D. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation.

2.13 ELECTRICAL QUICK DISCONNECT

A. Provide a factory-installed NEMA 6P electrical quick disconnect (EQD) for all power and control functions.

B. Provide from the factory 25 feet of useable electrical supply cable (ESC) to connect to the alarm panel.

C. The EQD shall seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing or junction boxes are not acceptable.

D. Each EQD shall include a watertight cover to protect the internal electrical pins while the EQD is unplugged.

2.14 CONTROLS

A. All motor starting controls shall be located in the cast iron enclosure of the core unit.

B. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Controls shall be intrinsically safe. Enclosure shall be manufactured from a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump.

C. Level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater. All connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit.

D. High-level sensing shall be accomplished with a similar separate air column sensor and pressure switch. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch.

E. Each assembly shall be equipped with a factory installed equalizer diaphragm that compensates for atmospheric pressure or temperature changes.

F. Float switches, including float trees, are not acceptable.

2.15 PANEL

A. Each grinder pump station package shall include a NEMA 4X panel. All panel components shall be UL-listed. The panel will be fed from a single source of power at 240 VAC, single phase, 60 Hz.

B. PANEL ENCLOSURE:

1. MOUNTING: Wall or pole mounting as indicated on the Drawings.

2. MATERIAL: Thermoplastic.

3. Provide a hinged, lockable cover with padlock hasp.

4. MAXIMUM DIMENSIONS: 12.5 inches wide by 16 inches high by 7.5 inches deep.

C. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides.

D. Each panel shall include the following features:

1. One 15-amp, single-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit.

2. Automatic resetting fuse for the AC power circuit.

3. Push-to-run button.

4. High level alarm circuit.

5. RUN-TIME/HOUR METER: A run-time meter to display the total run-time for the pump core.

6. EVENT/CYCLE COUNTER: A counter to display the number of operations of the pump core.

7. External visual alarm.

8. LEDs for status indication as described below.

9. LED for pump RUN indication.

E. HIGH LEVEL ALARM:

1. When liquid level in the tank rises above the alarm level, the contacts on the alarm pressure switch activate, visual alarms are activated.

2. Visual alarm remains illuminated until the level in the tank drops below the "off" setting of the alarm pressure switch.

3. Visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.

F. REMOTE CONTACTS:

1. PROVIDE ALARM ACTIVATED DRY CONTACTS: Normally open relay contact that closes upon any alarm activation, for connection to a remote monitoring location.

2. PROVIDE HIGH LEVEL ALARM ACTIVATED DRY CONTACTS: Normally open contacts that close on high level alarm, for connection to a remote monitoring location.

3. PROVIDE PUMP RUN ACTIVATED DRY CONTACTS: Normally open relay contact that closes upon pump running indication, for connection to a remote monitoring location.

G. PUMP PROTECTION: Provide protection from the following operating conditions:

1. RUN DRY PROTECTION. A 20-minute lockout cycle will prevent the motor from operating and will illuminate an LED when the wastewater level in the tank is below the pump inlet level. The condition is rechecked every 20 minutes. If the lockout cycle has been initiated and the condition is satisfied, the pump is not allowed to cycle normally but the LED remains latched. The LED will remain latched until the pump breaker is turned off and then on again (reset). If the condition is not satisfied after three consecutive attempts, the visual alarm will be activated until the pump breaker is turned off and on (reset) or until there is one cycle of normal operation. If a high level condition is presented at any time, a pump run cycle will be activated.

2. HIGH SYSTEM PRESSURE PROTECTION. A 20-minute lockout cycle will prevent the motor from operating and will illuminate an LED when the pressure in the discharge line is atypically high. The condition is rechecked every 20 minutes. If the condition resolves itself, the pump is allowed to cycle normally but the LED remains latched. If the condition does not resolve after three consecutive attempts, the pump is locked out indefinitely until the condition resolved (i.e. plug is removed or valve opened) and power is reset. The LED will remain latched until the pump breaker is turned off and then on again (reset). The visual alarm will be activated.

2.16 WIRING FOR VENDOR PACKAGES

A. All wiring between Vendor furnished components installed on a common skid or assembly shall be factory installed, terminated, and tested.

B. Wiring between Vendor furnished components shipped on separate skids or assemblies is not scheduled in the Construction Documents.

1. The Contractor is responsible for selecting, furnishing, installing, and testing wiring between Vendor-furnished components shipped on separate skids or assemblies.

2. Interconnection diagrams and termination requirements between Vendor furnished components shipped on separate skids or assemblies shall be developed by the Vendor and submitted as specified in this Section. Interconnection diagrams and termination requirements shall be as defined in the requirements for interconnection diagrams specified in Section 26 05 00.

3. Coordinate cable/conductor requirements with the Contractor to ensure the correct wiring configuration is furnished, installed, terminated, and tested for Vendor furnished components that are shipped on separate skids or assemblies.

C. Wiring between individual components, skids, or assemblies and the plant control system and/or power distribution are specified elsewhere in the Construction Documents. Wiring between individual components, skids, or assemblies and the plant control system and/or power distribution are not furnished by the Vendor unless specifically noted otherwise.

D. Vendor furnished panels shall be factory labeled consistent with the Vendor's connection diagram (wiring configuration) submittal.

PART 3--EXECUTION

3.01 DELIVERY

A. All grinder pump core units, including controls, will be delivered to the job site fully assembled, tested, and ready for installation. Grinder pump cores will be shipped separately from the tanks.

B. FIELD QUALITY CONTROL: The Contractor shall comply with manufacturer's handling and installation instructions and the referenced standards.

3.02 INSTALLATION

A. Comply with all manufacturer installation instructions.

B. Tanks shall not be set into the excavation until the foundation and excavation have been approved by the Owner.

C. The tank shall be placed such that the inlet sewer invert elevation(s) are true to plan, and the height of the accessway tube is adjusted such that the cover elevation will be consistent with the applicable Standard Detail based on the finished grade indicated on the Drawings.

D. Fill the tank to the bottom of the inlet with water prior to placing the concrete ballast collar, to prevent the unit from shifting while the concrete is being poured.

3.03 BACKFILL

A. After the concrete ballast has sufficiently cured, backfill the tank and accessway tube with Pipe Bedding and Zone Material for Perforated Drain Pipes (Gravel Backfill for Drains), compacted to 95% relative compaction, as specified in Section 31 23 00.

B. Take care not to damage the tank and accessway with compaction equipment or methods.

3.04 LEAK TESTING

A. After backfilling, the tank shall be leak tested in accordance with Section 01 75 00.

B. Repair all leaks to the satisfaction of the Owner prior to acceptance.

3.05 START-UP AND FIELD TESTING

A. The manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the Owner in the operation and maintenance of the equipment.

B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This includes, as a minimum, a portable generator and power cable (if temporary power is required), water in each basin (filled to a depth sufficient to verify the high level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.

C. Upon completion of the installation, the authorized factory technician(s) will perform the following test on each station:

1. Verify the discharge shut-off valve in the station is fully open.

2. Turn ON the alarm power circuit and verify the alarm is functioning properly.

3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic “on/off” controls are operative. The pump should immediately turn ON.

4. Consult the Manufacturer’s Service Manual for detailed start-up procedures.

D. Upon completion of the start-up and testing, the manufacturer shall submit to the Owner the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and all installation or manufacturing deficiencies have been corrected to the satisfaction of the Owner.

END OF SECTION

SECTION 33 39 00

SANITARY SEWERAGE UTILITY STRUCTURES

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies standard precast concrete sanitary sewer manholes and wet well structures, associated frames and covers, and appurtenances. This Section is applicable to RCW and DRT gravity piping systems, the wet well for the Filter Backwash Pump Station, manhole riser sections for the Filter Backwash Sedimentation Chamber, and other systems where specifically indicated on the Drawings.

1.02 QUALITY ASSURANCE

A. REFERENCED STANDARDS:

1. This Section incorporates by reference the latest revision of the following documents. They are a part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
AASHTO	Standard Specifications for Highway Bridges
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C55	Specification for Concrete Brick
ASTM C139	Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C150	Specification for Portland Cement
ASTM C443	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	Specification for Precast Reinforced Concrete Manhole Sections
ASTM C1028	Standard Test Method for Determining the Static Coefficient of Friction (Slip Resistance)
ASTM D3753	Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells
ASTM D4101	Specification for Polypropylene Injection and Extrusion Materials

Reference	Title
WSDOT Standard Specifications	Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition
Pierce County Sewer Utility, Sanitary Sewer Development Specifications	Pierce County Sewer Utility, Sanitary Sewer Development Specifications, 2012 edition

B. FACTORY QUALITY CONTROL: The Contractor shall furnish manufacturer's test results for all products as required herein and by the reference specifications.

C. FIELD QUALITY CONTROL: The Contractor shall comply with manufacturer's handling and installation instructions.

D. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Product information for precast manholes, inserts, frames and covers, riser sections, base sections, top slabs and cone sections, adjustment rings, pipe connectors, sealants, coatings, joints, and steps.

2. SHOP DRAWINGS: Indicate manhole locations, dimensions, and elevations. Provide sizes, locations, orientations, and pipe invert elevations of penetrations. Indicate type and location of joints, reinforcing steel, and layout of inserts and attachments.

   Indicate number and height of precast riser sections, and number and height of grade adjustment rings. Provide separate shop drawings specific to each manhole submitted. Submit modular mechanical expanding rubber seals and manhole connector product data.

3. A copy of this Section, addendum updates included, with each paragraph check marked to indicate compliance or marked to indicate requested deviations from Section requirements.

4. Submit design calculations for top, riser, and base sections substantiating conformance with ASTM C478, watertight construction for the manhole depths indicated on the Drawings, and demonstrating suitability for pressurized operation up to the hydraulic grade line elevation requirements specified.

PART 2--PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated on the Drawings, sanitary sewer manholes, and appurtenances shall be as specified herein.

B. The use of salvaged or scrap materials will not be permitted.

C. Standard manholes shall be constructed entirely of precast concrete sections conforming to ASTM C478 and shall be of watertight construction. Design wet well and tank drain manholes for pressurized operation up to a hydraulic grade line elevation of 52.0 feet.

D. Precast concrete manhole bases with manhole invert liners as specified herein shall be used for manhole installation on sewer mains 36-inch-diameter or less. Flow channels shall be completed as specified herein or as shown on the applicable Standard Details. Benches shall be sloped to drain into the channel.

E. Concrete manholes shall receive exterior protective coatings as specified herein.

F. Manholes shall be designed for AASHTO HS-20 minimum live loading and installation conditions.

2.02 PRECAST CONCRETE RISER SECTIONS

A. Unless otherwise indicated, manhole nominal inside diameter shall be 48 inches.

B. Per ASTM C478.

C. CEMENT: ASTM C150, Type II.

D. Minimum height of a riser section shall be 1 foot. Heights of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

E. Eccentric top cone, tapering to 24 inches inside diameter and between 18 inches and 36 inches high. Cone joining to the riser sections shall be similar to joining between riser sections, but the top surface shall be flat and at least 5 inches wide, radially, to receive grade adjustment rings.

F. Grade adjustment rings shall be precast, reinforced concrete meeting the requirements of ASTM C478. Individual grade rings above the cone section shall be 24 inches inside diameter and shall be between 4 inches and 6 inches high. The overall height of grade ring(s) shall be a minimum of 4 inches, and shall be no greater than 12 inches [two (2) 6-inch rings]. A maximum of two (2) grade rings shall be allowed on new manholes.

2.03 PRECAST BASE SECTIONS

A. Precast base sections shall conform to the requirements for precast riser sections except that a reinforced base slab shall be cast monolithically with the walls or otherwise constructed to achieve a watertight structure. Base slab thickness shall be 6 inches, minimum. Base slabs shall be reinforced with No. 4 steel bars on 12-inch centers placed in the middle third of the slab thickness and extending into the wall section of the base. The walls of the base section shall be reinforced in accordance with ASTM C478.

B. Pipe stubs shall be provided in the locations shown on the Drawings. Positioning of the stubs shall accommodate the pipe size, invert elevations and direction of sewer connections indicated on the Drawings.

2.04 JOINT SEALANT

A. Joints shall utilize both of the following sealant types simultaneously.

B. RUBBER GASKET TYPE: Sewage resistant elastomer, ASTM C443.

C. Pre-formed joint rope sealant form conforming to the requirements of Federal Specification SS-S-210. Kent SealTM as manufactured by Hamilton Kent, Ram-Nek XT as manufactured by Henry Co., or approved Equal.

2.05 EXTERIOR PROTECTIVE COATING

A. Bituminous coal tar epoxy, specially formulated for submerged service and exposure to raw sewage. Bitumastic No. 300M as manufactured by Koppers Company, Inc., or similar coating by TNEMEC, Ameron, or approved Equal.

2.06 MANHOLE AND STRUCTURE CONNECTIONS

A. MANHOLE CONNECTORS:

1. Modular Mechanical Expanding Rubber Seals:

a. Interlocking synthetic rubber links connected by bolts and nuts to form a continuous belt. Tightening of the bolts shall expand the rubber to form a watertight seal of the annular space between a pipe and the hole or sleeve in the wall. Both sides shall be grouted flush with non-shrink grout unless otherwise shown on the Drawings.

b. Hardware: Type 316 Stainless Steel

c. Elastomer: EPDM

d. Manufacturer: Link Seal LS-316 series or Approved Equal.

2. Inside drop manhole connections shall utilize ASTM C923. Kor-n-Seal Pipe-to-Manhole Connectors, stainless steel wedge, Boots as manufactured by Trelleborg NPC, Inc. or equivalent. Submit proposed product for review. Other connection devices may be considered provided they are made of elastomers resistant to sewage and grease, chemicals and normal sewer gases, and form a watertight seal at the point of connection with the manhole. Metallic parts shall be Type 316 stainless steel. The connectors shall be rated for a minimum of 13 psi head pressure.

2.07 STEPS AND GRAB BARS

A. GENERAL:

1. ASTM C478.

2. OSHA and WISHA standards.

3. Equally space steps no greater than 13 inches on center.

B. Reflective steps shall be installed in base sections, riser sections, and taper sections so that the completed manhole will have a continuous vertical ladder with equally spaced rungs as shown in the applicable Civil Standard Details. Infiltration from around steps will not be permitted.

C. Polypropylene manhole steps shall meet the requirements of ASTM C478 and AASHTO M-199. The polypropylene material shall be made of a copolymer polypropylene superior in its resistance to corrosiveness, meeting the requirements of ASTM D4101, and shall completely encapsulate a deformed 1/2-inch steel reinforcing rod conforming to ASTM A615, Grade 60.

D. “Lane Poly Steps”, Model P-14938, as manufactured by Lane International Corporation (Tualatin, Oregon), or Approved Equal.

2.08 FRAMES AND COVERS

A. Frames and covers shall be 24-inch diameter clear opening unless specified otherwise on the Drawings or Standard Details.

B. Frames and covers shall be fiberglass reinforced polyester unless specified otherwise on the Drawings or Standard Details. Frames and covers shall be manufactured to meet or exceed all specifications of ASTM D3753 and designed for H-20 traffic applications (withstand 40,000 lb wheel load) at a minimum. Covers shall be easily removed by one person and shall be interchangeable.

C. Frames and covers shall be manufactured from commercial grade unsaturated polyester thermoset resin with 45 to 70% fiberglass reinforcements. Material shall be corrosion resistant to sewer, sewer gas, salt water, and petrochemical hydrocarbons.

D. Frames and covers shall have quarter turn paddle locks or equivalent locking system. An integrated gasket system to reduce traffic shock, noise, and odors shall be used.

E. IDENTIFICATION AND MARKINGS: Comply with the Standard Details. The manufacturer's name shall be cast into an exposed surface. All covers must have the statement "Confined Space Permit Required" cast on the cover.

F. Provide non-slip low profile waffle tread for covers. Slip resistance shall be greater than 0.6 as described in ASTM C1028.

G. CANDIDATE MANUFACTURER: GMI Composites Inc. or approved equal.

2.09 NON-SHRINK GROUT

A. Prepackaged, cementitious, non-metallic, non-shrink grout. Speed Crete Red Line as manufactured by The Euclid Chemical Company, or approved equal.

2.10 SPARE PARTS

A. PROCEDURES: Section 01 78 43.

B. Provide the following spare parts:

1. Five (5) lifting handles and five (5) locking keys for each model of manhole frame and cover furnished.

C. Tag and store spare parts in accordance with Section 01 78 43.

PART 3--EXECUTION

3.01 MISCELLANEOUS

A. Provide an Exterior Protective Coating to the exterior surfaces of all precast base, risers, cone, and adjusting ring sections. The minimum DFT shall be 25 mils. Coating shall be applied in accordance with the manufacturer's recommendations.

B. Polypropylene steps shall be installed in accordance with the manufacturer's instructions. In no case will the pre-drilled hole be allowed to penetrate through the wall of the manhole section.

C. After manhole section placement, steel lifting loops or hooks for precast components shall be removed to a depth of 1 inch below the surface of the concrete and the concrete shall be patched. Lift holes shall be completely filled with non-shrink grout.

3.02 MANHOLE AND STRUCTURE PIPE CONNECTIONS

A. PIPE CONNECTIONS:

1. Make pipe connections in accordance with the connector manufacturer's instructions.

B. PIPE FLEXIBILITY AT MANHOLE AND STRUCTURE CONNECTIONS:

1. Provide one flexible connection where pipes connect to manholes, regardless of whether shown or not on the Drawings. Flexible connectors shall be as specified in Section 40 27 05.04.

2. Locate the flexible connection within a distance no greater than one-half of the outside diameter of the pipe or 12 inches, whichever is greater.

C. CONNECTIONS TO EXISTING MANHOLES OR STRUCTURES:

1. Submit proposed method of connection for review in conjunction with Piping Layout Drawings as specified in Section 40 27 00.

2. Verify existing invert elevations. Discrepancies in invert elevations shall be immediately brought to the attention of the Owner for direction.

3. The Contractor shall excavate completely around the structure to prevent unbalanced loading.

3.03 PLACING MANHOLE SECTIONS

A. In accordance with Section 31 23 00, scarify and compact foundation subgrade soil to minimum of 95 percent and place Crushed Surfacing Top Course a minimum of 6 inches depth for precast manhole bottom sections. Level the gravel to provide full bearing for the entire base slab. Leveling the base section by wedging is not allowed. Base sections shall be set level and perpendicular.

B. Precast riser sections and cones shall be set using the specified joint sealant and gasket as specified herein. Priming and preparation of surfaces and installation of jointing material shall be in accordance with the manufacturer's instructions. Position eccentric cone section per the Drawings or as directed by the Owner.

C. Manhole grade adjustment rings shall be set in a full bed of non-shrink grout.

D. Backfill around manholes and pipe connections in accordance with Section 31 23 00.

3.04 FRAME AND COVER INSTALLATION

A. In paved areas, frames and covers shall be set flush with the surface of the finished pavement in accordance with the following procedure:

1. Prior to paving or overlaying the roadway, install the grade adjusting rings to the required height. Do not install the frame and cover or concrete collar at this time.

2. Survey or take other measurements to record the exact horizontal location of the center of each manhole opening.

3. Temporarily cover the manhole opening with heavy duty plywood or steel plate of no greater dimension than the outer diameter of the concrete collar shown on the applicable Standard Details. Place the specified pavement aggregate subgrade over the plate to the level of the adjacent pavement subgrade.

4. Pave or overlay the roadway to the final course.

5. Mark the location of each manhole opening on the pavement based on the recorded horizontal locations. Using a jackhammer, excavate a circular hole in the pavement to the dimensions of the concrete collar shown on the applicable Standard Details. Remove the aggregate and temporary cover from the manhole opening.

6. Shim and set the manhole cover frame in a full bed of non-shrink grout. Comply with manufacturer's installation instructions. The rim shall be set flush with the adjacent finish pavement grade by using a straight screed bar bridging across the excavation, resting on the finished pavement surface on both sides. Both sides of the rim should touch the bottom of the screed bar. Check the level along two axes; perpendicular and parallel to the roadway centerline.

7. Install concrete collar where indicated on the Drawings or Standard Details, after grout has firmly set and is unyielding. Screed the concrete flush with the asphalt and rim. Quickly pressure wash any concrete residue on the adjacent asphalt to prevent permanent discoloration. Do not allow traffic on the concrete ring until the concrete has developed full compressive strength.

B. The frame and cover may be temporarily installed for testing purposes or during construction while temporary or base courses of asphalt pavement are in place. However the frame and cover shall be removed and the above procedure carried out at the time the final course of pavement is installed.

C. In landscaped and other areas not subject to vehicular traffic, the rim elevation shall be set 6 inches above finish grade. The rim shall be set 1 inch above finish grade in gravel roadway shoulders or other unpaved areas subject to vehicular traffic.

END OF SECTION

SECTION 33 41 00

STORM DRAINAGE PIPING

PART 1–GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies furnishing and installing all storm drainage piping as specified on the Drawings and as required for a complete and operable system.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM C923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM A746	Standard Specification for Ductile Iron Gravity Sewer Pipe
AWWA C104 (ANSI A21.4)	Cement-Mortar Lining for Ductile- Iron and Gray-Iron Pipe and Fittings for Water
AWWA C110 (ANSI A21.10)	Ductile-Iron and Gray-Iron Fittings
AWWA C111 (ANSI A21.11)	Rubber-Gasket Joints for Ductile- Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C150 (ANSI21.50)	Thickness Design of Ductile Iron Pipe

Reference	Title
AWWA C151 (ANSI A21.51)	Ductile-Iron Pipe, Centrifugally Cast
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
Pierce County	Pierce County Stormwater Management and Site Development Manual, 2012 edition.
King County Manual	King County Surface Water Design Manual, 2009 edition.
WSDOT Standard Specifications	Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

B. FACTORY QUALITY CONTROL: Furnish manufacturer's test results for all products as required herein and by the Reference Standards.

C. FIELD QUALITY CONTROL: Comply with manufacturer's handling and installation instructions.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Product Data: Submit sufficient data to show that the proposed products submitted under this Section conform to the requirements of this Section.

3. Pipe layout drawings, for both exposed and buried piping systems, depicting supports, locations of support, fittings and restraints, seismic restraint provisions, and other pertinent information, including wall and floor penetrations, where applicable. Piping layout drawings shall clarify detailed connections to new and existing equipment, piping, and structures. Drawings shall be original layouts by the Contractor; photocopies of Contract Drawings are not acceptable.

C. INFORMATIONAL SUBMITTAL ITEMS FOR THIS SECTION:

1. Potholing Report: Verify by excavation, inspection and survey/measurement of all installation conditions, including existing utilities and structures, for buried pipe before preparation of Shop Drawings. Submit field measurements, elevations, station locations, and photos.

2. Submit pipe manufacturer's test results, which shall include a certification that the materials to be delivered are represented by the samples tested and that such delivered materials meet or exceed the specification requirements.

PART 2--PRODUCTS

2.01 GENERAL

A. All materials delivered to the Plant shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

B. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Section 33 08 40.

C. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

D. Existing piping is designated by service. Existing pipe material types may not be the same as material types specified for new piping. Investigate and provide suitable connections, including electrical isolation, as necessary.

E. Where temporary piping is required, piping material and accessories shall be selected by the Contractor and submitted to the Owner for approval. Such piping shall be suitable for operation at the test pressure of the permanent piping system that the temporary piping is replacing. Plastic, steel, ductile iron, and polyethylene pipe may all be used at the Contractor's discretion in both buried and exposed service. Temporary piping shall be supported at intervals which prevent sagging or liquid accumulation. Remove temporary piping when permanent storm drainage systems are placed in service and temporary systems are no longer needed.

2.02 STORM DRAINAGE PIPE (STD)

A. POLYVINYL CHLORIDE (PVC)

1. PIPE:

a. All PVC pipe shall meet the requirements of ASTM D3034, SDR 35, or thicker. Do not mix different manufacturer's products.

b. Where specified on the Drawings, PVC pipe shall be perforated with two rows of ½" diameter holes 5 inches on center, parallel to the axis of the pipe and oriented 120° apart.

2. JOINTS:

a. Unless otherwise indicated, join by means of gasketed push-on joints.

b. Elastomeric gasket joints, ASTM D3212.

c. Perforated PVC pipe: Conform to ASTM D3034 with elastomeric or solvent weld joints.

3. GASKETS: Nitrile, ASTM F477.

B. DUCTILE IRON

1. GENERAL: Ductile iron pipe design, materials, and manufacture, including Special Thickness Class ductile iron pipe, shall comply with the following documents:

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	AWWA C151
Storm Drainage Pipe	ASTM A746
Joints: Rubber gasket	AWWA C111
Cement mortar lining	AWWA C104

2. PIPE: Unless otherwise specified or indicated on Drawings, ductile iron pipe shall be Pressure Class 350 and have nominal laying lengths of 18 or 20 feet.

3. JOINTS:

a. Unless otherwise specified, joints shall be rubber ring compression, push-on type joints suitable for buried service and shall conform to ANSI/AWWA A21.11/C111.

b. Joint assembly and field cut joints shall be made in strict conformance with AWWA C600 and manufacturer's recommendations. Gaskets shall be as specified in ANSI/AWWA A21.11/C111. Candidate manufacturers and products include:

1) U.S. Pipe Tyton Joint

2) American Cast Iron Pipe Company Fastite

3) Approved Equal

4. PIPE COATING AND LINING: Pipe shall be coated with asphaltic material as specified in ANSI/AWWA A21.51/C151. Interior surfaces of pipe and fittings shall be cement mortar lined in accordance with ANSI/AWWA A21.4/C104.

2.03 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors, and assembly bolts; washers and nuts, hangers, supports, gaskets, and flanges; all other appurtenant items showing on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

PART 3--EXECUTION

3.01 POTHOLING

A. Piping Modifications Based on Potholing Information:

1. Determine horizontal and vertical location of existing buried utilities that may affect installation of storm drainage piping through potholing.

2. Locations of potholes are not indicated on the Drawings. Contractor shall select locations of pothole excavations where interferences between the existing and new utilities may exist.

3. Based on information obtained, modify alignment and depth of new piping from that indicated on the Drawings as necessary to avoid conflicts with existing utilities. Clearly identify modifications on piping layout drawings submitted for review and approval. Do not proceed with ordering pipeline materials for those areas where modifications are proposed until receiving approvals through submittal reviews.

B. If the Contractor proceeds with the work without potholing or otherwise fully satisfying itself of the absence of conflicts at known utility crossings, it does so at its own risk and will be responsible for rework at no additional cost to the Owner due to conflicts at known utility locations.

3.02 FLOW CONTROL

1. Refer to Section 01 57 13 for surface drainage requirements during construction.

2. Divert and maintain storm drainage flows as required to construct the work, including storm drainage downspout connections. Furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the storm drainage flow around the pipeline reach in which work is to be performed. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis and engine drives are required, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be present to provide 100% redundancy. After the work has been completed, flow shall be restored to normal. Existing storm drainage piping to be demolished shall be disconnected, removed from the ground, and disposed of after the new service is operating.

3.03 PIPING INSTLLATION

A. GENERAL:

1. Comply with Section 40 27 00 as applicable.

B. STORAGE AND HANDLING:

1. Prevent damage to the pipe during handling, transportation, or storage. Pipe shall not be stored on rough ground and rolling of the pipe on the coating will not be permitted. Any damaged pipe sections shall be repaired or replaced at the expense of the Contractor as satisfactory to the Owner.

2. Store plastic pipe under opaque covers, which do not transmit ultraviolet light.

3. The Contractor shall comply with the manufacturer's handling and installation instructions.

C. GENERAL PIPING INSTALLATION:

1. Install pipe in accordance with the manufacturer's instructions.

2. Follow pipe routes on the Drawings as closely as possible. Submit proposed deviations in accordance with Section 01 33 00.

3. Trenching, bedding, and backfill for buried piping shall be as specified on the Drawings and as specified in Section 31 23 00.

4. The Drawings show invert elevations at certain structures and may show pipe slopes. In case of any conflicts, the invert elevations shall govern over slopes. Install pipe with straight grades between indicated invert elevations.

5. Cut pipe ends squarely, ream and deburr inside and out.

6. Lay each length of pipe on a firm bed with a true bearing for its entire length between bell holes. Excavate holes of only sufficient size to accommodate the bell at each joint location. Adjust line and grade by scraping away, filling in and tamping the earth to provide true grade to fit the barrel of the pipe. No wedging or blocking up of the pipe will be permitted. The trench and bell holes shall be kept free from water during the laying of the pipe.

7. Provide two flexible connections wherever rigid piping leaves a concrete encasement or concrete bedding in accordance with Section 40 27 00 and 40 27 05 and as shown on the Drawings.

8. All dirt and foreign matter shall be removed from the pipe interior prior to installation and all joints shall be thoroughly cleaned before joining.

9. Plug open ends of pipe when construction is not underway.

10. Lay pipe upgrade with bell end facing upstream.

11. After making each joint, rigidly secure the pipe in place by backfilling to the top of the pipe at the center, but not as to fill the bell hole nor interfere with the next jointing operation.

D. COUPLING INSTALLATION:

1. Prior to coupling installation, the Contractor shall thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket or rubber compounds. Care shall be taken that the gaskets or rubber compounds are wiped clean before they are installed.

E. POLYVINYL CHLORIDE (PVC) PIPE INSTALLATION REQUIREMENTS:

1. Place pipe within the installation areas at least 24 hours prior to installation to permit temperature equalization.

F. DUCTILE IRON (DI) PVC INSTALLATION REQUIREMENTS:

1. Install pipe in accordance with AWWA C600.

END OF SECTION

SECTION 33 49 00

STORM DRAINAGE STRUCTURES

PART 1--GENERAL

1.01 SUMMARY

A. SCOPE: This Section specifies standard precast concrete inlets, catch basins, and storm drainage manholes, including associated frames and covers and appurtenances.

1.02 QUALITY ASSURANCE

A. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
AASHTO	Standard Specifications for Highway Bridges
ASTM A48	Specification for Gray Iron Castings
ASTM A536	Specification for Ductile Iron Castings
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C55	Specification for Concrete Brick
ASTM C139	Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C150	Specification for Portland Cement
ASTM C443	Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478	Specification for Precast Reinforced Concrete Manhole Sections
ASTM C1028	Standard Test Method for Determining the Static Coefficient of Friction (Slip Resistance)

Reference	Title
ASTM D4101	Specification for Polypropylene Injection and Extrusion Materials
ASTM C923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
OSHA	Occupational Safety and Health Administration
WISHA	Washington Industrial Safety and Health Act
Pierce County	Pierce County Stormwater Management and Site Development Manual, 2012 edition.
King County Manual	King County Surface Water Design Manual, 2009 edition.
WSDOT	Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition

B. FACTORY QUALITY CONTROL: Furnish manufacturer's test results for all products as required herein.

C. FIELD QUALITY CONTROL: Comply with manufacturer's handling and installation instructions.

D. All materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years.

1.03 SUBMITTALS

A. PROCEDURES: Section 01 33 00.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

2. Product information, including dimensions, for precast catch basins and storm drainage manholes, frames and covers, riser sections, base sections, top slabs and cone sections, adjustment rings, pipe connectors, sealants, coatings, joints, and steps.

3. Shop drawings: Indicate concrete inlet, catch basin, storm drainage manhole locations, dimensions, and elevations. Provide sizes, locations, orientations, and pipe invert elevations of penetrations. Indicate type and location of joints, reinforcing steel, and layout of inserts and attachments.

PART 2--PRODUCTS

2.01 GENERAL

A. Unless otherwise specified on the Drawings, concrete inlets, catch basins, storm drainage manholes, and appurtenances shall be as specified herein.

B. The use of salvaged or scrap materials will not be permitted.

C. Catch basins and storm drainage manholes shall be constructed entirely of precast concrete sections conforming to ASTM C478 and shall be of watertight construction.

D. Concrete inlets, catch basins, and storm drainage manholes shall receive exterior protective coating as specified herein.

E. Storm drainage concrete inlets, catch basins, and manholes shall be designed for AASHTO HS-20 minimum live loading and installation conditions.

2.02 CONCRETE INLETS AND CATCH BASINS

A. Concrete Inlets and catch basin shall comply with WSDOT Standard Specifications Section 9-05.50.

B. Unless otherwise indicated, Type 2 catch basins shall have a diameter of 48 inches.

C. Gray iron frames and covers shall be suitable for H20 loading.

D. Minimum height of a riser section shall be 1 foot. Heights of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

2.03 STORM DRAINAGE MANHOLES PRECAST CONCRETE RISER SECTIONS

A. Unless otherwise indicated, storm drainage manhole nominal inside diameter shall be 48 inches.

B. Per ASTM C478.

C. CEMENT: ASTM C150, Type II.

D. Minimum height of a riser section shall be 1 foot. Heights of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

E. Eccentric top cone, tapering to 24 inches inside diameter and between 18 inches and 42 inches high. Cone joining to the riser sections shall be similar to joining between riser sections, but the top surface shall be flat and at least 5 inches wide, radially, to receive grade adjustment rings.

F. Grade adjustment rings shall be precast, reinforced concrete meeting the requirements of ASTM C478. Individual grade rings above the cone section shall be 24 inches inside diameter and shall be between 4 inches and 6 inches high. The overall height of grade ring(s) shall be a minimum of 4 inches, and shall be no greater than 12 inches [two (2) 6-inch rings]. A maximum of two (2) grade rings shall be allowed on new storm drainage manholes.

2.04 STORM DRAINAGE MANHOLE PRECAST BASE SECTIONS

A. Precast base sections shall conform to the requirements for precast riser sections except that a reinforced base slab shall be cast monolithically with a riser wall section or otherwise constructed to achieve a watertight structure. Base slab thickness shall be 6 inches, minimum. The walls of the base section shall be reinforced in accordance with ASTM C478.

B. Pipe stubs shall be provided in the locations shown on the Drawings. Positioning of the stubs shall accommodate the pipe size, invert elevations and direction of storm drainage connections indicated on the Drawings.

2.05 JOINT SEALANT

A. Rubber Gasket Type: ASTM C443.

2.06 EXTERIOR PROTECTIVE COATING

A. Bituminous coal tar epoxy, specially formulated for submerged service. Bitumastic No. 300M as manufactured by Koppers Company, Inc., or similar coating by TNEMEC, Ameron or approved Equal.

2.07 STORM DRAINAGE MANHOLE CONNECTIONS

A. CONNECTORS: PVC Manhole Adaptor as manufactured by GPK with external abrasive silica layer or Kor N Seal Boot.

B. ASTM C923: Kor-n-Seal Boot as manufactured by Trelleborg NPC, Inc. or approved equal. The connectors shall be rated for a minimum of 13 psi head pressure. Metallic parts shall be Type 316 stainless steel.

2.08 CATCH BASIN AND STORM DRAINAGE MANHOLE STEPS AND GRAB BARS

A. General:

1. ASTM C478.

2. OSHA and WISHA standards.

B. Reflective steps shall be installed in base sections, riser sections, and taper sections so that the completed catch basin and storm drainage manhole will have a continuous vertical ladder with equally spaced rungs as specified in the Standard Details. Infiltration from around steps will not be permitted.

C. Polypropylene catch basins and storm drainage manhole steps shall meet the requirements of ASTM C478 and AASHTO M-199. The polypropylene material shall be made of a copolymer polypropylene superior in its resistance to corrosiveness, meeting the requirements of ASTM D4101, and shall completely encapsulate a deformed 1/2-inch steel reinforcing rod conforming to ASTM A615, Grade 60.

D. "Lane Poly Steps", Model P-14938, as manufactured by Lane International Corporation (Tualatin, Oregon), or Approved Equal.

2.09 CONCRETE INLET AND CATCH BASIN FRAMES, GRATES, AND COVERS

A. Concrete inlet and catch basin frames, grates, and covers shall comply with the Standard Details and WSDOT Standard Specifications Section 9-05.15.

B. Cast gray iron meeting the requirements of ASTM A48, Class 30B. The castings shall be free of adhering sand, scale, cracks, and hot tears or other defects as determined by visual examination. They shall be smooth and well cleaned, and continuously machined to prevent rocking and rattling. No repairing by plugging or welding of any type shall be permitted.

C. Grates and covers shall be seated properly to prevent rocking, including the replacement of existing covers with solid metal covers. After seating, the frame and grate or frame and cover shall be maintained as a unit. Alternate designs are acceptable provided they conform to the manufacturer's shop drawings approved by the Owner.

2.10 STORM DRAINAGE MANHOLE FRAMES AND COVERS

A. Frames and covers shall be 24-inch diameter clear opening unless otherwise specified on the Drawings or Standard Details.

B. Storm drainage manhole frames and covers shall be fiberglass reinforced polyester, unless otherwise specified on the Drawings. Frames and covers shall be manufactured to meet or exceed all specifications of ASTM D3753 and designed for H-20 traffic applications (withstand 40,000 lb wheel load) at a minimum. Covers shall be easily removed by one person and shall be interchangeable.

C. Storm drainage manholes frames and covers shall be manufactured from commercial grade unsaturated polyester thermoset resin with 45-70% fiberglass reinforcements. Material shall be corrosion resistant to sewer, sewer gas, salt water and petrochemical hydrocarbons.

D. Storm drainage manhole frames and covers shall have quarter turn paddle locks. An integrated gasket system to reduce traffic shock, noise and odors shall be used.

E. Identification and markings on storm drainage manhole covers:

1. The manufacturer's name shall be cast into, and not stamped on, an exposed surface. All covers must have the statement "Confined Space Permit Required" cast on the cover.

2. Covers shall be cast with the text "DRAIN". Provide manufacturer's standard color.

F. Provide non-slip low profile waffle tread for storm drainage manhole covers. Slip resistance shall be greater than 0.6 as described in ASTM C1028.

G. Candidate Manufacturer: GMI Composites Inc. or Approved Equal.

2.11 NON-SHRINK GROUT

A. Prepackaged, cementitious, non-metallic, non-shrink grout. Speed Crete Red Line as manufactured by The Euclid Chemical Company, or approved Equal.

2.12 SPARE PARTS

A. PROCEDURES: Section 01 78 43.

B. Provide the following spare parts:

1. Five (5) lifting handles and five (5) locking keys for each model of storm drainage manhole frame and cover furnished.

C. Tag and store spare parts in accordance with Section 01 78 43.

PART 3--EXECUTION

3.01 MISCELLANEOUS

A. Provide an Exterior Protective Coating to the exterior surfaces of all precast base, risers, and adjusting sections. The minimum DFT shall be 30 mils. Coating shall be applied in accordance with the manufacturer's recommendations.

B. Polypropylene steps shall be installed in accordance with the manufacturer's instructions. This shall be accomplished by pre-drilling two parallel one inch diameter holes, 3-3/4 inch deep and 12 inches on center in the cured concrete base, and risers. The insertion ends of the step shall be fully coated with non-shrink grout then driven into the holes to the prescribed depth. In no case will the pre-drilled hole be allowed to penetrate through the wall of the catch basin or storm drainage manhole section.

C. After catch basin or storm drainage manhole section placement, steel lifting loops or hooks for precast components shall be removed to a depth of one inch below the surface of the concrete and the concrete shall be patched. Lift holes shall be completely filled with non-shrink grout.

3.02 STORM DRAINAGE MANHOLE PIPE CONNECTIONS

A. PIPE CONNECTIONS:

1. Make pipe connections in accordance with the connector manufacturer's instructions.

B. Not Used.

C. CONNECTIONS TO EXISTING CATCH BASINS, MANHOLES, OR STRUCTURES:

1. Submit proposed method of connection for review in conjunction with Piping Layout Drawings as specified in Section 33 41 00.

2. Verify existing invert elevations. Discrepancies in invert elevations shall be immediately brought to the attention of the Owner for direction.

3. The Contractor shall excavate completely around the structure to prevent unbalanced loading.

3.03. PIPE FLEXIBILITY AT CONCRETE ENCASEMENTS :

1. Provide a flexible connection (series of two) as specified in Section 40 27 00 and 40 27 05 where pipe passes through or connects to concrete encasements, regardless of whether or not shown on Drawings.

2. Locate the first flexible connection within a distance no greater than one-half of the outside diameter of the pipe or 12 inches, whichever is greater. Locate the second flexible connection within 3 feet of the first flexible connection.

3.04 PLACING CATCH BASIN AND STORM DRAINAGE MANHOLE SECTIONS

A. Per Section 31 23 00, scarify and compact base soil to minimum of 95 percent and place Crushed Surfacing Top Course a minimum of 6 inches depth for precast catch basins and a minimum depth of 12 inches for storm drainage manhole bottom sections. Level the gravel to provide full bearing for the entire base slab. Leveling the base section by wedging is not allowed. Base sections shall be set level and perpendicular.

B. Precast riser sections and cones shall be set using the specified joint sealant and gasket as specified herein. Priming and preparation of surfaces and installation of jointing material shall be in accordance with the manufacturer's instructions. Position riser section per the Standard Details and Drawings or as directed by the Owner.

C. Concrete inlet, catch basin, and storm drainage manhole grade adjustment sections or rings shall be set in a full bed of non-shrink grout.

D. Backfill around concrete inlets, catch basins, storm drainage manholes and pipe connections in accordance with Section 31 23 00.

3.05 FRAME AND COVER INSTALLATION

A. In paved areas, frames and covers shall be set flush with the surface of the finished pavement.

END OF SECTION