SEA Seattle-Tacoma International Airport

Port of Seattle

AVIATION FACILITIES AND INFRASTRUCTURE

CIVIL SYSTEMS STANDARDS

DECEMBER, 2020

TABLE OF CONTENTS

SECTION

I. PURPOSE

A. GENERAL

These standards include civil system design guideline, installation, and material standards for use at Seattle-Tacoma International Airport, and apply for both Airside and Landside areas of the Airport to 5-feet outside of building footprints. The Aircraft Operations Area (AOA) fence demarcates the Airside and Landside Areas.

These standards are the minimum design standards for the planning and design. Compliance with these standards does not relieve the designer or consultant of the responsibility to apply sound professional judgement. These are minimum standards and are intended to assist, but not substitute for competent work by the consultant or the designer.

II. DESIGN SUBMITTAL GUIDELINES

A. GENERAL

This section provides guidelines to assist the engineers and designers during the submittal process by establishing standard practices that achieve uniformity and quality designs for utilities.

B. REQUIREMENTS

Survey and Utility Locate Requirements

1. Site survey is required to be completed by the POS Survey/Locating Group no later than 30% design. Site survey to include utility base map and topography. Locate all equipment and above ground piping to permit service and meet all maintenance requirements for all components. Indicate service area, access doors and panels locations on drawings.
2. Pothole all utility crossings in accordance with 322333 Utility Trenching and Backfill no later than 60% design. POS Survey/Mapping to manage potholing. Provide copy of pothole results Report with 60% submittal; report shall include location, depth, pipe size, and pipe material type for each pothole.

Phasing Requirements

1. Designer to provide utility phasing plans as required to maintain Airport's 24 hours per day operation. Utility phasing plans that include outages may be allowed only if previously coordinated with the relevant utility owners no later than 90% submittal.

2. Designer to provide traffic phasing plans to maintain traffic flow during construction. Closure of pedestrian, transit, vehicular, tug or aircraft routes shall be coordinated with the Port of Seattle no later than 90% submittal.
3. Designer to provide a pavement restoration plan for approval and acceptance by F&I Representative no later than 90% submittal.

Drawing Requirements

1. Drawings shall be prepared in accordance with Port of Seattle A/E Design Submittal Requirements. Drawings and specifications will be completed in detail to define installation and operation of all systems.
2. Drawings shall comply with Port of Seattle CAD Standards, Current Edition.
3. The Consultant shall use AutoCAD Version 2016 or current Port version in use at the execution of the Agreement.
4. Civil plans shall have a maximum scale of 1" = 40' on 22"x34" sheet.
5. The Port will assign a drawing identification number to this project, which shall be indicated on all construction drawings prepared by the Consultant. Additionally, all contract documents including the Project Manual shall reference this number.
6. Standard Legends, Symbols, and Abbreviations will be incorporated and edited to suit project.
7. Details will be incorporated as required and edited to suit project.
8. Provide system profile drawings for each civil system (water distribution system, sanitary sewer system, stormwater drainage system, and industrial wastewater system) indicating manhole and catch basin rim elevations and piping system sizes, materials, and inverts. Identify all slopes and utility crossings, including existing crossings, new crossings, and planned to be demolished crossings.
9. Manholes, catch basins, water valves and fire hydrants will be assigned unique identification numbers obtained from Section IV Asset Identification System.

Utility Layout Requirements

1. Existing equipment, piping and components, etc. not being used shall be completely removed (including hangers and supports) and shown on separate demolition drawings. Do not abandon systems or portions of systems in-place.
2. Abandoned underground piping systems shall be plugged at the manholes. Abandoned manholes and catch basins shall be removed.
3. Existing utilities that will be used or extended shall be shown on drawings. Prior to design, existing systems shall be evaluated for capacity, condition, and remaining asset life for review and approval by Facilities and Infrastructure (F&I).

4. Under no circumstances should materials be reused for relocations. All products and materials shall be new including relocated utilities and shall meet current standards and codes.
5. New and existing infrastructure shall be constructed with maintenance access that is at least 15 ft (wide) by 20 ft (height).
6. All existing utilities that are in conflict with new building structures or foundations shall be rerouted a minimum of ten feet away from proposed structures. Contact F&I if there are no viable options.
7. All designed and constructed Airside facilities shall take into account traffic and jet engines blast, and be secured so items would not be dislodged.
8. Contractor shall prevent any debris, silt, or foreign material from entering any existing utility by installing, at a minimum, protection per Standard Detail SD-034 Minimal Protection of Active Sanitary Sewer. Manholes requiring protection shall be indicated on the drawings. If any debris, silt, or foreign material does enter an existing utility, such material shall be cleaned out by the Contractor, and work shall be performed at the Contractor's expense.
9. The Specifications shall be in accordance with the Port of Seattle Master Guide Specifications, and shall be edited to suit project requirements.

Asbuilt Requirements

1. Contractor shall contact the POS F&I Representative 24 hours in advance to locate utilities after installation but before backfilling.
2. At project close-out, construction redlines and as-built survey shall be submitted back to the Engineer of Record to develop the final engineering as-built CAD file and engineering archive plans (in both CAD and PDF format) that reflect the installed condition for POS review and approval. Asset ID table must be filled out on record drawings.

C. APPLICATION FOR CONNECTIONS

Prepare and Submit "Application for Connection" document for connections to the existing industrial waste, sanitary sewer, water distribution, and storm drainage systems. Refer to Section III below, "Application for Utility Connection Forms".

D. SUBMITTAL REQUIREMENTS

Submittals shall be in accordance with POS A/E Design Submittal requirements and POS CAD Standards. During each review, if a spot check indicates that a project is clearly not compliant with POS CAD Standards, the submittal will be returned only partially reviewed. Lack of compliance with POS CAD Standards can be used as justification to delay a project going to bid. Design submittal shall include the following requirements for each design phase:

Conceptual Design (15%)

1. Scope of Work (Basis of Design)
2. Industrial Waste, Storm Drainage, Sanitary Sewer, and Water Distribution System Plans
3. Application for Connection Forms
4. Asbestos Assessment
5. Cost Estimate
6. Outline Specifications

Schematic Design (30%)

1. Scope of Work (Basis of Design)
2. Site survey completed by POS Survey/Mapping.
3. Industrial Waste, Storm Drainage, Sanitary Sewer and Water Distribution System Drawings (Legend, Demolition Plan, System Plan)
4. Table and figure describing unknown or missing existing utility data, utility locate and pothole plan for all utility crossings.
5. Application for Connection Forms – including approximate flows and or demands
6. WISE Approvals
7. Responses to Review Comments
8. Asbestos Assessment
9. Cost Estimate
10. Outline Specifications

Design Development (60%)

1. Design Calculations for Water Distribution System, Industrial Waste System, and Sanitary Sewer System. Storm Drainage System calculations to be submitted as part of the Stormwater Site Plan.
2. Industrial Waste, Storm Drainage, Sanitary Sewer, and Water Distribution System Drawings (Legend, Demolition Plan, Plan View, Profiles, Details, and Standard Details)
3. Application for Connection Forms and Stormwater Site Plan
4. WISE Approvals
5. Utility Pothole Report
6. Responses to Review Comments
7. Asbestos Assessment
8. Cost Estimate
9. Specifications
10. Submit infrastructure for asset ID assignment.

Construction Documents (90% and 100%)

1. Industrial Waste, Storm Drainage, Sanitary Sewer, and Water Distribution System Drawings (Legend, Demolition Plan, Shutdown and Phasing Plan, Maintenance of Traffic Plan, Plan View, Profiles, Details, and Standard Details), both signed hard copies and electronic CAD files required at 100%.
2. Application for Connection Forms and Stormwater Site Plan
3. WISE Approvals
4. Responses to Review Comments
5. Asbestos Assessment
6. Cost Estimate
7. Specifications
8. Utilize assigned asset ID numbers, and submit Computerized Maintenance Management System (CMMS) Data Form submitted at 90%. CMMS form shall be indicated on construction documents and submitted in MS Excel format.

III. STANDARDS, CODES AND REGULATIONS

- Consult with Port of Seattle's Building Department on adopted codes and amendments.
- The Industrial Waste, Sanitary Sewer, Water Distribution, and Storm Drainage Systems Standards are based upon requirements of the latest adopted edition of all applicable standards, codes, regulations, and ordinances including, but not limited to, the following:

A. RELATED STANDARDS (PORT OF SEATTLE - SEATAC INTERNATIONAL AIRPORT): https://www.portseattle.org/Business/Construction-Projects/Airport-Tenants/Pages/Reference-Documents.aspx

1. Mechanical Systems Standard
2. Restroom Design Standards
3. Architectural Design Standards
4. A/E Design Submittal Requirements
6. Electrical System Standards
7. Direct Digital Controls (DDC) System Standards
8. CAD Standards

B. CODES

1. International Building Code (IBC)
2. Uniform Mechanical Code (UMC)

3. Uniform Plumbing Code (UPC)
4. Uniform Fire Code (NFC)
5. National Electrical Code (NEC)
6. Washington State Energy Code (WSEC)
7. Washington State Ventilation and Indoor Air Quality Code (WAC 51-13)

C. REGULATIONS, ORDINANCES AND REFERENCES

1. Federal Aviation Administration (FAA)
2. Port of Seattle Fire Department
3. Washington Industrial Safety and Health Act (WISHA)
4. Washington State Department of Transportation (WSDOT)
5. Washington State Department of Ecology (WA DOE)
6. Washington State Department of Health (WA DOH)
7. Puget Sound Air Pollution Control Agency (PSAPCA)
8. Environmental Protection Agency (EPA)
9. Occupational Safety and Health Administration (OSHA)
10. Americans with Disabilities Act (ADA)
11. American Association of State Highway and Transportation Officials (AASHTO)
12. Building Officials and Code Administrators International (BOCA)
13. American Society of Testing and Materials (ASTM)
14. American National Standards Institute (ANSI)
15. American Society of Mechanical Engineers (ASME)
16. American Water Works Association (AWWA)
17. American Gas Association (AGA)
18. National Fire Protection Association (NFPA)

D. Water Distribution, Sanitary Sewer, Stormwater Drainage, and Industrial Wastewater System Drawings

1. The following Sea-Tac International Airport's standard drawings, schedules and diagrams will be incorporated and edited to suit project.
   a. Legend, Symbols and Abbreviation, see Standard Details.
   b. Control Diagram, Sequence of Operations (DDC Point List), see Mechanical Standard #15900.
   c. Equipment Schedules, see Standard Details.
2. Refer to Port of Seattle CAD Standards Current Edition for additional symbols, abbreviations, schedules, diagrams and details.

IV. APPLICATION FOR UTILITY CONNECTION FORMS

A. PURPOSE

1. The purpose of the "Application for Connection" documents is to formalize the procedure for making connections to the existing industrial waste system, storm drainage system, sanitary sewer system, and water distribution systems, assess the impacts of additional services/loads on the systems, identify the point of connection, reserve the point of connection for the approved service/loads, assess construction impacts, establish and maintain configuration control of the system and plan for the long-term system development to meet the needs of SeaTac International Airport. By providing the information requested for each system, the Facilities and Infrastructure (F&I) Systems group can work with the Project Team to achieve the most effective point of connection for the proposed service/load while maintaining system integrity.
2. No connections to industrial waste, storm drainage, sanitary sewer, and water distribution will be allowed without an approved application.

B. PORT OF SEATTLE – APPLICATION FOR CONNECTION FORMS

1. Application for Connection to the Industrial Wastewater System
2. Application for Connection Stormwater Site plan to the Storm Drainage Systems per the Stormwater Management Manual
3. Application for Connection to the Sanitary Sewer Systems
4. Application for Connection to the Water Distribution System

C. PROCEDURES

Forms need to be completed and submitted in a timely matter to impacts to project scope. Utility connection forms to be completed (or updated) prior to each submittal design stage and WISE meetings.

D. FORMS AND RESPONSIBILITY

The Port of Seattle Project Manager is responsible for providing the form to the consultant or contractor and obtaining the required information prior to submitting to F&I. See sample forms at the end of the General Provisions Section.

V. ASSET IDENTIFICATION SYSTEM

A. PURPOSE

Identification of assets, including pipelines, structures, equipment, and components for the purpose of maintenance monitoring and record keeping.

B. PROCEDURES

All assets (pipes, valves, hydrants, manholes, catch basins, pumps, etc.) shall be provided with a unique asset ID number and indicated on construction documents. Coordinate asset ID numbers with F&I Representative. Submit infrastructure to POS F&I/POS Mapping at 60% for asset ID assignment. CMMS form shall be submitted at 90%.

C. STIA ASSET IDENTIFICATION SYSTEM CRITERIA

For the Water, Sanitary Sewer, and Industrial Waste Systems, the asset name will be a two-letter system name, followed by a two-letter asset abbreviation, followed by a five-digit asset identification number.

For the Storm Drainage System, the asset name will be a two-letter system name, followed by a two-digit basin name, followed by a two-letter asset abbreviation, followed by a five-digit asset identification number.

System Name	Asset Abbreviation	
WA =Water (Domestic/Fire) Distribution System	**Structures**	**Pipes**
	FC = Fire Department Connection	PM =Pipe Main
	FH = Fire Hydrant	DL =Water Domestic Lateral
	MH = Manhole Water	FL =Water Fire Lateral
	MR = Water Meter	
	VL = Water Valve	
	SP = Service Pit	
	VT = Water Vault	
	BP = Backflow Preventer/Hotbox	
SS = Sanitary Sewer System	**Structures**	**Pipes**
	CO = Cleanout	PM = Pipe Main
	LS = Lift Station	FM = Force Main
	MH = Manhole Sewer	PL = Pipe Lateral
	ST = Stub	

System Name	Asset Abbreviation	
	VT = Grease Interceptor Vault	
IW = Industrial Waste System	**Structures**	**Pipes**
	CO = Cleanout	FG = Flush Gutter
	LS = Lift Station	PM = Pipe Main
	MH = Manhole IWS	RD = Roof Drain
	VL = Valve	WL = Waste Oil Line
	ST = Structure	PP = Subdrain with Perforated Pipe
	OW = MH with Oil Water Separator	
	CB = Catch Basin	
SD = Storm Drainage System	CB = Catch Basin	CU = Culvert
	CO = Cleanout	DD = Drainage Ditch
	MC = Manhole Combination	GU = Gutter
	MH = Manhole Storm	FG = Flush Gutter
	OW = MH with Oil Water Separator	GH = Gutter Half Pipe
	MM = Manhole Metro	RD = Roof Drain
	ST = Structure	PM = Pipe Main
	WS = Level Spreader/Wood Separator	PP = Subdrain with Perforated Pipe

D. EXAMPLES

Example "SSPM00100":
System: SS = Sanitary Sewer System
Units: PM = Pipe Main
Number Sequence: 00100

Example "SSPL00100":
System: SS = Sanitary Sewer System
Units: PL = Pipe Lateral
Number Sequence: 00100

Example "SSMH00100":
System: SS = Sanitary Sewer System
Units: MH = Manhole

Number Sequence: 00100

Example “WAPM00100”:
System: WA = Water System
Units: PM = Pipe Main
Number Sequence: 00100

Example “WADL00100”:
System: WA = Water System
Units: DL = Domestic Lateral
Number Sequence: 00100

Example “WAWV00100”:
System: WA = Water System
Units: WV = Water Valve
Number Sequence: 00100

Example “IWPL00100”:
System: IW = Industrial Waste System
Units: PL = Pipe Lateral
Number Sequence: 00100

Example “SDE4CB00100”:
System: SD = Storm Drainage System
Basin: E4 = Drainage Basin E4
Units: CB = Catch Basin
Number Sequence: 00100

E. STRUCTURES AND PIPES THAT WILL NOT BE NAMED

SYSTEM	CAD CODE	NAME
AIRR	377	COMPRESSED AIR LINE (EXPOSED)
AIRR	387	PRECONDITIONED AIR LINE
AIRR	544	AIR SERVICE PIT
AIRR	551	AIR VENT
AIRR	842	COMPRESSED AIR LOCATES
IRRG	392	IRRIGATION PIPE (EXPOSED)
IRRG	393	SPRINKLER HEAD
IRRG	394	IRRIGATION CONTROL VALVE (SPRINKLER BOX)
IRRG	395	IRRIGATION CONTROL PANEL
IRRG	406	IRRIGATION CONTROL VALVE (ROUND)
IRRG	844	IRRIGATION LOCATES
FIRE	224	FIRE ALARM
FIRE	538	FIRE SPRINKLER LINE (EXPOSED)
SSWR	830	SEWER LOCATES
SSWR	853	SEWER UNKNOWN
SSWR	921	SEWER STRUCTURE UNDERGROUND
SSWR	521	SANITARY SEWER STRUCTURE
WATR	375	SHIP HYDRANT
WATR	401	WATER TANK
WATR	457	WATER WELL
WATR	461	WATERLINE (ABOVE GROUND)
WATR	462	WATER WITNESS POST
WATR	525	WATER STRUCTURE
WATR	838	WATER LOCATES
WATR	858	WATER UNKNOWN
WATR	925	WATER STRUCTURE UNDERGROUND
WATR	448	WATER LINE (EXPOSED)
WATR	460	WATER SPIGOT
	558	TOPO UTILITY STAND PIPE
	862	POTHOLES
IWSS	839	IWS LOCATES
IWSS	854	IWS UNKNOWN
IWSS	923	IWS STRUCTURE UNDERGROUND
STRM	171	UNKNOWN STORM DRAIN
STRM	295	MANHOLE UNKNOWN
STRM	860	STORM UNKNOWN
STRM	922	STORM STRUCTURE UNDERGROUND

VI. SOLE SOURCE EQUIPMENT MANUFACTURERS LIST

A. PURPOSE

1. To maintain system compatibility and maintainability, designers shall use products specified STIA Civil and Mechanical System Standards.
2. Exceptions: Justification with prior approval from POS Project Manager.

VII. WATER DISTRIBUTION, SANITARY SEWER, STORMWATER DRAINAGE, AND INDUSTRIAL WASTEWATER SYSTEM COMMISSIONING

A. SCOPE

1. The commissioning process is to certify to the Port of Seattle that Utilities and other related systems, equipment and controls function together properly to meet performance requirements, acceptance criteria, and design intent in accordance with the contract documents.
2. All project systems requiring mechanical or electrical components will be commissioned using the STIA Mechanical Systems Standards. The level of commissioning will be defined by the contract documents and Port of Seattle Project Manager based on the complexity and critical nature of systems and equipment to sustain operations at the Port. All systems and equipment will be commissioned in accordance with Division 1 - General Requirements, Section 019100 “Commissioning” in the contract documents.

B. DESIGN CRITERIA

System design shall incorporate complete testing of all systems and components prior to commissioning. Design shall incorporate provisions to test and commission at design conditions and in all modes of operation.

C. PERFORMANCE STANDARDS

Performance standards shall be developed by the designer to meet the owner’s requirements as a benchmark to evaluate acceptance criteria and functional testing results to performance standards.

D. ACCEPTANCE CRITERIA

Detailed acceptance criteria will be developed by the designer defining functional testing requirements. Functional testing will be performed by the contractor to prove system and equipment performance meets the acceptance criteria.

E. COMMISSIONING SUBMITTAL REQUIREMENTS

Designer will review with Project Manager Port of Seattle's submittal checklist to define specific project requirements.

F. COMMISSIONING SUPPORT

Provide Commissioning team with materials & information required for system Commissioning. Inspects & assure contractor installation and system/equipment meet design intent and specified standards. Resolve issues as defined during the Commissioning process, respond to RFI's or clarifications for design intent & system/equipment performance. Sign off that final system/equipment installation and performance meets design criteria & performance.

END OF SECTION

SECTION 024113.23
UTILITY DEMOLITION AND ABANDONMENT

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. All utilities, except those to remain in service, shall be demolished and completely removed, not abandoned in place, regardless of depth or size, unless specifically approved by Port Facilities and Infrastructure. Piping shall be removed to the limits of site work and capped or plugged. Piping to be plugged shall be filled with concrete for a minimum of two diameters of pipe. Backfill excavations from demolition with Gravel Borrow meeting the requirements of this Standards Section as described below. Demolition of the existing utilities shall be phased as required to have the storm drain, industrial waste and sanitary sewer systems operational at all times.

B. Where specifically approved for abandonment in place by Port Facilities and Infrastructure, pipes shall be abandoned in place by plugging or capping as described above in paragraph 1.01.A. above and by filling the pipe to refusal with Controlled Low Strength Material (CLSM).

C. All existing foundations, inlets, catch basins, manholes, or portions of other items within work limits, except those to remain in service, shall be removed to at least 20 feet below the top of the finished grade. The interior openings of any remaining portion of structures (e.g., manholes or catch basins) shall be completely filled with Controlled Low Strength Material (CLSM) to the removal elevation. The remaining excavation shall be backfilled with Gravel Borrow.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

B. American Society for Testing and Materials (ASTM) D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

C. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill

PART 2 - PRODUCTS

2.01 GRAVEL BORROW

A. Gravel Borrow shall meet the requirements of Section 322333 Utility Trenching and Backfill 2.02(A).

2.02 CONTROLLED LOW STRENGTH MATERIAL

A. Controlled Low Strength Material (CLSM) shall meet the requirements of Section 322333 Utility Trenching and Backfill 2.02(B).

PART 3 - EXECUTION – To be provided by Design Engineer

PART 4 - TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and backfill in accordance with ASTM D6938 requirements.

B. CLSM Testing: See Section 322333 Utility Trenching and Backfill 3.01(B) for CLSM testing requirements.

C. Where pipes are approved to be abandoned in place, the amount of required CLSM to fill the abandoned pipe to refusal shall be calculated and compared to the delivery ticket quantities of the actual CLSM utilized. The two quantities shall be within 10-percent of each other or the pipe shall be removed in its entirety.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Utility Trenching and Backfill shall conform to the Standard Details (Appendix A) and the below specifications.

B. Trench and excavation safety systems shall meet the following referenced requirements:
   1. RCW Chapter 49.17 WISHA.
   2. WAC 296-155 Safety Standards for Construction Work.
   3. RCW Chapter 39.04.180 Public Works/Trench Excavations - Safety Systems Required.
   4. Section 31 40 00 Trench Safety Systems.

C. Utility trench/excavation shall be as follows:
   1. Trench and Excavation Safety System shall be implemented on all other excavations in excess of 4 feet in depth conforming to the referenced requirements.
   2. Design process shall incorporate site survey and utility potholing. Site survey shall be completed by POS Survey/Mapping prior to 30% design. A pothole plan shall be submitted with 30% design, and the pothole survey shall be completed prior to the 60% submittal. All utility crossings shall be potholed to determine the horizontal and vertical location during the design process, no later than 60% design. All potholing shall be by hand digging or vacuum excavation and completed to minimize pavement damage.
   3. The Contractor's trench/excavation safety system shall be designed and stamped by a professional engineer licensed in the State of Washington; professional engineer's license shall be current and active at the time of the design and use of the safety system put in place.
   4. All excavation not included in trench and excavation safety systems shall also meet the WISHA safety standards.
   5. Restoration of surfaces shall be included. This shall include restorations of all paved surfaces per the Port of Seattle standards, such as full panel replacement of concrete panels located within the AOA.

D. Utility Clearances
   1. Protect and support existing utilities to remain. Adequate separation shall be provided per the following utility clearance tables and in accordance with standard detail SD-007. When adequate separation between proposed and existing utilities/structures cannot be provided, notify F&I which utilities cannot

achieve adequate clearances and if approved by F&I, install Polyethylene plastic foam (Ethafoam) to fill the separation between utilities. Utilities crossing over cathodic protection (i.e. jet fuel) that cannot meet clearances will need cathodic protection per Section 2.05(B).

Vertical Utility Minimum Clearance Table*		Top Utility: Water	Sewer (DI)	Sewer (non metal)	IWS/SD (DI)	IWS/SD (non-metal)	Gas (HDPE)	Jet Fuel	Comm	Electrical	Comm (Concrete encased)	Electrical (Concrete encased)
Bottom Utility	Water	1	prohibited	prohibited	prohibited	prohibited	1	prohibited				
	Sewer (DI)	1.5						2				
	Sewer (non metal)	2						1				
	IWS/SD (DI)	1.5			1			2			1	
	IWS/SD (non-metal)	1.5						1				
	Gas (HDPE)	1						1				
	Jet Fuel	2	2	1	2	1	1	2				
	Comm							2	1	1.5	1	1.5
	Electrical							2	1.5	1	1.5	1
	Comm (Concrete encased)				1			2	1	1.5	1	1.5
	Electrical (Concrete encased)							2	1.5	1	1.5	1

*All values in feet.

Horizontal Utility Minimum Clearance Table*		New Utility: Water	Sewer (DI)	Sewer (non metal)	IWS/SD (DI)	IWS/SD (non-metal)	Gas (HDPE)	Jet Fuel	Comm	Electrical	Comm (Concrete encased)	Electrical (Concrete encased)
Existing Utility	Water	5	10	10	10	10	5					
	Sewer (DI)											
	Sewer (non metal)											
	IWS/SD (DI)						10					
	IWS/SD (non-metal)											
	Gas (HDPE)											
	Jet Fuel											
	Comm											
	Electrical	5	10				See Note 1					
	Comm (Concrete encased)											
	Electrical (Concrete encased)											

*All values in feet.

Note 1: Contact F&I for clearance requirements

1.02 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittal Requirements. Furnish manufacturers' technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) B843 Standard Specification for Magnesium Alloy Anodes for Cathodic Protection
B. American Society for Testing and Materials (ASTM) C33 Standard Specification for Concrete Aggregates
C. American Society for Testing and Materials (ASTM) C150 Standard Specification for Portland Cement
D. American Society for Testing and Materials (ASTM) C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
E. American Society for Testing and Materials (ASTM) C989 Standard Specification for Slag Cement for Use in Concrete and Mortars
F. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
G. American Society for Testing and Materials (ASTM) D4832 Standard Test Method for Preparation and Testing of Controlled Low Strength Material Test Cylinders
H. American Society for Testing and Materials (ASTM) D6103 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)
I. American Society for Testing and Materials (ASTM) D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
J. American Society for Testing and Materials (ASTM) G57 Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four Electrode Method
K. American Society for Testing and Materials (ASTM) G187 Standard Test Method for Measurement of Soil Resistivity Using the Two-Electrode Soil Box Method
L. NACE International SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
M. NACE International SP0286-2007 (formerly RP0286), Electrical Isolation of Cathodically Protected Pipelines
N. Revised Code of Washington (RCW) Chapter 39.04.180 Public Works/Trench Excavations - Safety Systems Required
O. Revised Code of Washington (RCW) Chapter 49.17 Washington Industrial Safety and Health Act

P. Washington Administrative Code (WAC) 296-155 Safety Standards for Construction Work

Q. WSDOT - Standard Specifications for Road, Bridge, and Municipal Construction; and Amendments (current edition)

PART 2 - PRODUCTS

2.01 PIPE BEDDING

A. Utility bedding material shall be from a source that has WSDOT QPL Aggregate Source Approval, and shall be a crushed rock or gravel material meeting following requirements:

Crushed Surfacing Top Course

Sieve Size	Percent Passing
5/8″	99-100
½″	80-100
No. 4	46-66
No. 40	8-24
No. 200	10.0 max.
% Fracture	75 min.
Sand Equivalent	40 min.

Pipe bedding shall consist of aggregate base compacted to 95% of maximum density as determined by ASTM D1557.

The fracture requirement shall be at least one fractured face and will apply to the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

The portion of pipe bedding material retained on a No. 4 sieve shall not contain more than 0.15 percent wood waste.

The pipe bedding material shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material. Recycled material such as Hot Mix

Asphalt, Concrete Rubble, Recycle Glass, Steel Furnace Glass and others are prohibited.

2.02 PIPE BACKFILL

A. **Under pavement or within 10 feet of pavement**: backfill to subgrade with Controlled Low Strength Materials (CLSM), also known as controlled density fill (CDF). The CLSM Mix Design shall be as follows:

1. CLSM shall be designed to achieve a 28-day compressive strength between 100 psi to 200 psi for airfield FAA, and between 50 psi to 300 psi for landside, when tested in accordance with ASTM D4832. There should be no significant strength gain after 28 days.
2. The Contractor shall submit, to the Engineer, a mix design including the proportions and source of materials, admixtures, and dry cubic yard batch weights. The mix shall contain a minimum of 50 pounds of cement with the remainder of the volume composed of cementitious materials (fly-ash or ground granulated blast furnace slag), sand, water, and any approved, certified admixtures.
3. The mix shall be flowable, self-leveling and compacting with an unsegregated flow of 6 to 8 inches when tested in accordance with ASTM D6103.
4. Portland cement shall conform to requirements of ASTM C150 - Type I and II or ASTM C595 - Type IP, IS, and IL. If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.
5. Fly ash shall conform to ASTM C618, Class C or F
6. GGBF Slag cement shall conform to ASTM C989, Grade 100 or Grade 120
7. Fine aggregate (sand) shall conform to requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces performance characteristics of the CLSM specified herein will be accepted, provided the gradation meets the following criteria:

Sieve Size	Percent Passing by Weight
¾ inch	100
No. 200	0-12

8. Water used in mixing shall be potable, free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product. Dyes and other methods of coloring the backfill material may be incorporated if desired.

B. **Under non-paved areas and greater then 10 feet from pavement**, trench backfill shall be with fine, readily compactible soil, granular material selected from the pipe excavation, common excavation areas or Gravel Borrow meeting the following requirements:

Gravel Borrow

Sieve Size	Percent Passing
4″	99-100
2″	75-100
No. 4	50-80
No. 40	30 max.
No. 200	7.0 max.
Sand Equivalent	50 min.

The material, regardless of origin, shall not contain frozen lumps, stones, chunks of highly plastic clay, or other objectionable material larger than 2 inches. The backfill material shall be compacted in layers not exceeding 6 inches to at least 95% of maximum density as determined by ASTM D1557. Contractor shall submit a WSDOT QPL Certificate for imported backfill material.

Recycled material such as Hot Mix Asphalt, Concrete Rubble, Recycle Glass, Steel Furnace Glass and others are prohibited.

2.03 UTILITY WARNING TAPE AND LOCATE WIRE

A. Utility Locate wire shall be:
   1. Thermoplastic insulated, nylon sheathed, heat, moisture, oil, and gasoline resistant 600 volt stranded copper type THHN AWG size No. 10.
   2. Electrical splicing by 3M Direct Bury Splice Kit DBR/Y, or approved equal.
   3. Utility locate wire tag shall be non-corrosive metal or plastic tag with a permanent stamped label reading "Locate."

B. Underground Marking Tape: Inert polyethylene plastic, 4-millimeter thickness, and impervious to alkalis, acids, chemicals reagents and solvents likely to be encountered in the soil, with metallic foil core to provide most positive detection. Tape width shall be recommended by manufacturer, but must be at least 4-inches in width. Message should convey type of line buried below with the word "CAUTION". Color coding of tape follows:

Utility	Color
Water	Blue
IWS, Sewer and Storm Drain	Green
Electrical	Red
Communication	Orange
Gas, Oil and Jet Fuel	Yellow
Non-potable Water and Irrigation	Purple

2.04 PLASTIC FOAM (ETHAFOAM)

A. Polyethylene plastic foam (Ethafoam) used in underground utility separation must comply with the Federal Specification Cid A-A 59136 Type 1, Class 1, Grade A.

B. The width of the pad used in underground utility separation shall be based on the outside diameter (O.D.) of the larger crossing pipe. The length of the pad used in underground utility separation shall equal the width or as indicated on the plans.

C. Polyethylene plastic foam (Ethafoam) used for separation between new and existing utility structures and their respective frame and cover shall be sized as shown in SD-022 Utility Structure in Portland Cement Concrete and SD-023 Modification to Existing Utility Structure.

2.05 CATHODIC PROTECTION SYSTEM

A. Perform at least one soil resistivity measurement per 1,000 lf of new pipe, and not less than 2 per project. Perform Soil resistivity measurements in accordance with ASTM G57 or ASTM G187.

B. Metallic pipe shall have cathodic protection system when soil resistivity measurements are less than the following thresholds:
   1. Steel pipe: 10,000 ohm-cm
   2. Ductile iron pipe: 2,000 ohm-cm

C. Design cathodic protection system in accordance with NACE SP0169.
   1. Review existing metallic pipes for existing cathodic protection in the vicinity of new metallic pipes
   2. Connect anodes to pipelines through flush mounted test stations; anodes shall not be connected directly to pipeline.
   3. Flush Mounted Test station
      a. Furnish lid with letters “TS” or words “Test Station” cast into lid.
      b. Test Boards: 1/4-inch thick phenolic panel, NEMA Grade LE for electrical use under wet conditions.
      c. Provide permanent plastic labels with pipe size and type engraved onto label. Attach with adhesive adjacent to each test wire.
      d. Anode Metering Shunts: 0.1 ohm Holloway type, 2 ampere capacity, with 1 percent accuracy.
      e. Utility Box: Shall be below-ground flush-mounted in accessible rated hand hole per Section 334241.
      f. Provide 3-ft erosion control pad around test station if not located in paved area.
   4. Anodes shall be pre-packaged; bare anodes shall not be used. Anodes shall be standard potential magnesium, in accordance with ASTM B843, and shall have a minimum design life of 15 years.
      a. Prepackaged backfill shall be composed of:
         i. Ground Hydrated Gypsum: 75 percent.
         ii. Powdered Wyoming Bentonite: 20 percent.
         iii. Anhydrous Sodium Sulfate: 5 percent.
   5. Prepackaged Copper-Copper Sulfate Reference Electrodes:
      a. Permanent type, copper-copper sulfate reference electrode suitable for direct burial with a minimum design life of 15 years. Provide wire with sufficient length to extend from reference electrode to test station.

D. Wire Insulation: HMWPE

E. Insulating Flanges:
   1. Full-face Type E gaskets with elastomeric sealing element.
   2. NEMA G-10 grade insulating sleeves and washers.

F. Insulating blanket:
   1. Insulating blanket shall be 1/8" neoprene or butyl insulating material.

PART 3 – EXECUTION

3.01 PREPARATION FOR EXECUTION OF WORK

A. Prior to start of excavation contractor shall have designed, submitted and received approval from the engineer for Trench Safety Systems per Section 315000 Utility Trench Safety Systems.
B. Trench safety systems shall be installed as required during excavation.

3.02 EXECUTION OF WORK

A. Trench excavation shall be per Section 310000 Earthwork.
B. Pipe bedding shall be placed per section 2.01 with and Underground Pipe. Pipe bedding shall be compacted to 95% of maximum density as determined by ASTM D1557.
C. Pipe backfill shall be per section 2.02 above. When non-CDF Pipe back used it shall be compacted to 95% of maximum density as determined by ASTM D1557
D. Utility warning tape and locate wire shall be installed per section 3.04 below.
E. Trench backfill shall be per section 2.02 above.
F. Pavement shall be repaired per the plans and the Port of Seattle standards.
G. ACP Trench patching shall be sealed on all sides with a pigmented asphalt sealant approved submitted to the engineer for approval.

3.03 CLSM TRENCH DAMS

A. Install 5 feet of CLSM in lieu of utility bedding and trench backfill at locations indicated on the utility plan sheets. If none are shown, provide at a maximum spacing of 500 feet of pipe length.

3.04 UTILITY WARNING TAPE AND LOCATE WIRE

A. Install utility warning tape and locate wire along the full length of all utilities:
    1. Install utility locate tape along the top of the trench per the Pipe Bedding and Trench Backfill Detail SD-005 in a manner that will avoid damaging the wire during back filling or compaction of the trench.
    2. Install utility locate wire along the top of the utility in a manner that will avoid damaging the wire during back filling or compaction of the trench.
    3. Splice new utility locate wires into existing utility locate wires at tees or other locations where the utilities connect. Splices or repairs shall be made with pre-manufactured epoxy splice kit suitable for the intended application and installed in accordance with manufacturer's recommendations.
    4. Bring the locate wire up inside each manhole, catch basin, vault, valve box, handhole, pull box, clean-out, or similar structure along the route of the utility.

Terminate the wire for each utility entering the structure as shown on the standard details.

5. Permanently attach utility locate wire tags between 2 and 6 inches from the end of the wire.
6. Where utilities enter a building, bring locate wire to grade level 5 feet from the building and install in a water valve type box or equal.

3.05 CATHODIC PROTECTION SYSTEM AND TEST STATIONS

A. All metallic pipe shall be installed with test stations.

B. All joints of metallic pipe, except those joints to be welded, threaded, or designated as insulated, shall be electrically bonded as appropriate for joint type per STIA F&I Standard Details – Appendix A. Provide joint bonds of sufficient length such that the bonds are not under tension.

C. Electrically isolate new metallic pipe from existing metallic pipe, existing metallic pipe with cathodic protection system, structures, and electrically grounded equipment using dielectric unions, flanges or couplings per STIA F&I Standard Details – Appendix A .

D. Provide cathodic protection system per Standard Details.

E. Installation locations and spacing to be determined by corrosion engineering professional in accordance with NACE SP0169.

F. The following Cathodic Protection Test Stations shown in STIA F&I Standard Details – Appendix A shall be located as follows:

1. Determine location of test stations based on actual site conditions. Test station shall be located outside of the traveled way, safely accessible without traffic control.
2. Insulating blanket is required at metallic pipe crossings when one or both pipes have cathodic protection and the separation distance is 24-inches or less.
3. Test Wires: Use thermite weld process for all electrical connections of wires to steel and ductile iron pipe and fittings.
4. Flush Mounted Test Station Type FF-R: At the crossing of two metallic pipes.
5. Flush Mount Test Station Type FT-RA: As required to provide cathodic protection meeting criteria in NACE SP0169.
6. Flush Mounted Test Station Type FC-R: At both ends of cased crossings.
7. Flush Mounted Test Station Type FI-R: At buried insulated joints.

PART 4 - TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and non-CLSM backfill in accordance with ASTM D6938 requirements.

B. Locate Wire: Test wire to verify the installed locate wire is continuous with no breaks.

C. CLSM Shall be tested in accordance with the following requirements:
   1. CLSM shall achieve a 28-day compressive strength of 100 minimum to 200 pounds per square inch maximum and tested in accordance with ASTM D4832.
   2. Unless otherwise approved by Port, flow shall be between 6 inches and 8 inches when tested in accordance with ASTM D6103.

D. Cathodic Protection System
   1. Electrical Continuity Testing
      a. Test electrical continuity on buried joints that are required to be bonded. Test after bonds are installed but before backfilling of pipe.
   2. Insulated Joint Testing
      a. Test each joint after assembly with insulator tester in accordance with manufacturer's written instructions. For insulating flanges, test and record insulating values of each bolt in addition to the completed flange. Replace damaged or defective insulating parts.
   3. Cathodic Protection
      a. Test cathodic protection system for adherence to protection criteria in accordance with NACE SP0169.

END OF SECTION

PART 1 - GENERAL

1.01 CONVEYANCE DESIGN REQUIREMENTS

A. This section covers design standards and requirements for water distribution system requirements only.

B. All water distribution systems shall be designed in conformance with the Washington State Department of Health (DOH) Water System Design Manual (2020) unless otherwise stated.

C. Engineers shall use a hydraulic analysis to determine the minimum size of transmission or distribution mains. All distribution mains shall be at least 12 inches in diameter, unless a hydraulic analysis justifies another size.

D. Distribution system pressure requirements:

1. Distribution pipelines shall be able to deliver the Peak Hourly Demand (PHD) at minimum 30 psi. Engineer shall determine required PHD.
2. Individual pressure reducing valves are required on all potable services inside mechanical rooms refer to F&I Mechanical Section Standards, unless otherwise directed by Port of Seattle (POS) Facilities & Infrastructure (F&I) Utility Department.

E. Fireflow requirements shall be determined by the POS Fire Department.

1. POS Fire Department will determine available fireflow.
2. Minimum system pressure during fireflow analysis is 20 psi at all service connections.

F. Water velocity in mains shall not exceed 5 feet per second under the peak hourly demand conditions, and shall not exceed 10 feet per second during highest demand including fireflow.

G. See STIA F&I Civil Systems Standards General Provision for Design Submittal Guidelines.

H. Pipe restraint and concrete thrust blocking for all horizontal and vertical bends, valves, tees and crosses, and changes in pipe diameter for water and fire mains:

1. Buried water distribution pipe shall be restrained joint pipe in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings.
2. Concrete thrust blocking is required in addition to restrained joint pipe. Thrust blocking shall be in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings and

STIA F&I Civil Systems Standards Appendix A - Standard Details and as directed by the Engineer.

I. Testing, disinfection and cleaning shall be in accordance with the terms of the STIA F&I Water Systems Connection Procedure Requirements and Application for Connection to Water System.

J. All water vaults (backflow assembly, pressure reducing station, water meter vault, air release valve vault, etc.) shall include designs for floor drain piping draining to daylight, or, if daylight is not feasible, to a drainage system as approved by POS F&I.

K. Outside-installed Reduced Pressure Backflow Assemblies (RPBA) shall be installed in pre-manufactured, heated, and insulated above ground enclosures. The following drain requirements shall apply to enclosures. RPBA shall not be installed in vaults. Each enclosure design shall be as approved by the POS. Floor drains for RPBA shall not connect to closed storm drain systems. All RPBA enclosures shall be provided with a bore sighted daylight drain. This bore sighted drain to daylight shall be clearly visible end to end, sized to meet the flow requirements of the RPBA relief vent. Refer to STIA F&I Mechanical System Standards for backflow prevention requirements and for Reduced Pressure Backflow Assemblies located inside a building.

L. Service connections or water distribution system piping shall not be used for grounding of electrical systems or for the maintenance, integrity or continuity of any grounding attachment or connection.

M. Manufacturer’s certification of testing and accuracy shall be provided for all commercial meter installations.

N. The standard cover over water main shall be 3 feet below finished grade, except for pipe beneath pavement. Pipe located beneath pavement shall be 3 feet below the top of finished subgrade. Maximum 10 feet of cover for all water mains.

O. Designs shall be submitted to F&I to determine potential impacts to the POS water model evaluated. No installation shall occur without F&I concurrence. Submittal must include design drawings with valve location, type, and size.

P. All water distribution systems shall be designed in conformance with the latest published editions of AASHTO Standards, AWWA Standards and NFPA 24 unless otherwise stated.

Q. Pigging ports shall be required for new projects installing a minimum of 500 LF of pipe 12” or larger. Location of ports to be coordinated with POS F&I beginning at 30% design submittal WISE meeting.

1.02 VALVING DESIGN REQUIREMENTS

A. Water distribution system valves shall be in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings, STIA F&I Civil Systems Standards Section 331216 Water Valves and STIA F&I Civil Systems Standards Section 331216B Water Combination Air Valves.

B. 500-foot maximum distance between valves on distribution mains.

C. Additional valving may be required for area isolation.

D. Combination Air/Vacuum with vacuum check valves shall be installed at local high points in the water main.

E. Valves shall be installed on all legs of a tee or cross.

F. Dismantling joints shall be installed for each valve at a tee or cross. Dismantling joint shall be installed between valve and tee/cross fitting. Dismantling joint shall be sized to match adjacent pipe and appurtenance diameters.

1.03 FIRE HYDRANT DESIGN REQUIREMENTS

A. Fire hydrant number, distribution, and locations shall be in accordance with STIA F&I Section 331110 Water Distribution Systems and Section 331219 Fire Hydrants.

B. Fire hydrants shall be installed as required to provide hydrant flow to new and existing buildings. Minimum pressure at hydrant shall be 30 psi unless otherwise directed by POS Fire Department.

C. 3-foot minimum clearance shall be provided around outside of hydrant for operation. Provide 5 feet horizontal clearance from the outside of the hydrant to concrete walls, structures, utility poles and above grade electrical enclosures.

1.04 WATER STRUCTURE DESIGN REQUIREMENTS

A. Water structures shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110 Water Distribution System and the STIA F&I Standard Details – Appendix A requirements and the following requirements.

B. Aircraft-rated Water structures are required at any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass all of the Air Operations Area (AOA) at STIA, including the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), and within Perimeter Road.

C. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

D. Metal castings (Frames, Covers, and Grates) for aircraft rated Water structures shall support a minimum proof load of 100,000 pounds and 250 pounds per square inch tire pressure.

E. Metal castings (Frames, Covers, and Grates) for traffic-rated (AASHTO HS-25) Water structures shall meet the requirements of the heaviest vehicles utilizing the site, or AASHTO M306 and support a minimum proof load of 40,000 pounds whichever is greater. Special consideration should be given to areas inside and outside of the AOA but still utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment, and load rating shall be increased as necessary to accommodate the largest loading anticipated.

F. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration shall be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) dreat STIA have axle loadings that exceed

AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology shall be utilized based upon the actual loading encountered at the site.

G. Castings shall be ductile iron. No composite castings shall be allowed.

1.05 UTILITY CLEARANCE REQUIREMENTS

A. Horizontal clearance between water mains and sanitary sewers (SS); industrial waste sewers (IWS), storm drains (SD), and petroleum pipelines shall be a minimum of 10 feet measured edge-to-edge of each pipe. Minimum horizontal clearance between water main and other utilities, including natural gas, power, telephone/fiber optics shall be 5 feet measured edge-to-edge from the pipe to utility.

B. Water services and sewer stubs shall have 10 feet separation measured edge-to-edge of each pipe.

C. Vertical clearance between water mains and other non-potable conveyance piping or utilities shall be a minimum of 18-inches at utility crossings. Water piping shall cross over other non-potable (including but not limited to IWS, Storm, Sewer systems) conveyance piping, with one full length of water pipe centered over the crossing for maximum joint separation. Refer to utility crossing details in STIA F&I Civil System Standard Details – Appendix A. Washington Department of Ecology criteria for separation and clearance will also apply.

1. If the 18-inches minimum separation cannot be achieved, special approval from the POS F&I is required and special construction techniques to protect each utility will be required as follows:
    a. The water pipe shall be constructed of ductile iron pipe per AWWA C151 or PVC per AWWA C900, or as approved by the POS F&I. The crossings shall occur at the midpoint of full pipe length segment (18 feet minimum) of the utilities to maximize the spacing between joints.
    b. The crossing utility shall be encased in concrete, or in one quarter-inch thick continuous steel, ductile iron, or pressure rated PVC pipe with a dimension ratio of 18 or less, with all

voids filled with grout. The length of encasement or casing shall be 18 feet minimum.

c. The crossing utility shall be centered at the point of crossing with longest standard pipe length for maximum pipe joint separation.

D. When the design requires a non-potable conveyance system to pass over a water main, the design must be approved by POS F&I and meet all the following requirements:

1. A minimum vertical separation of 18-inches between the bottom of the non-potable utility and the top of the potable water main.
2. The water main and the non-potable conveyance pipeline must be made of ductile iron pipe meeting AWWA C151 standards.
3. The water main and the non-potable conveyance pipeline shall be encased in a pressure rated casing pipe designed to withstand a minimum static pressure of 150 psi.
4. The casing shall be 18 feet minimum and centered at the crossing to provide the maximum joint separation.

E. A minimum of 5-foot horizontal clearance is required between concrete thrust blocking and other buried utilities or structures.

F. If the minimum vertical distance between utility pipes is less than 6-inches and such installation is approved by POS F&I, a pad shall be placed between the pipes. The pad dimensions shall be O.D. x O.D. x 2.5 inches thick minimum or as required to protect the pipes. Above O.D. is equal to the outside diameter of the larger pipe. The pad shall be a polyethylene foam plank (Dow Plastics Ethafoam tm 220), or approved equal. Additional measures may be necessary to ensure system integrity and may be required as evaluated by POS F&I on a case by case basis.

G. Vertical and horizontal utility clearance requirements are summarized in table form in Section 322333 Utility Trenching and Backfill.

1.06 SLOPES

A. Maximum design pipe deflection shall not exceed one-half of pipe manufacturer's recommend maximum deflection. Vertical bends shall be used when joint deflection would exceed the design pipe deflection.

B. Concrete thrust blocking is required for vertical bends and shall be in accordance with STIA F&I Civil Systems Standard Details – Appendix A.

C. Concrete anchor blocks designed by the Engineer are required for slopes 20% or greater.

D. Timber baffle/hill holders shall be required on unpaved slopes that exceed 20%, maximum spacing shall be 20' on center.

1.07 CONNECTIONS TO EXISTING SYSTEM

A. Connections to existing mains shall be made by cutting in a tee, unless otherwise approved by POS F&I. Tapping tees are not allowed.

B. When connecting to existing steel pipe, a flange shall be welded to the existing steel pipe, and new or replaced pipe shall be ductile iron pipe and fittings; new steel pipe shall not be installed.

C. Valves at connections to existing mains shall be in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings, STIA F&I Civil Systems Standards Section 331216 Water Valves and STIA F&I Standard Details – Appendix A.

D. Connections to existing mains with a new tee or cross and connections to existing main ends, stub or end outlet of a tee or cross shall be made by installing two mechanical joint sleeves on the new water pipe segments. The pipe length between the two sleeves shall be cut to fit the required distance. “Wedding ring” or spacer pipe segments installed within sleeves shall not be allowed.

E. Deflect pipe joints of new water main piping as allowed to make connections to existing mains at different elevations. Vertical bend fittings with thrust blocks for connections to existing systems is not allowed without prior approval from POS F&I.

F. Where poured-in-place concrete thrust blocks are required at a point of connection to an existing watermain, the thrust blocking shall be installed prior to connection.

G. Cutting into or connecting pipe materials shall be accomplished without creating a dissimilar corrosion cell due to the pipe material used; insulation or corrosion protection shall be included to prevent corrosion.

H. Designer shall develop a detail at point of connection that shall be submitted as part of the STIA Application for Connection to Water System.

1.08 CROSS-CONNECTION CONTROL

A. Water systems shall be protected from contamination through cross-connections with non-potable water or other liquids conveyed through piping in accordance with Washington State Department of Health (DOH) and Washington Administrative Code (WAC) requirements.

B. Refer to STIA F&I Mechanical System Standards for cross-connection control program information and backflow prevention requirements.

C. Backflow prevention installations must be reviewed and approved by POS F&I prior to construction.

1.09 CATHODIC PROTECTION

A. All metal and steel casing pipes shall be cathodically protected in accordance with STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill Cathodic Protection Requirements.

B. All water pipe crossings with other metallic utilities where clearance between the utilities is 18-inches or less require installation of an insulating dielectric mat between the utilities.

1. Dielectric mat material and sizing shall be determined by the Engineer and shall be based on the sizing of the utilities.
2. Cathodic Protection Test Stations shall be installed at the intersection including test leads to the utilities, a permanent buried electrode and anodes for future mitigation unless otherwise directed by POS F&I. Installations at each utility crossing shall be reviewed and approved on a case-by-case basis by POS F&I.

1.10 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M199 Standard Specification for Precast Reinforced Concrete Manhole Sections

B. American Association of State Highway and Transportation Officials (AASHTO) M306 Standard Specification for Drainage, Sewer, Utility, and Related Castings

C. American Society for Testing and Materials (ASTM) C478 Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

D. American Society for Testing and Materials (ASTM) C497 Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
E. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
F. American Society for Testing and Materials (ASTM) D4101 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
G. American Society for Testing and Materials (ASTM) D4832 Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
H. American Society for Testing and Materials (ASTM) D6103 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)
I. American Society for Testing and Materials (ASTM) D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
J. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast.
K. American Water Works Association (AWWA) C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.Through 60 In.
L. FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes
M. National Fire Protection Association (NFPA) 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
N. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Application for Connection to Water System.
O. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Exterior Water System Connection Procedure and Requirements.
P. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 024113.23, Utility Demolition and Abandonment.
Q. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333, Utility Trenching and Backfill.
R. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110, Water Distribution Systems.
S. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216, Valves.

T. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216B, Water Distribution Combination Air Valves.
U. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331219, Fire Hydrants.
V. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A - Standard Details.
W. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Mechanical Systems Standards.
X. Water System Design Manual, Washington State Department of Health, December 2009.

PART 2 - PRODUCTS

2.01 GENERAL

A. Aircraft-rated structures shall meet the requirements as stated above in Paragraph 1.04 above, this Section. Concrete and reinforcement design shall be as required to support the loading design of the precast structure.
B. Steps and Ladders: Ductile iron or polypropylene covered rebar, ASTM C478, ASTM C497 and AASHTO M199. Polypropylene, ASTM D4101.
    1. Steps shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall for steps, or 3-inches from the structure wall inside the adjustment section. Steps within precast concrete structures shall be cast into the sides of the structure at the time the of manufacture or set in place after the structure is erected by drilling holes in the concrete and epoxying the steps in place. Steps shall be uniformly spaced at 12 inches and be vertically aligned
    2. Ladders shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall. Ladder shall be set in place after the structure is erected by drilling holes in the concrete and epoxying in place
C. Bedding for structures shall consist of a minimum of 6 inches (or as required for site conditions) of aggregate base compacted to 95% of maximum density as determined by ASTM D1557. The bedding shall extend a minimum of 1-foot past the structure's base in all directions for structures up to 60 inches in diameter and 2-feet past the structure's base in all directions for structures greater than 60 inches in diameter. The aggregate base material shall meet the requirements of Pipe Bedding per Seattle-Tacoma International Airport

Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill

D. Backfill of utility structure excavations:
    1. All utility structure excavations within pavement or within 10 feet of pavement shall be backfilled with controlled low-strength material density fill (CLSM) meeting requirements of Section 322333 Utility Trenching and Backfill
    2. All utility structure excavations within unpaved areas at least 10 feet or more from any pavements shall be backfilled with a material meeting the requirements of Pipe Backfill per Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and backfill in accordance with ASTM D6938 requirements. See Spec Section 322333.
B. Contractor shall submit testing plan to engineer for review and approval.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for Water Distribution systems piping and fittings are as described in this section. All water systems shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements.

C. Piping shall be installed a minimum of 5-feet away from buildings, structures and associated foundations.

D. In the situation of a new building, structures, and associated foundations conflicting with existing piping; the existing piping system shall be relocated a minimum of 5-feet away from the new building, structures and associated foundations.

E. When construction will impact active water distribution, systems phasing, and bypass plans shall be included. Water shall not be shut off more than 5 hours at night between midnight to 5:00 AM. Any variances require approval by POS F&I and the POS Fire Department.

1.02 SUBMITTALS

A. Submit materials data in accordance with Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products, including but not limited to pipe, fittings, gaskets, mechanical joint restraints, shackle rods and lugs.

B. Bypass and Phasing Plans when construction will impact active water distribution systems.

C. Calculations for thrust blocks, valve vault and manhole structures, fire flow and fire hydrant flow, and other elements requiring design calculations.

D. Hydrostatic testing plan and results for installed water pipe, valves and accessories.

E. Certification of flushing and sterilization for installed water pipe.

1.03 REFERENCES

A. American National Standards Institute (ANSI) A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
B. American Water Works Association (AWWA) C104 American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
C. American Water Works Association (AWWA) C110 Ductile Iron and Gray Iron Fittings.
D. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
E. American Water Works Association (AWWA) C150 Thickness Design of Ductile Iron Pipe.
F. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast.
G. American Water Works Association (AWWA) C153 Ductile Iron Compact Fittings for Water Service.
H. American Water Works Association (AWWA) C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
I. American Water Works Association (AWWA) C217 Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connection and Fittings for Steel Water Pipelines.
J. National Fire Protection Association (NFPA) 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
K. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill.
L. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216 Valves.
M. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331217 Water Distribution Combination Air Valves.
N. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331219 Fire Hydrants.
O. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A – Standard Details

PART 2 - PRODUCTS

2.01 WATER DISTRIBUTION PIPE, JOINTS AND FITTINGS

A. Pipe:

1. Ductile Iron Pipe:
    a. Pipe of 3-inch diameter and larger shall be AWWA C150 and AWWA C151, thickness Class 52 minimum. Pipe class shall be increased for depth and loading conditions exceeding class 52 specifications as per manufacturer recommendations.
    b. Cement mortar lining meeting ANSI/AWWA C104/A21.4.
    c. Asphaltic coating meeting ANSI/AWWA C151/A21.51.
    d. Restrained Joints - bell and spigot push-on type pipe joint with restrained gaskets. Products:
        i. US Pipe - Tyton Joint Pipe
        ii. American - Fastite Joint Pipe
        iii. McWane Ductile - Tyton Joint Pipe
        iv. Or approved equal
    b. Restrained Gaskets rated to 350 psi and meeting requirements of ANSI/AWWA C111/A21.11. Products:
        i. US Pipe - Field Lok 350 Gasket
        ii. Romac – Piranha Restraint Gasket
        iii. American – Black Fast-Grip Gasket
        iv. Or approved equal
2. Copper Pipe:
    a. Pipe under 3-inches in diameter shall be pipe ASTM B88 thickness class Type K.
    b. Joints shall be soldered.
    c. Compressible fittings shall not be allowed.
3. HDPE
    a. Pipe under 3-inches in diameter shall be PE pressure pipe for water mains shall meet the requirements of ANSI/AWWA C901.
    b. Pipe materials shall be high-density polyethylene PE4710.
    c. Fittings shall be butt fused to pipe.

4. Pipe ends shall be capped and protected when delivered to site up until installation and kept clear of deleterious material.

B. Fittings:

1. Ductile Iron conforming to ASTM A536. Minimum pressure rating of 350 psi for pipe diameter 3 to 24 inches. Minimum pressure rating of 250 psi for pipe diameter 30 to 48 inches. Fittings shall be new and recently manufactured. Refurbished fittings are not acceptable.
2. Mechanical or Flanged Joint. ANSI/AWWA C153/A21.53 Mechanical Wedge Action Type Joint:
    i. All mechanical joints shall be restrained with manufactured bolt-on restraint system. Products:
        1. EBAA Iron Mega-Lug
        2. Romac RomaGrip
        3. Tyler Union TUF Grip
        4. Star Pipe Products Stargrip
        5. Or approved equivalent
    ii. All mechanical or flanged joints shall be pressure rated to meet the greater minimum pressure requirements of adjacent pipes or to 250 psi, whichever is greater.
3. Cement Lining and Asphaltic Coating in accordance with ANSI/AWWA C104/A21.4
4. Rubber Gasket Joints Including Mechanical Joints, and Flanged Joints: In accordance with ANSI/AWWA C111/A21.11. Full faced flanges and gaskets to be used where available.
5. Restrained Dismantling Joints:
    a. Pressure Rating:
        i. Minimum working pressure rating shall not be less than rating of the connecting flange.
        ii. Proof testing shall conform to requirements of AWWA C219 for bolted couplings.
    b. Manufacturers and Products:
        i. Romac Industries; DJ400.
        ii. Baker Coupling Company (actual model number will vary with diameter).

iii. Viking Johnson DN 400 (actual model number will vary with diameter).

iv. Or approved equivalent.

c. Use stainless steel bolting material conforming to ASTM F593, TYP 304 stainless steel, Group 1, Condition SH1, 2, 3, or 4.

2.02 VALVES, VALVE BOXES AND EXTENSION STEMS

A. Combination air valves for water distribution systems shall be in accordance with STIA F&I Civil System Standards Section 331217 Water Combination Air Valves. Gate valves and other valves and valve boxes and extension stems shall be in accordance with STIA F&I Civil System Standards Section 331216 Valves.

B. Tapping sleeves and tapping valves are not allowed.

2.03 FIRE HYDRANTS

A. Standard upright hydrants, flush hydrants and shackle rods and lugs shall be in accordance with STIA F&I Civil System Standards Section 331219 Hydrants.

2.04 THRUST BLOCKS

A. Thrust blocks shall be in accordance with NFPA 24 Section 10.6.1 standards and STIA F&I Civil System Standards Appendix A – Standard Details.

1. Thrust blocks shall be permitted where undisturbed soil is stable and capable of resisting the anticipated thrust forces.
2. Thrust blocks shall be Class 3000 concrete, minimum compressive strength of 3000 psi at 28 days.
3. Thrust blocks shall be located so that the joints are accessible for repair.
4. All poured in place blocking shall have a minimum clearance of five feet from existing utilities or structures.
5. Plastic sheeting at thrust blocks shall be per STIA F&I Civil System Standards Appendix A – Standard Details.

2.05 COATINGS

A. After installation of above grade bolted valves, fittings, and couplings, the Contractor shall coat the bolting materials with high-build polyamide epoxy conforming to AWWA C210. Approved epoxy products meeting number of coats, thickness and requirements of AWWA C210 manufactured by Sherwin Williams, Carboline Carboguard, Tnemec or approved equal.

B. The Contractor shall coat all buried couplings, buried valves, and all exposed metal surfaces of buried flanges with insulating flange kits with petrolatum wax tape or heat shrink sleeve in accordance with AWWA C217.

2.06 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY (RPBA)

A. RPBA units must be of a type included in the Washington State Department of Health current listing of "Approved Reduced Pressure Backflow Assemblies."

B. Installation must be according to procedures outlined in the current edition of "Accepted Procedure and Practice in Cross Connection Control Manual" published by the Pacific Northwest Section, American Water Works Association.

C. Inspection of the installation, to ensure proper operation, will be conducted by backflow device testers certified by the Washington State Department of Health.

D. RPBAs must be inspected and tested annually during the life of the contract.

E. RPBAs must not be installed below ground.

2.07 PROTECTIVE INSULATED ENCLOSURE

A. Protective insulated enclosure shall be sized for the RPBA.

B. The drainage opening in the protective insulated enclosure shall be large enough to handle the discharge of a full relief valve opening

C. Protective insulated enclosure shall prevent freezing of the RPBA to at least 0°F.

D. An opened protective insulated enclosure shall allow access to all part of the RPBA assembly.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 FIELD TESTS

A. Testing, flushing and sterilization shall be conducted in accordance with the STIA F&I Exterior Water System Connection Procedure and Requirements.

4.02 CHLORINATED WATER DISPOSAL

A. The Contractor shall be responsible for the final removal and disposal of the chlorinated water used for sterilization. The Contractor is responsible for all permits and costs including conveying, pumping and the hauling required for the water disposal.

B. Chlorinated Water Disposal will be conducted in accordance with the STIA F&I Exterior Water System Connection Procedure and Requirements.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. This Section includes the design and selection requirements of general duty valves common to potable water and sewer utility piping systems at Sea-Tac International Airport. Combination air release/air vacuum valves for water distribution systems are included in Section 331216B – Water Distribution Combination Air Valves.

B. Valve Design Information:

1. Provide valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
2. Locate isolation valves at each branch take off. At water main intersections, valves shall be placed on 4 out of 4 legs at each cross, and 3 out of 3 legs at each tee.
3. On water distribution mains, isolation valves shall be located such that a length of water main no more 500 feet in length can be isolated by closing valves.
4. Grooved Piping System Compatible Valves: Allowed only for temporary piping and selected pumping assemblies with prior approval by Port of Seattle Facilities and Infrastructure.
5. The following valves are not allowed: Butterfly Valves.
6. Provide independent supports as required at concentrated loads from valves and flanges.

1. Valves diameter shall match size of adjacent pipe.
2. Valves shall be installed with a dismantling joint to allow removal of the valve without cutting adjacent pipe.

C. Valve Vaults or Manholes:

1. When depth from ground surface to top of operating nut for valves exceeds 6 feet, the valve(s) shall be placed in a vault or manhole. In addition to soil, traffic, and other loads required in these standards, vaults and manholes shall be designed to resist the thrust and other loads imposed by pipes and valves.
2. Refer to Standard Details for vault and manhole minimum clearances, layout, and details.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals.

B. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

D. Submit method for hydrostatic testing and test and inspection results.

E. Submit calculations for thrust blocks, restraints, and pipe supports within vaults and manholes.

F. Submit valve stem and valve extension stem length data, indicating when valve vaults or manholes are required.

1.03 REFERENCES

A. American Society for Mechanical Engineers (ASME) B.1.20.1 Pipe Threads, General Purpose.

B. American Society for Mechanical Engineers (ASME) B.16.1 Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250.

C. American Society for Mechanical Engineers (ASME) B.16.5 Pipe Flanges and Flanged Fittings, General Purpose.

D. American Society for Mechanical Engineers (ASME) B16.24 Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500.

E. American Society for Testing and Materials (ASTM) A276 Stainless Steel Bars and Shapes.

F. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings.

G. American Society for Testing and Materials (ASTM) B138 Standard Specification for Manganese Bronze Rod, Bar, and Shapes.

H. American Society for Testing and Materials (ASTM) B371 Standard Specification for Copper-Sinc-Silicon Alloy Rod.

I. American Society for Testing and Materials (ASTM) D429 Test Methods for Rubber.

J. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
K. American Water Works Association (AWWA) C515 Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service.
L. American Water Works Association (AWWA) C550 Protective Interior Coatings for Valves and Hydrants.
M. Environmental Protection Agency (EPA), Safe Drinking Water Act.
N. NSF International (NSF) NSF/ANSI 61 Drinking Water System Components—Health Effects.
O. NSF International (NSF) NSF/ANSI 372 Drinking Water System Components—Lead Content.
P. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Mechanical Systems Standards.
Q. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 013300-Submittals.
R. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110 – Water Distribution System.
S. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216B – Water Distribution Combination Air Valves.
T. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A – Standard Details.

PART 2 – PRODUCTS

2.01 GENERAL

A. Valves shall have no leakage (drip tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in referenced valve standard.
B. Valve to open by turning counterclockwise, unless otherwise specified.
C. Valve materials in contact with or intended for drinking water service shall comply with requirements of NSF/ANSI 61 and other applicable federal, state, and local requirements.
D. Components and Materials in Contact with Water for Human Consumption:
    1. Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that

components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

2. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 VALVES

A. Manufacturers:

1. Resilient Wedge Gate Valves: Crane (Class 150), Clow (Model 2638), M&H (Style 7000), Kennedy (Model KF-RW), American USA (2500 Series), or approved equivalent.
2. Ball Valves: Stockham, Conbraco-Apollo, Jenkins.
3. Globe or Angle Valves: Stockham, Crane, Jenkins.
4. Swing Check Valves: Stockham, Crane, Jenkins.
5. Non-Slam Check Valves: Stockham, Conbraco-Apollo, Keystone, Mueller.

B. Water Distribution Gate Valves:

1. Gate Valves shall be resilient wedge seat type meeting AWWA Standard C515.
2. Rated for 250 psi maximum working pressure and 500 psi static test pressure.
3. Operating mechanism shall be a standard 2-inch AWWA square operating nut opening to the left and shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover.
4. Ductile iron valve body with interior and fusion-bonded exterior epoxy coating meeting all applicable requirements of AWWA C550.
5. Flanged or Mechanical joint ends. Flanged valves shall conform in dimensions and drilling to the standard ANSI B16.1 for cast iron flanges and flanged fittings Class 250. Bolt holes shall straddle the vertical centerline. Mechanical joint ends shall meet AWWA C111 Standard. All mechanical joints shall be restrained.
6. Stuffing box shall be ductile iron stuffing box meeting ASTM A536 with rubber O-ring stuffing box seals and brass anti-friction washers. There shall be two O-ring stuffing box seals located above thrust collar and one below. Number, size and design shall conform to AWWA standards for gate valve O-ring stem seals.

7. Wedge shall be ductile iron wedge meeting ASTM A536, symmetrical and fully encapsulated with molded SBR or EPDM rubber and no exposed iron. The sealing rubber shall be permanently bonded to the wedge per ASTM D429. The wedge shall be two-faced with parallel seats and wedging devices between them.
8. Valve stem shall be non-rising type consisting of a non-corrosive manganese-bronze ASTM B138 or 305 stainless steel alloy ASTM A276 with material properties as follows:
    a. 2 inches to 54 inches Valves: Tensile 80,000 psi, Min Yield 45,000 psi.
    b. Valves exceeding 72 inches depth from ground surface to operator nut shall be in a vault or manhole.

C. Back-Flow Prevention Assemblies:

1. All backflow prevention assemblies shall be a make, model, and size approved by the Washington State Department of Health (DOH). Assemblies that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research are considered approved by the department. Assemblies must be installed in the approved orientation and cannot be physically altered.
   https://fccchr.usc.edu/list.html
2. Double check valve assemblies (DCVA) shall be complete assemblies, consisting of two weighted lever check valves, two gate valves and [four] test cocks. Check valves shall be cast iron and loaded to one psi in the direction of flow. Gate valves shall be of a 125-pound range pattern. The entire assembly shall meet the F&I Mechanical Standards and DOH requirements.
3. Reduced pressure backflow assemblies (RPBA) shall be complete assemblies, of bronze construction, including a strainer, shut-off valves, test cocks and a pressure differential relief valve between two check valves. The entire assembly shall meet the F&I Mechanical Standards and DOH requirements.
4. RPBA shall be installed in pre-manufactured, heated, and insulated above ground enclosures Refer to Section 331000 Water Distribution Requirements for additional requirements.
5. Refer to Seattle-Tacoma International Airport Facilities and Infrastructure Mechanical Systems Standards for additional cross connection and backflow prevention requirements.

D. Tapping Sleeves and Tapping Valves:
   1. Tapping sleeves, tapping valves, and corporation stops are not allowed.

E. Valve Marker Posts:
   1. Concrete marker post shall have 4" minimum square section and a minimum length of 42" with beveled edges and containing at least one #4 bar of reinforcing steel. Place markers as directed by the Water Department and set so as to leave 18" exposed above grade. Paint exposed portion of the marker posts with a coat of approved paint and then the size of the valve (for example, 6" G.V.). Stencil with black paint on the face of the post the distance in feet and inches to the valve, using a stencil, which will produce letters two inches high.

F. Valve Boxes:
   1. Valve boxes shall be cast iron with two-piece, adjustable sections with an 18” top section and regular 24” base section or base section as required. Valve boxes for water systems shall have the word “WATER” cast in raised letters. Valve boxes shall be in accordance with STIA F&I Civil System Standards Appendix A – Standard Details.

G. Valve Extension Stems:
   1. Valves shall be installed with extension stems when the operating nut is more than 24 inches below final grade. Operating extension stems shall be provided to bring the operating nut to a point 24 inches below the surface of the valve cover or ground surface. Supports shall be provided on all extension stem sections within vaults to secure the extension section against horizontal movement. Supports shall be anchored to vault walls with stainless steel hardware.
   2. Steel extension stems to operate the valves shall have at their lower end a 2-inch square socket end to fit over the 2-inch AWWA nut operator on the valve. The upper end of the extension stems shall have a 2-inch square operating nut similar to the valve. A guide plate shall be welded to each extension stem just below the 2-inch AWWA operating nut, to maintain the nut centered in the valve box. The strength and diameter of the extension stem shall be such that the extension stem will withstand 300 foot-pounds of torque.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

3.01 FUNCTIONAL AND HYDROSTATIC PRESSURE TESTING

A. Functional Pressure Test:

1. Test that valves open and close smoothly under operating pressure conditions.
2. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
3. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.

B. Hydrostatic Pressure Testing:

1. Hydrostatic testing of valves shall be performed in accordance with STIA F&I Civil System Standards 331110 Water Distribution System testing requirements.
2. Valve may be tested while testing pipeline or as a separate step after pipeline has been tested.
3. Apply test pressure to one side of valve and measure the pressure on the opposite side to determine if there is an increase in pressure caused by leakage. Then apply test pressure to the other side, and measure the pressure on the opposite side.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. A combination Air Valve shall be installed at all high points in the water main.

B. Design Air Valve, piping, and assembly size per the current edition of the Dezurik/APCO Air Valve Guide.

C. Air inlet and discharge vent piping shall be at least 18 inches above finished grade. Vent piping shall have a screened downward-facing vent opening.

D. Combination Air Valves shall be of the single housing style that combines the operating features of both an Air/Vacuum and Air Release Valve.

E. The Air/Vacuum portion shall automatically exhaust air during the filling of the pipeline and prevent air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, power outage, pipeline break, etc.

F. The Air Release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure, and during filling of the pipeline.

G. Combination air release/air vacuum valves shall comply with AWWA C512.

H. Exterior of air valves shall be coated in accordance with AWWA requirements. Interior of air valves shall be coated in accordance with AWWA C550.

I. Air valves shall be factory tested in accordance with AWWA C512.

J. Combination Air Valves shall be designed for operating pressures between 20 psi and 250 psi.

K. Design shall provide vault insulation as required to protect valve and assembly from freezing.

L. Design for air release valve shall have a vent above grade with a goose next vent. Locate valve and vent outside of any traveled way (taxiway, ramp, service road, etc. to prevent vehicular contact.

M. Design for air release vaults shall have a drain to storm drain system.

N. All valves and valve assemblies shall also meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A – Standard Details.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 – Submittals, including:

1. Calculations determining assembly size.
2. Product data sheets for make and model.
3. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
4. Maximum recommended test pressure; maximum and minimum recommended working pressures of air valves, isolation valves, flanges, connecting piping, and fittings.
5. Recommended seating materials for specified operating pressures.
6. Manufacturers' installation instructions and testing procedures of products specified.
7. Operations and maintenance data.
8. Affidavit of Compliance in accordance with AWWA C512 stating valve and all materials used conform to applicable requirements of AWWA C512 and these Specifications, and tests specified have been performed and all requirements have been met.
9. Affidavit of Compliance that materials comply with the requirements of the EPA Safe Drinking Water Act and other federal, state, and local requirements.

1.03 REFERENCES

A. American Society of Mechanical Engineers (ASME) B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).

B. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings.

C. American Water Works Association (AWWA) C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

D. American Water Works Association (AWWA) C550, Protective Interior Coatings for Valves and Hydrants.

E. ASSE International (ASSE) 1063 Performance Requirements for Air Valve and Vent Inflow Preventer.

F. Environmental Protection Agency (EPA) Safe Drinking Water Act.

G. NSF International (NSF) NSF/ANSI 61, Drinking Water System Components - Health Effects.

H. NSF International (NSF) NSF/ANSI 372, Drinking Water System Components - Lead Content.

I. Seattle-Tacoma International Airport Facilities and Infrastructure Section 013300 – Submittals.

J. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331000 – Water Distribution Requirements.

K. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110 – Water Distribution System.

L. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216 –Valves.

PART 2 - PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 COMBINATION AIR VALVE, WATER SERVICE, 1 INCH TO 16 INCHES

A. Combination Air Valve, Water Service, 1 Inch to 16 Inches:

1. Manufacturers and Products:
    a. Dezurik/APCO Valve and Primer Corp.; Series 143C to 147C or 1804 to 1816.
    b. Val-Matic Valve; Series 201C to 203C or 104/22 to 116/38.
    c. Crispin UL series
    d. Approved Equivalent.

2. Suitable for water service, combines operating features of air and vacuum valve and air release valve. Air and vacuum portion to automatically exhaust air during filling of system and allow air to re-enter during draining or when vacuum occurs. Air release portion to automatically exhaust entrained air that accumulates in system.
3. Valve single body or dual body, air release valve mounted on air and vacuum valve, isolation valve mounted between the dual valves. 1 inch through 3 inch valves with NPT threaded inlet and outlet, 4 inch and larger valves with ASME B16.1 Class 250 flanged inlet and cover outlet.
4. Rated 300 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
5. Equip 4 inch and larger with antislam device to throttle flow of water into air valve and prevent damage caused by rapid closure.

2.03 CONNECTION TO MAINLINE

A. No service saddle or corporation stop style connections to mainline are allowed.

B. Connections to mainline shall be made by cut-in-tee installation with 4-inch ductile iron pipe size minimum only. Refer to STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements and STIA F&I Civil Systems Standards Section 331110 Water Distribution Systems for connection to mainline requirements.

C. Flanged outlet or fitting connection shall have flange as required to match drilling pattern of adjoining valve and suitable for test pressure and working pressure.

D. Isolation valves shall be in accordance with the STIA F&I Civil Systems Standards Section 331216 – Valves.

2.04 PIPING BETWEEN MAINLINE AND AIR VALVE AND PIPING FOR AIR VENT

A. Ductile Iron Pipe, 4-inch diameter minimum, in accordance with STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements, STIA F&I Civil Systems Standards Section 331110 Water Distribution Systems.

2.05 VALVE VAULT

A. Precast concrete vault, in accordance with STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements, STIA F&I Civil Systems Standards Section 331110 Water Distribution Systems and STIA F&I Civil Systems Standard Details – Appendix A.

2.06 ACCESSORIES

A. Inflow Prevention Device on Vent Pipe:

1. Used to provide backflow prevention and prevent nonpotable water from entering the air vent piping.
2. Inflow preventer shall be designed, manufactured and tested in accordance with ASSE 1063 and rated lead-free in accordance with NSF/ANSI 61, Annex G.
3. Shall be rated for submergence to 25 psi.
4. Float checks and trim shall be Type 316 stainless steel. Resilient seats shall be EPDM with fiberglass reinforcement. The upper and lower chambers shall be constructed of ASTM A536, Grade 65 45 12 ductile iron.
5. Provide Type 304 stainless steel basket screen on device to minimize entrance of debris.
6. Manufacturer and Product: Val-Matic; FloodSafe.
7. Provide field test kit to confirm drip-tight closure of backflow prevention device.
8. Provide all necessary brackets and mounting hardware required and recommended by the manufacturer.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 VALVE TESTING AND INSPECTION

A. Air Valve:
   1. May be either tested while testing pipelines, or as a separate step.
   2. Isolation valves shall be in open position during pipeline test.

B. Isolation Valves: Test that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other.

C. Air and Vacuum Valves: Inspect valves as pipe is being filled to verify venting and seating is fully functional.

D. Verify leak-free performance during testing.

E. Using the test kit provided by the manufacturer of the inflow prevention device, perform inflow prevention test as recommended by the manufacturer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Hydrants shall be a standard pattern of a single manufacturer approved by the Engineer. The name or mark of the manufacturer, size of the valve opening, and the year made shall be plainly cast in raised letters and so placed on the hydrant barrel as to be visible after the hydrant is installed.

B. Hydrants shall be designed for a minimum working pressure of 250 psi and 500 psi test pressure. Hydrants shall conform to AWWA C502 and the following requirements stated in this section for workmanship, design, and material.

C. The hydrant body shall be cast iron, fully mounted with approved non-corrodible metals. All wear surfaces shall be bronze or other non-corrodible material. There shall be no moving bearing or contact of iron or steel with iron or steel. All contact surfaces shall be finished or machined and all wearing surfaces shall be easily renewable.

D. The design of the hydrant shall be such that all working parts may be removed through the top of the hydrant.

E. The hydrant stem shall have the AWWA specified number of turns to open the gate and area equal to the area of the valve opening.

F. All upright hydrants shall be provided with collision protection, breakaway devices, and sidewalk flanges. In addition to the protection, hydrants shall be designed to provide a minimum 5 feet clear access directly behind the hydrant.

G. All hydrants shall have two (2) means of restraint with the primary means being thrust blocking. Mega-lug type connections are not approved for installation without additional thrust blocking or rodding.

H. Hydrant locations shall be as approved by the POS Fire Department and in accordance with the following:

1. Hydrants shall be located outside the Runway Object Free Area (ROFA) and the Taxiway Object Free Area (TOFA), and shall be easily accessible.
2. Hydrants shall not be located on dead-end mains.
3. Fire hydrants along access roads shall be located no further than 300 feet apart, measured along the centerline of the road. Hydrants shall have the minimum setback from curb faces in accordance with the Seattle-Tacoma International Airport (STIA) Facilities and

Infrastructure (F&I) Civil System Standards Appendix A – Standard Details. Additional hydrants may be required to meet hydrant flow requirements.

4. A fire hydrant shall be located within 50 feet of Fire Department Connections (FDC). Refer to STIA F&I Mechanical System Standards for additional FDC and fire system requirements.
5. Fire hydrants shall be located at low points within the system to provide flushing capacity.

I. Existing hydrants may not be removed or relocated, or otherwise have their capacity impacted, without providing calculations to verify that the required hydrant flow to all potentially affected buildings is maintained.

J. Fire hydrant service lines shall be adequately sized to provide a minimum fire flow and duration in accordance with POS Fire Department requirements and NFPA 24. Fire hydrant service line piping between the water main and the foot valve at the hydrant shall be sized according to the following minimum requirements:

1. Length of service line less than 50 feet: 6” diameter.
2. Length of service line greater than 50 feet: 8" diameter minimum pipe size with reducer to 6" diameter past the foot valve at the hydrant. Foot valve nearest the hydrant shall be installed no less than 4 feet and no more than 10 feet from the base of the hydrant. Hydrants with laterals longer than 50 feet require a second foot valve on the lateral, located at the tee at the main. The maximum allowed distance from the water main to the foot valve at the hydrant is 100 feet.

K. All hydrants shall be painted red with reflectorized silver top in accordance with the requirements of this section.

L. The dimensions of the bell or hub end connection shall conform to the dimensions of AWWA Standard C100. The dimensions of the mechanical joint (if used) shall conform to AWWA C110.

M. Hydrant drain holes for upright hydrants shall be connected by piping and shall terminate above the surface. Hydrant drain holes for flush hydrants shall be connected by piping and shall terminate within the hydrant pit vault. Piping shall be in accordance with the STIA F&I Civil System Standards Appendix A – Standard Details.

N. Flush hydrant vaults shall have a sloped base to drain and shall include a 4” drain piped to a drainage system as approved by STIA F&I.

O. Design requirements for water distribution piping are as described in the STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements.

P. All fire hydrants shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details.

Q. Fire hydrants shall meet the requirements of the NFPA 415 – Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways as well as the International Fire Code with Washington State Amendments and as amended in this Section.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 – Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

B. Submit hydrostatic test data. Before the hydrant is painted at the factory, it shall be subjected to an internal hydrostatic test of 500 pounds per square inch with the hydrant valve closed and again with the hydrant valve open. The Contractor shall submit copies of the test reports in accordance with Section 013300 – Submittals.

C. Submit calculations for thrust blocks.

D. Certificate of Compliance: Upon completion of the system installation, verify all fire department hose connections, and check all fire safety devices to ensure their readiness for emergency connection and operation.

1.03 REFERENCES

A. American Society for Testing Materials (ASTM) A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

B. American Water Works Association (AWWA) C100, Cast-Iron Pipe Specifications.

C. American Water Works Association (AWWA) C110, Ductile-Iron and Gray-Iron Fittings.

D. American Water Works Association (AWWA) C502, Dry-Barrel Fire Hydrants.

E. NSF International (NSF) NSF/ANSI 61, Drinking Water System Components - Health Effects.

F. NSF International (NSF) NSF/ANSI 372, Drinking Water System Components - Lead Content.
G. National Fire Protection Association (NFPA) 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
H. National Fire Protection Association (NFPA), NFPA 415 – Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways.
I. International Fire Code (IFC), International Fire Code with Washington State Amendments.
J. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331000 Water Distribution Requirements.
K. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333 – Utility Trenching and Backfill.
L. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil System Standards Appendix A – Standard Details
M. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Mechanical System Standards.
N. Washington State Department of Transportation (WSDOT), M-41 Standard Specifications for Road, Bridge and Municipal Construction, current version.

PART 2 - PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
    1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 UPRIGHT FIRE HYDRANT

A. Products:

i. M&H - Style 929 “Reliant”
ii. Mueller - Super Centurion
iii. Kennedy - Guardian
iv. Or approved equal

1. Hydrant foot valve to be installed no less than four (4) feet and no more than ten (10) feet from the base of the hydrant.
2. Drain holes shall be connected by piping and shall terminate above ground.
3. Upright hydrants shall be provided with collision protection and reflective markings in accordance with STIA F&I Civil System Standards Appendix A – Standard Details.
4. Hydrant shall have connections per 2.04.A and 2.04.B

2.03 FLUSH FIRE HYDRANT

A. Mueller - 5 ¼” Flush Type Fire Hydrant (made to accommodate 250 psi)
1. Hydrant foot valve to be installed no less than four (4) feet and no more than ten (10) feet from the base of the hydrant.
2. Drain holes shall be connected by piping and shall terminate within the vault.
3. Flush hydrant vault to be provided with adequate drainage to keep water from accumulating inside the box.
4. Flush hydrant location to be marked with reflective hydrant signs to match present standards.
5. Hydrant shall have connections per 2.04.A and 2.04.B

B. Flush Hydrant Vault
1. Flush hydrant vault shall consist of a prefabricated pit vault assembly with fiberglass liner, pit cover and all necessary components, including:
a. Designed to support a minimum of 200,000 lbs wheel load with 250 PSI tire pressure.
b. Lid shall be lift assist.
c. Lid shall have tool less entry.
d. Inside clear space dimensions of 38” by 38”.

e. Sloped base to 4" drain.
f. No substitution is permitted

2.04 FIRE HYDRANT CONNECTIONS

A. Hydrant Steamer Adapter
   1. Provide a quick connect fitting with blind cap and cable on all fire hydrants.
   2. Quick connect fitting shall be 5" Storz to Rigid Rocker Lug Style
      a. 4" Pacific Coast Pumper thread: six (6) threads per inch
      b. Outside diameter: 4.828 inches
      c. Thread root diameter: 4.580 inches
      d. Thread length of male nipple: P.C.P. Standard
      e. No substitution is permitted
   1. Material to be hardcoat anodized MIL-A-8625-F, type 3, dark grey of 6061-T6.
   2. Aluminum and cap secured to nozzle with 2 stainless screws set 180 degree apart. The cap shall be tethered with a 0.125" vinyl coated aircraft cable.
   3. All parts, cables, and levers to be AISI 304/316 stainless steel. Storz gasket shall be BUNA-N.

B. Hydrant Hose Connections
   1. Provide 2 side hose nozzle connections with
      a. 2-½" NST, and 7.5 threads per inch at 60 degree V thread. Thread length of 1 inch.
      b. Root diameter of thread to be 2.8715 inches.
      c. Outside diameter of finished nozzle to be 3.0625 inches.
      d. Blind cap and cable
      e. No substitution is permitted

C. Fire Department Connection (FDC)
   1. All FDC's shall be either:
      a. Storz 5" with Blind Cap and Cable per 2.04.A
      b. Siamese Connection - 2 side hose nozzle connections with 2-½" NST per 2.04.B

2.05 SHACKLE RODS AND CONNECTIONS

A. Shackle rods (tie rods) shall be ¾-inch diameter ASTM A193 Grade B7 alloy steel all thread rods. Nut and Washers shall be high strength low allow steel per AWWA C111.

B. Connections of shackle rods to the fittings for thrust restraint shall be made using either 90 degree eye bolts or dual flange bolt harness lugs, single flange bolt ductile lugs are not acceptable.

   a. 90 degree eye bolts with 3/4" UNC rolled thread, high strength, low alloy steel per AWWA C111 (Corten or Mayari-R)

   b. Harness lug shall be ASTM A36 Steel with three holes, two for flange bolts and one for shackle rod. Bolt pattern to match fitting. Fusion bonded epoxy coated.

A. When required, lugs for harnessing the hydrant to the connecting pipe from the main shall be provided on the bell of the elbow or on the hydrant bottom casting. A drawing of the lug construction shall be submitted for approval, on request by the Engineer.

2.06 OPERATING NUTS

A. Hydrant stem and nozzle cap operating nuts shall be the same for all hydrants. Operating nuts shall be patterned to a tapered pentagonal shape, 1.0625 inches high. The nut shall measure 1.35 inches at the base and 1.23 inches at the top measured from point to flat. All hydrant valves and caps shall be opened by turning counterclockwise.

2.07 SIDEWALK FLANGE CONSTRUCTION

A. Provide hydrants with a sidewalk flange. Breakaway devices shall be at the sidewalk flange which will allow the barrel of the hydrant to separate at the break point with a minimal damage. The operating stem shall have a safety stem coupling which will shear or uncouple at the time of impact. All hydrants shall be equipped with 0-Ring stem seals.

2.08 FIRE HYDRANT COATINGS

A. All hydrants shall be painted red with reflectorized silver top.

   1. Thoroughly clean and paint all iron parts of the hydrant, both inside and outside. For Airport use, coat all inside surfaces and the outside

surfaces below the ground line with two coats of asphalt varnish in accordance with AWWA C502-80.

2. Paint the outside of the hydrant above the ground line in accordance with AWWA C502-80. Paint is based upon Sherwin Williams Fast Dry Acrylic Enamel (F78R27), equivalent by Benjamin Moore, Pittsburgh, Carboline, Tnemec, Kelly-Moore, Parker Paint, or approved equal. This is a water based product used for the red base. The top is based upon Rust-Oleum High Performance Acrylic Enamel (5215) equivalent by Benjamin Moore, Pittsburgh, Carboline, Tnemec, Kelly-Moore, Parker Paint, or approved equal. This is also a water based product. Reflectorized glass beads to be Potter Industries "Highway Safety Spheres", Brite Blend by Flex-O-Lite, Swarco Beads from Swarco Industries, or approved equal. The beads are to be applied to the silver top only.

2.09 BACKFILL

A. Backfill shall be control density fill (CDF) and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333 – Utility Trenching and Backfill.

2.10 PIPE BEDDING

A. Pipe bedding material shall be utility bedding and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333 – Utility Trenching and Backfill.

2.11 CONCRETE FOR THRUST BLOCKS

A. Thrust blocks shall be in accordance to NFPA 24 Section 10.6.1 standards and STIA F&I Civil System Standards Appendix A – Standard Details.
   1. Thrust blocks shall be permitted where soil is stable and capable of resisting the anticipated thrust forces.
   2. Thrust blocks shall be placed and of commercial concrete meeting the requirements of STIA Civil System Standards 331110 Water Distribution System.

2.12 CONSTRUCTION GEOTEXTILE FOR SEPARATION

A. Construction geotextile for separation shall be Subdrain Geotextile Filter Fabric and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334116 Subdrainage.

2.13 CRUSHED DRAIN ROCK

A. Crushed drain rock shall be Porous backfill for subdrains and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334116 Subdrainage.

PART 3 - EXECUTION – To be provided by Design Engineer

PART 4 - TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 GENERAL

1.01 GENERAL DESIGN REQUIREMENTS

A. This section covers design standards and requirements for sanitary sewer conveyance.

1.02 CONVEYANCE DESIGN REQUIREMENTS:

A. Conveyance design shall be performed to verify there is adequate capacity in the proposed sewer and existing sewers downstream of the proposed facilities.

B. Lift stations should be avoided whenever possible. If gravity conveyance cannot be achieved, request for a lift station shall be submitted to the Port for consideration prior to lift station design.

C. Drop connections should be avoided whenever possible. Drop connections shall be submitted to the Port for consideration in order to avoid a conflict with an existing utility, but may not be used to avoid extra excavation.

D. All new sanitary conveyance infrastructure shall be sized to convey the peak flow from the facility without the flow depth exceeding 25% of the pipe diameter.

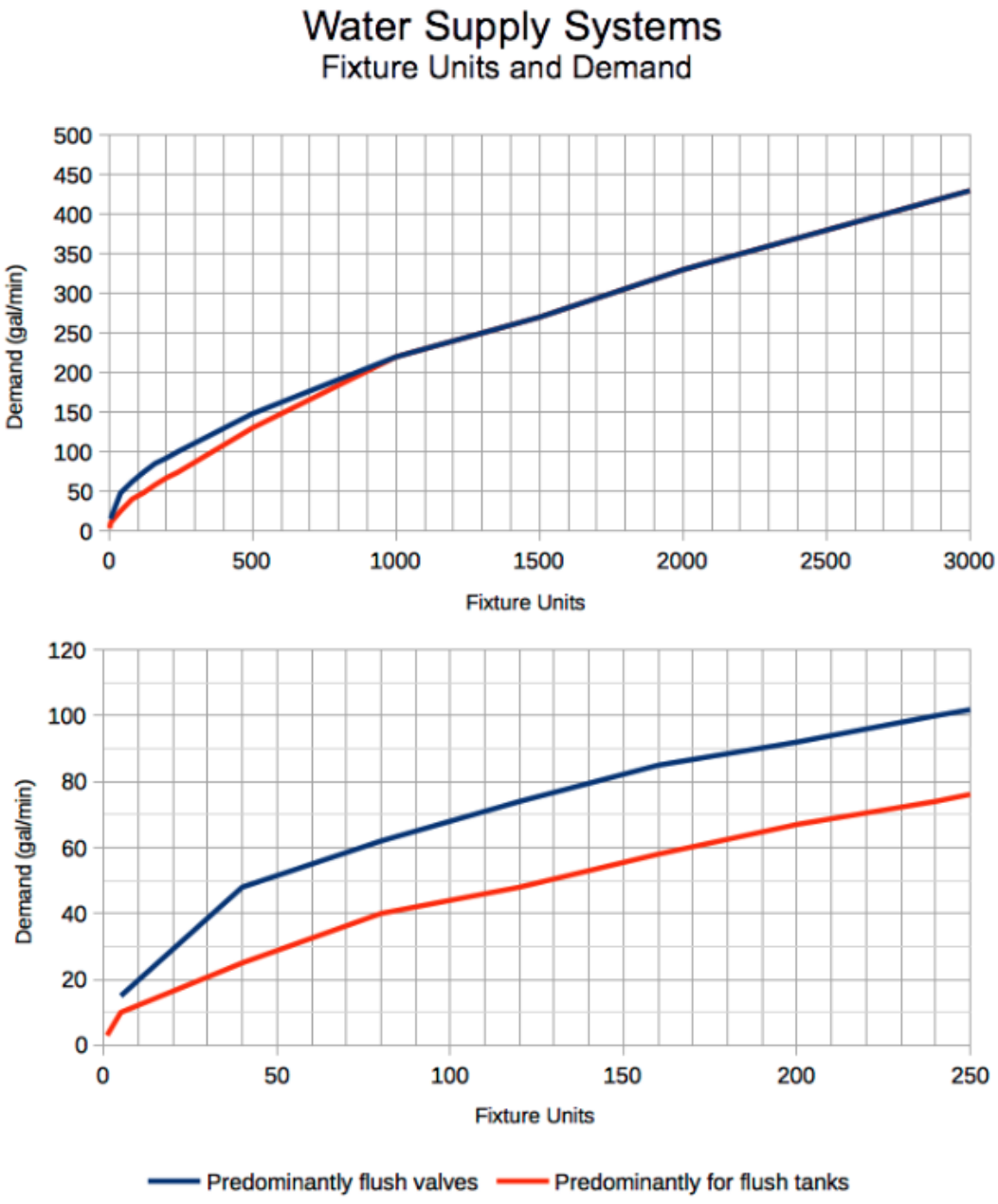
E. All existing sanitary conveyance infrastructure downstream of the new sanitary conveyance infrastructure shall be checked that the proposed increase in flow will not cause the flow depth to exceed 75% of the existing sanitary sewer pipe diameter.

F. Peaks flows shall be determined as follows:

1. First determine the total number of fixture units served by the proposed sanitary sewer using the table below

Fixture	Fixture Units
Water Closet	6
Water Closet <1.6 GPF	3
Urinal	5
Lavatory	1
Sink, bar	2
Sink, kit	3
Sink, mop	3
Sink, service	3
Drinking Fountain	1
Floor Drain	2
Dishwasher	3
Clotheswasher	2
Floor Sink	8
Shower	2

2. Using the chart below convert the number of fixture units to a flow rate. Apply a peaking factor of four (4) to the flow rate.



G. Hydraulic analysis for pipe systems shall meet the requirements of Criteria for Sewage Works Design (Orange Book), section C1-4.

H. Minimum pipe size shall be 8 inches.

1.03 EXTERIOR GREASE INTERCEPTOR REQUIREMENTS:

A. Whenever a commercial and/or retail food preparation operation discharges animal/vegetable fats, oils or grease (F.O.G.) waste to the sanitary sewer, a separate grease waste line to a grease interceptor device shall be required. Fixtures to be connected shall include dishwashers, pot sinks, range woks, janitor's sink and floor sinks. Toilets, urinals, and wash basins shall not flow through the grease interceptor.

B. Effluent discharged from the proposed grease interceptor shall not contain excess of 100 milligrams of F.O.G per liter.

C. Install grease interceptor vaults for any food preparation operation defined in 1.03.A. Proposed grease interceptor capacity shall be determined using the calculations provided in the Uniform Plumbing Code. Minimum capacity shall be 9,000 gallons.

D. When located in the AOA, the maintenance access shall be coordinated with the pavement design and pavement jointing. Pavement openings in the AOA shall be minimized.

E. Grease interceptor located outside shall have clear access and be within ten feet of vehicle driveway for access by maintenance vehicles.

F. Grease interceptor location and access approach shall be a minimum of 15 ft (wide) by 20 ft (height).

G. No grease interceptor shall have a buried grease waste line greater than 100-feet in length.

H. Grease waste line shall have cleanouts positioned to access the downstream pipe. Cleanouts shall be located on the grease waste line as follows:

1. Where the grease waste line enters the building.
2. Upstream of all bends.
3. Spaced 50-feet maximum along the grease waste line.

I. Grease waste line 90-degree bends shall be made using two 45-degree bends.

J. Each cell of the grease interceptor shall be adequately vented.

K. Finished floor of vault shall not exceed 12 ft from finished grade.

L. The inlet and outlet piping shall be visible and can be cleaned from the surface.

M. The design of the grease interceptor shall include the ability to pump out and clean the grease interceptor and baffles without entering the grease interceptor. To achieve this

additional cleanouts or maintenance access might need to be added to the roof of the grease interceptor. Pavement openings in the AOA shall be minimized.

1.04 SANITARY SEWER FORCE MAIN REQUIREMENTS:

A. Force mains shall be designed to take into account surge pressures.

1.05 SANITARY SEWER PUMP REQUIREMENTS:

A. All pumping system shall have duplex pumps, where one pump shall be able to pump at peak flow.

B. The STIA F&I Mechanical Systems Standards should be referenced for all applicable portions of force main systems (e.g., pumps, direct digital controls)

1.06 UTILITY CLEARANCE REQUIREMENTS:

A. Horizontal clearance between sanitary sewers and other non-potable piping conveyance or utilities shall be a minimum of 10 feet measured center to center.

B. Vertical clearance between sanitary sewer piping and other non-potable conveyance piping or utilities shall be a minimum of 12-inches at utility crossings. Vertical clearances of between 6-inches and 12-inches may be allowed at crossings in certain circumstances if no other options exist, and if it is specifically approved by Port Facilities and Infrastructure. Sanitary sewer piping at utility crossings shall be as shown in the STIA F&I Civil Systems Standards Appendix A - Standard Details.

C. Horizontal clearance between sanitary sewer piping (non-potable) piping and potable water mains shall be spaced a minimum of 10 feet measured center to center. Non-potable piping shall be laid at a lower invert elevation than potable water mains and maintain an 18-inch vertical clearance at crossings for ductile iron pipe, and 24-inch vertical clearance at crossings for non-metal pipe. These crossings shall occur at the midpoint of full length pipe segments (18 feet minimum) of the utilities to maximize the spacing between joints. Sanitary sewer piping at utility crossings shall be as shown in the STIA F&I Civil Systems Standards Appendix A - Standard Details.

D. When the design requires a non-potable conveyance system (sanitary sewer piping) to pass over a potable water main, the design must be approved by Port Facilities and Infrastructure, and meet all of the following requirements:

1. A minimum vertical spacing of 18-inches between the bottom of the non-potable and the top of the potable water main.
2. The water main and the non-potable conveyance pipeline must be made of ductile iron pipe meeting AWWA C151 standards.

3. The water main and the non-potable conveyance pipeline shall be encased in a pressure rated casing pipe designed to withstand a minimum static pressure of 150 psi.
4. The casing shall utilize a full pipe length (18 feet minimum) at the crossing with the pipe length centered to provide the maximum joint separation.

E. Vertical and horizontal utility clearance requirements are summarized in table form in Section 322333 Utility Trenching and Backfill.

1.07 CIVIL SYSTEMS STANDARDS REFERENCES

A. All sanitary sewer design shall meet the requirements of the following Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Sections:

B. STIA F&I Civil Systems Standards Section 024113.23, Utility Demolition and Abandonment

C. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

D. STIA F&I Civil Systems Standards Section 333111, Sanitary Sewer Piping

E. STIA F&I Civil Systems Standards Section 333120, Grease Interceptor Vaults

F. STIA F&I Civil Systems Standards Section 334216, Storm Drainage, Sanitary Sewer, and IWS Force Main Piping

G. STIA F&I Civil Systems Standards Section 334231, Storm Drainage, Sanitary Sewer and IWS Structures

H. STIA F&I Civil Systems Standards Section 334241, Frames, Covers and Grates for Storm Drainage, Sanitary Sewer and IWS Structures

I. STIA F&I Civil Systems Standards Appendix A - Standard Details

1.08 CIVIL SYSTEMS STANDARDS REFERENCES

A. All sanitary sewer design shall meet the requirements of the latest published editions of the following documents:

B. Criteria for Sewage Works Design (Orange Book), Washington State DOE

C. Various Sewer district codes (Midway, Southwest Suburban, Valley View)

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for Sanitary Sewer Systems gravity conveyance systems are as described in the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 333100 Sanitary Sewage Requirements. All gravity conveyance shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. Refer to STIA F&I Civil System Standards Section 331000 Sanitary Sewage Requirements, Paragraph 1.06 for utility clearance requirements of sanitary sewer conveyance systems.

C. The minimum cover requirements for all pipe shall be 3-feet below finished grade. The maximum cover for force mains shall be 10 feet. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements of sanitary sewer conveyance systems.

D. Piping less than 8-inches in diameter shall not be utilized for gravity conveyance of sanitary sewer systems.

E. Piping shall be installed a minimum of 5-feet away from buildings, structures and associated foundations.

F. In the situation of a new building, structures, and associated foundations conflict with existing piping; the existing piping system shall be relocated a minimum of 5-feet away from the new building, structures and associated foundations. If there are no viable options to reroute the existing pipe, contact POS F&I Representative.

G. Connection between sanitary sewer mains shall only occur at manholes. No tee connections.

H. Sanitary sewer manholes spacing is a minimum of one manhole per every 300 feet.

I. There shall be no bends in sanitary sewer mains. For sanitary sewer laterals, bends can be used when no other options are possible, 90-degree bends shall be made with two 45-degree bends.

J. Double cleanouts shall be installed immediately upstream and downstream of all sanitary sewer bends and 5-ft from all buildings.

K. No IWS flow or Storm flow shall enter or be connected to the sanitary sewer system.

L. When construction will impact active sanitary sewer facilities phasing and bypass plans shall be included. No closing of bathrooms or concessions will be permitted unless approved by Port operations.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

B. Bypass and phasing plans when construction will impact active sanitary sewer facilities.

C. Testing plan for installed sewer pipe per Part 3.

D. Testing results of installed sewer pipe per Part 3.

E. Submit all updated sanitary sewer data for conveyance modeling, including,

1.03 REFERENCES

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

B. American Society for Testing Materials (ASTM) applicable provisions

C. American Society for Testing and Materials (ASTM) A746 Standard Specification for Ductile Iron Gravity Sewer

D. American Water Works Association (AWWA) C104 American National Standard for Cement-Mortar Lining for Ductile iron Pipe and Fittings for Water

E. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

F. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast

G. FAA regulations Air Operations Area (AOA)

H. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill

I. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewage Requirements

J. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333120 Grease Interceptor Vaults

K. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334231 Storm Drainage, Sanitary Waste and IWS Structures

L. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage, Sanitary Waste and IWS Structures

M. STIA F&I Civil System Standards Appendix A – Standard Details

N. Washington State Department of Transportation Standard Specification Section 7-17.3(2)F Low Pressure Air Test for Sanitary Sewers Constructed of Non Air Permeable Materials

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPE – UNDER PAVED AREAS

A. Ductile-Iron Sewer Pipe:

1. Class 52 meeting AWWA C151.
2. Joints: Push-on joint meeting AWWA C111.
3. Lining: Protecto 401 Ceramic Epoxy
4. Coating: Asphaltic Coating meeting ANSI/AWWA C151
5. Gaskets: Shall be made of elastomer nitrile (NBR) meeting AWWA C111.
6. Manufacturing quality control testing shall meet the requirements of ASTM A746.
7. Bends shall match pipe material.

2.02 SANITARY SEWER PIPE – NON PAVED AREAS

A. Sanitary sewers located at least 10-feet (horizontal) from paved area shall be either Ductile-Iron Sewer Pipe per section 2.01 above or rigid polyvinyl chloride (PVC) conforming with the following requirements:

1. Pipe and fittings shall meet the requirements of ASTM D3034.

2. The standard dimension ratio (SDR) of the pipe shall be 23.5 and have a pipe stiffness of 153 psi.
3. The PVC compound shall be composed of ASTM D1784 Cell Class 12454.
4. Joints for pipes and fittings shall utilize bell and spigot connections with a spun-on, welded or integral bell. Joints shall be watertight and meet or exceed the requirements of ASTM D3212.
5. Gaskets shall meet the requirements of ASTM F477.
6. Bends shall match pipe material.

2.03 INSIDE DROP CONNECTION

A. PVC Pipe for Inside Drop: AWWA C900.

B. Ductile Iron Fittings: ANSI/AWWA C111/A21.11

C. Joints: Shall be mechanical joint that are compatible with both the ductile iron fittings and the PVC pipe.

D. MH structure shall be sized to accommodate inside drop and provide at least 4.5-feet clearance from drop to edge of MH.

2.04 CLEANOUTS

A. Cleanouts shall be constructed as shown on the Drawings and Details.

B. Cleanouts shall be tested for watertightness along with the sewers to which they are connected.

C. Riser shall be Ductile-Iron Sewer Pipe: ASTM A746, Class 52, for push-on joints.

D. Wye shall match adjacent pipe material.

E. Ring and Cover: 12-inch ductile iron locking ring and cover meeting Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage, Sanitary Sewer, and IWS Structures.

F. Double cleanouts shall be used as indicated in Section 1.01 Design Requirements.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 INSPECTION SANITARY SEWERS

A. Pipe shall be cleaned prior to inspection to remove all debris. Cleaning approach shall collect all debris and not flush any debris into existing system.

B. Inspection: Pipe shall be subject to inspection and rejection in accordance with the provisions of ASTM C14. Obtain approval of pipe installation from the Engineer prior to backfilling.

C. Television inspection for pipes is required. Television inspection shall be in accordance with Section 7-17.3(2)H of the WSDOT Standard Specifications.

D. Deflection testing of PVC pipe shall be in accordance with Section 7-17.3(2)G of the WSDOT Standard Specifications.

4.02 TESTING OF SANITARY SEWERS

A. At the engineers option, all installed gravity sanitary sewer shall be subjected to either:

1. Low-pressure air test, in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications.
2. Hydrostatic test, in accordance with Section 7-17.3(2)C of the WSDOT Standard Specifications.
3. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for exterior grease interceptor vault systems are as described in the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 333000 Sanitary Sewer Requirements. All grease interceptor vaults shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Shop drawings and technical data for vaults, including engineering calculations for sizing, structural loads and as required.
2. Shop drawings and technical data for frames, grates, and covers.
3. Shop drawings for steel reinforcement.
4. Aircraft-rated structures shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington for approval by the Port prior to fabrication.
5. Evaluation of the vehicles or aircraft imparting the highest load factors.

B. Bypass and phasing plans when construction will impact active sanitary sewer facilities.

C. Testing plan for installed vault and grease waste pipe per Part 4.

D. Testing results of installed vault and grease waste pipe per Part 4.

1.03 REFERENCES

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

B. American Society for Testing Materials (ASTM) applicable provisions

C. American Society for Testing and Materials (ASTM) C1613 Standard Specification for Precast Concrete Grease Interceptor Tanks

D. Washington State Department of Transportation Standard Specification Section 7-17.3(2)B Exfiltration Test

E. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

F. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching And Backfill

G. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage Sanitary and IWS Structures

PART 2 PRODUCTS

2.01 GREASE INTERCEPTOR VAULT

A. Grease interceptor vault shall be of the configuration per the plans. The plans show the minimum size and volume for a grease interceptor, the required system sizing shall be verified and increased as needed to treat the expected flow.

B. Pre-cast concrete vault shall consist of a vault with piping, grease retaining baffle(s), access cover(s) and frames. It shall be gas and watertight. All components of the system shall be designed for the expected structural loading as noted below.

C. Aircraft-rated grease interceptor vault is required at any airport location that will be subjected to loading by aircraft, or that is located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass most of the Air Operations Area (AOA) at STIA, including but not limited to the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), Head of Stand Utility between nose of aircraft and terminal building, and within Perimeter Road.

D. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

E. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration should be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service

equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) operating at STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology should be utilized based upon the actual loading encountered at the site.

F. All structural calculations for the vault shall include the depth of cover over the vault.

G. Structural calculations for the grease interceptor vault shall be completed by a Washington state licensed engineer.

H. Vault access castings shall meet Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage and IWS Structures

I. Excavation and backfill shall be per STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

J. Finished floor of vault shall not exceed 12-ft from finished grade.

2.02 EXTERIOR GREASE WASTE PIPE

A. Exterior piping that convey the grease waste to the grease interceptor shall be made of a material that does not corrode in the presence of grease.

B. Materials for grease waste:

1. Polypropylene Pipe shall be smooth walled Schedule 80 and manufactured in accordance with ASTM D4101 and conforming to ASTM D2837 for hydrostatic design basis, or approved alternative.
2. Pipe: Polypropylene piping, shall use electrofusion couplers, ASTM F1412.
3. Fittings: Polypropylene, shall use electrofusion couplers, ASTM F1412.

C. Double cleanouts shall be installed before and after each bend, every 50-feet along the length of the grease waste line, and at 5-ft from buildings.

2.03 GREASE INTERCEPTOR VENT PIPE

A. Ductile-Iron Sewer Pipe: ASTM A746, Class 52, for push-on joints.

1. Lining: AWWA C104, asphaltic material seal coat, minimum 1 mil thick.

2. Gaskets: AWWA C111, rubber.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 GREASE WASTE LINE TESTING

A. At the engineers option, all installed grease waste line shall be subjected to either:

1. Low-pressure air test, in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications.
2. Hydrostatic test, in accordance with Section 7-17.3(2)C of the WSDOT Standard Specifications.

B. Contractor shall submit testing plan to engineer.

4.02 GREASE INTERCEPTOR VAULT TESTING

A. In order to demonstrate water tightness, the entire grease interceptor vault shall be tested prior to acceptance in accordance with *ASTM C1613-17 Standard Specification for Precast Concrete Grease Interceptor Tanks*.

B. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Subdrain systems shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance, the Standard Details (Appendix A) requirements and the below specifications.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M252 Standard Specification for Corrugated Polyethylene Drainage Pipe
B. American Association of State Highway and Transportation Officials (AASHTO) M278 Standard Specification for Class PS46 Polyvinyl Chloride Pipe
C. American Association of State Highway and Transportation Officials (AASHTO) M288 Geotextiles
D. American Society for Testing and Materials (ASTM) F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
E. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance

PART 2 - PRODUCTS

2.01 SUBDRAIN PIPING

A. Piping utilized for subdrain systems shall be one of the following:
    1. PVC Pipe and Fittings: Perforated per AASHTO M278, except that the minimum perforation shall be 0.18-inches in diameter and the maximum perforation shall be 0.25-inches in diameter, spaced approximately 3-inches on-center. The minimum pipe size shall be 6-inches. The maximum pipe diameter shall be 10-inches.
    2. HPDE Pipe and Fittings: AASHTO M252, Type SP with AASHTO M252 Class 2, slotted holes 1.18-inches long and 0.125-inches wide. Water inlet area a minimum of 0.945 square inches per foot of pipe. The minimum pipe diameter shall be 6-inches. The maximum pipe diameter shall be 10-inches.
B. Elastomeric Seals: ASTM F477

C. Porous backfill for subdrains shall be from a source that has WSDOT QPL Aggregate Source Approval, and shall be a gravel material free of clay, humus, or other objectionable matter and shall conform to the following gradings:

SIEVE DESIGNATION	PERCENTAGE BY WEIGHT PASSING
1”	99-100
3/4”	80-100
3/8”	0-40
No. 4	0-4
No. 200	0-2

D. Subdrain Geotextile Filter Fabric: Pervious sheet of polyester, polyethylene, nylon, or polypropylene filaments, non-woven and formed into a uniform pattern. Filter fabric shall be AASHTO M 288 Class 2 and have the following minimum properties when measured in accordance with the referenced standard as shown in the table.

Fabric Property	Test Method	Test Requirement
Grab Tensile Strength, lbs	ASTM D4632	125 min
Grab Tensile Elongation %	ASTM D4632	50 min
Burst Strength, psi	ASTM D3785	125 min
Trapezoid Tear Strength, lbs	ASTM D4533	55 min
Puncture Strength, lbs	ASTM D4833	40 min
Abrasion, lbs	ASTM D4886	15 max loss
Equivalent Opening Size	ASTM D4751	70-100
Permittivity sec^{-1}	ASTM D4491	0.80
Accelerated Weathering (UV Stability) (Strength Retained - %)	ASTM D4355 *(500 hrs exposure)	70

E. Cleanout piping shall be a minimum of 6-inches in diameter, or sized to match the subdrain system, whichever is greater. Cleanouts shall be placed at the end of any subdrain piping system, at all tees, elbows or crosses, and at the transition of any perforated piping to non-perforated conveyance piping. Cleanout frame and covers shall meet the requirements of Section 334241 - Frames, Covers and Grates for Storm Drainage, Sanitary Sewer, and IWS Structures

F. Unless otherwise shown on the Standard Details, a 4-inch bed of porous backfill material shall be spread in the bottom of the trench throughout the entire length under all perforated pipe subdrains.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING – To be provided by Design Engineer.

END OF SECTION

PART 1 – GENERAL DESIGN REQUIREMENTS

This section covers design standards and requirements for stormwater drainage system (SDS) and industrial wastewater system (IWS) conveyance only. Design of detention, flow control and water quality facilities, including the design flow rates for such facilities, should be performed in accordance with the Seattle-Tacoma International Airport (STIA) Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016) and all applicable sections of the Stormwater Management Manual for Western Washington (SWMMWW; Department of Ecology 2014 amended).

A. All gravity conveyance shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. IWS standards, as described in this section, shall apply for conveyance of all runoff originating within the STIA identified IWS basins. Reference the Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016) for locations of the IWS basins.

C. The minimum cover requirements for all pipe shall be 3 feet below finished grade. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements of storm drainage and IWS gravity conveyance systems.

D. Piping less than 12-inches in diameter shall not be utilized for gravity conveyance of storm or IWS flow from inlets, catch basins, channel drains, surface drains, manholes, swales or ditches. Piping less than 12-inches in diameter may be utilized, if appropriately sized to convey peak flow, for gravity connections of underdrain systems, roofing downspout (rain leader) systems or electrical and communications vault drains to storm drainage or IWS structures. Piping less than 12-inches in diameter shall be referred to as non-perforated pipe (NPP) and shall meet the requirements of this section.

E. Piping shall be installed a minimum of 5-feet away from buildings, structures and associated foundations.

F. In the situation of a new building, structures, and associated foundations conflict with existing piping; the existing piping system shall be relocated a minimum of 5-feet away from the new building, structures and associated foundations. If there are no viable options to reroute the existing pipe; a sleeve shall be used to isolate piping from concrete.

1.01 CONVEYANCE DESIGN REQUIREMENTS:

A. Drainage conveyance design shall be performed for all stormwater and IWS piping and drainage structures (inlets, manholes, catch basins, trench drains, etc.). All storm drainage and IWS conveyance design and analysis shall utilize an approved runoff computation method as described in the King County Surface Water Design Manual (2016 or latest edition), as modified herein. This manual provides for the acceptable uses of the various available computation methods. Table 3.2 of the 2016 King County Surface Water Design Manual (SWDM 2016), Chapter 3 – Hydrologic Analysis and Design is applicable as modified herein:

Table 1-Runoff Computation Methods for Peak Flow Conveyance Sizing

Applied to:	Rational Method	TR55/SBUH	King County SWDM 2016 Approved Continuous Models[1] (WWHM2012, MGS Flood, HSPF)
Tributary Area ≤ 1 Acre	REQUIRED, no storage routing to be performed	Not Applicable	Not Applicable
1 Acre < Tributary Area < 10 Acres	OKAY if no storage routing is performed	OKAY if no storage routing is performed	OKAY if using 15-minute time steps and 15-minute rainfall time series. (storage routing allowed)
Tributary Area ≥ 10 Acre	Not Applicable	OKAY if no storage routing is performed	OKAY if using 15-minute time steps and 15-minute rainfall time series (storage routing allowed)

Note 1 – See 2016 King County Surface Water Design Manual Reference 6-D for supplemental modeling guidelines. Note that basin-specific calibrated HSPF parameters have been developed for Des Moines Creek, Miller Creek and Walker Creek and are included in the Stormwater Management Manual for Port Aviation Division Property.

B. All new drainage conveyance infrastructure shall be sized to convey and contain the peak flow for a 25-year design storm, without system surcharge, at Seattle-Tacoma International Airport. Pipe systems may surcharge and structures may overtop for runoff events that exceed the 25-year design capacity, provided the overflow from a 100-year runoff event does not create or aggravate a severe flooding problem or severe erosion problem as described in Core Requirement #2 – Offsite Analysis, Section 1.2.2 of the King County

Surface Water Design Manual (2016, or latest edition). Any overflow occurring onsite for runoff events up to and including the 100-year event must discharge at the natural location for the project site, and must be demonstrated by hydraulic analysis.

C. Hydraulic analysis for pipe systems shall meet the requirements of King County Surface Water Design Manual, Chapter 4 – Conveyance System Analysis and Design, Sections 4.2 and 4.3.

D. Sizing of IWS conveyance piping and surface drainage structures may require additional capacity based on regularly occurring, site-specific runoff generation activities. Such activities may include aircraft de-icing pads, fire department practice areas, or areas designed for containment of petroleum or de-icing products.

E. All projects must incorporate the applicable minimum stormwater management requirements for new development or redevelopment as described in the STIA Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016). As such, all projects are required to prepare and submit a Stormwater Site Plan for Port review and approval. The Stormwater Site Plan is the comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with the minimum stormwater management requirements. The STIA Stormwater Management Manual describes these minimum requirements based on project size and type, describes the content to be included in the Stormwater Site Plan submittal to the Port, and provides preparation instructions. A template for the Stormwater Site Plan is also available from the Port through their Aviation Stormwater Management group.

1.02 SYSTEM LAYOUT REQUIREMENTS

A. Gravity Systems: System layout requirements for gravity industrial waste and storm drainage systems shall meet the requirements of the STIA F&I Civil Systems Standards Section 334211 - Storm Drainage and IWS Gravity Conveyance, the STIA F&I Civil Systems Standards Appendix A - Standard Details, and this Section.

B. Force Main Systems: System layout requirements for industrial waste and storm drainage force main systems shall meet the requirements of the STIA F&I Civil Systems Standards Section 334216 - Storm Drainage, Sanitary Sewer, and IWS Force Main Piping, the STIA F&I Civil Systems Standards Appendix A - Standard Details, and this Section.

1.03 UTILITY CLEARANCE REQUIREMENTS

A. Horizontal clearance between IWS or storm drain piping and other non-potable piping conveyance or utilities shall be a minimum of 10 feet measured center to center. Vertical clearance between IWS or storm drain pipping and other non-potable conveyance piping or utilities shall be a minimum of 12-inches at utility crossings. Vertical clearances of between 6-inches and 12-inches may be allowed at crossings in certain circumstances if no other options exist, and if it is specifically approved by Port Facilities and Infrastructure. IWS or storm drain piping at utility crossings shall be as shown in the STIA F&I Civil Systems Standards Appendix A - Standard Details.

B. Horizontal clearance between IWS or storm drainage (non-potable) piping and potable water mains shall be spaced a minimum of 10 feet measured center to center. Non-potable piping shall be laid at a lower invert elevation than potable water mains and maintain an 18-inch vertical clearance at crossings. These crossings shall occur at the midpoint of full length pipe segments (18 feet minimum) of the utilities to maximize the spacing between joints.

C. When the design requires a non-potable conveyance system (e.g., IWS or storm drain) to pass over a potable water main, the design must be approved by Port Facilities and Infrastructure, and meet all of the following requirements:

1. A minimum vertical spacing of 18-inches between the bottom of the non-potable and the top of the potable water main.
2. The water main and the non-potable conveyance pipeline must be made of ductile iron pipe meeting AWWA C151 standards.
3. The water main and the non-potable conveyance pipeline shall be encased in a pressure rated casing pipe designed to withstand a minimum static pressure of 150 psi.
4. The casing shall utilize a full pipe length (20 feet minimum) at the crossing with the pipe length centered to provide the maximum joint separation.

D. Vertical and horizontal utility clearance requirements are summarized in table form in Section 322333 Utility Trenching and Backfill.

1.04 REFERENCES

A. All drainage design shall meet the requirements of the following Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Sections:

1. STIA F&I Civil Systems Standards Section 024113.23, Utility Demolition and Abandonment
2. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill
3. STIA F&I Civil Systems Standards Section 334116, Subdrainage
4. STIA F&I Civil Systems Standards Section 334211, Storm Drainage and IWS Gravity Conveyance
5. STIA F&I Civil Systems Standards Section 334216, Storm Drainage, Sanitary Sewer, and IWS Force Main Piping
6. STIA F&I Civil Systems Standards Section 334231, Storm Drainage, Sanitary Sewer, and IWS Structures
7. STIA F&I Civil Systems Standards Section 334236, Channel Drains
8. STIA F&I Civil Systems Standards Section 334241, Frames, Covers and Grates for Storm Drainage, Sanitary Sewer, and IWS Structures
9. STIA F&I Civil Systems Standards Appendix A - Standard Details

B. All drainage design shall meet the requirements of the latest published editions of the following documents:
   1. National Fire Protection Associations (NFPA) 415, Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways
   2. Federal Aviation Administration (FAA) Advisory Circulars (AC), including but not limited to:
      a. AC 150/5300-13A Airport Design
      b. AC 150/5200-33B Hazardous Wildlife Attractants On or Near Airports
      c. AC 150/5320-5D Airport Drainage
      d. AC 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes
   3. STIA Wildlife Hazard Management Plan (WHMP; Port of Seattle and United States Department of Agriculture 2004)
   4. STIA's NPDES Permit No. WA-002465-1
   5. STIA Airport Certification Manual
   6. STIA Stormwater Low-Impact Development Guideline (2016)
   7. Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016 for consistency with the 2014 amended Ecology SWMMWW

8. Stormwater Management Manual for Western Washington (SWMMWW; Ecology 2014 amended)
9. STIA Model Stormwater Management Guidelines for Infrastructure New Development and Redevelopment (Salmon-Safe 2016)
10. Various City Codes (SeaTac, Burien, Des Moines): These local city codes apply to development on airport property outside of the STIA NPDES Permit boundary. The City of SeaTac, City of Burien, and City of Des Moines stormwater programs and discharges are permitted under the NPDES Phase II MS4 Permit. All Phase II Municipalities are required to update their codes to require LID consistent with the SWMMWW (amended 2014) by December 31, 2016.
11. King County Surface Water Design Manual (King County 2016)

END OF SECTION

PART 1 - GENERAL

1.01 GRAVITY STORM DRAINAGE SYSTEM LAYOUT REQUIREMENTS

A. The STIA storm drainage system (SDS) shall be laid out such that the connections of any piping (e.g., laterals, branch lines, roof drains), regardless of size, to the SDS, occurs at a standard SDS manhole or catch basin meeting the requirements of STIA F&I Civil Systems Standards Section 334231 Storm Drainage, Sanitary Sewer, and IWS Structures. Direct connection of any type of piping directly to SDS piping, such as through the use of "inserta-tees", fittings, or pipe coring and grouting, is not permitted.

B. In-line catch basins are permitted on SDS piping provided the SDS catch basin is sized sufficiently to convey and contain the 25-year design storm without surcharge. See STIA F&I Civil Systems Standards Section 334200 Stormwater Conveyance.

C. Changes between pipe material along the SDS piping, such as changing from polypropylene to ductile iron piping, shall occur only at standard SDS manholes or catch basins.

D. No IWS flow or piping shall enter or be connected to the SDS.

1.02 GRAVITY INDUSTRIAL WASTE SYSTEM LAYOUT REQUIREMENTS

A. All STIA industrial waste system (IWS) piping and components shall meet the requirements of National Fire Protection Association (NFPA) 415, Chapter 5 – Aircraft Fueling Ramp Drainage.

B. Drainage inlets and other surface drainage collection, where provided, shall be located a minimum of 50 feet from any structures as defined in NFPA 415, Paragraph 5.1.1. In no case shall the design allow fuel to collect on the aircraft fueling ramp or adjacent ground surfaces where it could constitute a fire hazard. NFPA 415, Chapter 5 minimum slope requirements for aprons apply.

C. The IWS shall be laid out such that the connections of any piping to the IWS, regardless of size, occurs at an IWS manhole or catch basin meeting the requirements of STIA F&I Civil Systems Standards Section 334231 Storm Drainage, Sanitary Sewer, and IWS Structures. Direct connection of any type of piping directly to IWS piping, such as through the use of "inserta-tees", fittings, or pipe coring and grouting, is not permitted.

D. The IWS shall be designed so that the fuel or its vapor cannot enter into the drainage system of buildings, areas utilized for automobile parking, public or private streets or outdoor passenger areas, the airport terminal or aircraft

hangar structures. A catch basin equipped with a vapor trap, as depicted in the STIA F&I Civil System Standards Appendix A – Standard Details, shall be utilized in between any drainage collection piping (e.g., from roof drainage, building drains) and the connection to the IWS.

E. Channel drains and catch basins shall be individually drained to the IWS by laterals to an approved IWS structure on the IWS line, per paragraph 1.03.C. above. For additional channel drain requirements see STIA F&I Civil Systems Standards Section 334236 - Channel Drains and NFPA 415, Chapter 5 – Aircraft Fueling Ramp Drainage.

F. Unlike the SDS, in-line catch basins are not permitted in the IWS.

G. IWS flows must be wholly segregated from any other conveyance systems (e.g., SDS or Sanitary Sewer).

H. All IWS piping and components shall be noncombustible and inert to fuel, petroleum products, ethylene glycol, propylene glycol, potassium acetate, and sodium acetate.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

B. American Society for Testing and Materials (ASTM) A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement

C. American Society for Testing and Materials (ASTM) A276 Standard Specification for Stainless Steel Bars and Shapes

D. American Society for Testing and Materials (ASTM) A496 Standard Specification for Deformed Steel Wire for Concrete Reinforcement

E. American Society for Testing and Materials (ASTM) A497 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete

F. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings

G. American Society for Testing and Materials (ASTM) A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

H. American Society for Testing and Materials (ASTM) A746 Standard Specification for Ductile Iron Gravity Sewer Pipe

I. American Society for Testing and Materials (ASTM) B21 Standard Specification for Naval Brass, Rod, Bar, and Shapes

J. American Society for Testing and Materials (ASTM) B138 Standard Specification for Manganese Bronze Rod, Bar and Shapes

K. American Society for Testing and Materials (ASTM) B584 Standard Specification for Copper Alloy Sand Castings for General Applications
L. American Society for Testing and Materials (ASTM) C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
M. American Society for Testing and Materials (ASTM) C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
N. American Society for Testing and Materials (ASTM) C655 Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
O. American Society for Testing and Materials (ASTM) C1103 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
P. American Society for Testing and Materials (ASTM) C1417 Standard Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design
Q. American Society for Testing and Materials (ASTM) D1784 Standard Specification for Rigid PolyVinyl Chloride (PVC) Compounds
R. American Society for Testing and Materials (ASTM) D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
S. American Society for Testing and Materials (ASTM) F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
T. American Society for Testing and Materials (ASTM) F2306 Standard Specification for 12 to 60 in. Annular Corrugated Profile-Wall Polyethylene Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications
U. American Society for Testing and Materials (ASTM) F2376 Standard Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems
V. American Society for Testing and Materials (ASTM) F2487 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene and Polypropylene Pipelines
W. American Society for Testing and Materials (ASTM) F2881 Standard Specification for 12 to 60 in. Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications
X. Association of State Highway and Transportation Officials M170 Standard Specification for Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe

Y. Association of State Highway and Transportation Officials M330 Corrugated Polypropylene Pipe
Z. American Water Works Association (AWWA) C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
AA. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
BB. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast
CC. American Water Works Association (AWWA) C515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
DD. American Water Works Association (AWWA) C550 Protective Interior Coatings for Valves and Hydrants
EE. American Water Works Association (AWWA) C560 Cast-Iron Slide Gates
FF. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill
GG. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance
HH. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334231 Storm Drainage, Sanitary Sewer, and IWS Structures
II. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334236 Channel Drains
JJ. Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016)
KK. Washington State Department of Transportation Standard Specification Section 7-17.3(2)F Low Pressure Air Test for Sanitary Sewers Constructed of Non Air Permeable Materials

PART 2 - PRODUCTS

2.01 STORM DRAINAGE PIPE, 12-INCH to 60-INCH DIA. UNDER NON-PAVED SURFACES

Gravity storm drainage pipe 12-inches to 60-inches in diameter under non-paved surfaces shall be one of the following:

A. Pipe shall be ductile iron pipe meeting the requirements of Paragraph 2.02 below, or:
B. Pipe shall be double-walled with a smooth interior and annular corrugations and shall be manufactured of a polypropylene compound meeting the following material requirements:

1. Size 12-inch to 30-inch diameter pipe and fittings: ASTM F2376 and AASHTO M330.
2. Size 36-inch to 60-inch diameter pipe and fittings: ASTM F2881 and AASHTO M330.
3. Joints for pipes and fittings shall utilize bell and spigot connections with a spun-on, welded or integral bell. Joints shall be watertight and meet or exceed the requirements of ASTM D3212.
4. All pipes and fittings shall utilize a double-gasketed spigot with gaskets meeting ASTM F477.
5. Manufacturing quality control testing shall meet the requirements of ASTM F2306

2.02 STORM DRAINAGE PIPE, 12-INCH to 60-INCH DIA. UNDER PAVEMENTS

Gravity storm drainage pipe 12-inches to 60-inches in diameter under paved surfaces shall be ductile iron pipe meeting the following material requirements:

A. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application).
B. Push-on joint: AWWA C111
C. Cement mortar lining: AWWA C104
D. Asphaltic Coated: AWWA C151
E. Rubber gasket: AWWA C111
F. Manufacturing quality control testing shall meet the requirements of ASTM A746

2.03 STORM DRAINAGE PIPE, OVER 60-INCH IN DIA.

Gravity storm drainage pipe 60-inches in diameter or larger, regardless of location, shall be reinforced concrete pipe meeting the following material requirements:

A. Reinforced concrete pipe, meeting ASTM C76 and AASHTO M170, Class V, or as designed using D-Load strength requirements per ASTM C655
B. Joint Performance: Bell and spigot single offset joint, sealed with elastomeric rubber gasket, watertight, ASTM C443.
C. Material Properties: Min. compressive strength and mix design requirements per ASTM C76, pipe class designation per ASTM C655 and ASTM C1417. Reinforcing steel per ASTM A82, A185, A496 or A497 and bars in ASTM A615.

2.04 IWS PIPE, 12-INCH to 60-INCH DIA.

Gravity IWS pipe 12-inches to 60-inches in diameter, regardless of location, shall be ductile iron pipe meeting the following material requirements:

A. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application).
B. Push-on joint: AWWA C111
C. Cement mortar lining: AWWA C104
D. Asphaltic Coated: AWWA C151
E. Gaskets for IWS pipes shall be made of elastomer nitrile (NBR) and meet the requirements of AWWA C111
F. Manufacturing quality control testing shall meet the requirements of ASTM A746

2.05 IWS PIPE, OVER 60-INCH DIA.

Gravity IWS pipe 60-inches in diameter or larger, regardless of location, shall be reinforced concrete pipe meeting the following material requirements:

A. Reinforced concrete pipe, meeting ASTM C76 and AASHTO M170, Class V, or as designed using D-Load strength requirements per ASTM C655
B. Joint Performance: Bell and spigot single offset joint, sealed with elastomeric rubber gasket, watertight, ASTM C443.
C. Material Properties: Min. compressive strength and mix design requirements per ASTM C76, pipe class designation per ASTM C655 and ASTM C1417. Reinforcing steel per ASTM A82, A185, A496 or A497 and bars in ASTM A615.

2.06 NON-PERFORATED PIPE, UNDER 12-INCH DIA.

A. Piping less than 12-inches in diameter may be utilized, if appropriately sized to convey peak flow, for gravity connections of underdrain systems, roofing downspout (rain leaders) systems or electrical and communications vault drains to storm drainage or IWS structures. Storm drainage and IWS conveyance piping, piping conveying surface drainage, or piped connections with conveyances requiring diameters larger than 12-inches, shall meet the standards defined above for storm drain or IWS Pipe, as applicable.
B. Piped connections from electrical and communications vault drains shall be sized as required, or a minimum of 4-inches in diameter, and shall connect to an approved IWS or storm drainage structure.
C. Piped connections from subdrain systems or roofing downspout systems shall be a minimum of 6-inches in diameter, and shall connect to an approved

storm drainage structure. Connection to IWS structures shall meet the requirements of Paragraph 1.03 above, this Section.

D. Material standards for piping under 12-inches in diameter shall be as follows:
   1. Within IWS basins, regardless of location: Piped connections in areas receiving runoff within the STIA identified IWS basins shall utilize the ductile iron pipes and fittings standards for IWS pipe as defined in Paragraph 2.04 above, this Section.
   2. Within SDS basins, under pavement: Piped connections in areas receiving runoff within the STIA identified SDS basins, and under pavement shall utilize the ductile iron pipes and fittings standards for SDS pipe under pavements as defined in Paragraph 2.02 above, this Section.
   3. Within SDS basins, under non-paved areas: Piped connections in areas receiving runoff within the STIA identified SDS basins, and under non-paved areas shall utilize rigid polyvinyl chloride (PVC) conforming with the minimum requirements:
      a. Pipe and fittings shall meet the requirements of ASTM D3034.
      b. The standard dimension ratio (SDR) of the pipe shall be 23.5 and have a pipe stiffness of 153 psi.
      c. The PVC compound shall be composed of ASTM D1784 Cell Class 12454
      d. Joints for pipes and fittings shall utilize bell and spigot connections with a spun-on, welded or integral bell. Joints shall be watertight and meet or exceed the requirements of ASTM D3212.
      e. Gaskets shall meet the requirements of ASTM F477.

2.07 STORM DRAINAGE AND IWS GATE VALVES AND SLIDE GATES

A. Gate valves for use with piped gravity conveyance utilizing ductile iron pipe, such as IWS or storm drainage pipe under pavement, shall be as follows:
   1. Gate valves shall be resilient wedge seat type meeting AWWA Standard C515.
   2. Gate valves shall be rated for 250 psi maximum working pressure and 500 psi static test pressure.
   3. Operating mechanism shall be a standard 2 inch AWWA square operating nut opening to the left and shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem

and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover.

4. Ductile iron valve body with interior and exterior epoxy coating meeting all applicable requirements of AWWA C550.
5. Valve may be push-on or mechanical joint ends meeting AWWA C111.
6. Stuffing box shall be ductile iron stuffing box meeting ASTM A536 with rubber O-ring stuffing box seals and brass anti-friction washers. There shall be two O-ring stuffing box seals located above thrust collar and one below.
7. Wedge shall be ductile iron wedge meeting ASTM A536, symmetrical and fully encapsulated with molded SBR or EPDM rubber and no exposed iron. The sealing rubber shall be permanently bonded to the wedge per ASTM D429. The wedge shall hall be two-faced with parallel seats and wedging devices between them.
8. Valves utilized in conveyance piping that will be regularly exposed to hydrocarbons, fats, oils, greases, chemicals, oils and refined petroleum (Jet Fuel), or that will be utilized for the purpose of fuel spill containment, shall use an approved Nitrile (NBR) wedge encapsulation
9. Valve stems shall be non-rising type consisting of a non-corrosive manganese-bronze ASTM B138 or 305 stainless steel alloy ASTM A276 with material properties as follows:
    a. 2” to 16” Valves: Tensile 70,000 psi, Min Yield 48,000 psi
    b. 18” to 54” Valves: Tensile 70,000 psi, Min Yield 30,000 psi

B. Slide valves for piped gravity conveyance shall be as follows:

1. Slide (or sluice) gates shall meet AWWA C560, be purpose designed for their application and be capable of controlling the flow of fluid through the opening under the design seating and unseating heads.
2. Design head ratings for slide gates shall be as calculated by Engineer or meet the following minimums, whichever is greater:
    a. Minimum seating head shall be 20-feet.
    b. Minimum unseating head shall be 10-feet
3. Slide gates for use with piping shall be furnished with a round back flange for attaching to pipe flanges, or other mechanical means to provide for a watertight seal when utilized in combination with conveyance piping at the design head rating required. All slide gates installed in new openings should be bolted to a new cast-in-place cast iron wall thimble. Thimbles shall be circular when utilized with pipe openings.

4. Slide gates utilized in-line with piping shall be mounted within structures meeting the requirements of STIA F&I Civil Systems Standards Section 334231 Storm Drainage, Sanitary Sewer, and IWS Structures. Slide gates shall be mounted flush to concrete surfaces of flat headwalls or rectangular storm vaults. Where mounting inside circular manholes, a cast-in-place, vertical concrete support face tied to the manhole structure shall be utilized to mount the slide gate with a cast-in-place wall thimble. All structures, or structure modifications, shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington.
5. Bronze to bronze seating surfaces are required.
6. High tensile adjustable bronze side, top and bottom wedges are required.
7. Gate operating systems:
    a. Utilize above ground, pad mounted manually operated floor stand style system with removable cranks. A grout pad shall be used under the floor stand to insure proper alignment between hoist and operating stem.
    b. The manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40-pounds on the crank and shall be able to withstand, without damage, an effort of 80-pounds. The crank shall be removable and fitted with a corrosion resistant rotating handle. The maximum crank radius shall be 15-inches. All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings.
    c. Where location dictates a flush mounted or below-grade operating system, a non-rising stem with a 2-inch AWWA square operating nut that can be engaged by a T-handle wrench shall be utilized. The stem shall open to the left and the operating nut shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover. The ductile iron valve box should extend between the finished grade and through the top slab of the structure housing the slide gate. For structures in

which the top slab is at finished grade, the valve box may be cast with the top slab.

8. Stems shall be stainless steel shall have a slenderness ratio (length/radius) less than 200 and be designed to withstand a torsional force of twice the maximum effort required to operate the gate. For stems in more than one piece, the different sections shall be joined together by solid bronze couplings.
9. Stem guides shall be stainless steel, be equipped with ultra-high molecular weight polyethylene bushings and be positioned as per the slide gate manufacturers recommendations.

C. Materials for slide gates shall meet the following requirements:

1. Gate frame, wall thimbles, disc and stem guides shall be ductile iron (ASTM A536, Grade 65-45-12)
2. Wedges, thrust nuts, lift nuts and couplings shall be bronze (ASTM B-584, C86500 or C87300)
3. Seating surfaces shall be bronze (ASTM B-21, C46400 Bronze)
4. Tongue and guide liners shall be bronze (ASTM B-98, C65500 Bronze)
5. Stems and fasteners shall be stainless steel (ASTM A276, Type 304 or 316)

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 TESTING AND PERFORMANCE REQUIREMENTS FOR STORM DRAINAGE AND IWS GRAVITY CONVEYANCE PIPING

A. Pipe and structures shall be cleaned prior to inspection. Cleaning approach shall collect all debris and not flush any debris into existing system.

B. All gravity storm and IWS pipes constructed of polyvinyl chloride (PVC), polyethylene (PE) or ductile iron pipe shall be subjected to a low-pressure air test, in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications. Pipes 30-inches in diameter or less may be tested from manhole, catch basin to catch basin or shorter lengths as determined by the Contractor. Pipes over 30-inches in diameter and above shall be tested at every joint.

C. All gravity storm and IWS pipes constructed of reinforced concrete pipe shall be tested in accordance with ASTM C1103.

D. Deflection test and/or television inspection for pipes may be required at Engineer's request. Deflection testing shall be in accordance with Section 7-

17.3(2)G of the WSDOT Standard Specifications. Television inspection shall be in accordance with Section 7-17.3(2)H of the WSDOT Standard Specifications.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for storm drainage and IWS systems are as described in the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance. All force main conveyance shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. IWS standards, as described in this section, shall apply for conveyance of all runoff originating within the STIA identified IWS basins. Reference the Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016) for locations of the IWS basins.

C. Sanitary Sewer standards, as described in this section, shall apply for sanitary sewers. Reference Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 333100 Sanitary Sewer Requirements.

D. Refer to STIA F&I Civil System Standards Section 334200 Stormwater Conveyance, Paragraph 1.03 for utility clearance requirements of storm drainage and IWS gravity conveyance systems.

E. The minimum cover requirements for all pipe shall be 3 feet below finished grade. The maximum cover for force mains shall be 10 feet. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements of storm drainage, sanitary sewer and IWS conveyance systems.

F. This section describes piping and related material standards for storm drainage, sanitary sewer and IWS force main systems. The STIA F&I Mechanical Systems Standards shall be referenced for all other applicable portions of force main systems (e.g., pumps, direct digital controls).

G. Calculations for the design of thrust blocks and/or joint restraints shall be performed and stamped by a licensed structural engineer in the State of Washington for approval by the Port.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) A276 Stainless Steel Bars and Shapes

B. American Society for Testing and Materials (ASTM) A536 Ductile Iron Castings
C. American Society for Testing and Materials (ASTM) B138 Manganese Bronze Rod, Bar, and Shapes
D. American Society for Testing and Materials (ASTM) D429 Test Methods for Rubber
E. American Water Works Association (AWWA) C104 (ANSI A21.4) Cement mortar lining
F. American Water Works Association (AWWA) C110 Ductile Iron Fittings
G. American Water Works Association (AWWA) C111 Rubber Gasket Joints for Ductile Iron Pressure Pipe
H. American Water Works Association (AWWA) C151 Ductile Iron Pipe and Fittings
I. American Water Works Association (AWWA) C500 Metal Seated Gate Valves
J. American Water Works Association (AWWA) C515 Resilient Seated Gate Valves
K. American Water Works Association (AWWA) C550 Protective Interior Coatings for Valves
L. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill
M. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance
N. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer Requirements
O. Seattle-Tacoma International Airport Facilities and Infrastructure Mechanical Systems Standards (2015)
P. Washington State Department of Transportation Standard Specification Section 6-02.3(2)B Commercial Concrete

PART 2 - PRODUCTS

2.01 STORM DRAINAGE, SANITARY SEWER AND IWS PIPE FOR FORCE MAINS

A. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application). All pipe shall be restrained joint pipe.
B. Lining for IWS and SD pipes: Cement mortar lining meeting AWWA C104
C. Lining for SS pipes: Protecto 401 Ceramic Epoxy or equal.

D. Asphaltic Coated: AWWA C151

E. Gaskets for IWS pipes shall be made of elastomer nitrile (NBR) and meet the requirements of AWWA C111

F. Manufacturing quality control testing shall meet the requirements of ASTM A746

G. Joints:

1. Restrained Joints - Manufactured proprietary joint that mechanically restrains pipe to adjoining pipe. Manufacturers and Products:
    a. American Cast Iron Pipe; Flex-Ring, Field Flex-Ring, and Lok-Ring.
    b. Pacific States Pipe; Thrust-Lock.
    c. U.S. Pipe; TR Flex and HP Lok.
2. Mechanical joints, AWWA C110 and AWWA C111.
    a. All mechanical joints shall be restrained with manufactured bolt-on restraint system such as EBAA Iron's MegaLug, Romac Romagrip, Star Pipe Products Stargrip, or approved equal.
    b. Use only in areas where adjoining to fixed points where laying length is determined in field.
    c. Prior to purchase and installation, type and application of this joint shall be approved by Engineer.
3. Use of set screws for restraint or field-lock gaskets shall not be allowed.

H. Fittings:

1. Mechanical or Restrained Joint. Minimum pressure rating of 350 psi for pipe diameter 3 to 24 inches. Minimum pressure rating of 250 psi for pipe diameter 30 to 48 inches. Fittings shall be new and recently manufactured. Refurbished fittings will not be accepted.
2. Rubber Gasket Joints Including Mechanical Joints, and Flanged Joints: In accordance with AWWA C111/A21.11.
3. Mechanical Joint Fittings: In accordance with AWWA C110/A21.10 and AWWA C153/A21.53.

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I. Thrust blocks shall be in accordance to NFPA Section 10.6.1 standards.

1. Thrust blocks shall be permitted where soil is stable and capable of resisting the anticipated thrust forces.
2. Thrust blocks shall be of commercial concrete meeting the following requirements:

a. Commercial concrete shall have a minimum compressive strength at 28 days of 3,000 psi in accordance with AASHTO T22.
b. Commercial concrete placed above the finished ground line shall be air entrained and have an air content from 4.5 percent to 7.5 percent in accordance with FOP for AASHTO T 152.
c. Commercial concrete does not require mix design or source approvals for cement, aggregate, and other admixtures.

3. Thrust blocks shall be placed between undisturbed earth and the fitting to be restrained and can resist the calculated thrust forces.
4. Wherever possible, thrust blocks shall be located so that the joints are accessible for repair.

J. Sewer force mains shall have a “Pig Launcher” for future assessment and maintenance of the sewer line. Number and location of "Pig Launchers" to be coordinated with L&I Staff.

K. Sewer force main design shall include analyses for if airvac valves are needed.

2.02 GATE VALVES

A. Gate Valves shall be resilient wedge seat type meeting AWWA Standard C515.

B. Rated for 250 psi maximum working pressure and 500 psi static test pressure

C. Operating mechanism shall be a standard 2-inch AWWA square operating nut opening to the left and shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover.

D. Ductile iron valve body with interior and exterior epoxy coating meeting all applicable requirements of AWWA C550.

E. Mechanical joint ends meeting AWWA C111 Standard. All mechanical joints should be restrained. See paragraph 2.01.F. above.

F. Stuffing box shall be ductile iron stuffing box meeting ASTM A536 with rubber O-ring stuffing box seals and brass anti-friction washers. There shall be two O-ring stuffing box seals located above thrust collar and one below.

G. Wedge shall be ductile iron wedge meeting ASTM A536, symmetrical and fully encapsulated with molded SBR or EPDM rubber and no exposed iron. The sealing rubber shall be permanently bonded to the wedge per ASTM D429. The wedge shall hall be two-faced with parallel seats and wedging devices between them.

H. for the purpose of fuel spill containment, shall use an approved Nitrile (NBR) wedge encapsulation.

I. Valve stem shall be non-rising type consisting of a non-corrosive manganese-bronze ASTM B138 or 305 stainless steel alloy ASTM A276 with material properties as follows:

1. 2 inches to 54 inches Valves: Tensile 80,000 psi, Min Yield 40,000 psi.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 TESTING AND REQUIREMENTS FOR STORM DRAINAGE, SANITARY SEWER AND IWS FORCE MAIN PIPING

A. Hydrostatic test, in accordance with Section 7-17.3(2)C of the WSDOT Standard Specifications.

B. All force main piping shall be hydrostatically tested to 1.5 times design working pressure. Test duration shall not be less than 2 hours. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.

C. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Drainage structures shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance, Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer Requirements, STIA F&I Civil Systems Standards Section 334211 Storm Drainage and IWS Gravity Conveyance, the Standard Details (Appendix A) requirements and the below specifications.

B. Aircraft-rated Storm Drainage, Sanitary Sewer and IWS structures are required at any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass most of the Air Operations Area (AOA) at STIA, including but not limited to the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), Head of Stand Utility between nose of aircraft and terminal building, and within Perimeter Road.

C. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6F Airport Pavement Design and Evaluation, Appendix B – Design of Structures" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

D. Metal castings (Frames, Covers, and Grates) for aircraft rated structures shall meet the requirements of STIA F&I Civil Systems Standards Section 334241 Frames, Covers and Grates for Storm Drainage, Sanitary Sewer and IWS Structures.

E. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration should be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service

equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) operating at STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology should be utilized based upon the actual loading encountered at the site.

F. Metal castings (Frames, Covers, and Grates) for traffic rated AASHTO HS-25 Structures shall meet the requirements of STIA F&I Civil Systems Standards Section 334241 Frames, Covers and Grates for Storm Drainage Sanitary Sewer and IWS Structures. All other metal castings shall meet the requirements of paragraph 1.01.D. above.

G. Vapor traps shall be installed where buildings connect to IWS Structures.

1.02 MODIFICATION AND ADJUSTMENT OF EXISTING UTILITY STRUCTURES

A. Where the Engineer wishes to retain an existing utility structure within the limits of a project area, the Engineer shall evaluate that structure to determine its suitability in meeting the loading design criteria for its location.

B. Existing structures falling within any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft (e.g., TSA or RSA), shall be modified to be made aircraft rated or replaced wholly with an aircraft rated structure.

C. Existing structures outside of the AOA, or outside of the operational areas that would require aircraft loading capabilities, should be assessed to determine if the structure meets the loading requirements (with required factors of safety) for the most demanding vehicles utilizing the site and modified or wholly replaced with an appropriately rated structure.

D. The utility structures shall be adjusted as required to meet the new grade, top or orifice opening elevations or other modifications as required.

E. The utility structure modifications shall meet the Paragraph 1.01 Design Requirements and Part 2 Product Requirements of this Standards Section.

F. Frames, grates, and covers shall be new, rated for their intended location, and meet the requirements of Section 334241 Frames, Covers and Grates for Storm Drainage, Sanitary Sewer and IWS Structures.

G. All utility structure modifications shall require drawings stamped by a licensed professional engineer in the State of Washington.

1.03 SUBMITTALS

A. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Shop drawings and technical data for manholes, including engineering calculations as required.
2. Shop drawings and technical data for frames, grates, and covers.
3. Shop drawings for steel reinforcement.
4. Aircraft-rated, fuel truck rated, and AARF truck rated structures shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington for approval by the Port prior to fabrication.
5. Evaluation of the vehicles or aircraft imparting the highest load factors.

B. Testing plan for installed structures per Part 3.

C. Testing results of installed structures per Part 3.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) C144 Standard Specification for Aggregate Masonry Mortar

B. American Society for Testing and Materials (ASTM) C150 Standard Specification for Portland Cement

C. American Society for Testing and Materials (ASTM) C478 Standard Specification for Precast Reinforced Concrete Manhole Sections

D. American Society for Testing and Materials (ASTM) C497 Standard Test Methods for Concrete Pipe, Manhole Sections or Tile

E. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

F. American Society for Testing and Materials (ASTM) D4101 Standard Specification for Polypropylene Injection and Extrusion Materials

G. Association of State Highway and Transportation Officials (AASHTO) M199 Standard Specification for Precast Reinforced Concrete Manhole Sections

H. Association of State Highway and Transportation Officials (AASHTO) M306 Drainage, Sewer, Utility, and Related Castings

I. Federal Aviation Administration (FAA) Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes

J. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill

K. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance

L. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer Requirements

M. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers and Grates for Storm Drainage, Sanitary Sewer and IWS Structures

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Aircraft-rated structures shall meet the requirements as stated above in Paragraph 1.01 above, this Section. Concrete and reinforcement design shall be as required to support the loading design of the precast structure.

B. Traffic-rated AASHTO HS-25 structures shall meet the requirements of ASTM C478 (AASHTO M199).

C. Inlet and Outlet Pipes: Shall extend through the walls of structures for a sufficient distance beyond outside surface to allow for connections but shall be cut off flush with the wall on the inside surface. Mortar shall be placed around pipes to form a watertight, neat connection.

D. All jointing and connections between portions of precast concrete structures shall have rubber gaskets conforming to ASTM C443 in the tongue and groove joints. Handling of the precast units shall be done carefully to avoid disturbing or damaging the gasket or contaminating it with foreign material. Care shall be exercised to attain proper alignment before the joints are entirely forced home. A layer of joint mortar shall be applied to the outside of the joint.

E. Predl Liner manhole bases or approved equal to be installed on new Sanitary Sewer System manholes.

F. Sanitary sewer manholes spacing is a minimum of one manhole per every 300 feet.

G. When installing structures on active existing pipe, construct cast-in-place saddle manhole base in accordance with the plans. The base shall be installed prior to placement of the saddle riser. The manhole base shall be designed by a licensed Professional Engineer in the State of Washington with adequate rebar to meet the expected loading. The Contractor must submit a shop drawing of the reinforcing mat that meets the following minimum requirements:

Saddle MH Depth	Cast-in-Place MH Base Reinforcing Steel Min Sq In/Ft, Top Face, in Each Direction
20'	0.89
30'	1.13
40'	1.37

H. Saddle manholes and all new sanitary sewer system manholes that might be located below the groundwater level shall have all interior surfaces (less the Predl Liner manhole base for new manholes) coated and sealed with an approved epoxy based liner system, installed per the manufacturer's specifications. Approved epoxy based lining systems shall be Raven 404, Neopoxy, or an approved equal.

I. Steps and Ladders: Ductile iron or polypropylene covered rebar, ASTM C478, ASTM C497 and AASHTO M199. Polypropylene, ASTM D4101.

1. Steps shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall for steps, or 3-inches from the structure wall inside the adjustment section. Steps within precast concrete structures shall be cast into the sides of the structure at the time the of manufacture or set in place after the structure is erected by drilling holes in the concrete and epoxying the steps in place. Steps shall be uniformly spaced at 12 inches and be vertically aligned
2. Ladders shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall. Ladder shall be set in place after the structure is erected by drilling holes in the concrete and epoxying in place

J. Bedding: Bedding for structures shall consist of a minimum of 6 inches (or as required for site conditions) of aggregate base compacted to 95% of maximum density as determined by ASTM D1557. The bedding shall extend a minimum of 1-foot past the structure’s base in all directions for structures up to 60 inches in diameter and 2-feet past the structure’s base in all directions for structures greater than 60 inches in diameter. The aggregate base material shall meet the

requirements of Pipe Bedding per Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill

K. Backfill of utility structure excavations:

1. All utility structure excavations within pavement or within 10 feet of pavement shall be backfilled with controlled low-strength material density fill (CLSM) meeting requirements of Section 322333 Utility Trenching and Backfill 2.02(B).
2. All utility structure excavations within unpaved areas at least 10 feet or more from any pavements shall be backfilled with a material meeting the requirements of Section 322333 Utility Trenching and Backfill 2.02(A).

L. Fibers for traffic rated pre-cast units

1. Synthetic fibers shall be monofilament or monofilament/fibrillated blend made of polyolefn, polypropylene, or polypropylene/polyethylene blend, meeting the requirements of ASTM C1116, Section 4.1.3, and ICC ES Acceptance Criteria 32, Sections 4.1.3 and 4.1.2. Additionally, the vendor or manufacturer must furnish an Engineering Report that provides test data in accordance with ASTM C1018 and/or ASTM C1399 from an ICC-qualified commercial laboratory relating to the specification requirements. The vendor or manufacturer shall provide a letter of certification stating compliance with specifications and/or standard codes.
2. The fibers shall be a minimum of 2 inches in length and have an aspect ratio (length divided by the equivalent diameter of the fiber) between 70 and 100 when the fibers are in their final phase.
3. The fibers shall have a minimum tensile strength of 50 ksi and a minimum modulus of elasticity of 600 ksi, when tested in accordance with ASTM D3822.
4. Precast drainage units shall have a minimum dosage rate of 3.75-lbs/cu yd. or more in order to obtain an Average Residual Strength (ARS) of 175 psi when tested in accordance with ASTM C1018 and/or ASTM C1399. The fiber supplier shall submit independent laboratory data to support ARS results.

M. Joint Mortar

1. Mortar for hand mortared joints shall consist of one part portland cement or blended hydraulic cement Type I/II, three parts fine sand, and sufficient water to allow proper workability.

2. Cement shall conform to the requirements of AASHTO M85, Type I or Type II.
3. Sand shall conform to the requirements of AASHTO M45.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and backfill in accordance with ASTM D6938 requirements.

B. CLSM Shall be tested in accordance with the following requirements:
   1. CLSM shall achieve a 28-day compressive strength of 100 to 200 pounds per square inch and tested in accordance with ASTM D4832.
   2. Unless otherwise approved by Port, flow shall be between 6 inches and 8 inches when tested in accordance with ASTM D6103.

C. Prior to backfilling, each manhole that might be located below the groundwater level shall be tested using the vacuum testing method specified in ASTM C1244 to ensure that the manhole is watertight.
   1. The Contractor shall furnish all equipment and labor required, including necessary piping/hoses, pneumatic plugs, test vacuum equipment (vacuum pump and vacuum plate/head), vacuum gauge, and second timer. The vacuum gauge shall have a maximum range of 0-30 inches of mercury (Hg) and the vacuum gauge intervals shall be in ½ inch increments.
   2. If a coating or lining has been applied to the interior of the manhole, the vacuum test must not be performed until the coating or lining has been cured according to the manufacturer's recommendations. In addition, this existing manhole must be structurally sound prior to vacuum testing.
   3. Drop connections shall be installed prior to testing.
   4. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab, or grade rings.
   5. The vacuum test shall be performed by the Contractor per ASTM C1244 in the presence of the Engineer. The Contractor shall furnish test reports of each test to the Engineer.

D. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Channel drain systems shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance, the Standard Details (Appendix A) requirements and the below specifications

B. The channel drain systems shall be located and designed to capture and convey the peak runoff entering the trench drain from the contributing area as generated by the 25-year design storm without surcharge. Calculations demonstrating that the channel drain meets these requirements shall be performed by the Engineer and submitted as part of the SW Site Plan or Project Design Report documentation as specified in STIA F&I Civil Systems Standards Section 334200 Stormwater Conveyance, paragraph 1.01.D.

C. Layout requirements for channel drains on aircraft fueling ramps and other areas of the IWS basin shall meet the requirements of NFPA 415, Chapter 5 and as follows:

1. Channel drains segments shall be no more than 125 feet in length.
2. A minimum interval of 6 feet between channel drain sections is required to act as a fire stop.
3. Each 125-feet section shall be individually drained through underground ductile iron piping to an approved drainage structure.

D. Channel drain systems in the Aircraft Operations Area (AOA) shall be rated for EN-1433 Load Class F of 200,000 pounds or support a minimum proof load of 200 KIPs using 250 pounds per square inch tire pressure.

E. Channel drain systems outside of Aircraft Operations Area (AOA) shall be rated for the most demanding vehicles utilizing the site, or EN-1433 Load Class E, rated for 135,000 pounds, whichever is greater. Special consideration should be given to loading requirements of areas outside of the AOA but still utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment.

1.02 REFERENCES

A. National Fire Protection Association (NFPA) 415 Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

B. American Society for Testing Materials (ASTM) A536-84 Standard Specification for Ductile Iron Castings
C. American Society for Testing Materials (ASTM) A-36 Standard Specification for Carbon Structural Steel
D. American Society for Testing Materials (ASTM) A123 Standard Specification for Zink (Hot-Dip Galvanized) Coatings on Iron and Steel Products
E. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance

PART 2 - PRODUCTS

2.01 CHANNEL DRAINS SYSTEMS

A. Collection and conveyance channels shall be designed and constructed to be fully compatible with the channel drain grating and frame assembly. Materials for conveyance channels shall be one of the following:
   1. Interlocking prefabricated reinforced polymer concrete units, encapsulated in portland cement concrete pavement as shown on the standard details.
   2. Cast-in-place utilizing the contract specified portland cement concrete pavement.
B. The channel drain system shall be resistant to petroleum products, ethylene glycol, propylene glycol, potassium acetate, and sodium acetate.
C. The system shall comply with NFPA 415 Chapter 5, paragraph 5.1.8: Underground piping and components used in drainage systems shall be noncombustible and inert to fuel. Products using fiberglass, polyester resins, vinyl esters, polyethylene, plastic, powder coatings or painted surfaces are not allowed.
D. If formed concrete is utilized for the surface of the collection and conveyance channel, it shall be finished so as to be smooth and free of voids.
E. The minimum interior width of the collection and conveyance channel shall be 6-inches.
F. Grating shall be ductile iron meeting ASTM A536-84, Grade 65-45-12 or Grade 80-55-06
G. Frames shall be Ductile Iron meeting on of the following:
   1. ASTM A536-84, Grade 65-45-12 or Grade 80-55-06
   2. Hot Dipped Galvanized Structural Steel meeting ASTM A-36, with galvanizing to meet ASTM A123-89a.

H. Channel drain grating shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for an access to the channel drain. Individual grate pieces shall be vertically and horizontally retained with locking or bolt down fasteners at a minimum of all four corners of the grate. Channel grating systems which fasten only at the center of the grates are not allowed.

I. The channel drain system, including grating and frame assembly shall not cross concrete panel joints.
   1. Frame systems integrally cast with the concrete may be pre-cut or cut with the concrete panel provided a minimum of four concrete anchors will be integrally cast within the shortest length of any frame section. Spacing of the frame sections shall be such that that a minimum of 3-inches of separation between the concrete anchors and the nearest PCC panel joint is provided.
   2. If using pre-cast channel drain units, the channel drain unit joint shall be no closer than 1 foot from the pavement joint. Frame and unit shall be cut at panel joint.

J. Channel drain systems in Aircraft Operations Area (AOA) shall be rated for EN-1433 Load Class F, 200,000 pounds and be one of the following products or approved equivalent:
   1. ACO PowerDrain Series S200K and S300K
   2. ABT TrenchFormer-XHD Airport Rated Trench Drain Frame and Grate Assembly
   3. East Jordan 6901 Bolted Extra Heavy Duty Airport Trench Drain Assembly
   4. Neenah Foundry Bolted Extra Heavy Duty Airport Trench Drain Assembly with R-4993 Type T Superior Durability Frame

K. Submittals/Certifications: Submit detailed technical data and drawings, including:
   1. Shop drawings and technical data, including engineering load and flow calculations as required.
   2. Shop drawings and technical data for frames and grates.
   3. Shop drawings for steel reinforcement.
   4. Evaluation of the vehicles or aircraft importing the highest load factors.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING – To be provided by Design Engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Metal castings (Frames, Covers, and Grates) for aircraft-rated Storm Drainage, Sanitary Sewer and IWS structures shall support a minimum proof load of 100,000 pounds and 250 pounds per square inch tire pressure.

B. Metal castings (Frames, Covers, and Grates) for traffic-rated (AASHTO HS-25) Storm Drainage, Sanitary Sewer and IWS structures shall meet the requirements of the heaviest vehicles utilizing the site, or AASHTO M306 and support a minimum proof load of 40,000 pounds whichever is greater. Special consideration should be given to areas inside and outside of the AOA but still utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment.

C. The Air Operations Area (AOA) is any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. This includes the aprons, hardstands, taxi lane, taxiways and runways, including the taxi lane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), and within Perimeter Road.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

B. Certification of proof load testing for castings is required with all construction submittals for Port approval prior to acceptance.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M306 Standard Specifications for Drainage, Sewer, Utility, and Related Castings

B. American Society for Testing and Materials (ASTM) A48 Standard Specification for Gray Iron Castings

C. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings

D. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance
E. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer Requirements

PART 2 - PRODUCTS

2.01 METAL FRAMES, COVERS AND GRATES

A. Frames, Covers, and Grates shall consist of castings made from uncoated gray iron meeting ASTM A48, Class 35B or ductile iron meeting ASTM A536 Class 70-50-05 or 80-55-06.
B. All manholes and clean-outs noted on the plans to have solid covers shall be stamped with the appropriate utility identification as identified on the drawings:
    1. “STORM” for structures in the stormwater drainage system
    2. "SEWER" for structures in the sanitary sewer system
    3. “IWS” for structures in the industrial wastewater system
    4. “SDCO”, “SSCO”, or “IWSCO” for cleanout structures

    In addition, all castings shall have a clear and smooth space large enough to accommodate nine ½-inch characters at a minimum to be permanently marked by the Port of Seattle with the structure ID number per the Asset Identification System per Port of Seattle requirements. The marking shall be made by the Port of Seattle with a minimum character height of ½-inches.
C. Each frame and cover or grate unit shall be provided with fastening members (minimum of two per grate or cover) to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure. Bolts associated with installation shall be applied with anti-seize lubricant prior to installation.
D. Metal castings (Frames, Covers, and Grates) shall be rated for the following proof loads:
    1. Within the AOA, metal castings shall support a minimum proof load of 100,000 pounds and 250 pounds per square inch tire pressure.
    2. For all areas outside the AOA, metal castings shall meet the requirements of the heaviest vehicles utilizing the site, or AASHTO M306 and support a minimum proof load of 40,000 pounds whichever is greater.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING – To be provided by Design Engineer.

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for exterior oil-water (O/W) separator vault systems shall be as described in the API Publication 421 Design and Operation of Oil/Water Separators and ASTM D6104 Standard Practice for Determining the Performance of Oil/Water Separators Subjected to Surface Run-Off.

B. All O/W separator vaults shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Shop drawings and technical data for vaults, including engineering calculations for vault sizing, structural loading and as required.
2. Shop drawings and technical data for frames, grates, and covers.
3. Shop drawings for steel reinforcement.
4. Aircraft-rated structures shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington for approval by the Port prior to fabrication.
5. Evaluation of the vehicles or aircraft imparting the highest load factors.

B. Bypass and phasing plans when construction will impact active sanitary sewer and other utility facilities.

C. Testing plan for installed vault and piping per Part 4.

D. Testing results of installed vault and piping per Part 4.

1.03 REFERENCES

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

B. American Society for Testing Materials (ASTM) applicable provisions

C. American Society for Testing and Materials (ASTM) C1613 Standard Specification for Precast Concrete Grease Interceptor Tanks

D. Washington State Department of Transportation Standard Specification Section 7-17.3(2)B Exfiltration Test

E. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

F. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching And Backfill

G. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage Sanitary and IWS Structures

H. API Publication 421 Design and Operation of Oil/Water Separators

I. ASTM D6104 Standard Practice for Determining the Performance of Oil/Water Separators Subjected to Surface Run-Off

PART 2 PRODUCTS

2.01 OIL-WATER SEPARATOR VAULT

A. Oil-water separator vault shall be of the configuration per the plans. It shall be sized to treat the expected flow.

B. Pre-cast concrete vault shall consist of a vault with piping, oil retaining baffle(s), access cover(s) and frames. It shall be gas and watertight. All components of the system shall be designed for the expected structural loading as noted below.

C. Aircraft-rated oil-water separator vault is required at any airport location that will be subjected to loading by aircraft, or that is located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass most of the Air Operations Area (AOA) at STIA, including but not limited to the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), Head of Stand Utility between nose of aircraft and terminal building, and within Perimeter Road.

D. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

E. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways,

runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration should be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) operating at STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology should be utilized based upon the actual loading encountered at the site.

F. All structural calculations for the vault shall include the depth of cover over the vault.

G. Structural calculations for the oil-water separator vault shall be completed by a Washington state licensed engineer.

H. Vault access castings shall meet Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage and IWS Structures

I. Excavation and backfill shall be per STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

J. Finished floor of vault shall not exceed 12-ft from finished grade.

K. Double cleanouts shall be installed before and after the vault.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 OIL-WATER SEPARATOR VAULT TESTING

A. In order to demonstrate water tightness, the entire oil-water separator vault shall be tested prior to acceptance in accordance with *ASTM C1613-17 Standard Specification for Precast Concrete Grease Interceptor Tanks*.

B. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. General:

1. Design, size, and locate piping support systems, whether shown in drawings and details or not.
2. Meet requirements of MSS SP 58 and ASME B31.1 or as modified by this section.

B. Pipe Support Systems:

1. Design pipe support systems for gravity and thrust loads imposed by weight of pipes or internal pressures, weight of fluid in pipes.
2. Design pipe support systems for seismic loads in accordance with governing codes and site-specific design criteria.
3. Design pipe support systems for wind loads in accordance with governing codes and site-specific design criteria.
4. Maximum Support Spacing and Minimum Rod Size: In accordance MSS SP 58 Table 3 and Table 4.
    a. Ductile-iron Pipe 8 Inches and Under: Maximum span limited to that for standard weight steel pipe for water service.
    b. Ductile-iron Pipe 10 Inches and Larger: Maximum span limited to 20 feet.

C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

D. Vertical Sway Bracing: 10-foot maximum centers.

1.02 SUBMITTALS

A. Action Submittals:

1. Catalog information and drawings of piping support system, locating each support, sway brace, seismic brace, hanger, guide, component, and anchor for piping 6 inches and larger. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.
2. Calculations for each type of pipe support, attachment and anchor.

3. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.
4. Seismic anchorage and bracing drawings, and cut sheets.

B. Informational Submittals:

1. Seismic anchorage and bracing calculations that use site-specific design criteria.
2. Maintenance information on piping support system.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. American Society of Mechanical Engineers (ASME): B31.1, Power Piping.
3. Manufacturers' Standardization Society (MSS):
   a. SP 58, Pipe Hangers and Supports—Materials, Design and Manufacture.
   b. SP 127, Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, and Application.

B. Piping support systems shall be designed and Shop Drawings prepared and sealed by a Registered Professional Engineer in the State of Washington.

2 PART 2 PRODUCTS

2.01 GENERAL

A. Pipe supports shall be manufactured from Type 316 stainless steel.

3 PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install support systems in accordance with MSS SP 58, unless shown otherwise.
2. Support no pipe from pipe above it.
3. Support piping connections to equipment or valve by pipe support and not by equipment or valve.

4. A Support large or heavy valves, fittings, and appurtenances independently of connected piping.
5. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
6. Do not use adhesive anchors, and do not attached supports for horizontal pipes to ceiling or walls.
7. Do not install pipe supports in equipment or maintenance access areas.
8. Install lateral supports for seismic loads at changes in direction.
9. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
10. Repair mounting surfaces to original condition after attachments are completed.

B. Standard Pipe Supports:

1. Where pipe support type is not shown on the Drawings, the following pipe supports shall be used wherever possible.
2. Horizontal Piping Supported from Floors:
    a. Saddle Supports:
        i. Pedestal Type, elbow and flange.
        ii. Provide minimum 1-1/2-inch grout beneath baseplate.
    b. Floor Mounted Channel Supports:
        i. Use for pipe smaller than 3-inch running along floors and in trenches at pipe elevations lower than can be accommodated using pedestal pipe supports.
        ii. Attach channel framing to floors with baseplate on minimum 1-1/2-inch nonshrink grout and with anchor bolts.
        iii. Attach pipe to channel with clips or pipe clamps.
    c. Concrete Cradles: Use for pipe larger than 3 inches along floor and in trenches at pipe elevations lower than can be accommodated using stanchion type.
3. Vertical Pipe: Support with wall bracket and elbow support, or riser clamp on floor penetration.

C. Standard Attachments:

1. New Concrete Ceilings: Concrete inserts, concrete attachment plates, or concrete anchors as limited below:

a. Single point attachment to ceiling allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
b. Where there is vibration or bending considerations, do not connect a single pipe support hanger rod directly to a drilled concrete anchor (single point attachment) regardless of size.

2. Existing Concrete Ceilings: Channel type support with minimum of two anchor points, concrete attachment plates or concrete anchors as limited below:
   a. Single point attachment to ceiling is allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
   b. Where there is vibration or bending considerations do not connect a single pipe support hanger rod directly to a drilled concrete anchor (single point attachment) regardless of size.
3. Concrete Walls: Concrete inserts or brackets or clip angles with concrete anchors.

D. Saddles for Steel or Concrete Pipe: Provide 90-degree to 120-degree pipe saddle for pipe sizes 6 inches and larger when installed on top of steel or concrete beam or structure, pipe rack, trapeze, or where similar concentrated point supports would be encountered.

E. Intermediate and Pipe Alignment Guides:
1. Provide pipe alignment guides, or pipe supports that provide same function, at expansion joints and loops.
2. Guide pipe on each side of expansion joint or loop at 4 pipe and 14 pipe diameters from each joint or loop.
3. Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.

F. Accessories:
1. Dielectric Barrier:
   a. Provide between painted or galvanized carbon steel members and copper or stainless steel pipe or between stainless steel supports and nonstainless steel ferrous metal piping.
   b. Install rubber wrap between submerged metal pipe and oversized clamps.

PART 4 TESTING – To be provided by Design Engineer.

END OF SECTION

AVIATION FACILITIES AND INFRASTRUCTURE

SEATTLE-TACOMA INTERNATIONAL AIRPORT

FACILITIES AND INFRASTRUCTURE

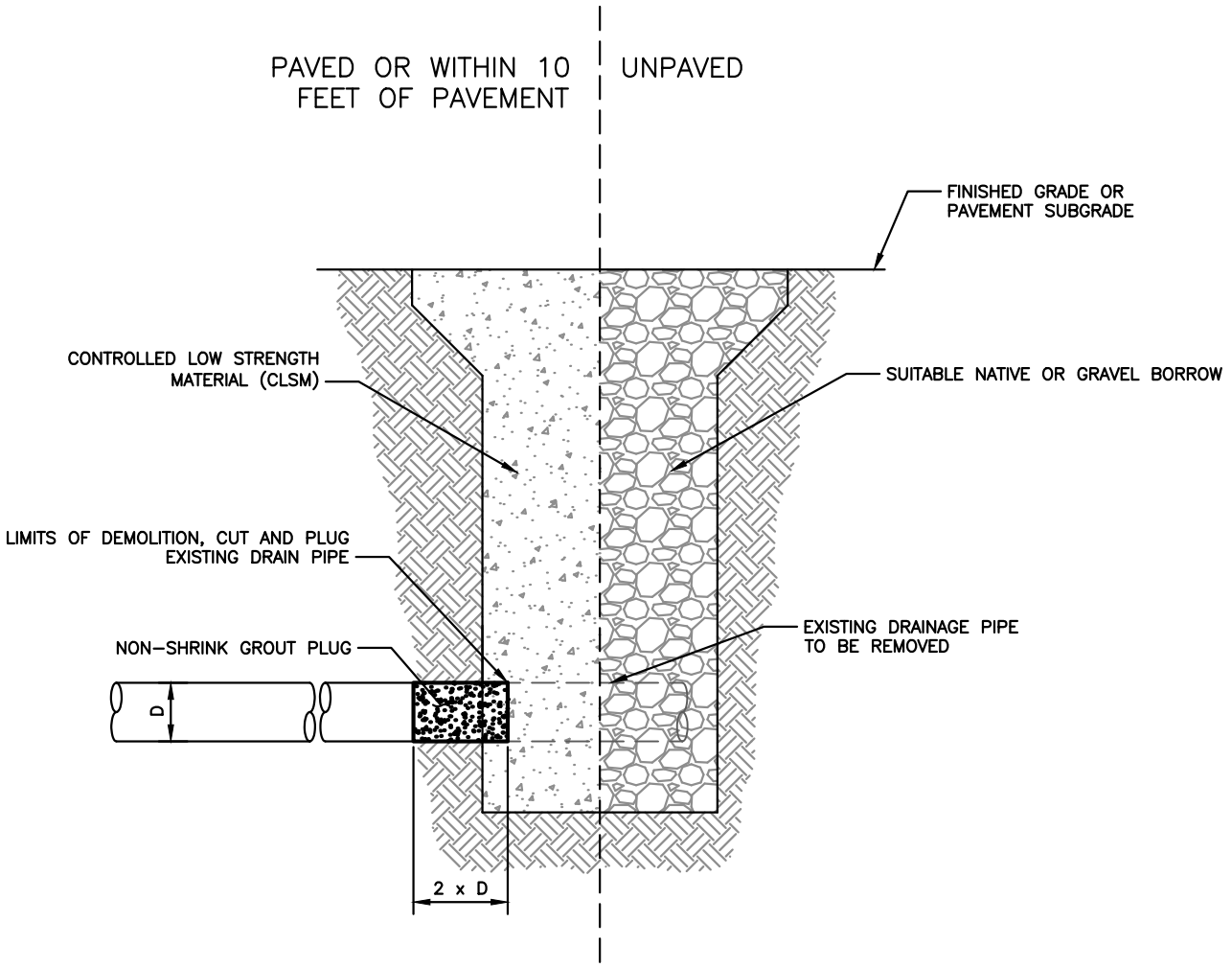
CIVIL SYSTEMS STANDARDS

APPENDIX A

STANDARD DETAILS

TABLE OF CONTENTS

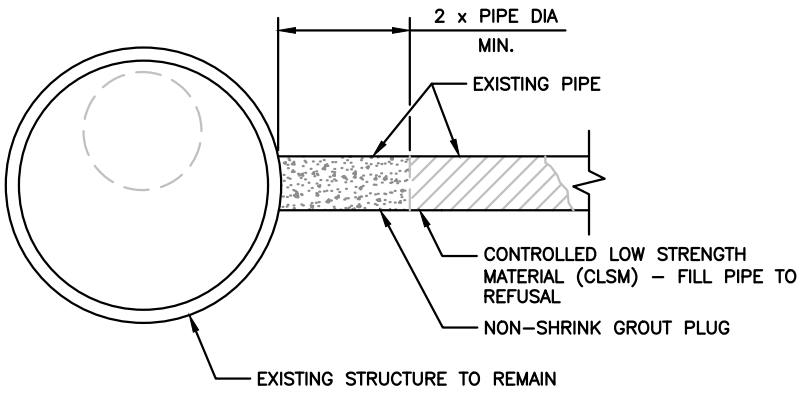
SD-124B	GREASE INTERCEPTOR DETAILS
SD-125	OIL AND WATER SEPARATOR
SD-126	MH COVER LIFT ASSIST DEVICE
SD-600	FIRE HYDRANT
SD-601	REMOTE FDC & VAULT ASSEMBLY
SD-602A	FLUSH FIRE HYDRANT ASSEMBLY
SD-602B	FLUSH FIRE HYDRANT VAULT AND HATCH DETAIL
SD-603A	CONCRETE THRUST BLOCKING HORIZONTAL FITTINGS
SD-603B	CONCRETE THRUST BLOCKING VERTICAL FITTINGS
SD-604	VALVE BOX & OPERATING NUT EXTENSION
SD-605	HYDRANT AND FDC BOLLARD LOCATION PLAN
SD-606	BOLLARD
SD-607	COMBINATION AIR RELEASE AND AIR VACCUM VALVE
SD-608	WATER BLOW OFF VALVE
SD-609	IRRIGATION CONNECTION
SD-610	WATER VALVE TEE ASSEMBLY
SD-611	WATER VALVE TEE ASSEMBLY IN VAULT
SD-612	AIRCRAFT RATED WATER VALVE MANHOLE
SD-613	THERMOPLASTIC LETTERING FOR VALVES
SD-700	CATHODIC PROTECTION INSULATED BLANKET
SD-701	CATHODIC PROTECTION WIRING FOR STEEL AND DI PIPE
SD-702	CATHODIC PROTECTION TEST STATION TYPE FF-R
SD-703	CATHODIC PROTECTION TEST STATION TYPE FT-RA
SD-704	CATHODIC PROTECTION TEST STATION TYPE FI-R
SD-705	CATHODIC PROTECTION TEST STATION TYPE FC-R
SD-706	CATHODIC PROTECTION PUSH-ON JOINT BOND
SD-707	CATHODIC PROTECTION FLANGED JOINT BOND
SD-708	CATHODIC PROTECTION FLEXIBLE JOINT BOND
SD-709	CATHODIC PROTECTION CEMENT COATED STEEL JOINT BOND
SD-710	CATHODIC PROTECTION MECHANICAL JOINT BOND
SD-711	CATHODIC PROTECTION CONCRETE PIPE JOINT BOND
SD-712	CATHODIC PROTECTION INSULATED FLEXIBLE COUPLING



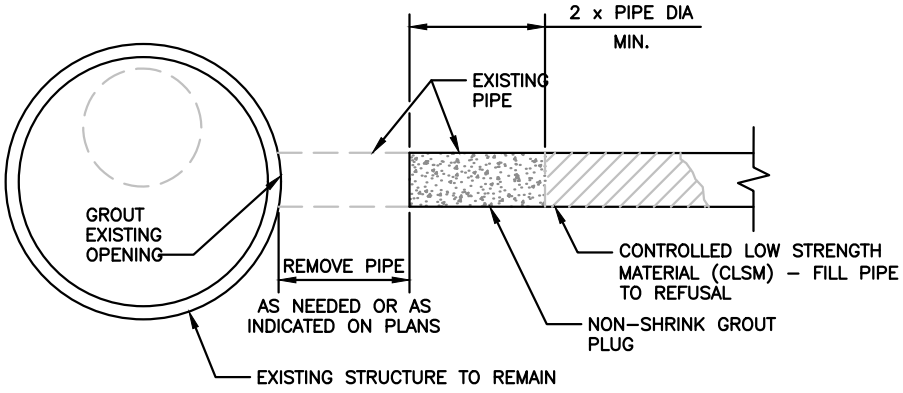
DETAIL 1/001
TYPICAL UTILITY DEMOLITION
SCALE: NTS

NOTES:
1. BACKFILL MATERIALS SHALL MEET THE REQUIREMENTS OF SECTION 322333 UTILITY TRENCHING AND BACKFILL.
2. SUITABLE NATIVE OR GRAVEL BORROW BACKFILL SHALL BE COMPACTED TO 95% MAX. DENSITY.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	TYPICAL UTILITY DEMOLITION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **001**



PLAN VIEW (OPTION 1)

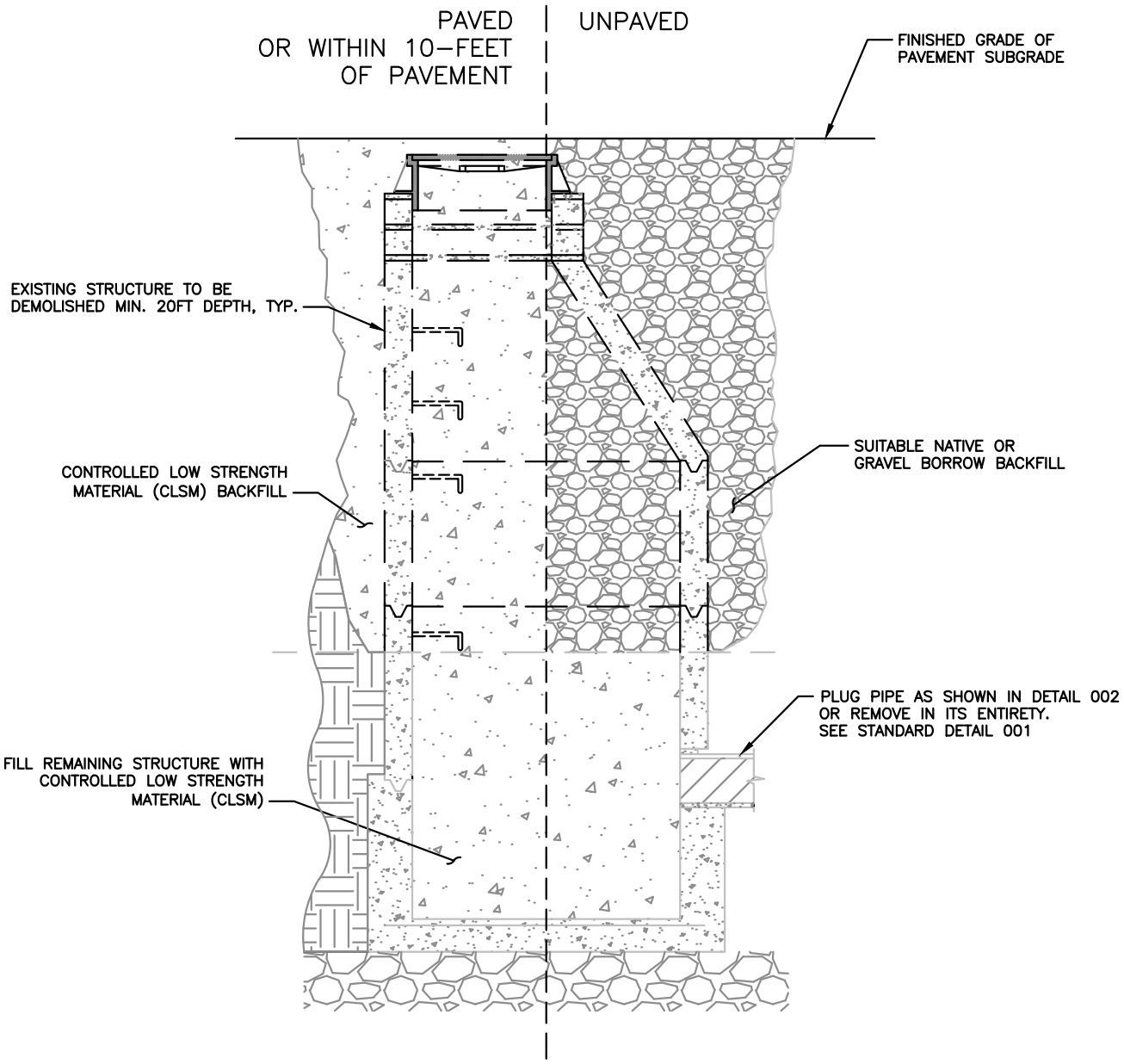


PLAN VIEW (OPTION 2)

DETAIL 1/002
PIPE ABANDONMENT
SCALE: NTS

NOTES:
1. PIPING SHALL ONLY BE ABANDONED IN PLACE WHERE SPECIFICALLY APPROVED BY PORT FACILITIES AND INFRASTRUCTURE.
2. ABANDONED PIPE SHALL BE MARKED ON AS–BUILT DRAWINGS FOR RECORD KEEPING.

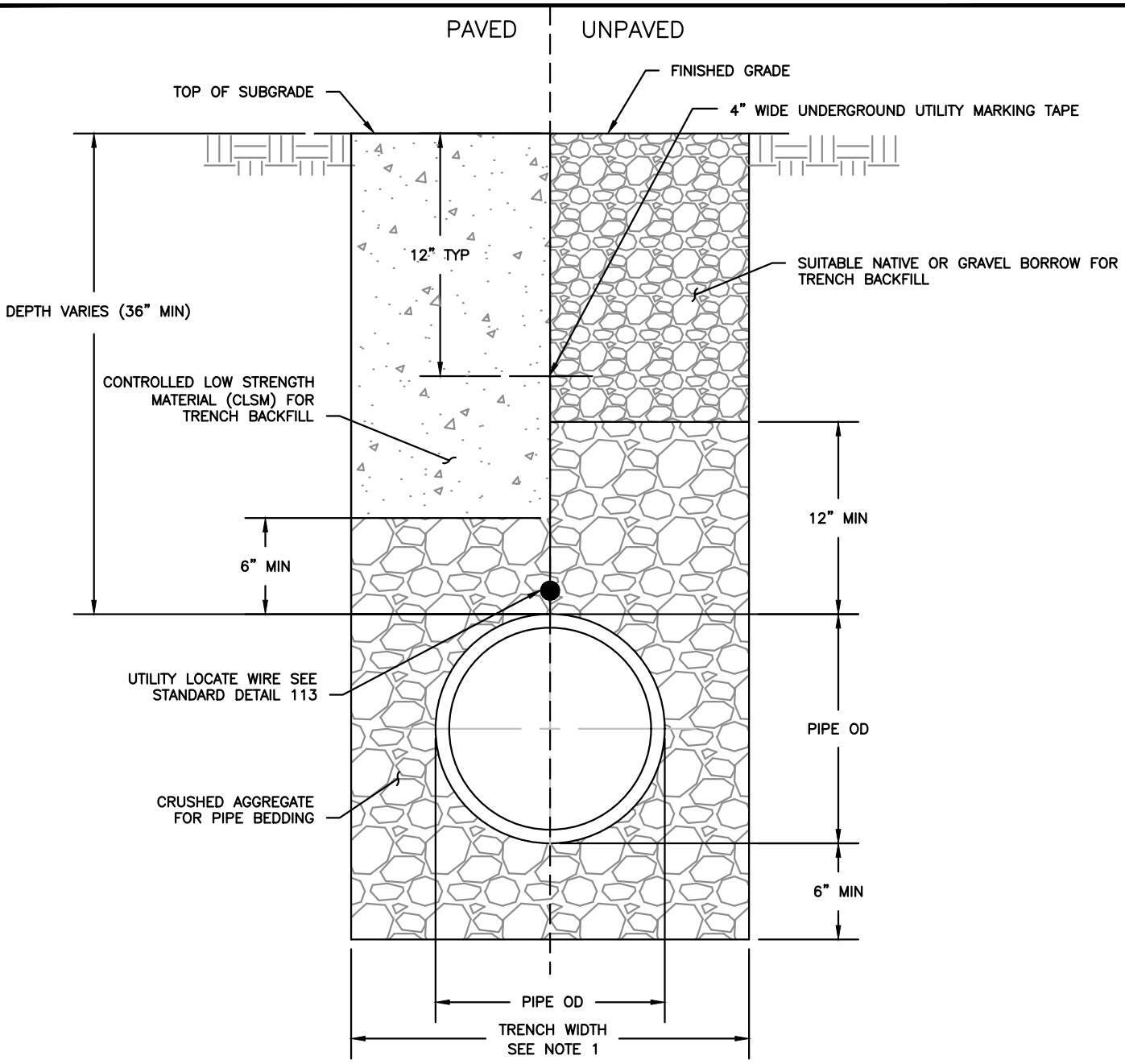
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	PIPE ABANDONMENT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **002**



NOTES:
1. BACKFILL MATERIALS SHALL MEET THE REQUIREMENTS OF SECTION 322333 UTILITY TRENCHING AND BACKFILL.
2. SUITABLE NATIVE OR GRAVEL BORROW BACKFILL SHALL BE COMPACTED TO 95% MAX. DENSITY.

DETAIL 1/003
MANHOLE ABANDONMENT
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	MANHOLE ABANDONMENT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **003**

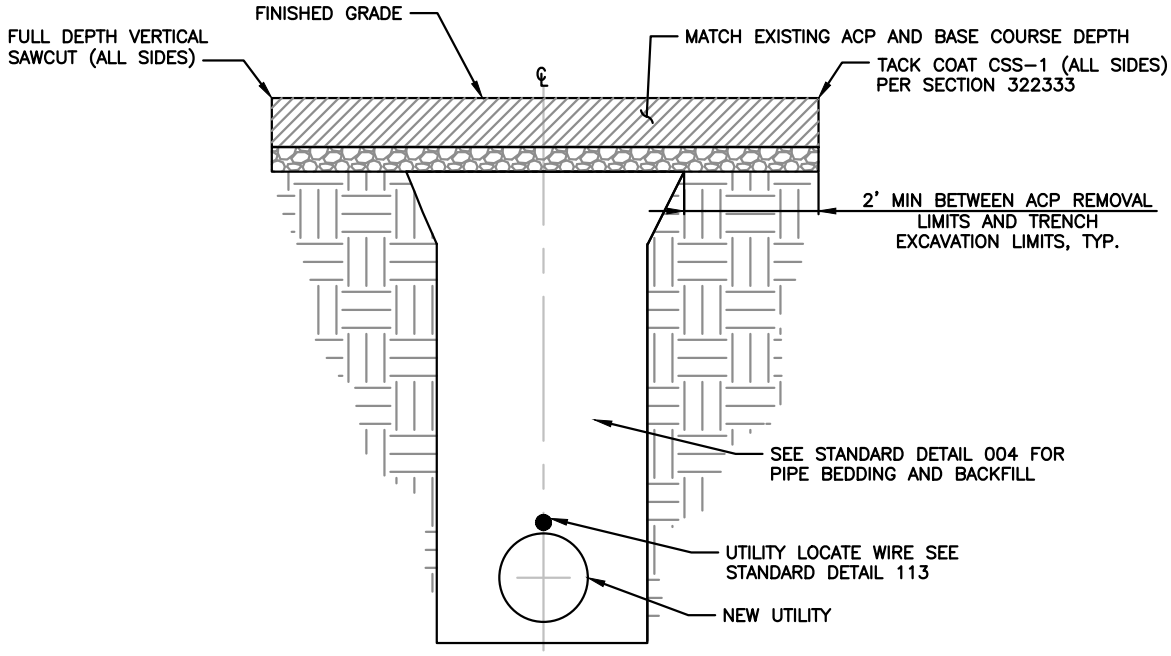


NOTES:

1. PIPE TRENCH WIDTH SHALL BE:
   FOR OD >/= 18" : (1.5 X I.D.) + 18"
   FOR OD < 18": I.D. + 30"
2. CDF TRENCH DAMS (ALL UTILITIES): INSTALL 5' OF CLSM IN LIEU OF UTILITY BEDDING AND TRENCH BACKFILL AT LOCATIONS TO BE INDICATED BY ENGINEER. IF NONE ARE SHOWN, PROVIDE AT A MAXIMUM SPACING OF 500 FEET OF PIPE LENGTH.
3. ALL BACKFILL AND PIPE BEDDING SHALL MEET THE REQUIREMENTS OF SECTION 322333 – UTILITY TRENCHING AND BACKFILL.

SECTION 1
PIPE BEDDING AND TRENCH BACKFILL 004
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	PIPE BEDDING AND TRENCH BACKFILL
SEA F&I STANDARD DETAILS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO **004**

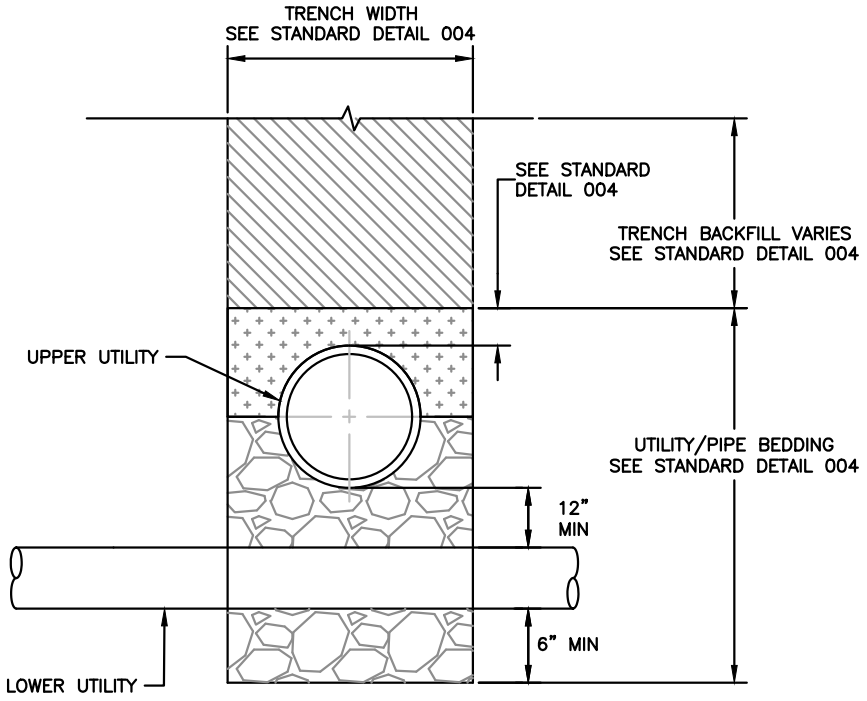


SECTION 1

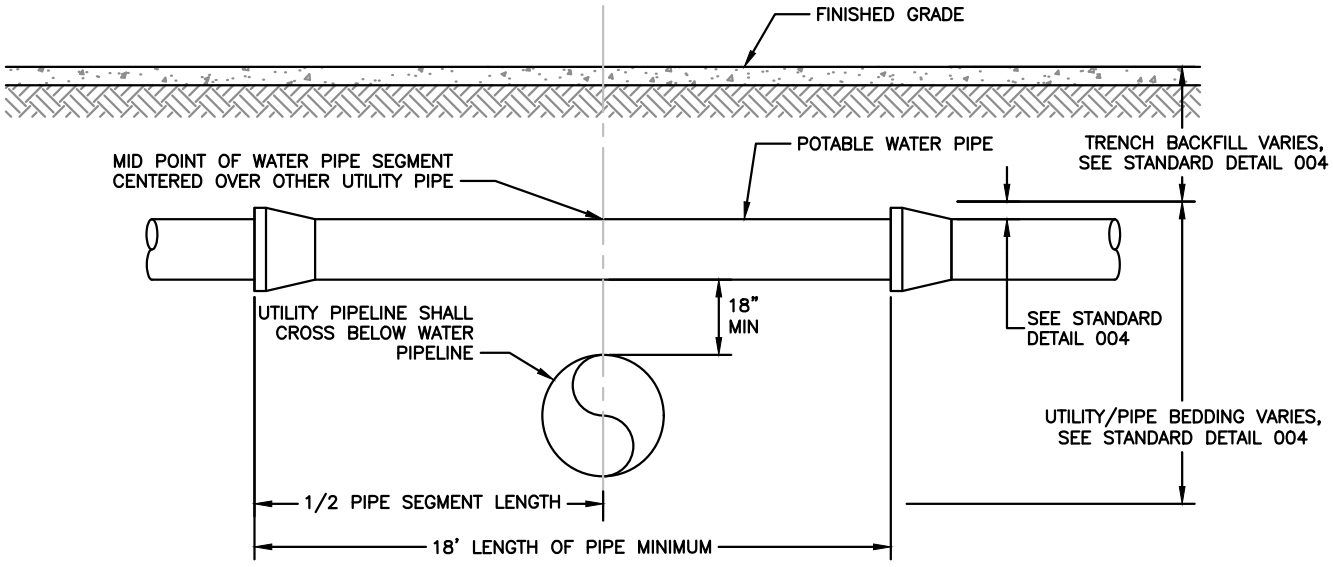
ACP TRENCH PATCH
SCALE: NTS

005

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	ACP TRENCH PATCH
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **005**



DETAIL 1 / 006
TYPICAL UTILITY CROSSINGS (EXCLUDING WATER)
SCALE: NTS

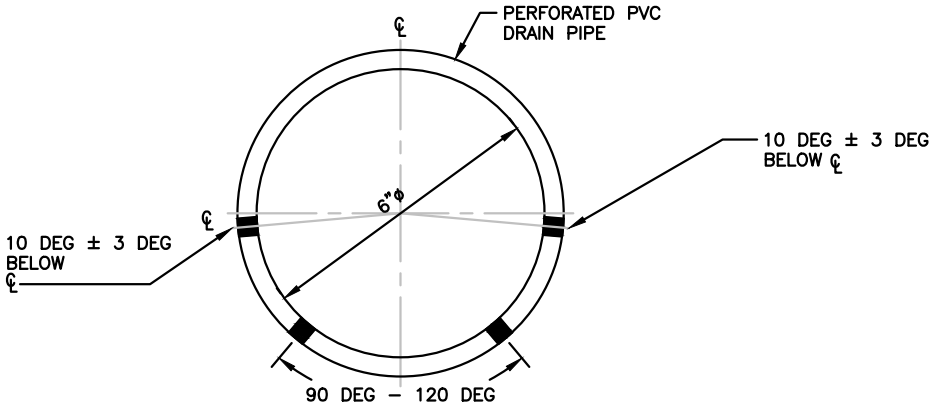


DETAIL 2 / 006
WATER PIPE CROSSING
SCALE: NTS

NOTES:

1. VERTICAL SEPARATION BETWEEN STORM DRAIN, IWS, SANITARY SEWER, AND OTHER NON-POTABLE WATER CONVEYANCE OR UTILITY SHALL BE 12" OR MORE. VERTICAL SEPARATIONS LESS THAN 12" MUST BE APPROVED BY F&I AND CLSM SHALL BE USED AS BEDDING BETWEEN UTILITIES.
2. FOR ALL WATER MAIN CROSSINGS REFER TO DETAIL 2, THIS SHEET.
3. WHEN CROSSING CATHODIC PROTECTED UTILITY (I.E. JET FUEL), PROVIDE INSULATED BLANKET PER STANDARD DETAIL 700.
4. FOR ALL WATER PIPE CROSSINGS, SEE STANDARD SPECIFICATION 331000 WATER DISTRIBUTION REQUIREMENTS SECTION 1.05 UTILITY CLEARANCE REQUIREMENTS.

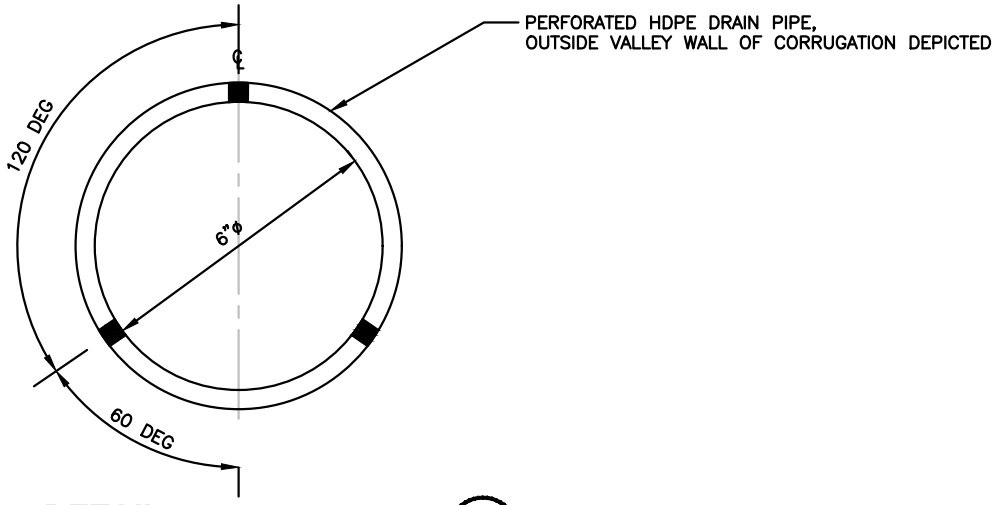
SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	TYPICAL UTILITY CROSSINGS STANDARD DETAIL NO. **006**



DETAIL 1/100

TYPICAL PERFORATIONS FOR 6" DIA
PVC DRAIN PIPE
SCALE: NTS

NOTES:
1. PIPE SHALL UTILIZE AASHTO M278 PERFORATION PATTERN AS SHOWN ON DETAIL.
2. SEE SECTION 334116, SUBDRAINAGE.

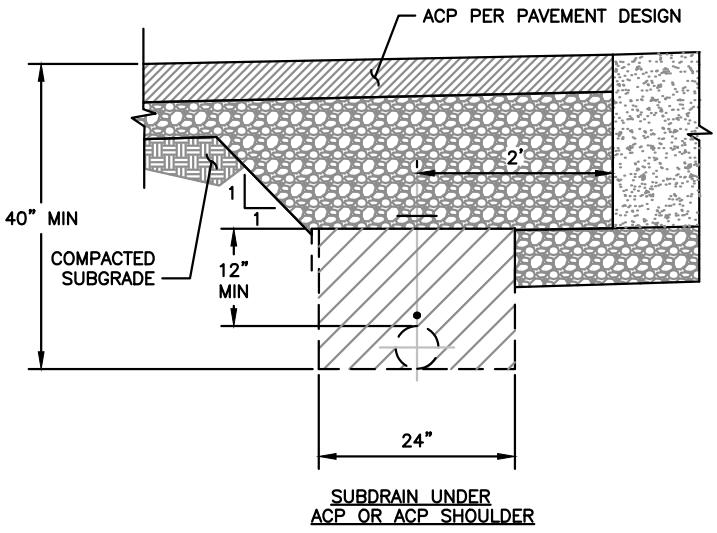


DETAIL 2/100

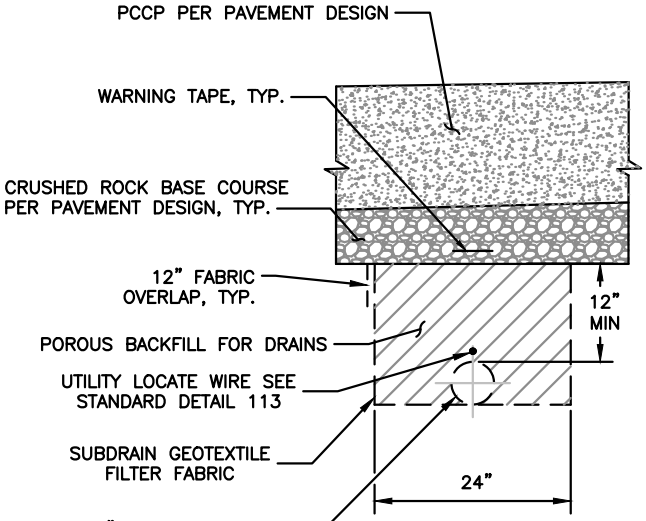
TYPICAL PERFORATIONS FOR 6" DIA
HDPE DRAIN PIPE
SCALE: NTS

NOTES:
1. PIPE SHALL UTILIZE AASHTO M252 CLASS II PERFORATIONS AS SHOWN ON DETAIL.
2. SEE SECTION 334116, SUBDRAINAGE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	SUBDRAIN PIPE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **100**



SUBDRAIN UNDER ACP OR ACP SHOULDER

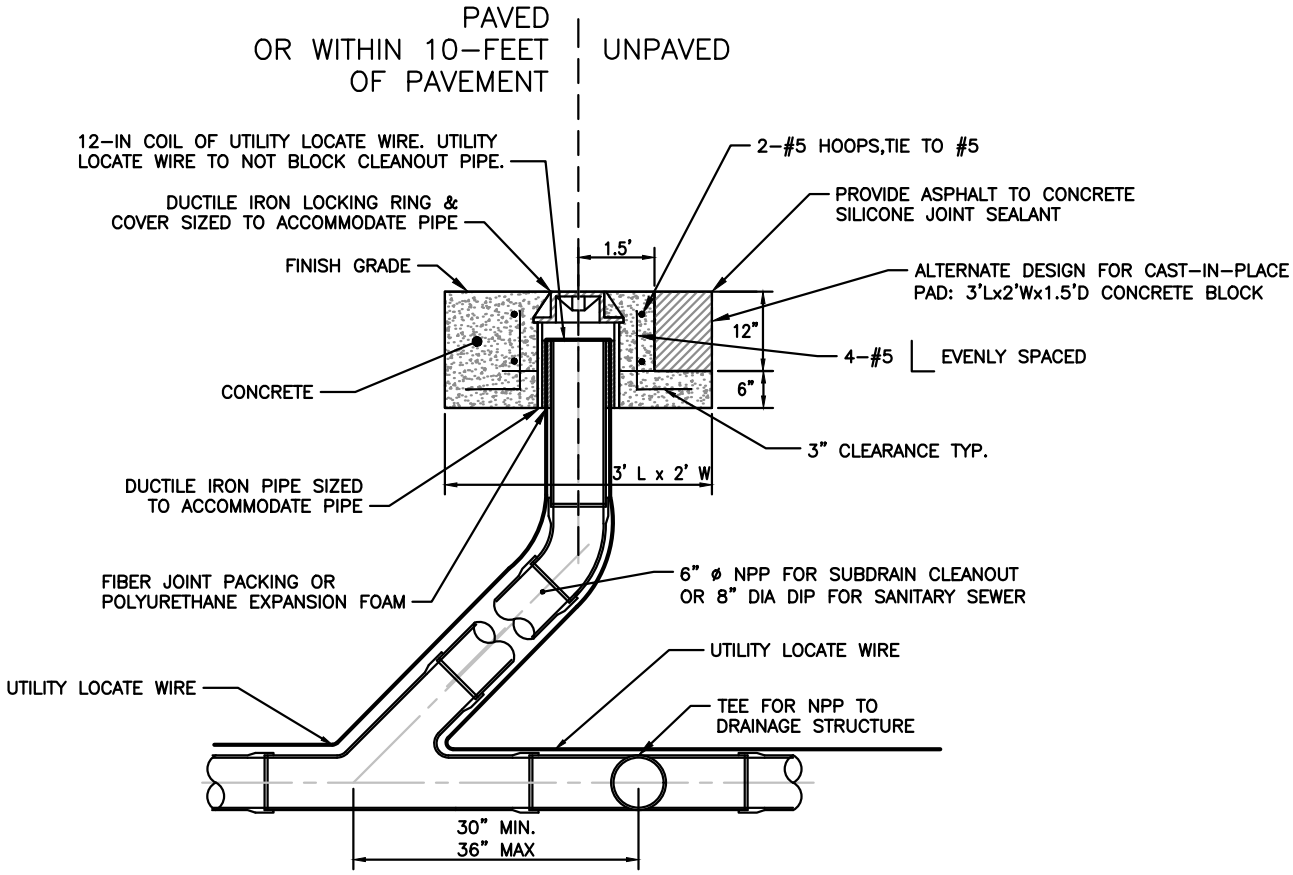


SUBDRAIN UNDER PCC PAVEMENT

SECTION	1
SUBDRAIN SYSTEM UNDER PAVEMENT SCALE: NTS	101

NOTES:
1. SEE STANDARD DETAIL 102 FOR CLEANOUT DETAILS.
2. SEE STANDARD DETAIL 100 FOR SUBDRAIN PIPE.
3. SEE SECTION 334116, SUBDRAINAGE, FOR POROUS BACKFILL FOR DRAINS AND OTHER PIPING REQUIREMENTS.

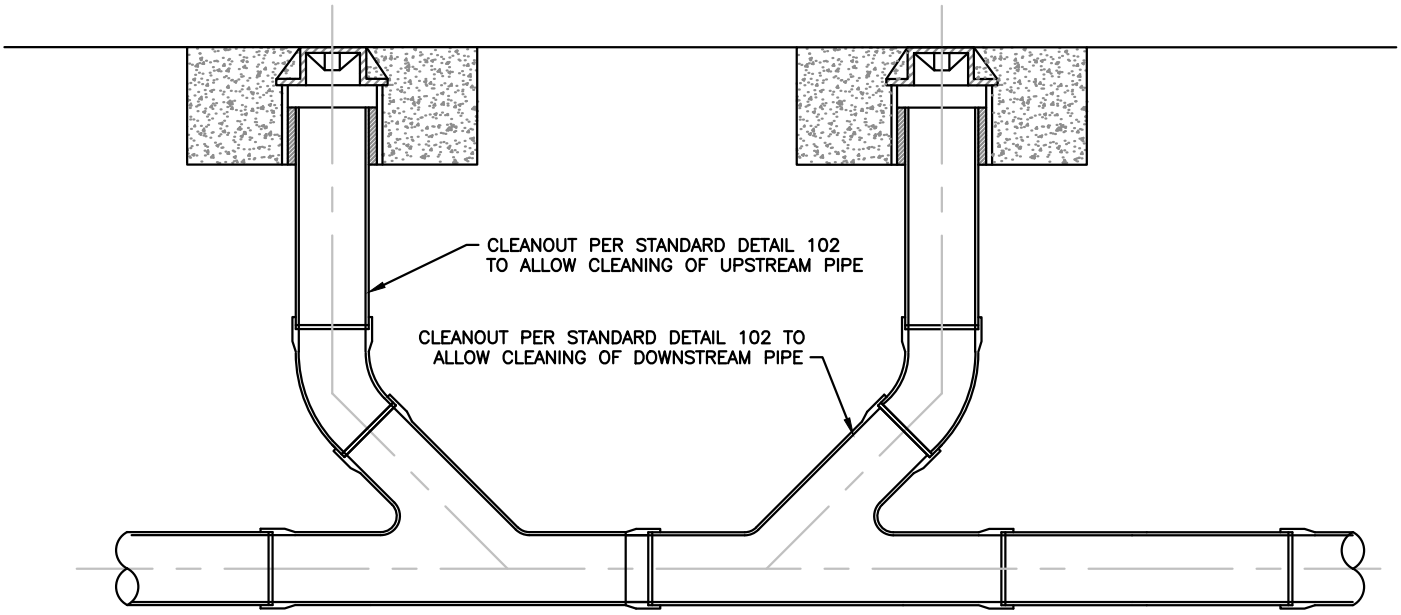
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	SUBDRAIN SYSTEM UNDER PAVEMENT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **101**



DETAIL 1/102
TYPICAL CLEANOUT
SCALE: NTS

NOTES:
1. NPP (NON PERFORATED PIPE) MATERIAL FOR CLEANOUTS SHALL MATCH PIPE MATERIAL STANDARD OF SUBDRAIN SYSTEM OR HORIZONTAL CONVEYANCE PIPING.
2. METAL CASTINGS SHOULD MEET THE LOADING REQUIREMENTS IN SPEC SECTION 334241.
3. UTILITY LOCATE WIRE SHALL BE PER SECTION 32233, UTILITY TRENCHING AND BACKFILL.

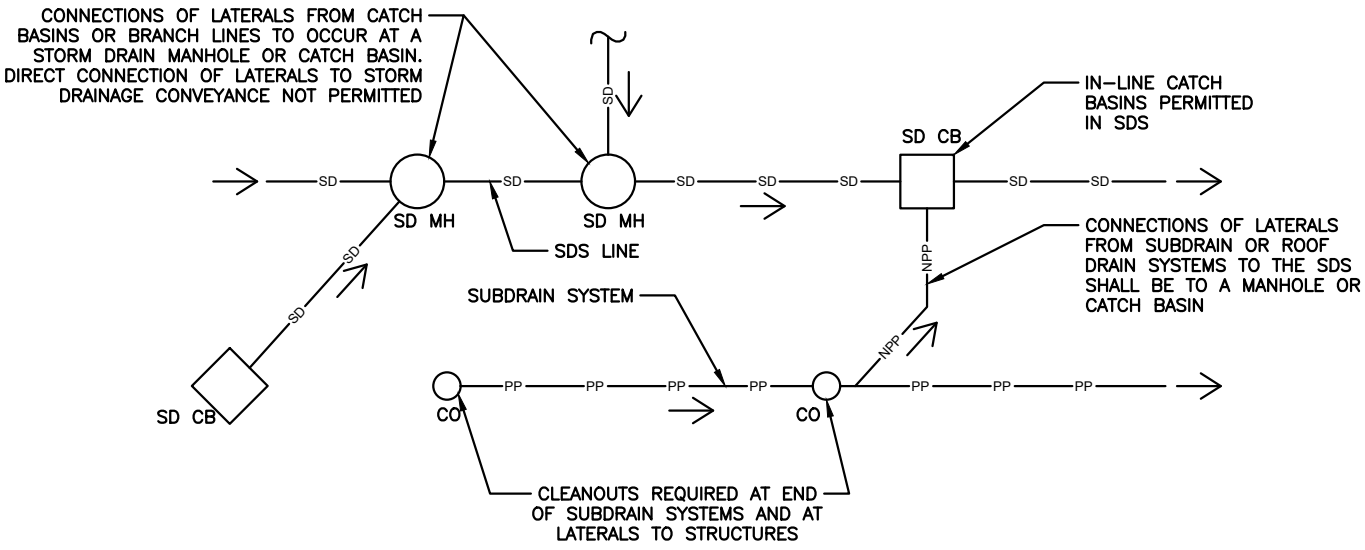
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	TYPICAL CLEANOUT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **102**



DETAIL 1/103
TYPICAL DOUBLE CLEANOUT
SCALE: NTS

NOTES:
1. SEE STANDARD SPECIFICATION 333111 FOR DOUBLE CLEANOUT REQUIREMENTS.
2. METAL CASTINGS SHOULD MEET THE LOADING REQUIREMENTS IN SPEC SECTION 334241.

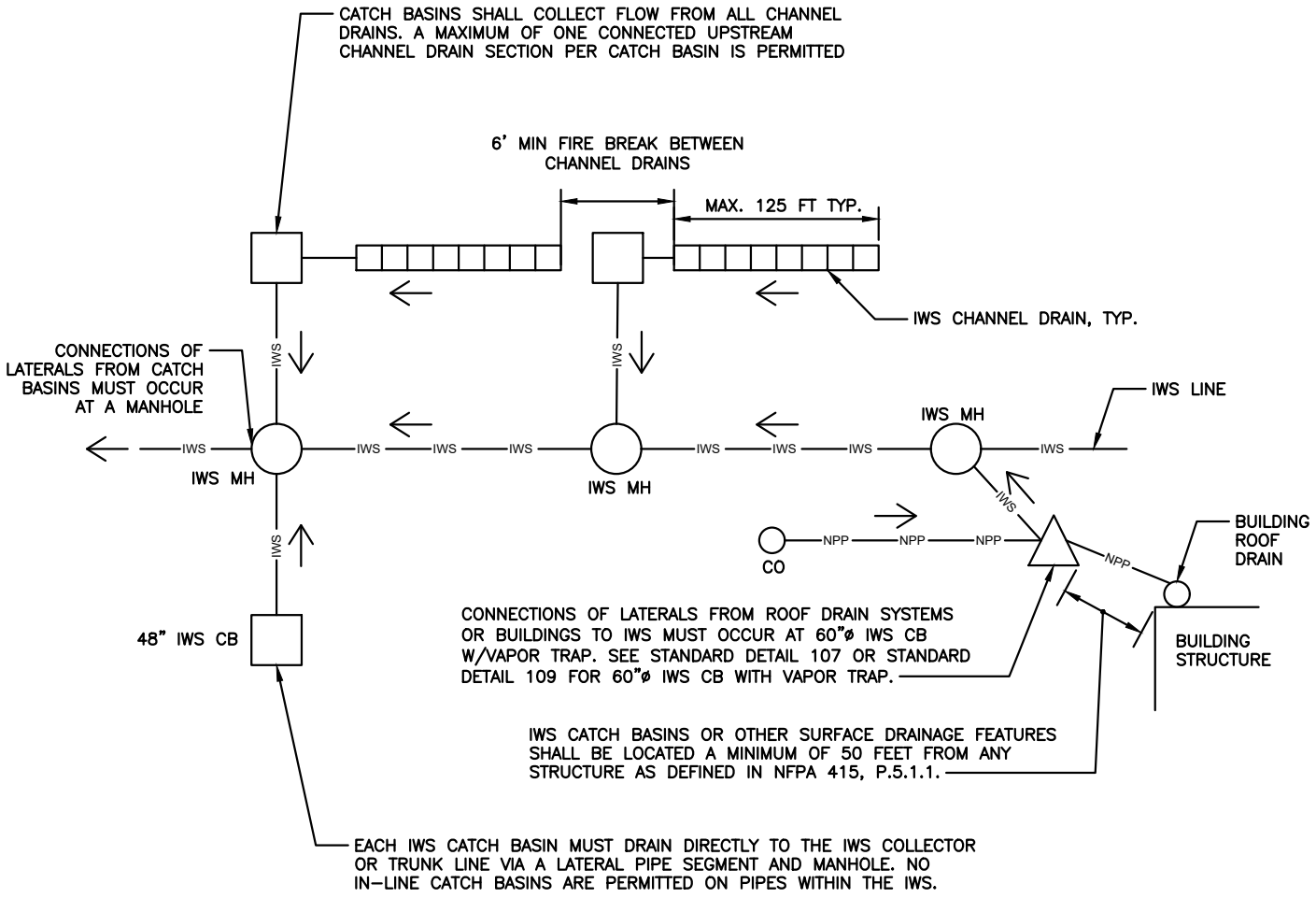
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	TYPICAL DOUBLE CLEANOUT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **103**



DETAIL 1/104

TYPICAL STORM DRAINAGE SYSTEM (SDS) LAYOUT
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	STORM DRAINAGE SYSTEM CONFIGURATION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **104**

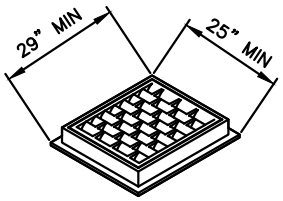


TYPICAL INDUSTRIAL WASTEWATER SYSTEM (IWS) LAYOUT

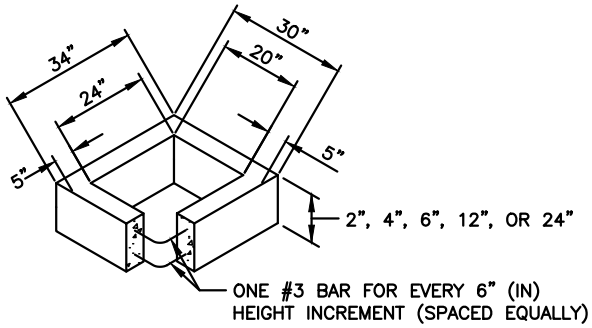
DETAIL 1/105
TYPICAL INDUSTRIAL WASTE SYSTEM (IWS) LAYOUT
SCALE: NTS

NOTE:
1. FOR ADDITIONAL REQUIREMENTS GOVERNING DRAINAGE ON RAMPS WHERE AIRCRAFT FUELING OCCURS, SEE NFPA 415, CHAPTER 5.

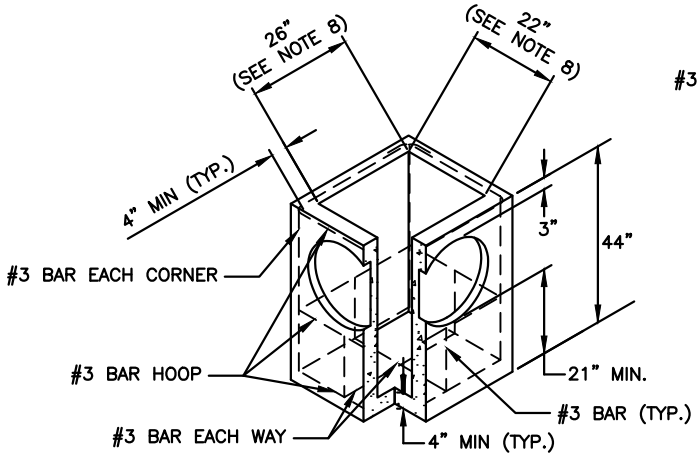
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	INDUSTRIAL WASTE SYSTEM CONFIGURATION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **105**



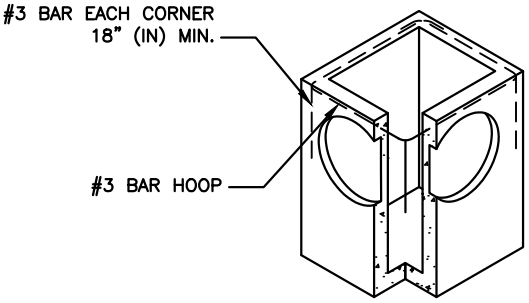
FRAME AND VANED GRATE



RECTANGULAR ADJUSTMENT SECTION



PRECAST BASE SECTION



(SEE NOTE 2)

ALTERNATIVE PRECAST BASE SECTION

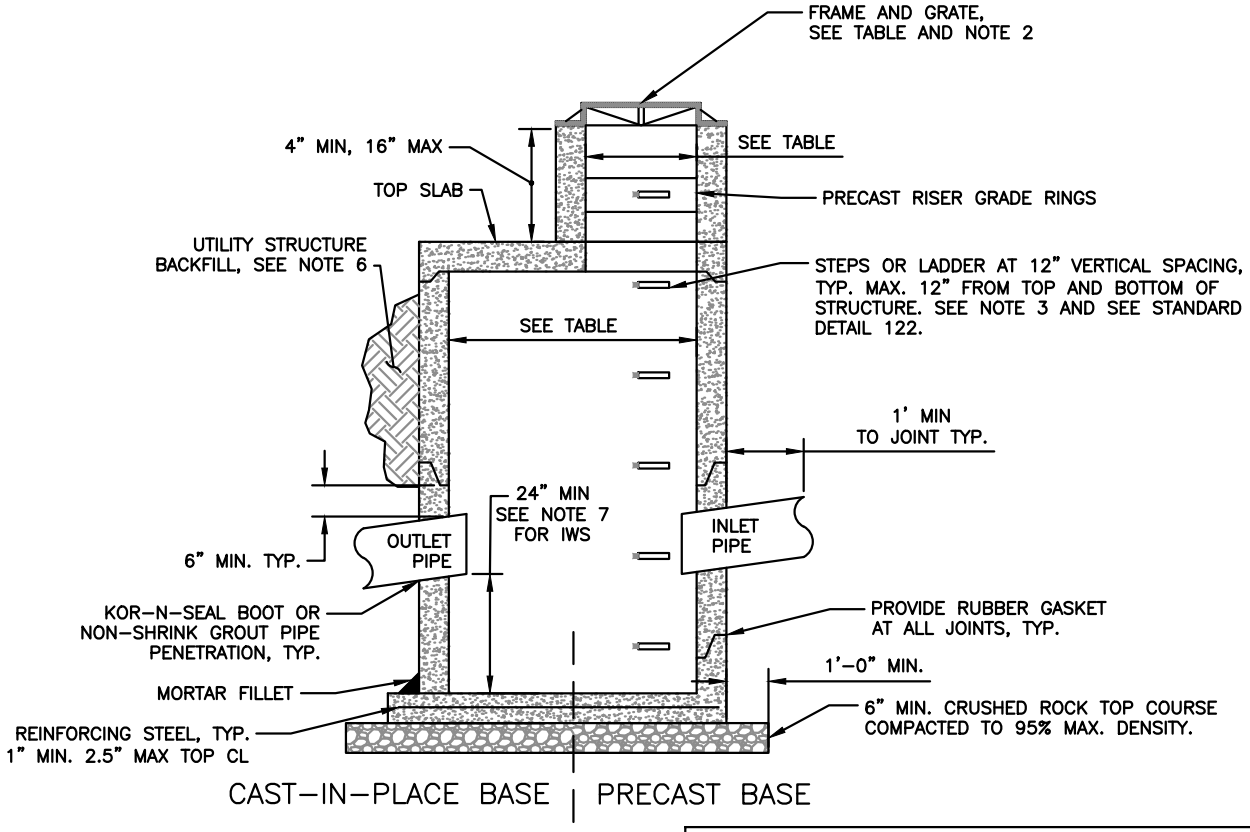
DETAIL 1/106

TRAFFIC RATED CATCH BASIN INLET
SCALE: NTS

NOTES:

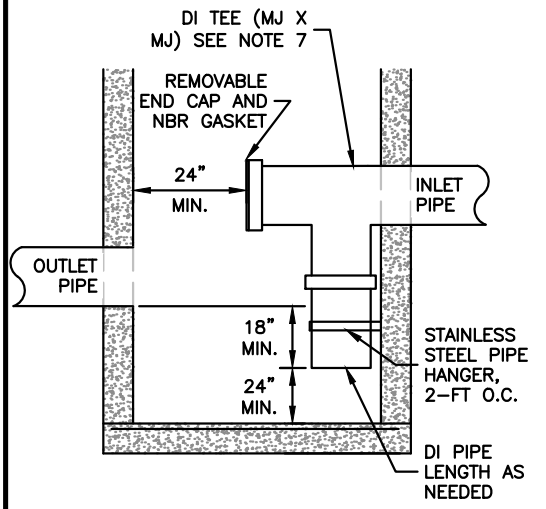
1. TRAFFIC RATED CATCH BASIN INLET FOR LANDSIDE APPLICATION ONLY.
2. AS ACCEPTABLE ALTERNATIVES TO THE REBAR SHOWN IN THE PRECAST BASE SECTION, FIBERS (PLACED ACCORDING TO THE SPECIFICATIONS), OR WIRE MESH HAVING A MINIMUM AREA OF 0.12 SQUARE INCHES PER FOOT SHALL BE USED WITH THE MINIMUM REQUIRED REBAR SHOWN IN THE ALTERNATIVE PRECAST BASE SECTION. WIRE MESH SHALL NOT BE PLACED IN THE KNOCKOUTS.
3. THE KNOCKOUT DIAMETER SHALL NOT BE GREATER THAN 20" (IN). KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" (IN) MINIMUM TO 2.5" (IN) MAXIMUM. PROVIDE A 1.5" (IN) MINIMUM GAP BETWEEN THE KNOCKOUT WALL AND THE OUTSIDE OF THE PIPE. AFTER THE PIPE IS INSTALLED, FILL THE GAP WITH JOINT MORTAR IN ACCORDANCE WITH SPECIFICATION SECTION 334231.
4. THE MAXIMUM DEPTH FROM THE FINISHED GRADE TO THE LOWEST PIPE INVERT SHALL BE 5' (FT).
5. THE FRAME AND GRATE MAY BE INSTALLED WITH THE FLANGE DOWN, OR INTEGRALLY CAST INTO THE ADJUSTMENT SECTION WITH FLANGE UP.
6. GRATE SHALL BE BOLTED PER SECTION 334241.
7. THE PRECAST BASE SECTION MAY HAVE A ROUNDED FLOOR, AND THE WALLS MAY BE SLOPED AT A RATE OF 1:24 OR STEEPER.
8. THE OPENING SHALL BE MEASURED AT THE TOP OF THE PRECAST BASE SECTION.
9. ALL PICKUP HOLES SHALL BE GROUTED FULL AFTER THE BASIN HAS BEEN PLACED.
10. TRAFFIC RATED STRUCTURES TO BE DESIGNED FOR AASHTO HS-25 LOADING AND CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478).

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	TRAFFIC RATED CATCH BASIN INLET
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **106**



SECTION 1
TRAFFIC RATED CATCH BASIN 107
SCALE: NTS

CATCH BASIN DIMENSIONS					
CATCH BASIN DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"

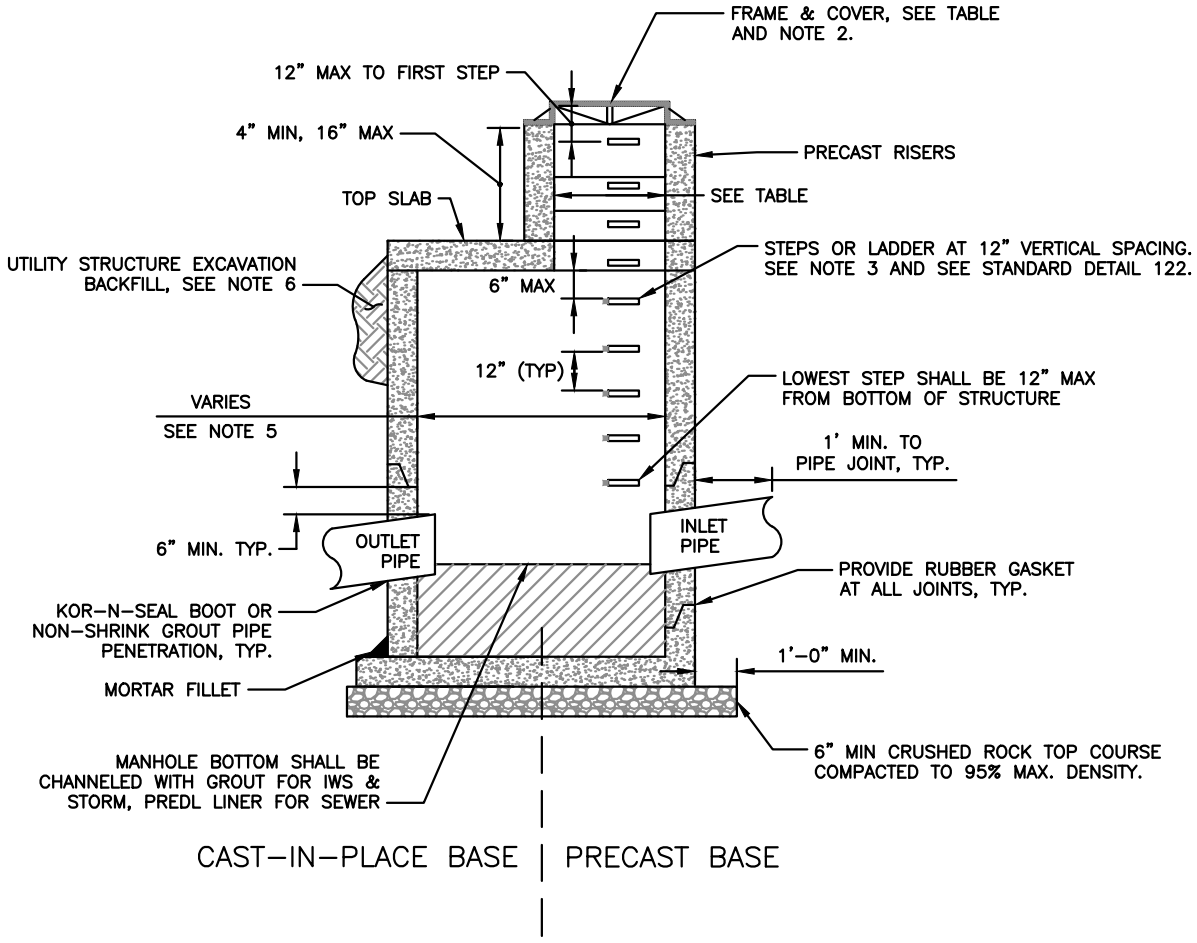


DETAIL 2
IWS VAPOR TRAP 107
SCALE: NTS

NOTES:

1. TRAFFIC RATED STRUCTURES TO BE DESIGNED FOR AASHTO HS-25 LOADING AND CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478). STRUCTURE RATING SHALL BE INCREASED IN AREAS UTILIZED BY CARGO OPERATORS, AIRCRAFT RESCUE FIRE FIGHTING VEHICLES, AIRLINE GROUND SERVICE EQUIPMENT, OR PORT AND AIRLINE MAINTENANCE EQUIPMENT.
2. METAL CASTINGS SHALL MEET THE REQUIREMENTS IN SPEC SECTION 334241. MINIMUM 2 BOLTED FASTENERS.
3. STEPS IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER IN CB'S SHALL HAVE 6" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER SHALL BE VERTICALLY ALIGNED. STEPS AND LADDER SHALL BE PER STANDARD DETAIL 122.
4. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM.
5. SIZES TO BE INDICATED ON PLANS BASED ON DESIGN REQUIREMENTS.
6. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL PER SPEC SECTION 334231.
7. IWS STRUCTURES RECEIVING INLET PIPES FROM BUILDINGS (I.E., ROOFS, DRAIN PIPES, ETC.) AND ELECTRICAL VAULTS SHALL BE 60-INCH DIAMETER IWS CATCH BASINS WITH A VAPOR TRAP, AS SHOWN IN DETAIL 2 THIS SHEET.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	TRAFFIC RATED CATCH BASIN
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **107**



SECTION 1

TRAFFIC RATED MANHOLE
SCALE: NTS

108

MANHOLE DIMENSIONS					
MANHOLE DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"

NOTES:

1. TRAFFIC RATED STRUCTURES TO BE DESIGNED FOR AASHTO HS-25 LOADING AND CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199(ASTM C 478). STRUCTURE RATING SHALL BE INCREASED IN AREAS UTILIZED BY CARGO OPERATORS, AIRCRAFT RESCUE FIRE FIGHTING VEHICLES, AIRLINE GROUND SERVICE EQUIPMENT, OR PORT AND AIRLINE MAINTENANCE EQUIPMENT.
2. METAL CASTINGS SHOULD MEET THE LOADING REQUIREMENTS IN SPEC SECTION 334241. MIN. 2 BOLTED FASTENERS.
3. STEPS IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER IN MH'S SHALL HAVE 6" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER SHALL BE VERTICALLY ALIGNED. STEPS AND LADDER SHALL BE PER STANDARD DETAIL 122.
4. PRECAST BARREL SECTIONS SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM.
5. SIZES TO BE INDICATED BY THE PLAN BASED ON DESIGN REQUIREMENTS.
6. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL PER SPEC SECTION 334231.

SEA Seattle-Tacoma International Airport

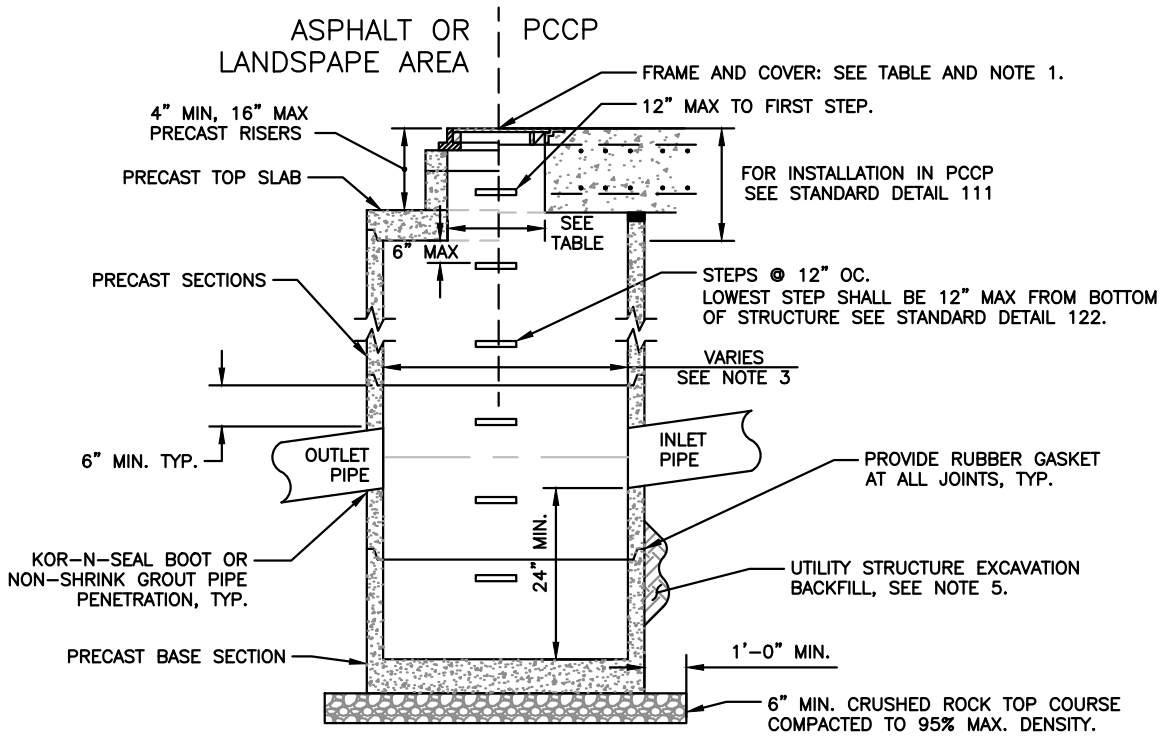
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2020

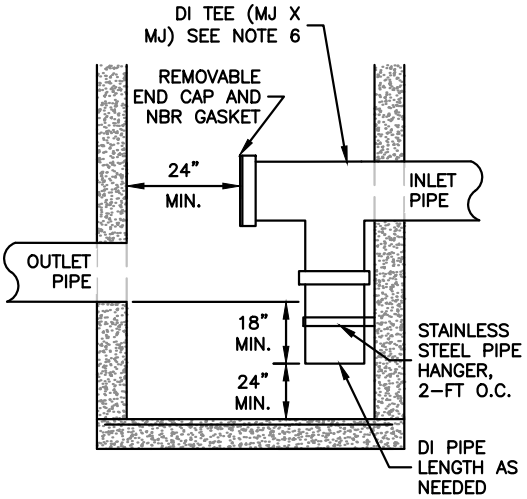
TRAFFIC RATED MANHOLE

STANDARD DETAIL NO. **108**



SECTION 1
AIRCRAFT RATED CATCH BASIN 109
SCALE: NTS

CATCH BASIN DIMENSIONS					
CATCH BASIN DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"

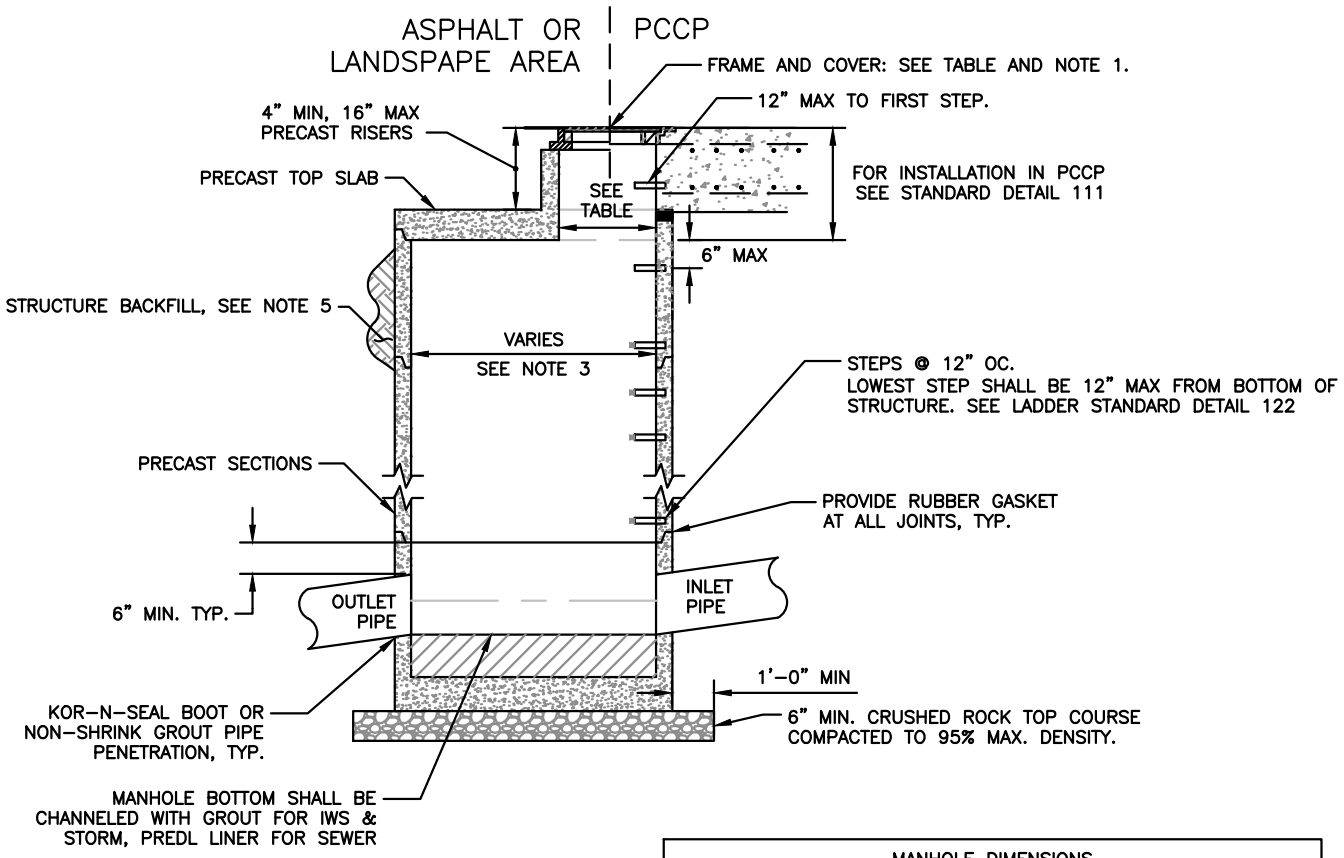


DETAIL 2
IWS VAPOR TRAP 109
SCALE: NTS

NOTES:

1. FRAME & GRATE:
   a. FRAMES AND GRATES SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   b. GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS).
   c. PROVIDE CAST PERMANENT LETTERING GRATE, EITHER "STORM" OR "IWS" ON THE GRATE AS DIRECTED BY THE ENGINEER ON ALL CB'S.
2. CATCH BASINS SHALL BE PRECAST AND DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B, DESIGN OF STRUCTURES (OR LATEST EDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
3. SIZES TO BE INDICATED ON PLANS BASED ON DESIGN REQUIREMENTS.
4. STEPS IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER IN CB'S SHALL HAVE 6" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER SHALL BE VERTICALLY ALIGNED. STEPS AND LADDER SHALL BE PER STANDARD DETAIL 122.
5. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL PER SPEC SECTION 334231.
6. IWS STRUCTURES RECEIVING INLET PIPES FROM BUILDINGS (I.E., ROOFS, DRAIN PIPES, ETC.) AND ELECTRICAL VAULTS SHALL BE 60-INCH DIAMETER IWS CATCH BASINS WITH A VAPOR TRAP, AS SHOWN IN DETAIL 2 THIS SHEET.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	AIRCRAFT RATED CATCH BASIN
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **109**



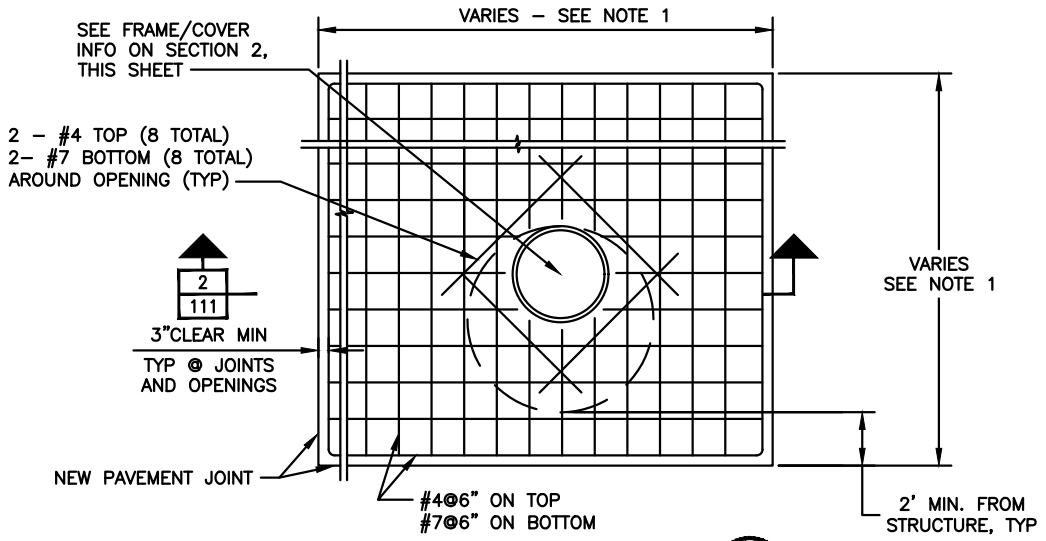
SECTION 1
AIRCRAFT RATED MANHOLE 110
SCALE: NTS

MANHOLE DIMENSIONS					
MANHOLE DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"

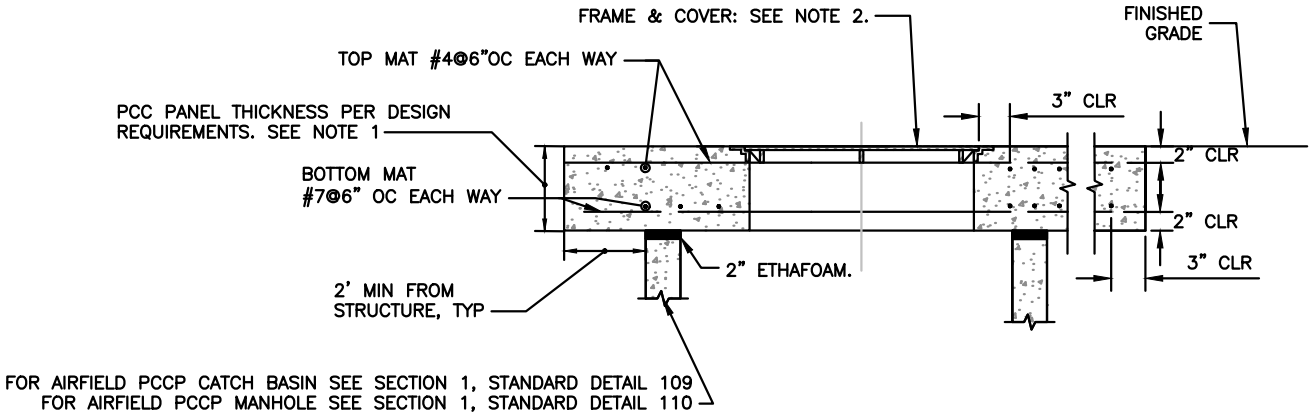
NOTES:

1. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "SEWER," "STORM," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
   b. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   d. SEAL SDS MH COVER/FRAME JOINT AND PICK HOLES OF ALL SDS MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
   e. 36" FRAME AND COVER SHOULD INCLUDE LID LIFT-ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
2. MANHOLES SHALL BE PRECAST AND DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B – DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
3. SIZES TO BE INDICATED BY THE PLANS BASED ON DESIGN REQUIREMENTS.
4. STEPS IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER IN MH'S SHALL HAVE 6" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS/LADDER SHALL BE VERTICALLY ALIGNED. STEPS AND LADDER SHALL BE PER STANDARD DETAIL 122.
5. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL WITH "GRAVEL BORROW" (PER SPEC SECTION 334231).
6. IWS STRUCTURES RECEIVING INLET PIPES FROM BUILDINGS (I.E., ROOFS, DRAIN PIPES, ETC.) AND ELECTRICAL VAULTS SHALL BE 60-INCH DIAMETER IWS CATCH BASINS WITH DUCTILE IRON, NBR GASKETED REMOVABLE TEES, AS SHOWN IN STANDARD DETAIL 109.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	AIRCRAFT RATED MANHOLE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **110**



DETAIL 1/111
UTILITY STRUCTURE IN PCCP
SCALE: NTS



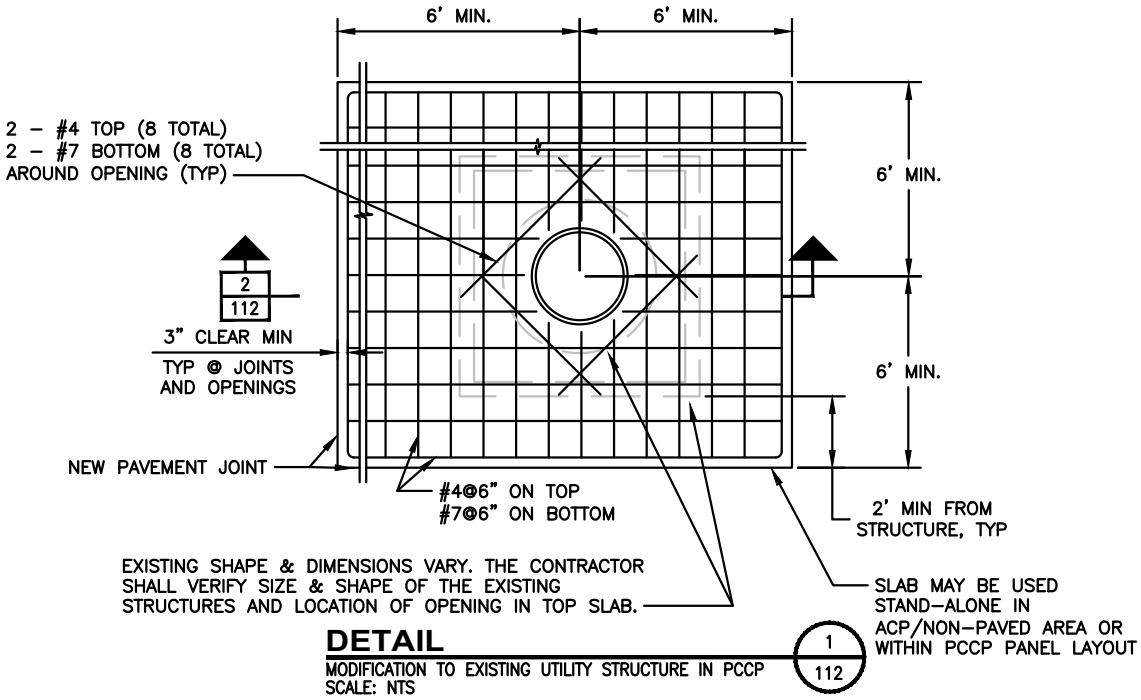
SECTION 2/111
UTILITY STRUCTURE IN PCCP
SCALE: NTS

NOTE:

1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MINIMUM PCC THICKNESS. PCC THICKNESS, PANEL SIZE, AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

2. FRAME AND COVER:
   a. FOR 48" DIA/54" DIA. MH'S, PROVIDE 30" DIAMETER FRAME AND COVER.
   b. 60" DIA AND LARGER MH'S, PROVIDE 36" DIAMETER FRAME AND COVER.
   c. PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "STORM", "SEWER," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
   d. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   e. GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   f. SEAL SD MH COVER/FRAME JOINT AND PICK HOLES OF ALL SD MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
   g. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.

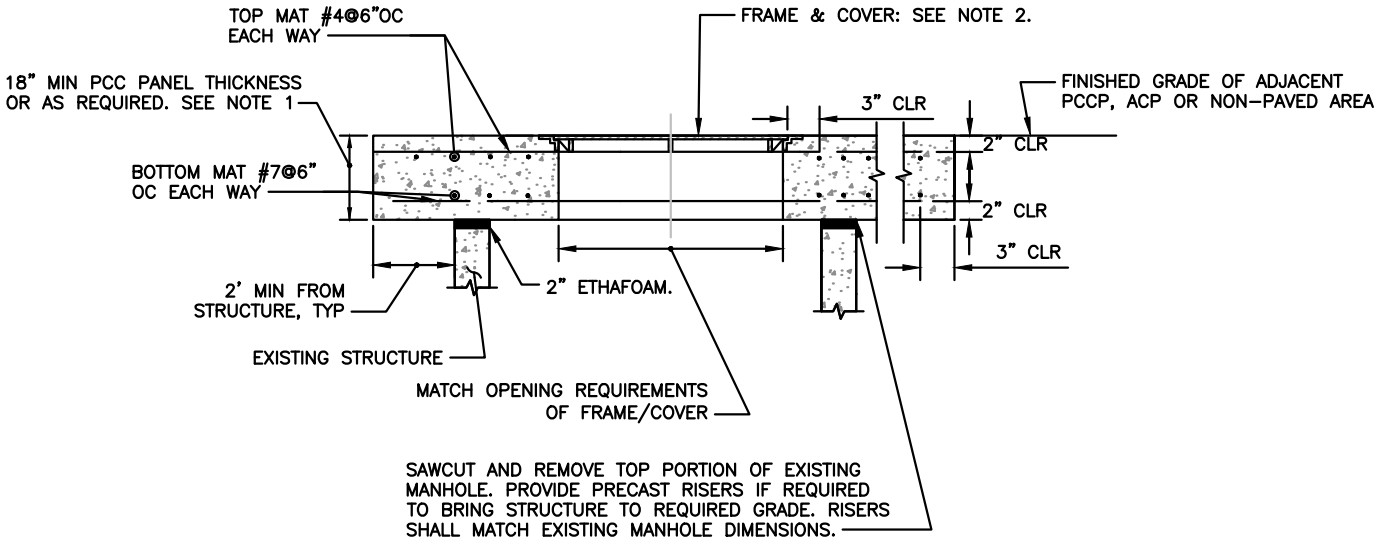
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	UTILITY STRUCTURE IN PCCP
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **111**



DETAIL

MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP
SCALE: NTS

1
112



SECTION

MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP
SCALE: NTS

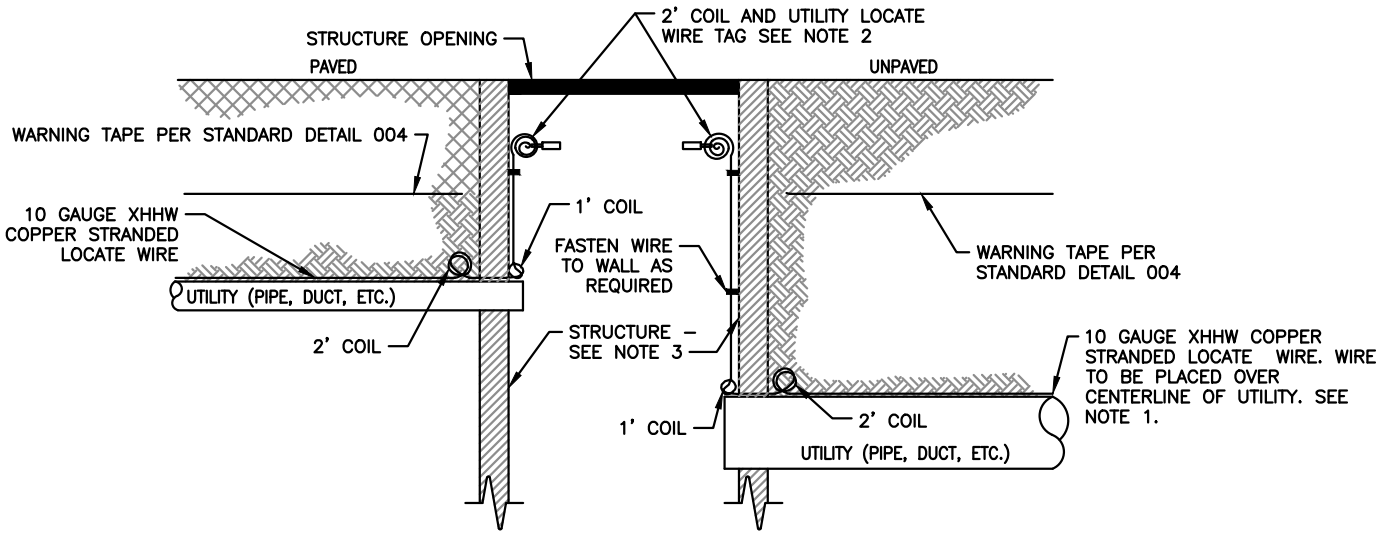
2
112

NOTE:

1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MINIMUM PCC THICKNESS. PCC THICKNESS, PANEL SIZE, AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

2. FRAME AND COVER:
   a. FOR 48" DIA/54" DIA. MH'S, PROVIDE 30" DIAMETER FRAME AND COVER.
   b. 60" DIA AND LARGER MH'S, PROVIDE 36" DIAMETER FRAME AND COVER.
   c. PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "STORM," "SEWER," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
   d. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   e. GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   f. SEAL SD MH COVER/FRAME JOINT AND PICK HOLES OF ALL SD MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
   g. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP STANDARD DETAIL NO. **112**



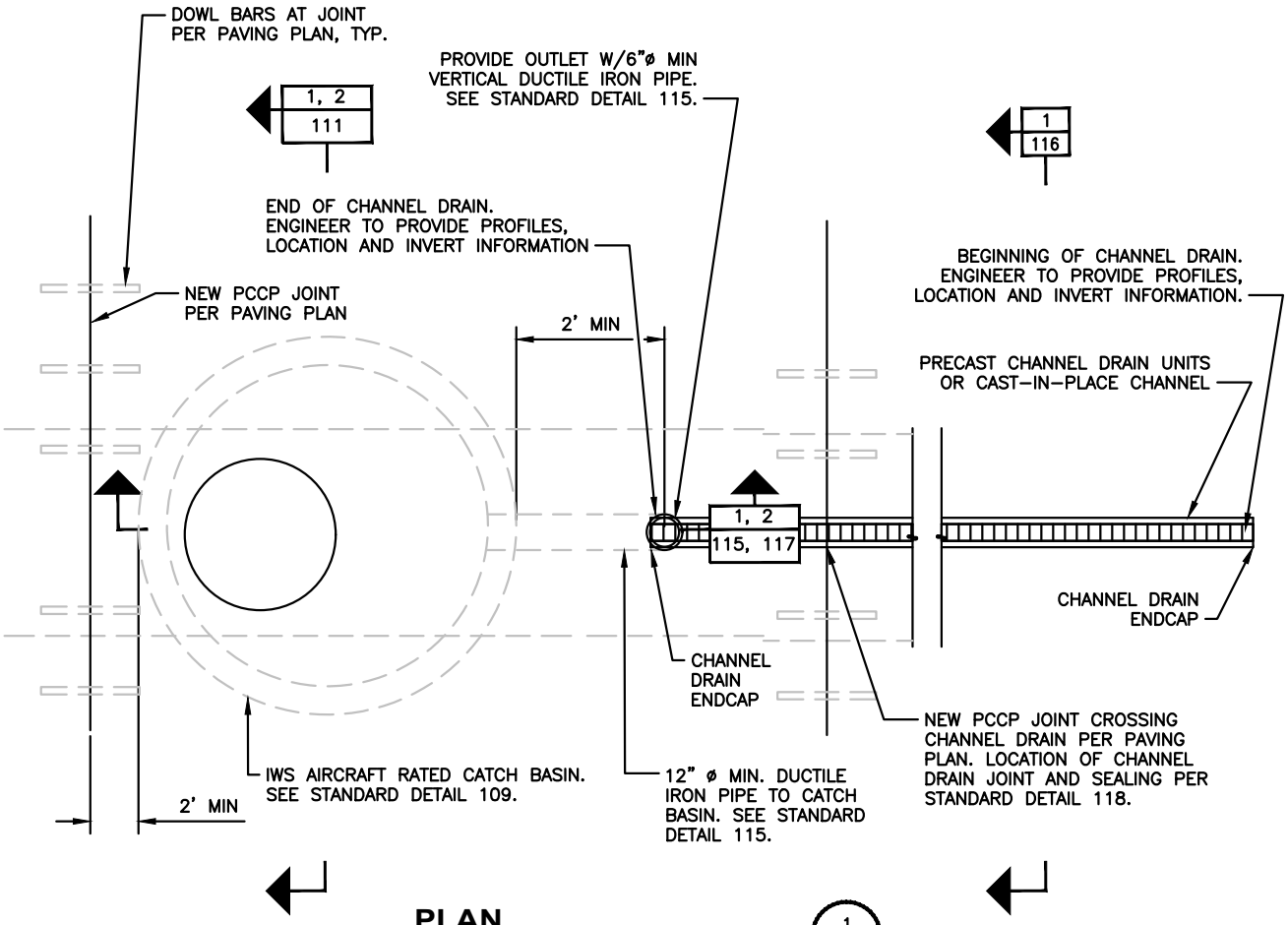
DETAIL 1/113

TYPICAL UTILITY LOCATE DETAIL
SCALE: NTS

NOTES:

1. FASTEN LOCATE WIRE TO UTILITY (TOP CENTERLINE) USING NON-CONDUCTING TIES OR OTHER SUITABLE MEANS. FASTEN AT SUFFICIENT NUMBER OF LOCATIONS TO ENSURE WIRE WILL REMAIN IN PLACE DURING BACKFILLING OPERATIONS.
2. LOCATE COIL WITHIN ONE FOOT OF OPENING. LABEL COIL "LOCATE".
3. STRUCTURE REFERS TO INLETS, CATCH BASINS, MANHOLES, HEAD WALLS, VALVE BOXES, VAULTS, HAND HOLES, JUNCTION AND PULL BOXES, AND SIMILAR ACCESS DEVICES.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	UTILITY LOCATE DETAIL
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **113**

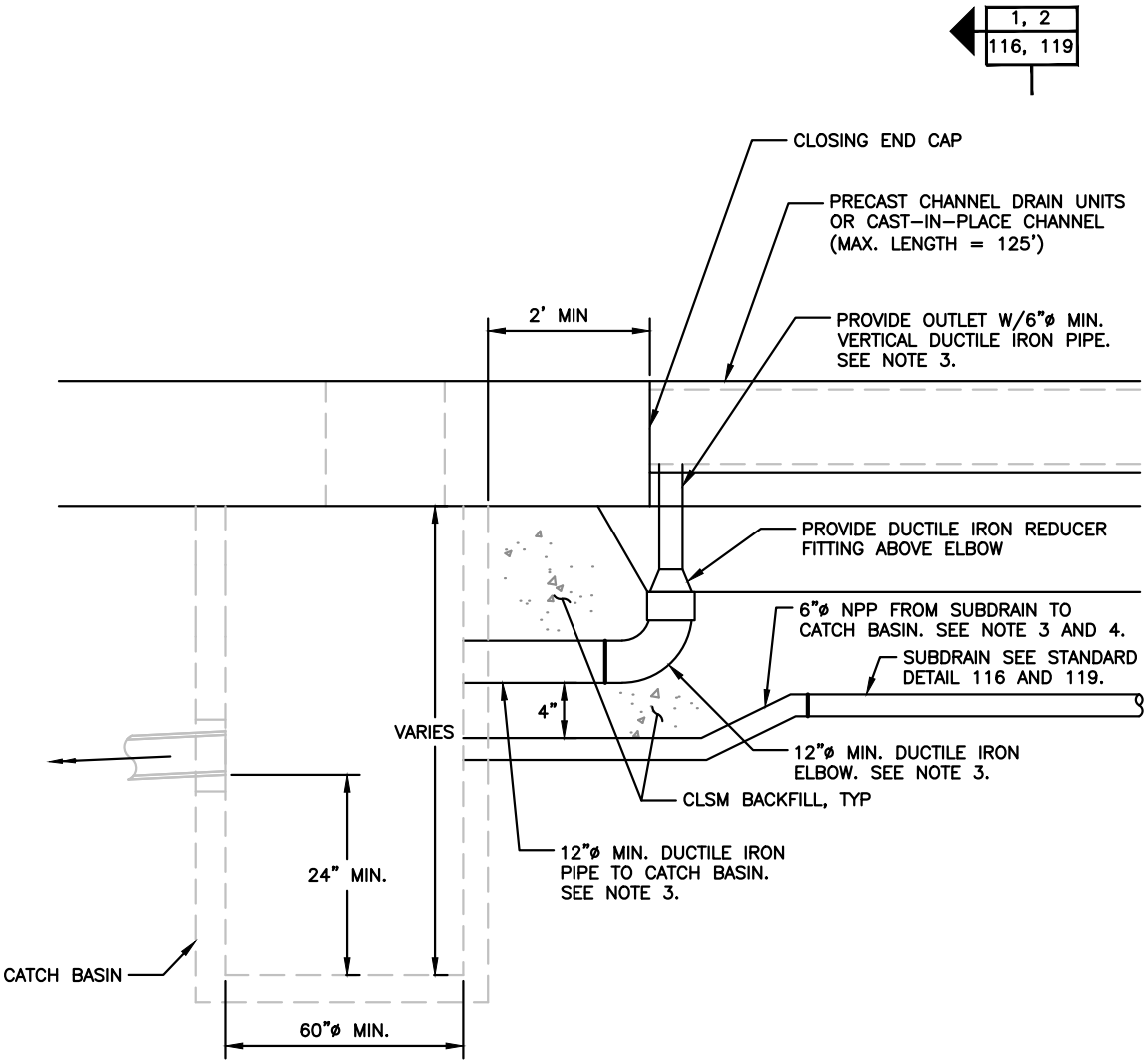


PLAN (1/114)

AIRCRAFT RATED CHANNEL DRAIN PLAN IN PCCP
SCALE: NTS

NOTE:
1. PRECAST CHANNEL DRAINS MAY BE USED WITH A REVERSE SLOPE RELEVANT TO THE PROPOSED SURFACE AS APPROVED BY F&I.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	AIRCRAFT RATED CHANNEL DRAIN PLAN IN PCCP STANDARD DETAIL NO. **114**



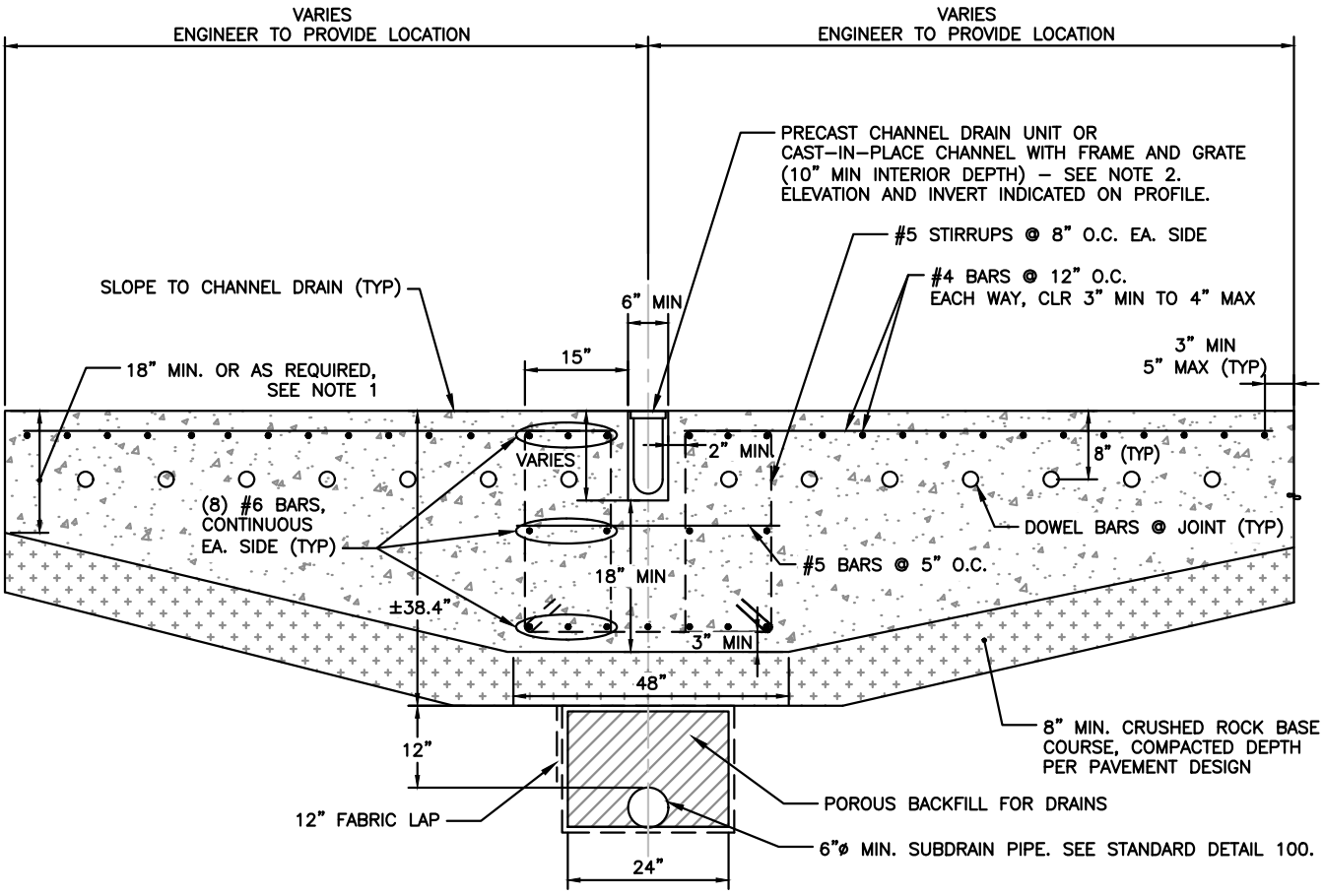
SECTION 1

CHANNEL DRAIN CONNECTION PROFILE 115
SCALE: NTS

NOTES:

1. CATCH BASIN SHALL COLLECT FLOW FROM ONE CHANNEL DRAIN ONLY. ADDITIONAL UPSTREAM DRAINAGE COLLECTION STRUCTURES ARE NOT PERMITTED AT IWS CHANNEL DRAIN CATCH BASIN.
2. SEE STANDARD DETAIL 105 FOR ADDITIONAL IWS LAYOUT REQUIREMENTS.
3. PIPE AND FITTINGS SHOULD BE SIZED TO CONVEY THE DESIGN FLOW.
4. NPP FROM CATCH BASIN TO SUBDRAIN SHALL BE A NON-COMBUSTIBLE MATERIAL.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CHANNEL DRAIN CONNECTION PROFILE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **115**



SECTION

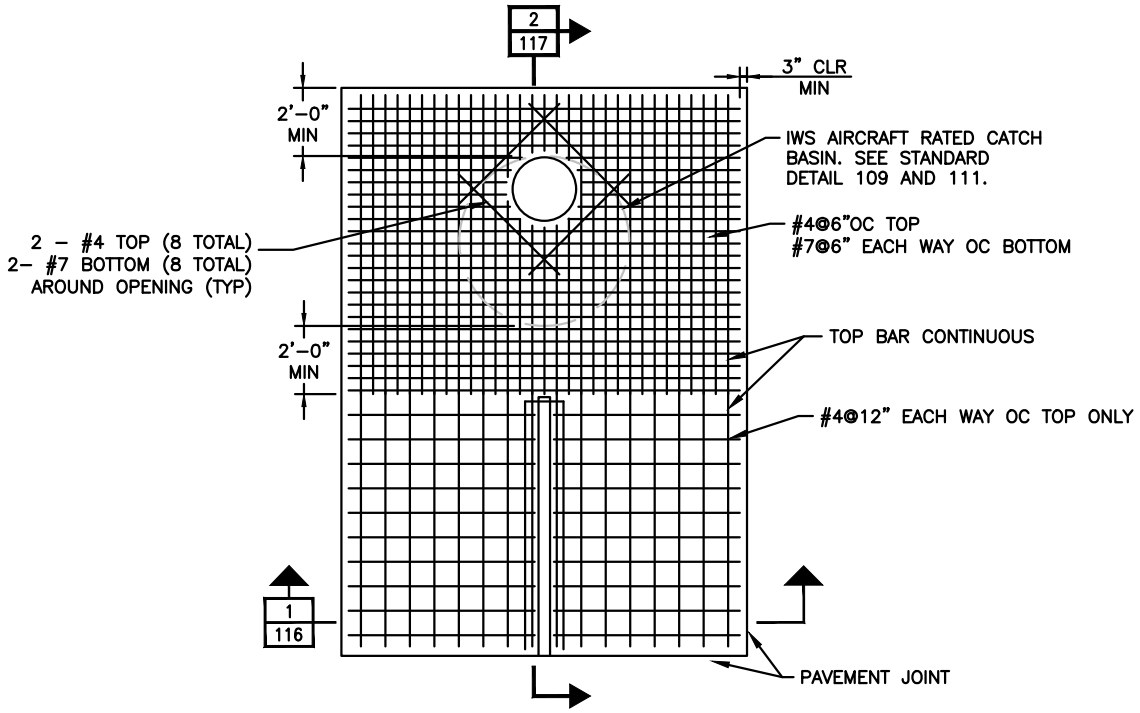
AIRCRAFT RATED CHANNEL DRAIN SECTION IN PCCP
SCALE: NTS

1
116

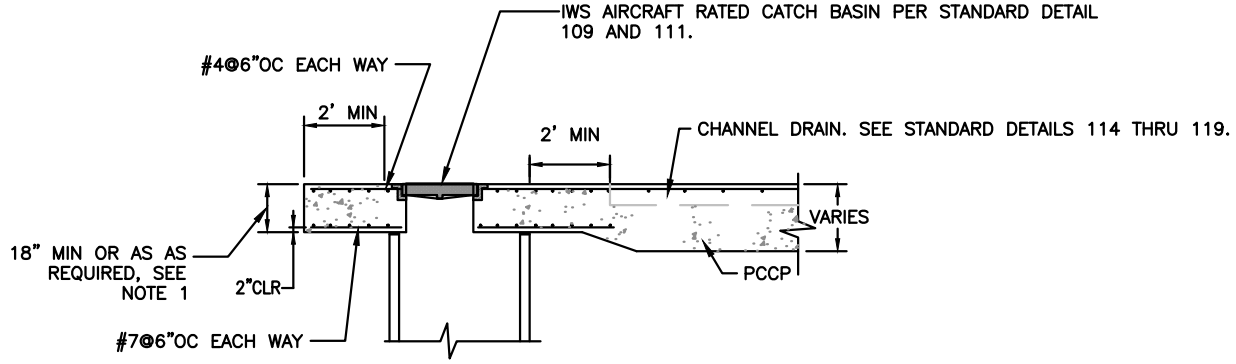
NOTES:

1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MIN. PCC THICKNESS AT PANEL EDGE AND 18" MIN. PCC THICKNESS BELOW CHANNEL DRAIN. PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.
2. PRE–CAST CHANNEL DRAIN UNITS (IF USED), FRAMES AND GRATES WITHIN AOA SHALL BE EN1433 LOAD CLASS F RATED FOR 200 KIPS.
3. REBAR SHOWN IS MINIMUM SIZE AND QUANTITY REQUIRED. STRUCTURAL DESIGN ENGINEER TO REVIEW AND CONFIRM REBAR SIZES AND SPACING ARE ADEQUATE TO SUPPORT SITE CONDITIONS.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	AIRCRAFT RATED CHANNEL DRAIN SECTION IN PCCP
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **116**



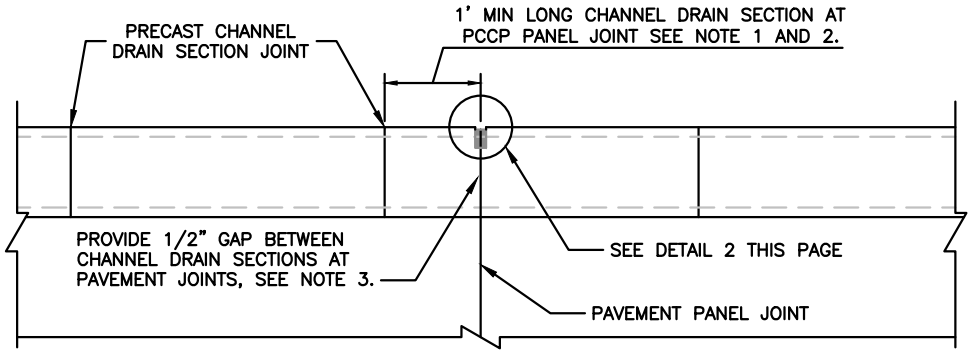
DETAIL 1/117
AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP
SCALE: NTS



SECTION 2/117
AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP
SCALE: NTS

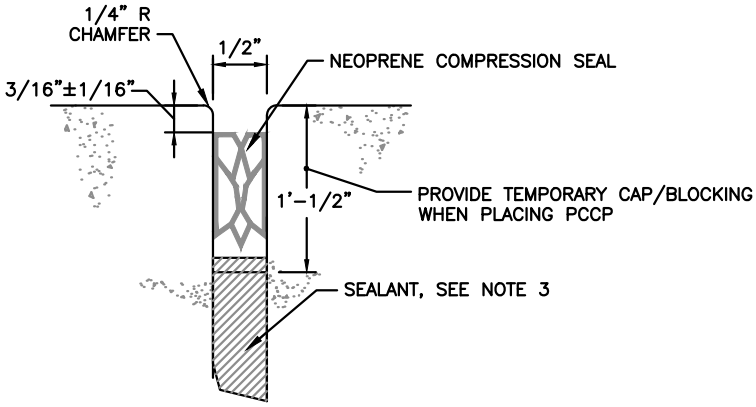
NOTE:
1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MIN. PCC THICKNESS AT PANEL JOINTS. PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP STANDARD DETAIL NO. **117**



SECTION 1/118

CHANNEL DRAIN SYSTEM IN PCCP – SECTION
SCALE: NTS



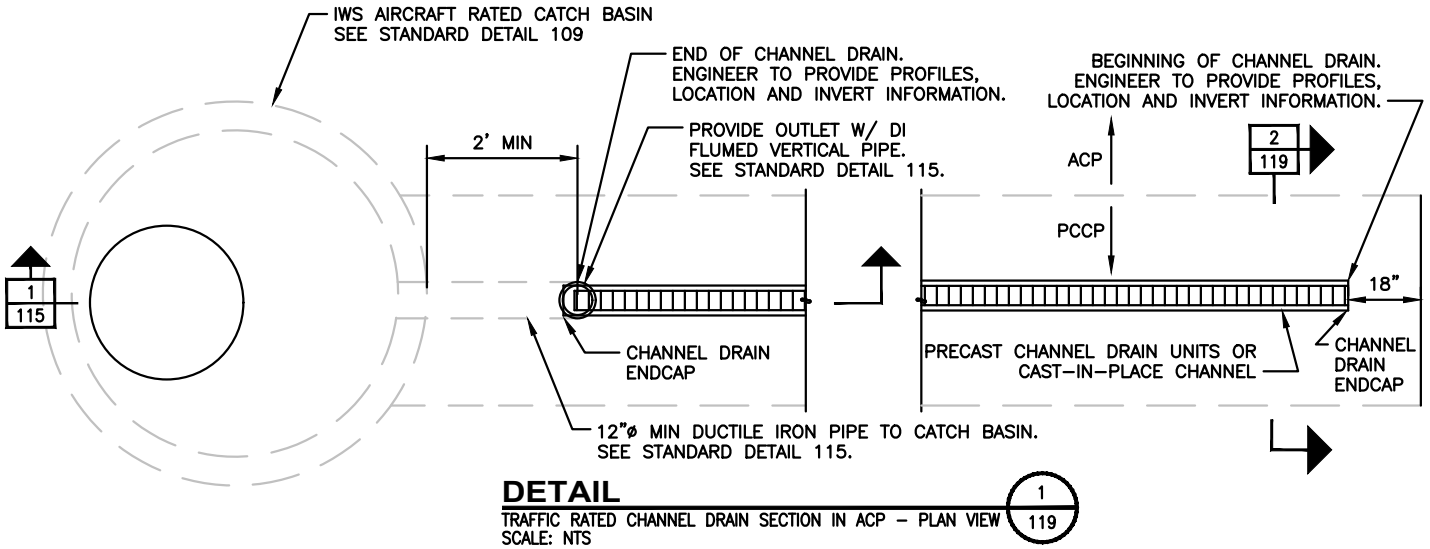
DETAIL 2/118

AIRCRAFT RATED CHANNEL DRAIN JOINT DETAILS
SCALE: NTS

NOTES:

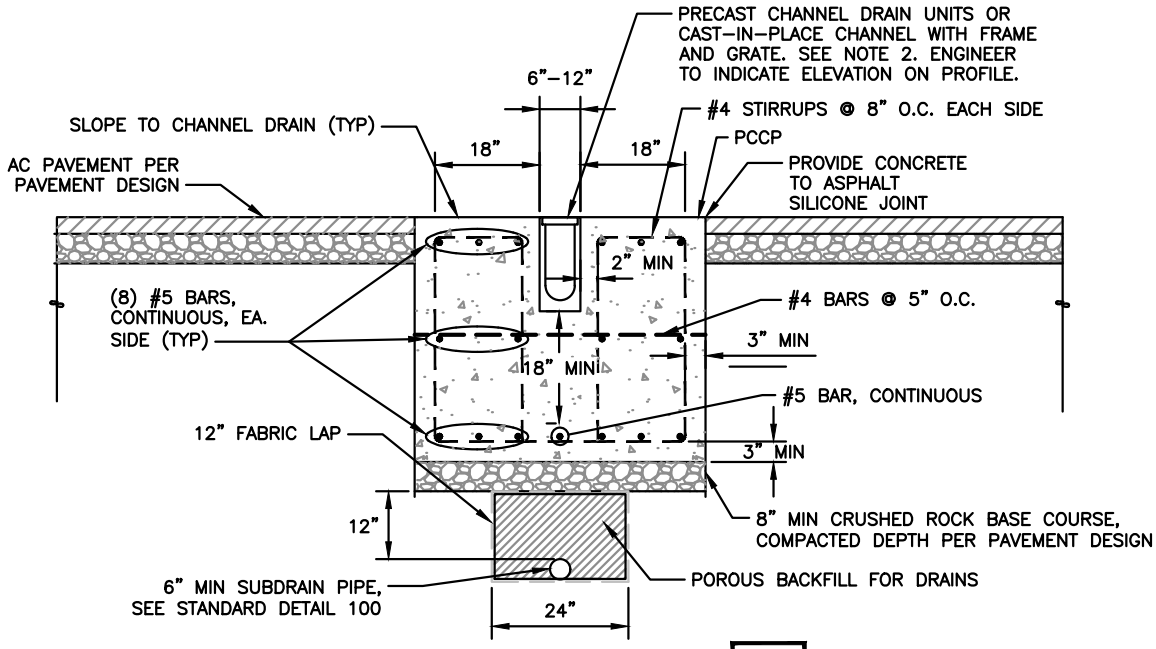
1. IF USING PRECAST CHANNEL DRAIN UNITS, LAYOUT CHANNEL DRAIN SECTION JOINTS SUCH THAT NO CHANNEL DRAIN JOINT IS CLOSER THAN 1' TO THE PAVEMENT JOINT. CUT FRAME AND UNIT AT PANEL JOINT.
2. IF USING CAST–IN–PLACE CHANNEL DRAIN FRAME SYSTEM, FRAME SHALL BE LAID OUT SO THAT WHEN CUT AT PCC PANEL JOINT, A MINIMUM OF 4 CONCRETE FRAME ANCHORS WILL BE INTEGRALLY CAST WITHIN THE SHORTEST LENGTH OF ANY FRAME SECTION. SPACING OF THE FRAME SECTION SHALL ALSO PROVIDE A MINIMUM OF 3" SEPARATION BETWEEN ANCHORS AND NEAREST PCC PANEL JOINT.
3. SEAL GAP WITH LOW MODULUS, 1 COMPONENT, POLYURETHANE BASED, JET FUEL RESISTANT, NON–SAG ELASTOMERIC SEALANT.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	AIRCRAFT RATED CHANNEL DRAIN JOINT DETAILS
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **118**



DETAIL 1/119

TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP – PLAN VIEW
SCALE: NTS



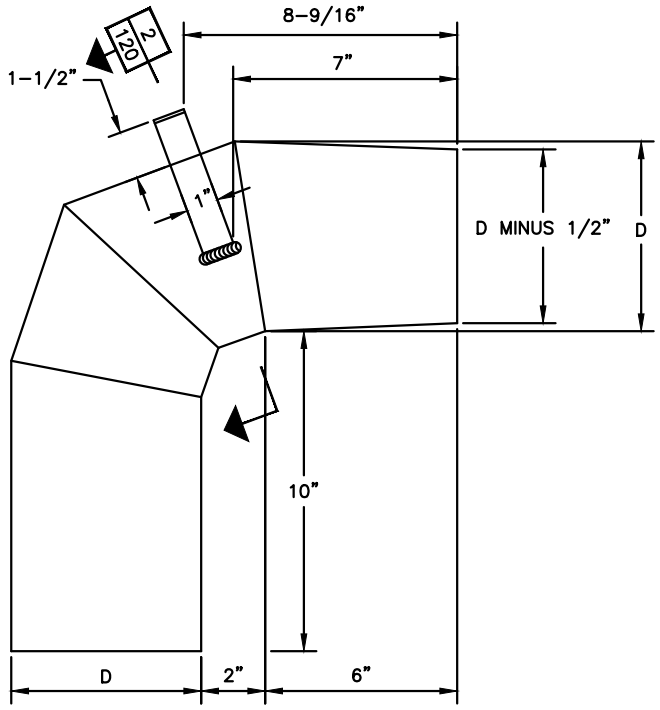
SECTION 2/119

TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP
SCALE: NTS

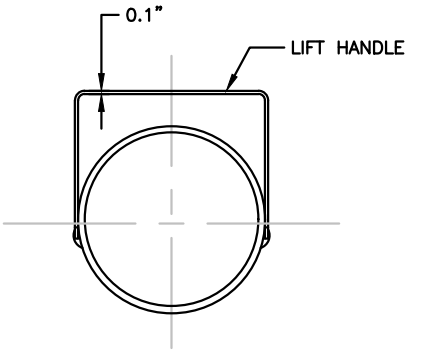
NOTES:

1. REINFORCEMENT SHOWN IS MINIMUM FOR AREAS WITHIN THE AOA, BUT OUTSIDE OF AIRCRAFT MOVEMENT AREA (AMA). PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE VEHICLES UTILIZING THE PAVEMENT. SPECIAL CONSIDERATION SHOULD BE GIVEN TO AREAS INTENDED FOR USE BY CARGO OPERATORS, AIRCRAFT RESCUE FIREFIGHTING EQUIPMENT, AIRLINE GROUND SERVICE EQUIPMENT OR PORT AND AIRCRAFT MAINTENANCE VEHICLES.
2. PRE-CAST CHANNEL DRAIN UNITS (IF USED), FRAMES AND GRATES SHALL BE EN1433 LOAD CLASS E RATED FOR 135 KIPS.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP STANDARD DETAIL NO. **119**



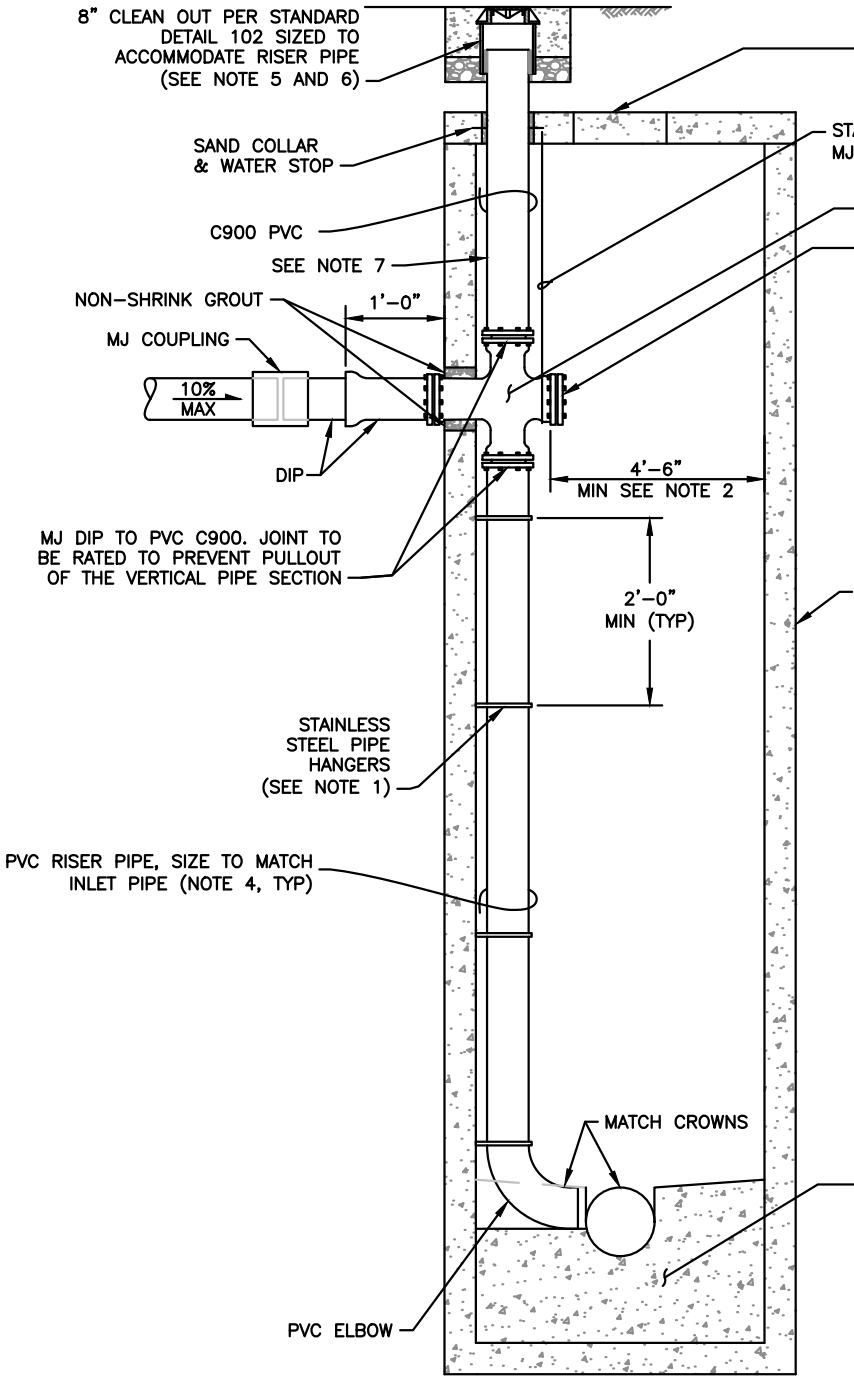
DETAIL 1/120
OPTIONAL ALUMINUM OUTLET TRAP
SCALE: NTS



SECTION 2/120
OPTIONAL ALUMINUM OUTLET TRAP
SCALE: NTS

NOTES:
1. TRAP TO BE MADE OF 16 GA ALUMINUM.
2. ALL JOINTS TO BE SEAMED AND SOLDERED, OR WELDED.
3. ALL LONGITUDINAL JOINTS TO BE RIVETED OR WELDED.
4. DIAMETER "D" IS NOMINAL DIAMETER OF OUTLET PIPE.
5. LIFT HANDLE SHALL BE WELDED TO OUTSIDE OF TRAP (1" WIDE X 0.1" THICK).
6. TRAP IS NOT A SUBSTITUTE FOR GASKETED DUCTILE IRON VAPOR TRAP REQUIRED ON IWS CATCH BASINS DRAINING INLET PIPES FROM BUILDINGS, PER STANDARD DETAIL 107.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	ALUMINUM OUTLET TRAP
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **120**



DETAIL

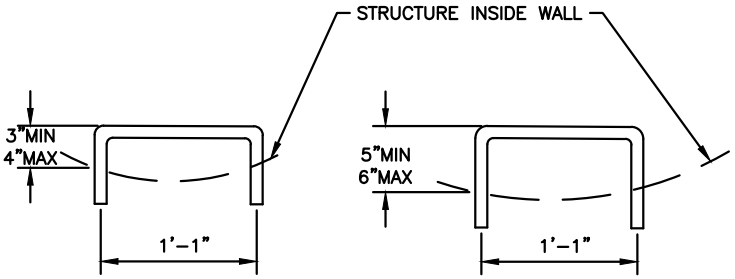
INSIDE DROP CONNECTION
(18" DIAMETER PIPE MAXIMUM)
SCALE: NTS

1
121

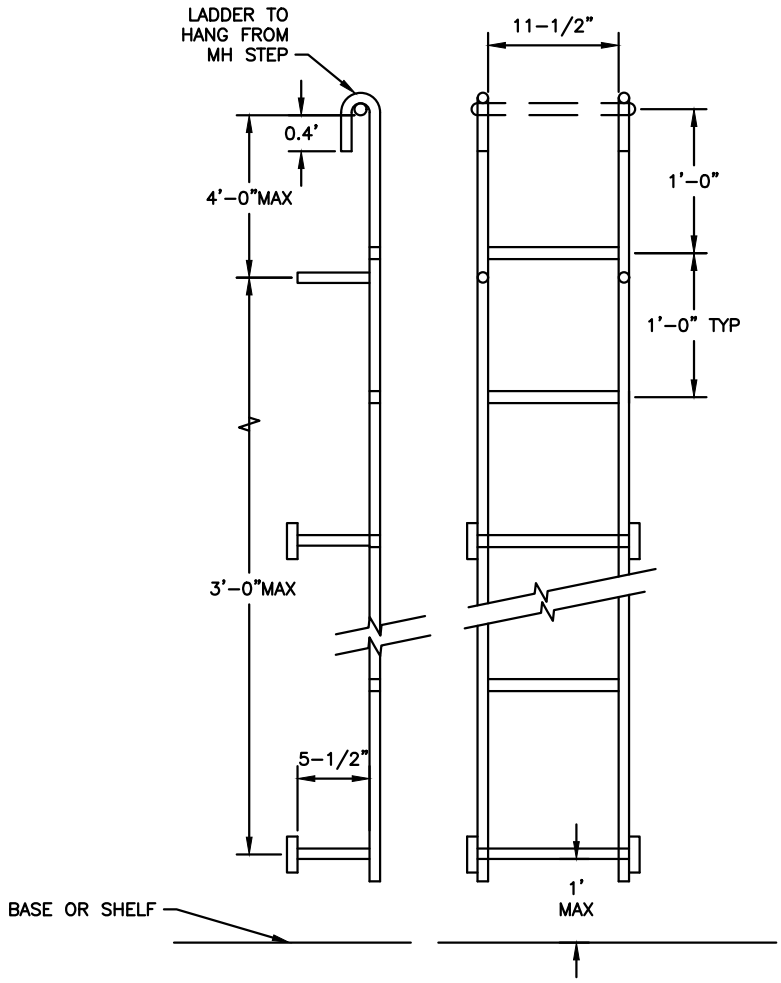
NOTES:

1. PROVIDE PIPE MANUFACTURER RECOMMENDATION FOR PIPE HANGER AND CONCRETE ANCHORAGE TO F&I FOR APPROVAL.
2. SIZE MH TO MEET MINIMUM INSIDE CLEARANCE.
3. DUCTILE IRON PIPE SHALL BE PER SPECIFICATION 334216.
4. PVC PIPE & ELBOW MUST BE C900 PVC.
5. CLEAN-OUT MUST BE LOCATED AS APPROVED BY F&I.
6. 2-FT MINIMUM HORIZONTAL SPACING BETWEEN CLEAN OUT AND MANHOLE COVER.
7. IF SEWER PIPE IS GREATER THAN 8" DIA., AN MJ X MJ ECCENTRIC REDUCER CAN BE USED.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	INSIDE DROP CONNECTION STANDARD DETAIL NO. **121**



HANDHOLD STEP

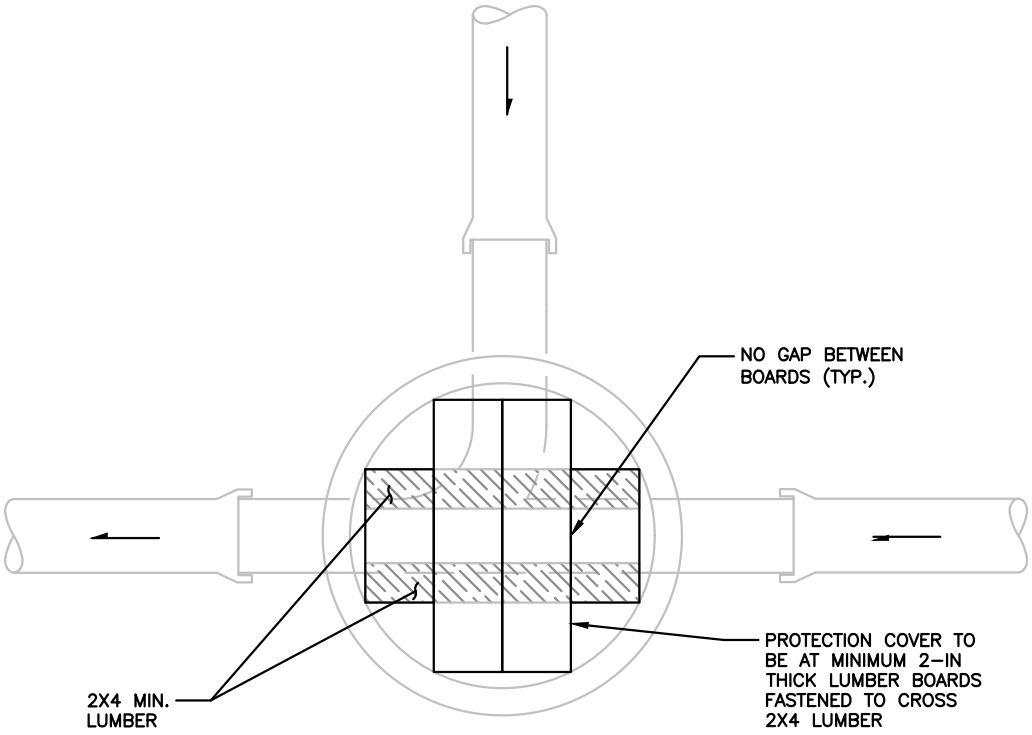


LADDER

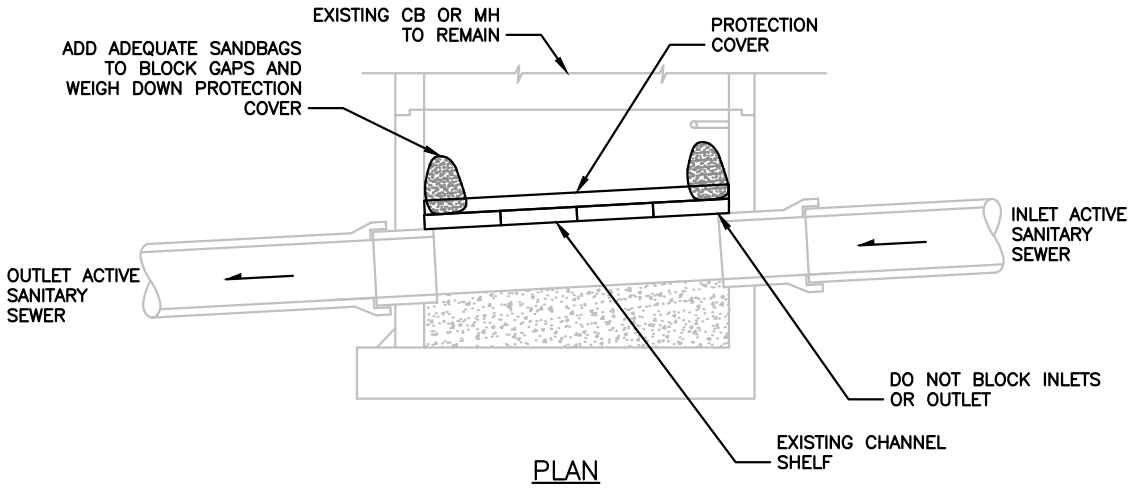
DETAIL 1/122
MANHOLE LADDER, STEP AND HANDHOLD
SCALE: NTS

NOTES:
1. MATERIAL – STEEL REINFORCED POLYPROPYLENE
2. DIMENSIONS FOR THE MH LADDER AND STEP ARE MINIMUM REQUIREMENTS ONLY.
3. WHEN THE DISTANCE FROM THE LAST (HIGHEST) STEP OR HANDHOLD TO THE TOP OF THE MH FRAME EXCEEDS 1'–6", A HANDHOLD MUST BE INSTALLED MID–WAY IN THE LEVELING BRICK OR COLLAR.
4. EITHER STEPS, LADDERS OR A COMBINATION OF THE TWO CAN BE USED. IF BOTH STEPS AND LADDERS ARE USED IN ANY MH, THEY MUST BE FROM THE SAME MANUFACTURER.
5. A VERTICAL HANDHOLD MUST BE INSTALLED 4'–0" ABOVE THE SHELF WHEN INDICATED IN MH PLAN VIEW.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	MANHOLE LADDER, STEP AND HANDHOLD
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **122**



SECTION 1
MINIMAL PROTECTION OF ACTIVE SANITARY SEWER 123
SCALE: NTS

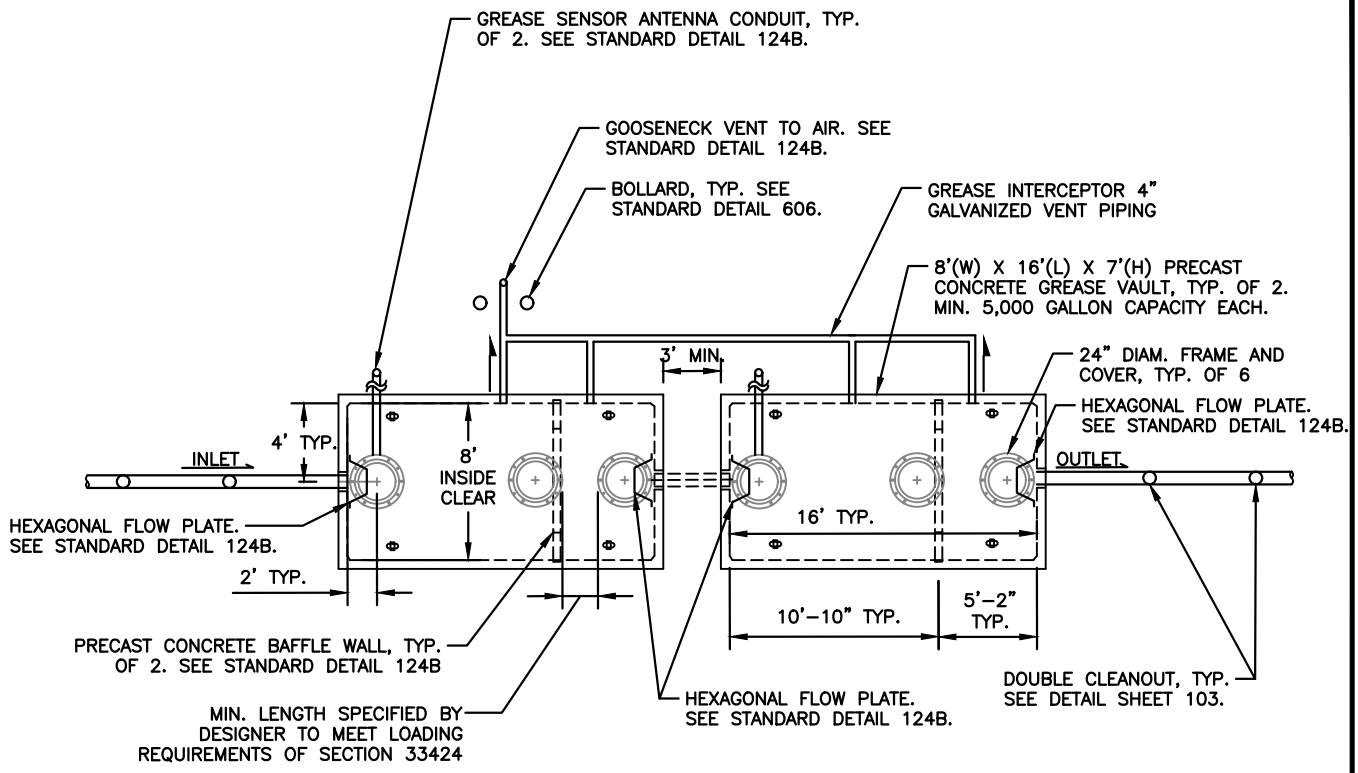


PLAN

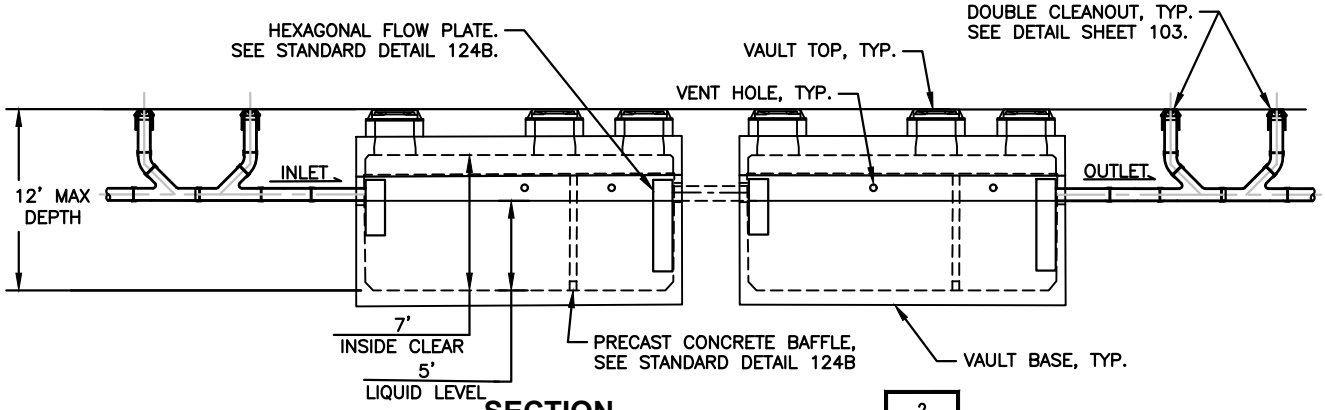
DETAIL 2
MINIMAL PROTECTION OF ACTIVE SANITARY SEWER 123
SCALE: NTS

NOTES:
1. CONTRACTOR SHALL PREVENT ALL CONSTRUCTION DEBRIS, ROCKS, CONCRETE, ETC. FROM ENTERING AN ACTIVE SANITARY SEWER.
2. THIS DETAIL SHOWS THE MINIMAL AMOUNT OF PROTECTION. THE CONTRACTOR SHALL MODIFY THE DETAIL AS NEEDED TO PROTECT ACTIVE SEWERS.
3. PRIOR COMPLETION OF THE PROJECT AND WITH THE ENGINEER'S PERMISSION CONTRACTOR SHALL REMOVE THE PROTECTION COVER WITHOUT ANY DEBRIS ENTERING THE ACTIVE SEWER.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	MINIMAL PROTECTION OF ACTIVE SANITARY SEWER
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **123**



DETAIL 1 / 124A
GREASE INTERCEPTOR
SCALE: NTS

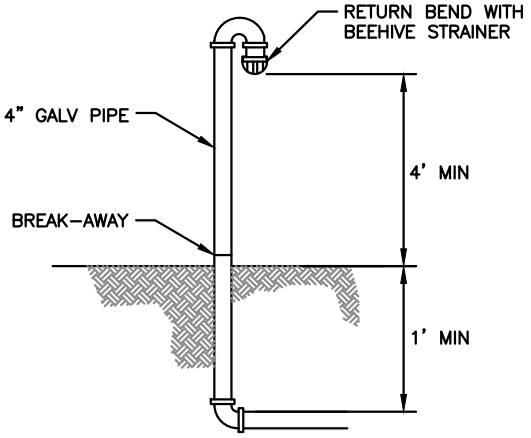


SECTION 2 / 124A
GREASE INTERCEPTOR
SCALE: NTS

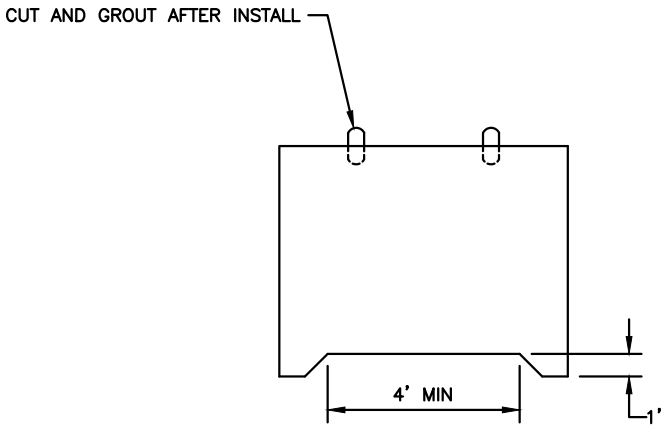
NOTES:

1. GREASE INTERCEPTOR LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
2. GRAY WATER ONLY SHALL ENTER THE GREASE INTERCEPTOR. BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
3. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT "SEWER" LETTERING ON COVER,
   b. WITHIN THE AOA FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. OUTSIDE THE AOA, FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF HS-25 LOADING.
   d. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   e. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
4. DETAIL ABOVE IS FOR MINIMUM GREASE INTERCEPTOR SIZING. VAULT SHALL BE UP-SIZED AS NEEDED TO ACCOMMODATE CALCULATED FLOWS.
5. VAULT
   a. WITHIN THE AOA, THE VAULT SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B – DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
   b. OUTSIDE THE AOA, THE VAULT SHALL BE DESIGNED FOR HS-25 LOADING
6. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
7. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
8. ALL RINGS AND COVERS SHALL BE AIR AND GAS TIGHT BOLT-LOCKING (TYP), RATED PER SECTION 334241.
9. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.

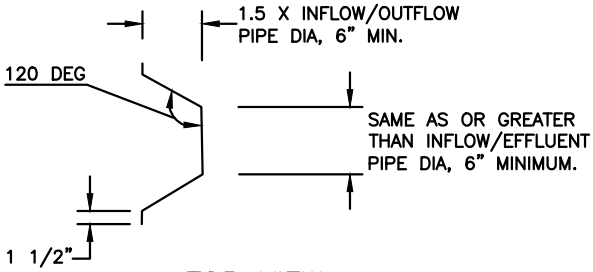
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	GREASE INTERCEPTOR
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **124A**



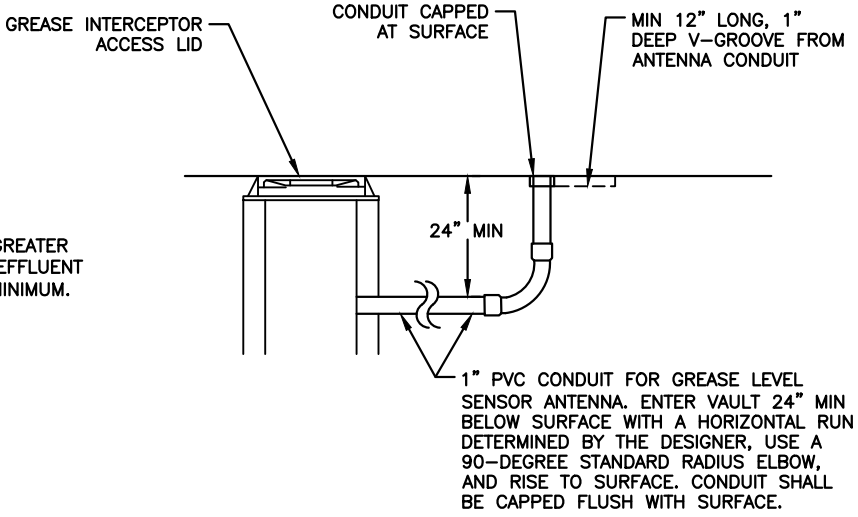
DETAIL 1 / 124B
GOOSENECK VENT
SCALE: NTS



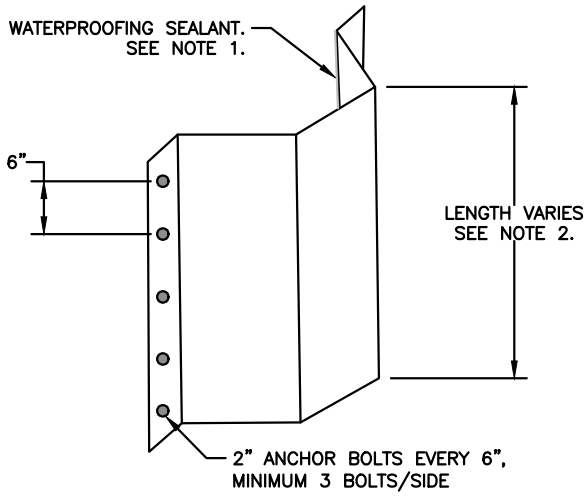
DETAIL 2 / 124B
PRECAST CONCRETE BAFFLE
SCALE: NTS



TOP VIEW



DETAIL 4 / 124B
GREASE SENSOR ANTENNA CONDUIT
SCALE: NTS



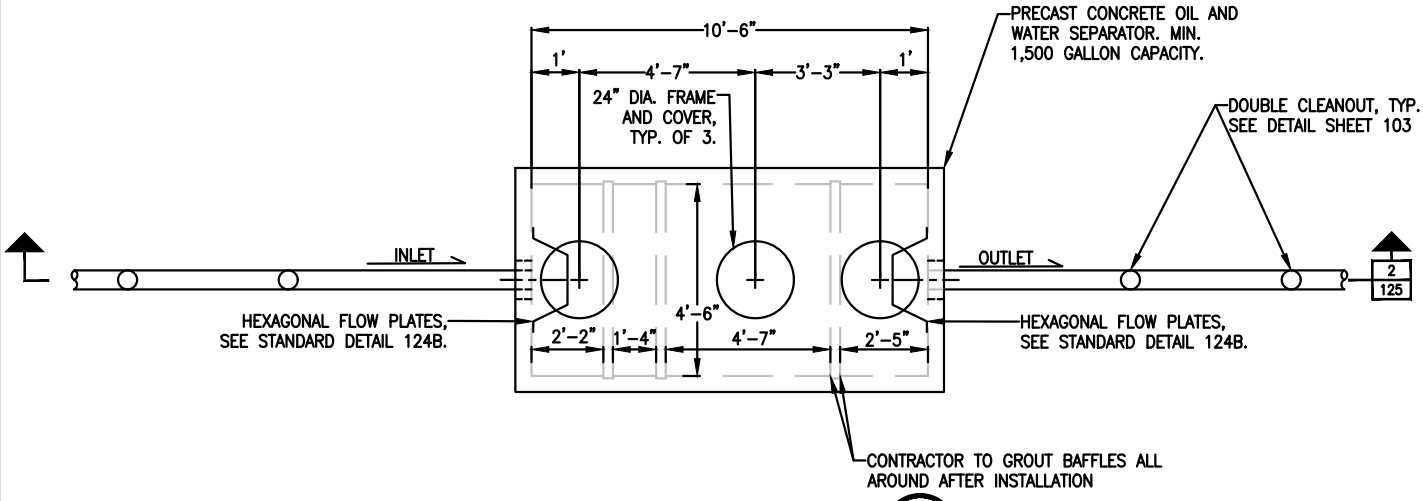
ISOMETRIC VIEW

DETAIL 3 / 124B
HEXAGONAL FLOW PLATE
SCALE: NTS

NOTES:

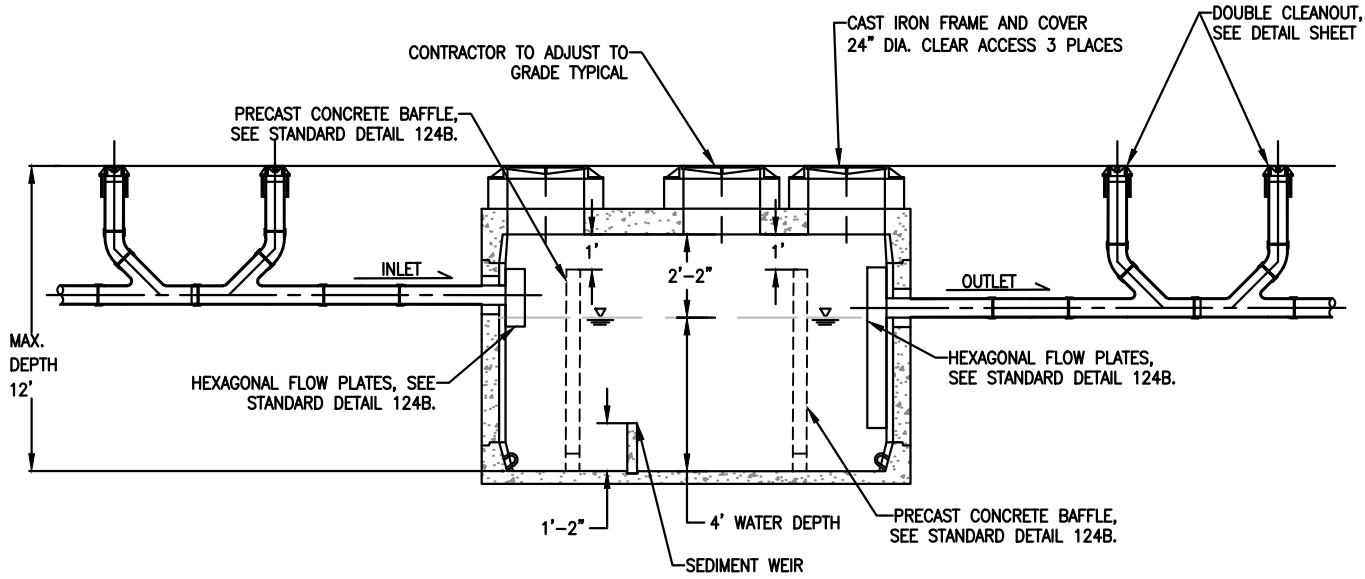
1. HEXAGONAL PLATE LINED WITH POLYURETHANE WATERPROOFING SEALANT WHERE CONTACTING GREASE INTERCEPTOR WALL.
2. FOR INFLOW PLATE, HEXAGONAL PLATE SHALL DROP 1' BELOW INFLOW PIPE'S IE. OUTFLOW HEXAGONAL PLATES SHALL DROP TO 1' ABOVE GREASE INTERCEPTOR BOTTOM. ALL PLATES SHALL RISE 6" MINIMUM ABOVE LIQUID LEVEL, OR ONE PIPE DIAMETER ABOVE TOP OF FLOW PIPES, WHICHEVER IS GREATER.
3. HEXAGONAL FLOW PLATE MADE OF 5MM MIN AUSTENITIC STAINLESS STEEL.
4. ANCHOR BOLTS MADE OF AUSTENITIC STAINLESS STEEL.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	GREASE INTERCEPTOR (DETAILS)
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **124B**



PLAN
OIL AND WATER SEPARATOR
SCALE: NTS

1
125



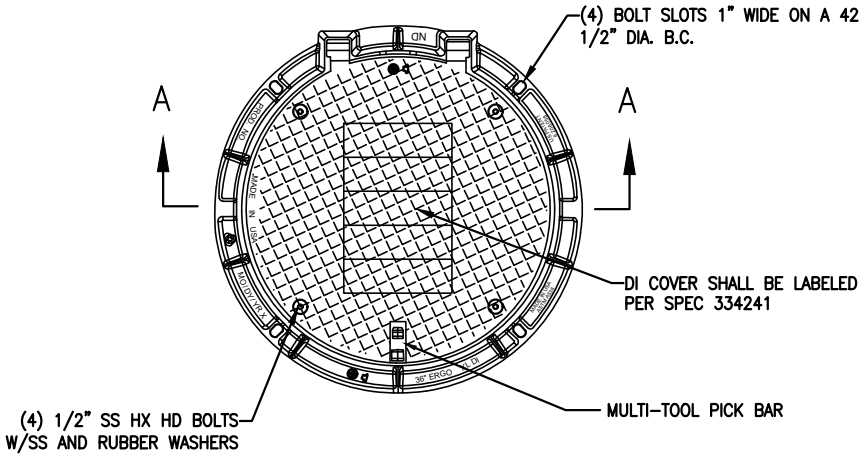
SECTION
OIL AND WATER SEPARATOR
SCALE: NTS

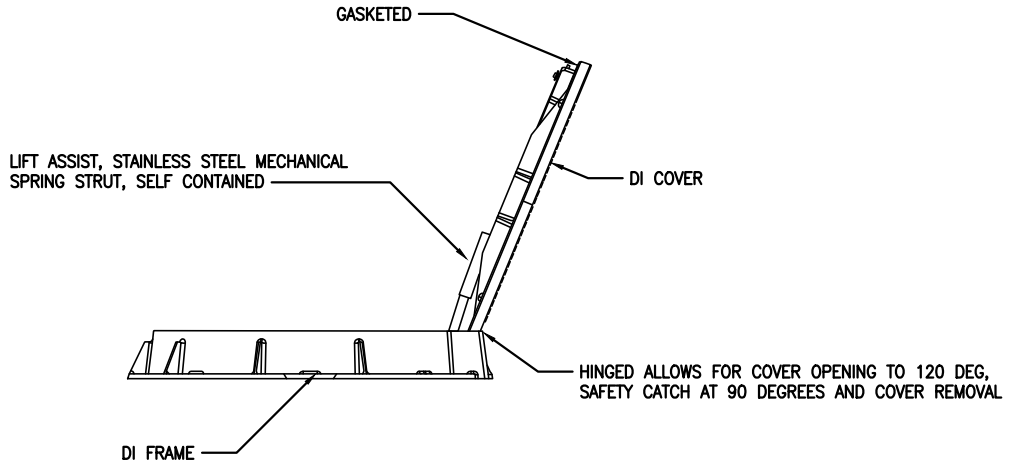
2
125

NOTES:

1. VAULT LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
2. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT "SEWER" LETTERING ON COVER.
   b. WITHIN THE AOA FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. OUTSIDE THE AOA, FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF HS-25 LOADING.
   d. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   e. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
3. VAULT
   a. WITHIN THE AOA, THE VAULT SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B – DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
   b. OUTSIDE THE AOA, THE VAULT SHALL BE DESIGNED FOR HS-25 LOADING
4. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
5. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
6. ALL RINGS AND COVERS SHALL BE AIR AND GAS TIGHT BOLT-LOCKING (TYP), RATED PER SECTION 334241.
7. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
8. DETAIL ABOVE IS FOR MINIMUM OIL AND WATER SEPARATOR SIZING. VAULT SHALL BE UP-SIZED AS NEEDED TO ACCOMMODATE CALCULATED FLOWS.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	OIL AND WATER SEPARATOR STANDARD DETAIL NO. **125**

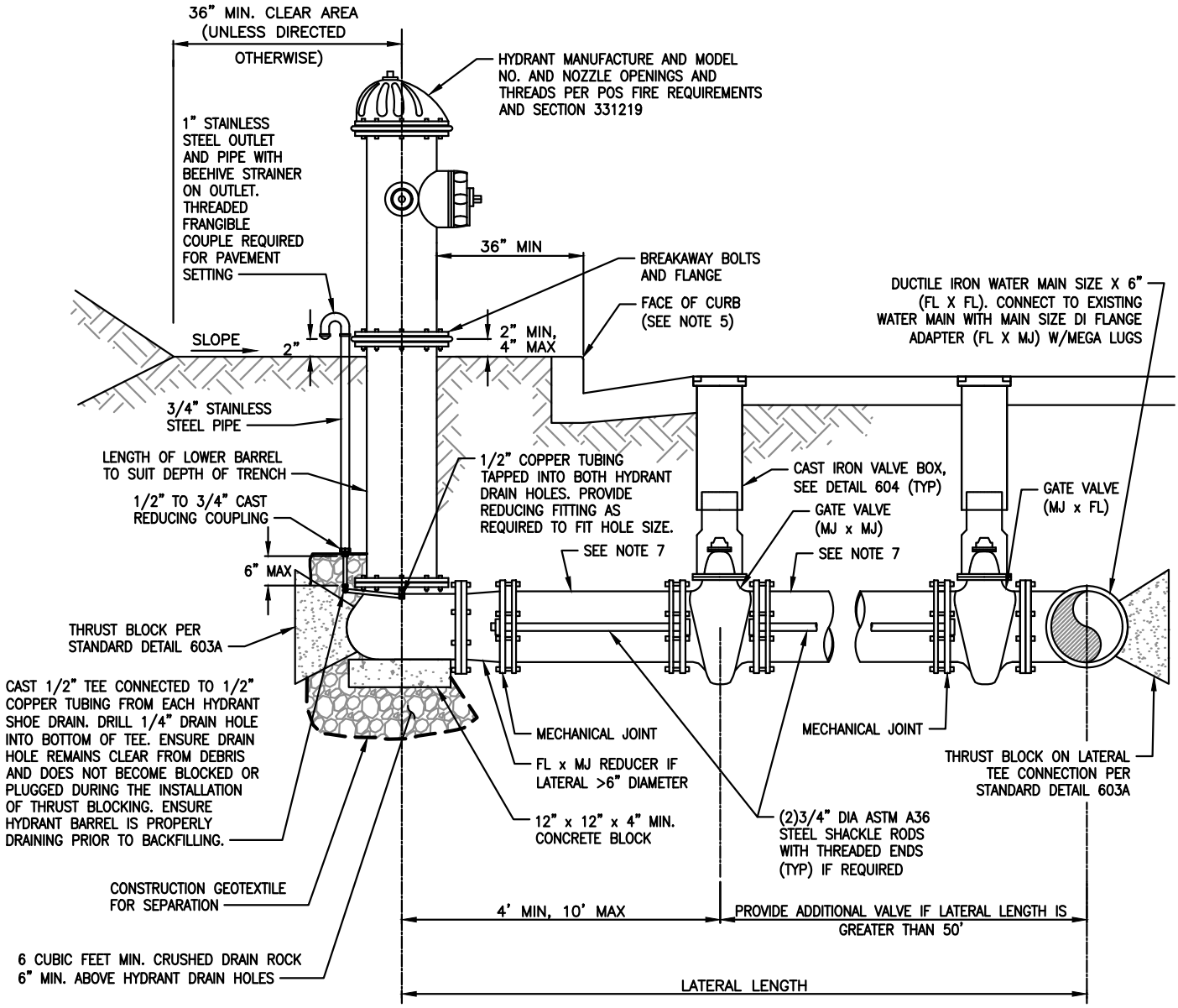




DETAIL 1/126
LID ASSIST DEVICE
SCALE: NTS

NOTES:
1. METAL CASTINGS SHOULD MEET THE REQUIREMENTS IN SPEC SECTION 334241.
2. STRUCTURES WITH COVERS 30" OR LARGER SHALL USE A LID LIFT-ASSIST DEVICE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	MH COVER LIFT ASSIST DEVICE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **126**

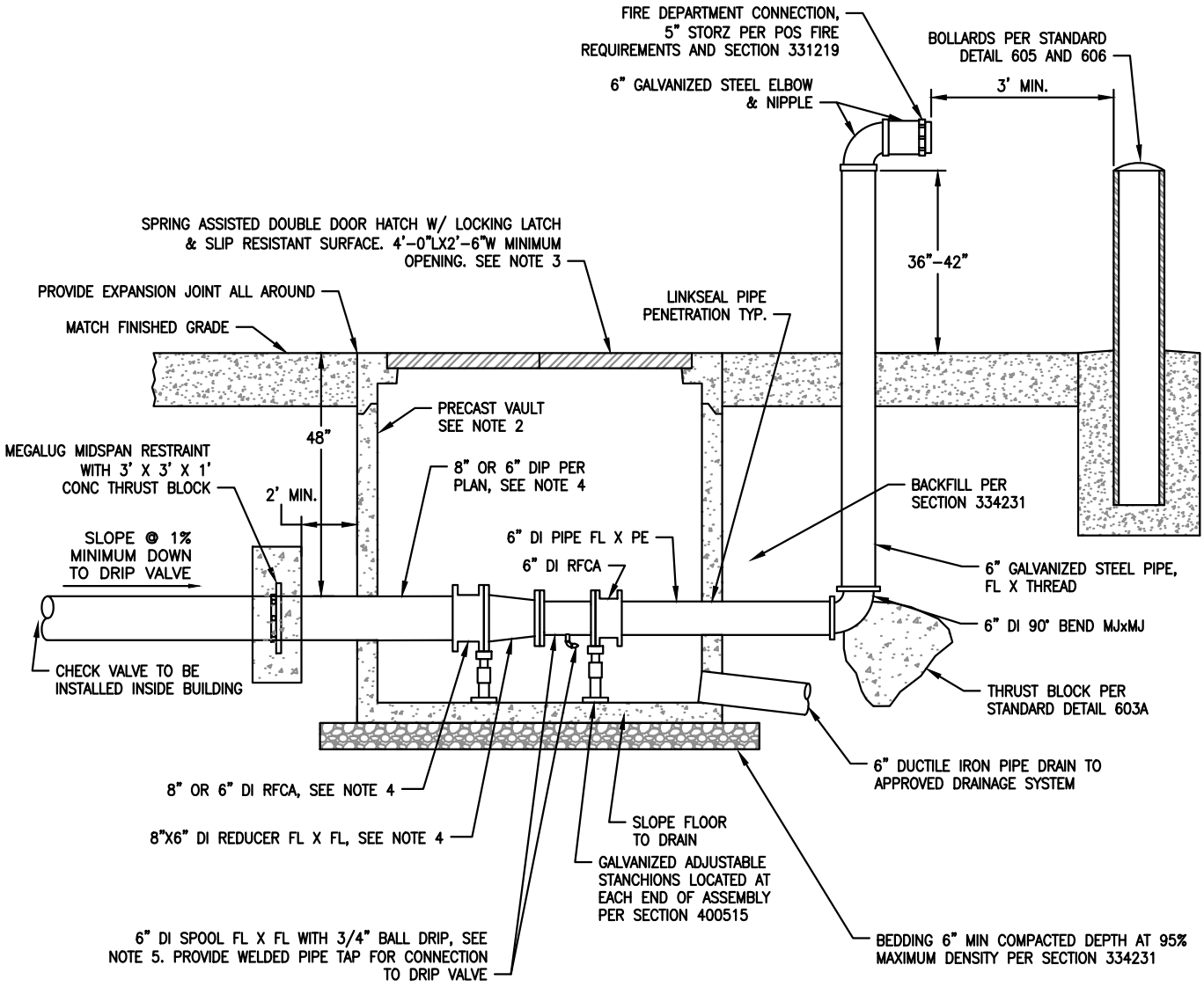


DETAIL 1/600
FIRE HYDRANT
SCALE: NTS

NOTES:

1. FIRE HYDRANT SHALL BE PAINTED RED WITH REFLECTORIZED SILVER TOP, SEE SECTION 331219, FIRE HYDRANTS.
2. ALL JOINTS SHALL BE RESTRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT OR APPROVED EQUAL.
3. AFTER INSTALLATION, ALL SHACKLE RODS, COPPER TUBING AND MECHANICAL JOINT GLANDS SHALL BE CLEANED AND COATED WITH TWO COATS OF ROYSTON R28 ASPHALT MASTIC.
4. SURFACE OF GROUND WITHIN 36" OF HYDRANT SHALL BE SMOOTH.
5. HYDRANTS NOT LOCATED ALONG ROAD WITH CURB LINE SHALL BE PROVIDED WITH BOLLARDS PER STD DETAIL 605 AND 606 AND AS APPROVED BY F&I.
6. SHACKLE RODS CAN BE UTILIZED IN LIEU OF THRUST BLOCK AT HYDRANT WITH POS FD APPROVAL.
7. IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. IF LATERAL IS >50' THEN PIPE SIZE SHALL BE 8" MIN.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	FIRE HYDRANT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **600**



DETAIL 1/601

REMOTE FDC & VAULT ASSEMBLY
SCALE: NTS

NOTES:

1. ALL PIPE OPENINGS IN VAULT WALLS SHALL BE FILLED WITH NON-SHRINK GROUT.

2. PRECAST UTILITY VAULT AND LID:
   A. VAULTS LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE PRECAST AND DESIGNED FOR FAA LOADS AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION).
   B. VAULTS NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR THE VAULT SHALL BE STAMPED BY A LICENSED PROFESSIONAL STRUCTURAL ENGINEER AND SUBMITTED TO F&I FOR APPROVAL PRIOR TO FABRICATION.

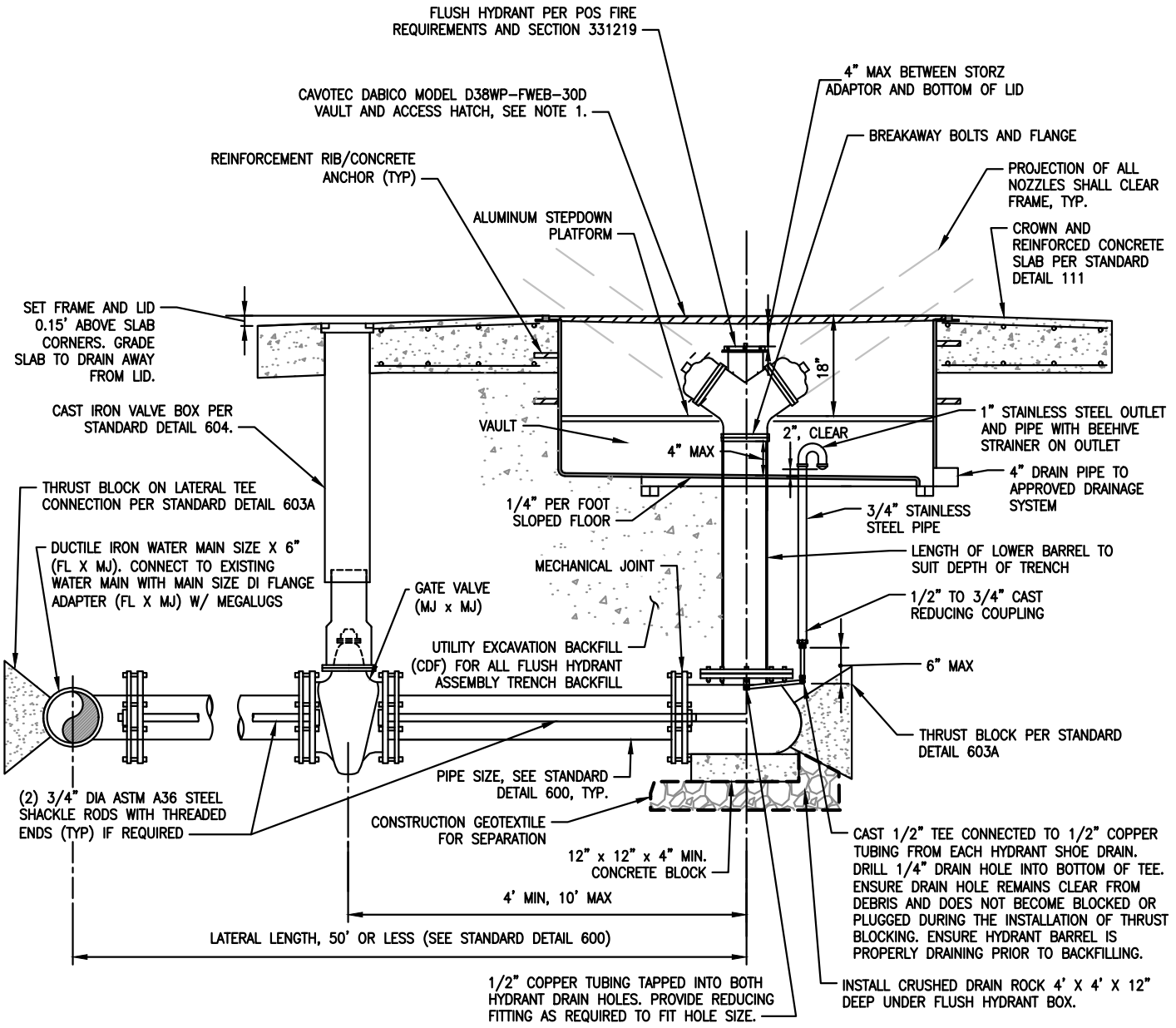
3. HATCHES FOR VAULTS:
   A. HATCHES LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE LOCKING, AIRCRAFT RATED AND DESIGNED TO SUPPORT A MINIMUM 100,000 LB WHEEL LOAD WITH 250 PSI TIRE PRESSURE.
   B. HATCHES NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. HATCH SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED TO POS F&I FOR APPROVAL PRIOR TO FABRICATION.

4. PROVIDE GALVANIZED PIPE AND FITTINGS AS INDICATED IN DETAIL. ABOVE GROUND PIPING/FITTINGS AND PIPING/FITTINGS EXPOSED IN VAULT THAT IS GALVANIZED SHALL BE PAINTED RED.

5. REMOTE FDC PIPE RUN SHALL BE SIZED AS SHOWN ON PLANS. FOR 6" FDC PIPE RUN, REDUCER IS NOT REQUIRED AND MJ X FL ADAPTER SHALL BE INSTALLED ADJACENT TO GALVANIZED COUPLING.

6. 3/4" AUTOMATIC BALL DRIP SHALL HAVE A MIMINUM WORKING PRESSURE OF 250 PSI. VALVE SHALL OPEN UNDER A MINIMUM PRESSURE OF 10 PSI. ELEVATION DIFFERENCE BETWEEN BALL DRIP AND TOP OF FDC OR SPRINKLER ROOM CHECK VALVE (WHICHEVER IS HIGHER) SHALL NOT EXCEED 10'.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	REMOTE FDC & VAULT ASSEMBLY
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **601**



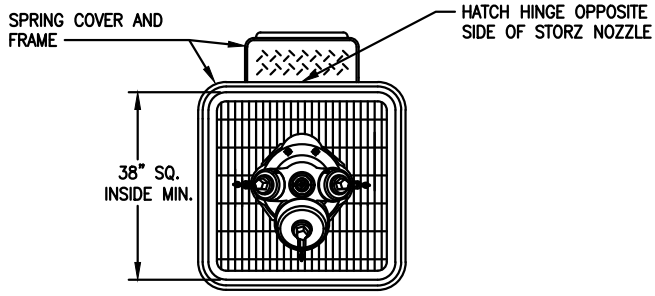
DETAIL 1 / 602A

FLUSH HYDRANT ASSEMBLY AND VAULT
SCALE: NTS

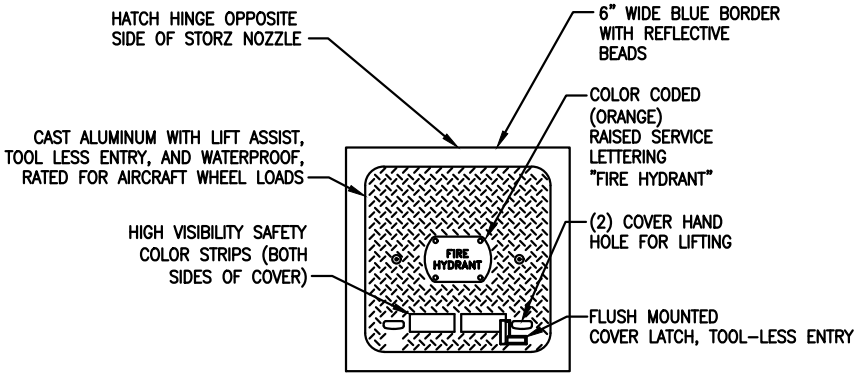
NOTES:

1. VAULT AND HATCH LOCATED IN RAMP AIR OPERATIONS AREA (AOA) SHALL BE AIRCRAFT RATED AND DESIGNED TO SUPPORT A MINIMUM OF 200,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE. HATCH SHALL BE WATERPROOF, LIFT ASSISTED, AND TOOL LESS ENTRY. HATCH AND VAULT SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
2. ALL JOINTS SHALL BE RESTRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT, EBAA IRON MEGALUG, ROMAC ROMAGRIP, STAR PIPE PRODUCTS STARGRIP, OR APPROVED EQUAL.
3. AFTER INSTALLATION, ALL SHACKLE RODS, COPPER TUBING AND MECHANICAL JOINT GLANDS SHALL BE CLEANED AND COATED WITH MIN. TWO 20-MM COATS OF COLD-APPLIED RUBBERIZED ASPHALT MASTIC COATING SUITABLE FOR CORROSION RESISTANCE OF METAL MECHANICAL FITTINGS. (ROYSTON ROSKOTE MASTIC R28).
4. SHACKLE RODS CAN BE UTILIZED IN LIEU OF THRUST BLOCKS WITH POS FD APPROVAL.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	FLUSH FIRE HYDRANT ASSEMBLY
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **602A**



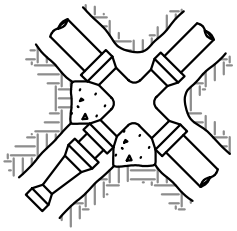
DETAIL 1 / 602B
VAULT ACCESS PIT ASSEMBLY
COVER REMOVED
SCALE: NTS



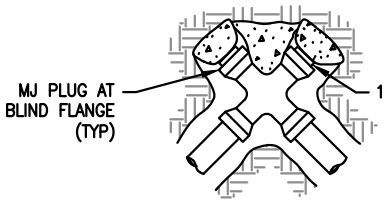
DETAIL 2 / 602B
TORSION ACTUATED WATERPROOF COVER
SCALE: NTS

SEE NOTES ON SHEET 602A.

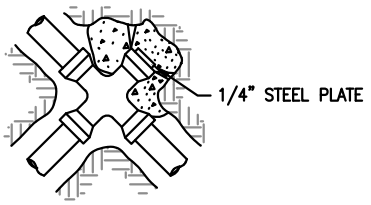
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	FLUSH FIRE HYDRANT VAULT AND HATCH DETAIL
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **602B**



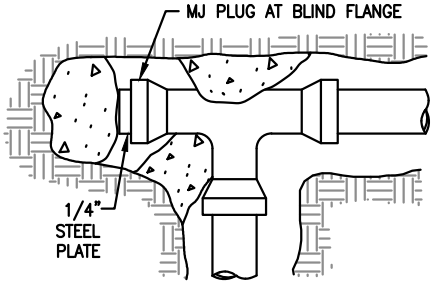
UNBALANCED CROSS
(USE COLUMN A)



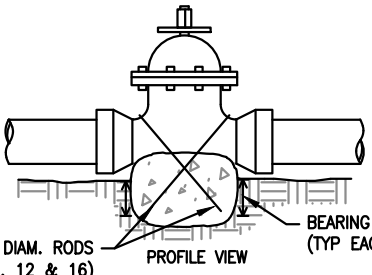
PLUGGED CROSS
(USE COLUMN B)



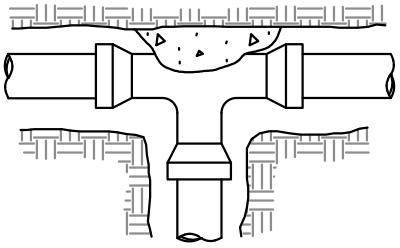
PLUGGED CROSS
(USE COLUMN A)



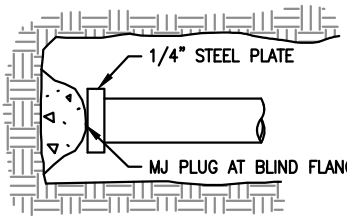
PLUGGED TEE
(USE COLUMN B)



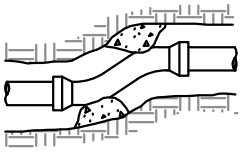
PROFILE VIEW
CUT-IN VALVE
(USE COLUMN A)



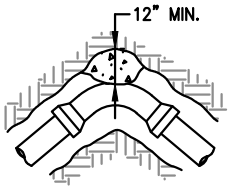
TEE
(SEE NOTE 15)



DEAD END



OFFSET
(USE COLUMNS B~E)



BEND

SOIL TYPE	SAFE BEARING LOAD (PSF)
MUCK, PEAT, ETC.	0
SOFT CLAY	1000
SAND	2000
SAND AND GRAVEL	3000
SAND AND GRAVEL CEMENTED W/CLAY	4000
HARD SHALE	10000

TABLE 1 THRUST BLOCK REQUIREMENTS–HORIZONTAL BEARING

	A		B		C		D		E	
PIPE SIZE (INCHES)	CUT–IN VALVE, TEES AND DEAD ENDS THRUST (IN LBS)	SF*	90 DEGREE BEND THRUST (IN LBS)	SF*	45 DEGREE BEND THRUST (IN LBS)	SF*	22–1/2 DEGREE BEND THRUST (IN LBS)	SF*	11–1/4 DEGREE BEND THRUST (IN LBS)	SF*
4	4,525	3.4	6,398	4.8	3,463	2.6	1,765	1.3	888	0.7
6	9,348	7.0	13,220	9.9	7,155	5.4	3,648	2.7	1,833	1.4
8	16,083	12.1	22,743	17.1	12,308	9.2	6,275	4.7	3,153	2.4
10	24,193	18.1	34,213	25.7	18,515	13.9	9,440	7.1	4,743	3.6
12	34,213	25.7	48,383	36.3	26,185	19.6	13,350	10.0	6,708	5.0
16	59,448	44.6	84,070	63.1	45,498	34.1	23,195	17.4	11,653	8.7

*MINIMUM BEARING AREA AGAINST UNDISTURBED SOIL (BASED ON SAFE SOIL BEARING OF 2000 PSF)

1. BEARING AREA OF CONCRETE THRUST BLOCKS SHOWN IN TABLE 1 BASED ON 250 PSI PRESSURE AND SAFE SOIL BEARING LOAD OF 2,000 POUNDS PER SQUARE FOOT.
2. BEARING AREAS SHALL BE ADJUSTED FOR OTHER PIPE SIZES, SOIL CONDITIONS AND PRESSURES, WITH SOIL BEARING PRESSURE DETERMINED BY A LICENSED GEOTECHNICAL ENGINEER. DIVIDE THRUST BY SAFE BEARING LOAD TO DETERMINE REQUIRED AREA (IN SQUARE FEET) OF CONCRETE TO DISTRIBUTE LOAD. LOCATION AND SIZE OF BLOCKING FOR PIPE LARGER THAN 16" DIAMETER AND FOR PRESSURE AND SOIL TYPES DIFFERENT THAN SHOWN SHALL BE DETERMINED BY THE ENGINEER.
3. SIZE OF THRUST BLOCKS TO BE PER NFPA 24 AND USE A SAFETY FACTOR OF 1.5.
4. CONCRETE BLOCKING (CLASS 3000) SHALL BE CAST IN PLACE AGAINST UNDISTURBED NATIVE EARTH.
5. CONCRETE THRUST BLOCK AREAS SHALL BE CENTERED ON PIPE.
6. CONCRETE BLOCKING SHALL BEAR AGAINST FITTINGS ONLY AND SHALL BEAR AGAINST THE GREATEST FITTING SURFACE AREA POSSIBLE, BUT SHALL BE CLEAR OF JOINTS TO PERMIT TAKING UP OR DISMANTLING OF JOINT.
7. CONTRACTOR SHALL INSTALL BLOCKING ADEQUATE TO WITHSTAND FULL TEST PRESSURE UNDER ALL CONDITIONS OF SERVICE.
8. PLACE SHEET PLASTIC OVER NUTS AND BOLTS PRIOR TO CONCRETE POUR USING 8–MIL POLYETHYLENE PER AWWA C 105.
9. ALL POURED THRUST BLOCKS SHALL BE BACKFILLED AFTER MIN. 1 DAY. PRESSURE TESTING SHALL OCCUR AFTER CONCRETE HAS REACHED NOMINAL COMPRESSIVE STRENGTH.
10. WHERE POURED–IN–PLACE BLOCKING IS REQUIRED AT A POINT OF CONNECTION TO AN EXISTING WATERMAIN, THE BLOCKING SHALL BE INSTALLED PRIOR TO CONNECTION.
11. PROVIDE TWO 1"(IN) MINIMUM DIAMETER RODS WITH MINIMUM 17"(IN) EMBEDMENT ON VALVES UP THROUGH 10"(IN) DIAMETER. TIE RODS FOR VALVES LARGER THAN 10" TO BE DESIGNED BY STRUCTURAL ENGINEER.
12. AFTER INSTALLATION, TIE RODS AND TURNBUCKLES SHALL BE CLEANED AND COATED WITH 2 COATS OF ROYSON R28 ASPHALT MASTIC OR APPROVED EQUAL.
13. TEMPORARY BLOCKING, IF USED, SHALL BE APPROVED BY THE ENGINEER.
14. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS.
15. UNBALANCED TEES WITH DIFFERENT PIPE SIZES ON RUN REQUIRE ADDITIONAL THRUST BLOCKING. THRUST CALCULATIONS BY A LICENSED ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO INSTALLATION.
16. THRUST BLOCKS ARE REQUIRED FOR CUT–IN VALVES CONNECTING TO EXISTING UNRESTRAINED WATERMAIN PIPING. THRUST BLOCK CALCULATIONS FOR CONDITIONS NOT COVERED IN TABLE TO BE PERFORMED BY A LICENSED ENGINEER AND SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO INSTALLATION.

SEA Seattle-Tacoma International Airport

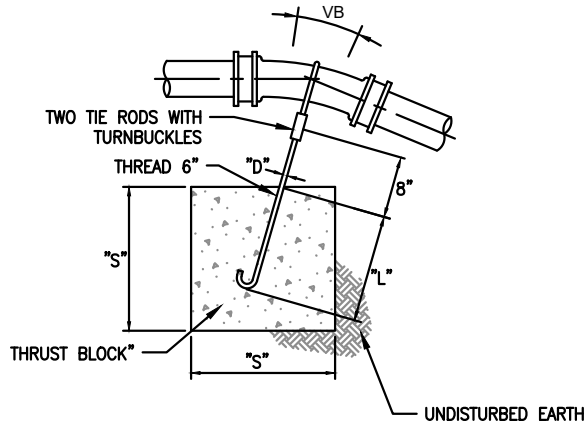
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2020

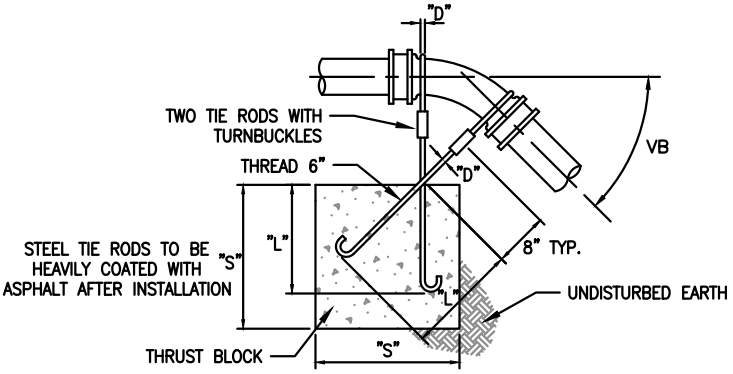
CONCRETE THRUST BLOCKING HORIZONTAL FITTINGS

STANDARD DETAIL NO. **603A**



11 1/4° THRU 22 1/2°

VERTICAL BENDS



45° VERTICAL

BEND

PIPE SIZE DIA (INCHES)	TEST PRESSURE (PSI)	VERTICAL BEND, VB (DEGREES)	NO OF CU FT OF CONCRETE BLOCKING	SIDE OF CUBE, "S" (FEET)	DIAMETER OF TIE RODS, "D"(INCHES)	DEPTH OF RODS IN CONCRETE, "L" (INCHES)
4"	250	11 1/4	6	1.8	5/8"	17
		22 1/2	12	2.3		
6"		11 1/4	14	2.4		
		22 1/2	27	3.0		
8"		11 1/4	25	2.9		
		22 1/2	48	3.6		
10"		11 1/4	38	3.4		
		22 1/2	75	4.2		
12"		11 1/4	55	3.8		
		22 1/2	108	4.8		
14"		11 1/4	75	4.2		
		22 1/2	147	5.3	3/4"	20
16"		11 1/4	98	2.4	5/8"	17
		22 1/2	192	3.0	7/8"	24

PIPE SIZE DIA (INCHES)	TEST PRESSURE (PSI)	VERTICAL BEND, VB (DEGREES)	NO OF CU FT OF CONCRETE BLOCKING	SIDE OF CUBE, "S" (FEET)	DIAMETER OF TIE RODS, "D"(INCHES)	DEPTH OF RODS IN CONCRETE, "L" (INCHES)
4"	250	45	22	2.8	5/8"	17
6"			50	3.7		
8"			89	4.5		
10"			139	5.2	3/4"	20
12"			200	5.8	7/8"	24
14"			272	6.5	1"	27
16"			355	7.1	1-1/8"	30

NOTES

1. LOCATION AND SIZE OF BLOCKING FOR PIPE LARGER THAN 16" DIAMETER AND FOR PRESSURE DIFFERENT THAN SHOWN SHALL BE DETERMINED BY THE ENGINEER.
2. VERTICAL BENDS THAT REQUIRE A THRUST BLOCK VOLUME EXCEEDING 135 CUBIC FEET (5 CUBIC YARDS) REQUIRE SPECIAL BLOCKING DETAILS.
3. CONCRETE BLOCKING (CLASS 3000) SHALL BE CAST IN PLACE AGAINST UNDISTURBED NATIVE EARTH.
4. CONTRACTOR SHALL INSTALL BLOCKING ADEQUATE TO WITHSTAND FULL TEST PRESSURE UNDER ALL CONDITIONS OF SERVICE.
5. PLACE SHEET PLASTIC OVER NUTS AND BOLTS PRIOR TO CONCRETE POUR.
6. ALL POURED THRUST BLOCKS SHALL BE BACKFILLED AFTER MIN. 1 DAY. PRESSURE TESTING SHALL OCCUR AFTER CONCRETE HAS REACHED NOMINAL COMPRESSIVE STRENGTH.
7. WHERE POURED-IN-PLACE BLOCKING IS REQUIRED AT A POINT OF CONNECTION TO AN EXISTING WATERMAIN, THE BLOCKING SHALL BE INSTALLED PRIOR TO CONNECTION.
8. MINIMUM ROD DIAMETER SHALL BE 5/8" ASTM A-307 WITH 36KSI YIELD STRENGTH.
9. AFTER INSTALLATION, TIE RODS AND TURNBUCKLES SHALL BE CLEANED AND COATED WITH 2 COATS OF ROYSON R28 ASPHALT MASTIC OR APPROVED EQUAL.
10. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS, PER STANDARD DETAIL 603A.

SEA Seattle-Tacoma International Airport

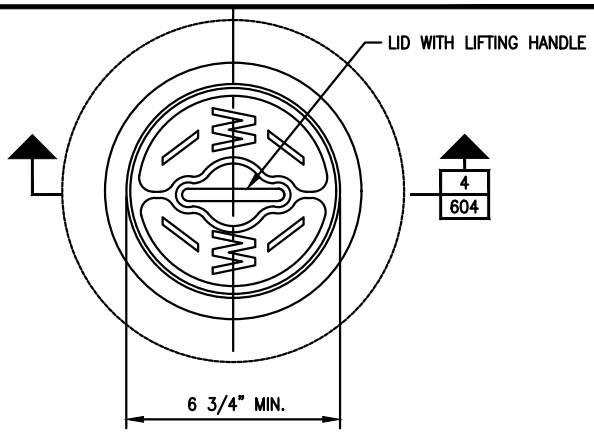
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

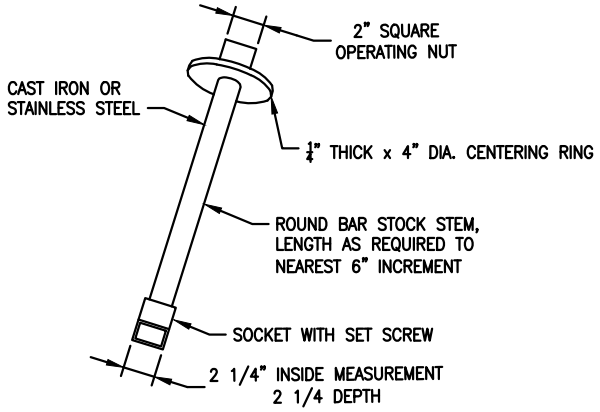
REVISION DATE: DEC. 2020

CONCRETE THRUST BLOCKING VERTICAL FITTINGS

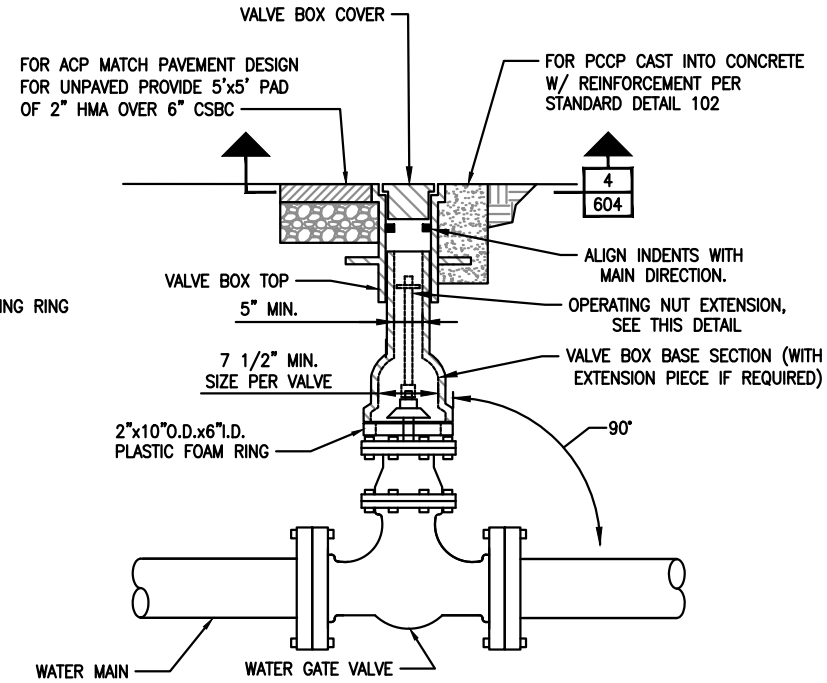
STANDARD DETAIL NO. **603B**



DETAIL 3 / 604
VALVE BOX COVER
SCALE: NTS



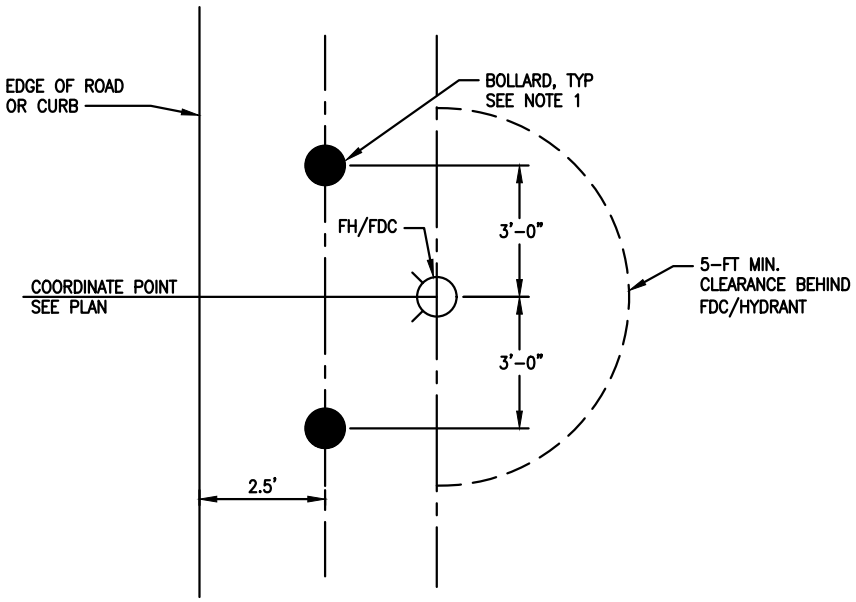
DETAIL 2 / 604
OPERATING NUT EXTENSION
SCALE: NTS



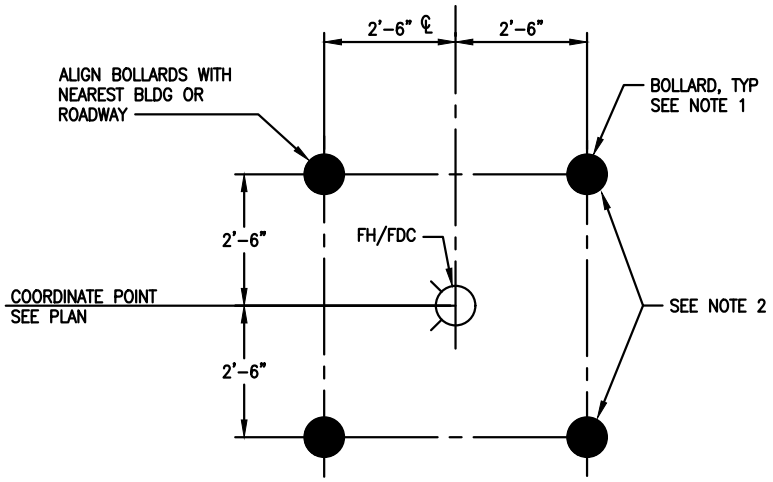
SECTION 4 / 604
VALVE BOX
SCALE: NTS

NOTES:
1. BOX SHALL BE PERPENDICULAR TO THE VALVE AND MAIN.
2. BOX SHALL BE CENTERED OVER VALVE NUT.
3. NO DEBRIS WILL BE ALLOWED AROUND THE VALVE NUT.
4. ALL VALVE BOX PARTS AND EXTENSIONS SHALL BE GRAY CAST IRON OR DUCTILE IRON, ASPHALTIC COATED.
5. VALVE BOX AND LID SHALL BE EAST JORDAN 68/8555 (SEE APPROVED MATERIAL LIST).
6. EXTENSIONS FOR DEEP VALVES MAY BE ACCOMPLISHED WITH CAST IRON DRAIN PIPE. BELL END OVER LOWER SECTION.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	VALVE BOX & OPERATING NUT EXTENSION STANDARD DETAIL NO. **604**



DETAIL 1/605
BOLLARD LOCATIONS ADJACENT TO ROADWAY
SCALE: NTS

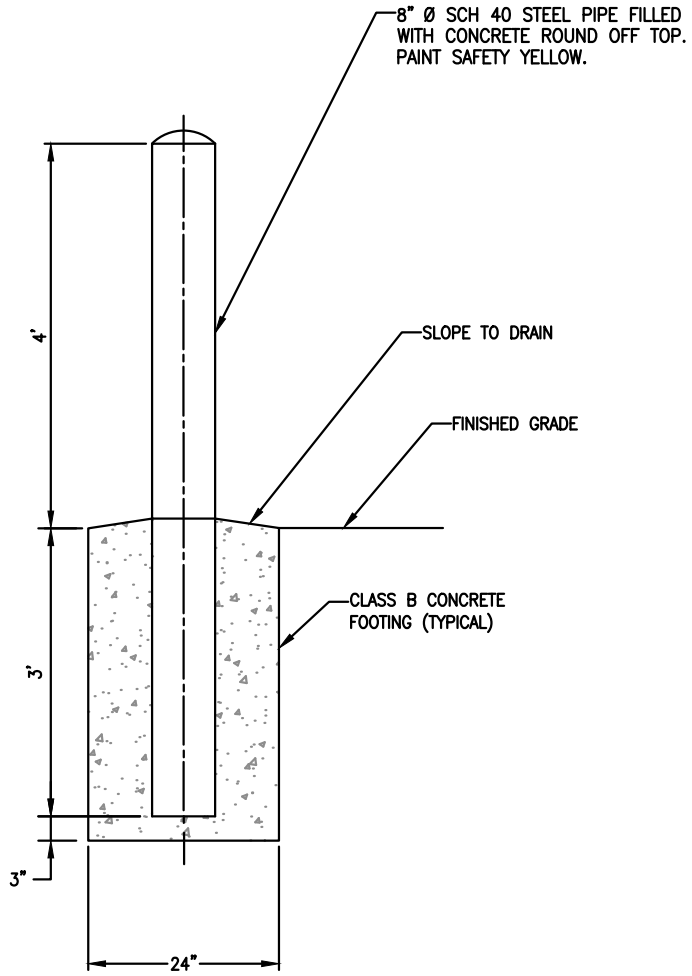


DETAIL 2/605
HYDRANT AND FDC BOLLARD LOCATION PLAN
SCALE: NTS

NOTES:

1. BOLLARD LOCATIONS SHALL BE APPROVED BY POS F&I PRIOR TO INSTALLATION.
2. BOLLARDS SHALL BE IN ACCORDANCE WITH STANDARD DETAIL 606.

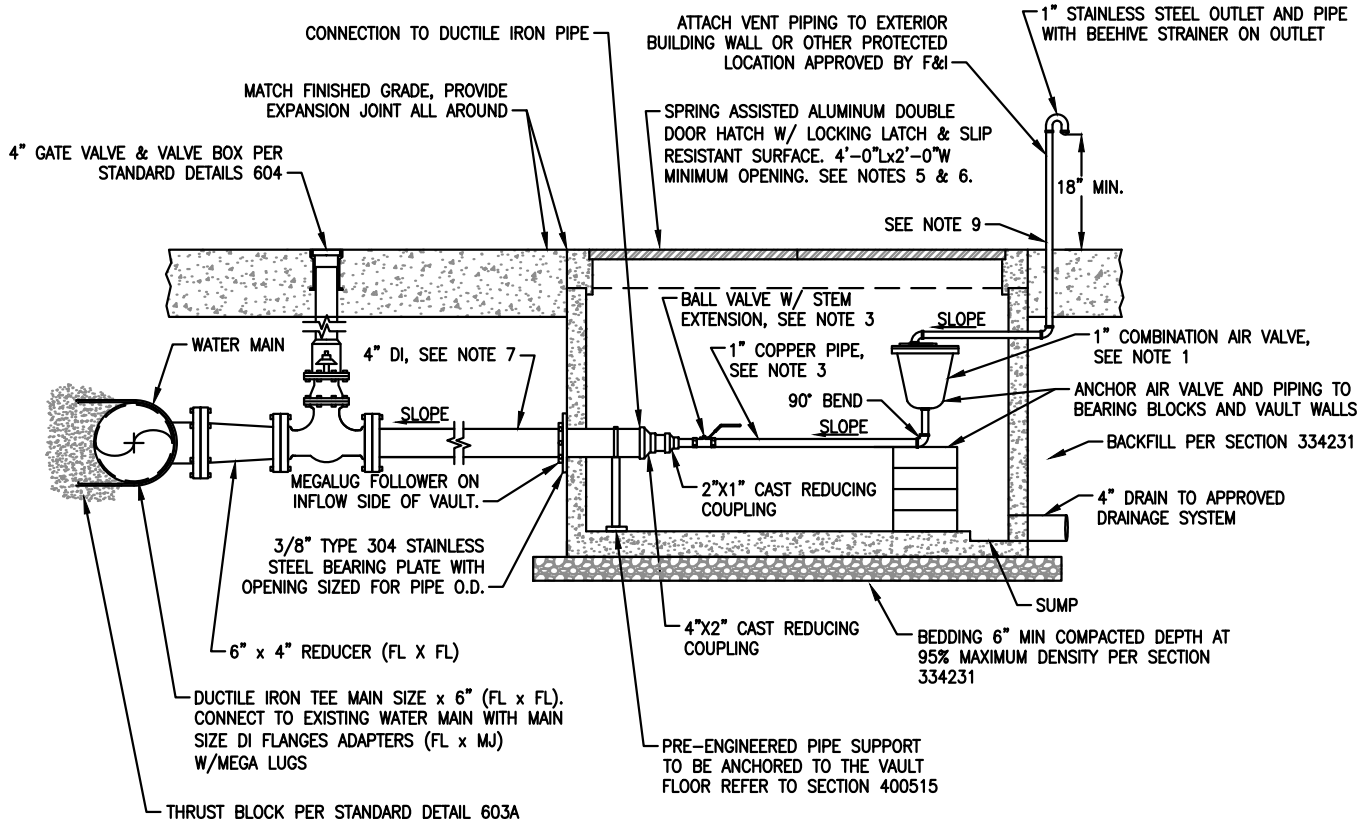
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	HYDRANT AND FDC BOLLARD LOCATION PLAN
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **605**



DETAIL 1/606

BOLLARD
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	BOLLARD
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **606**



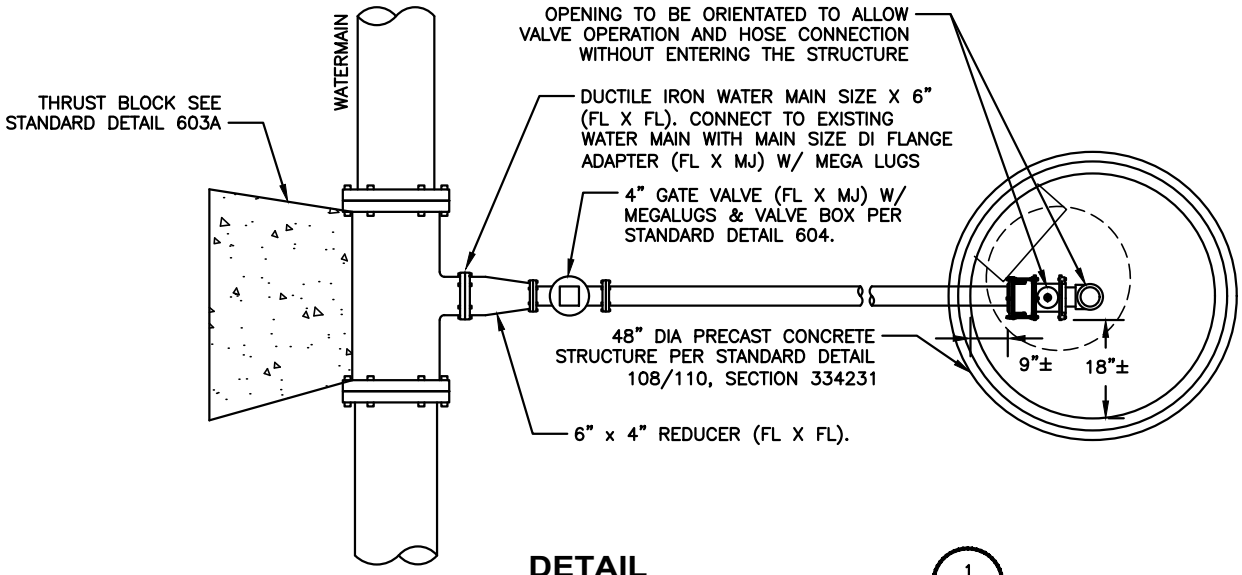
DETAIL 1 / 607

COMBINATION AIR RELEASE AND AIR VACUUM VALVE
SCALE: NTS

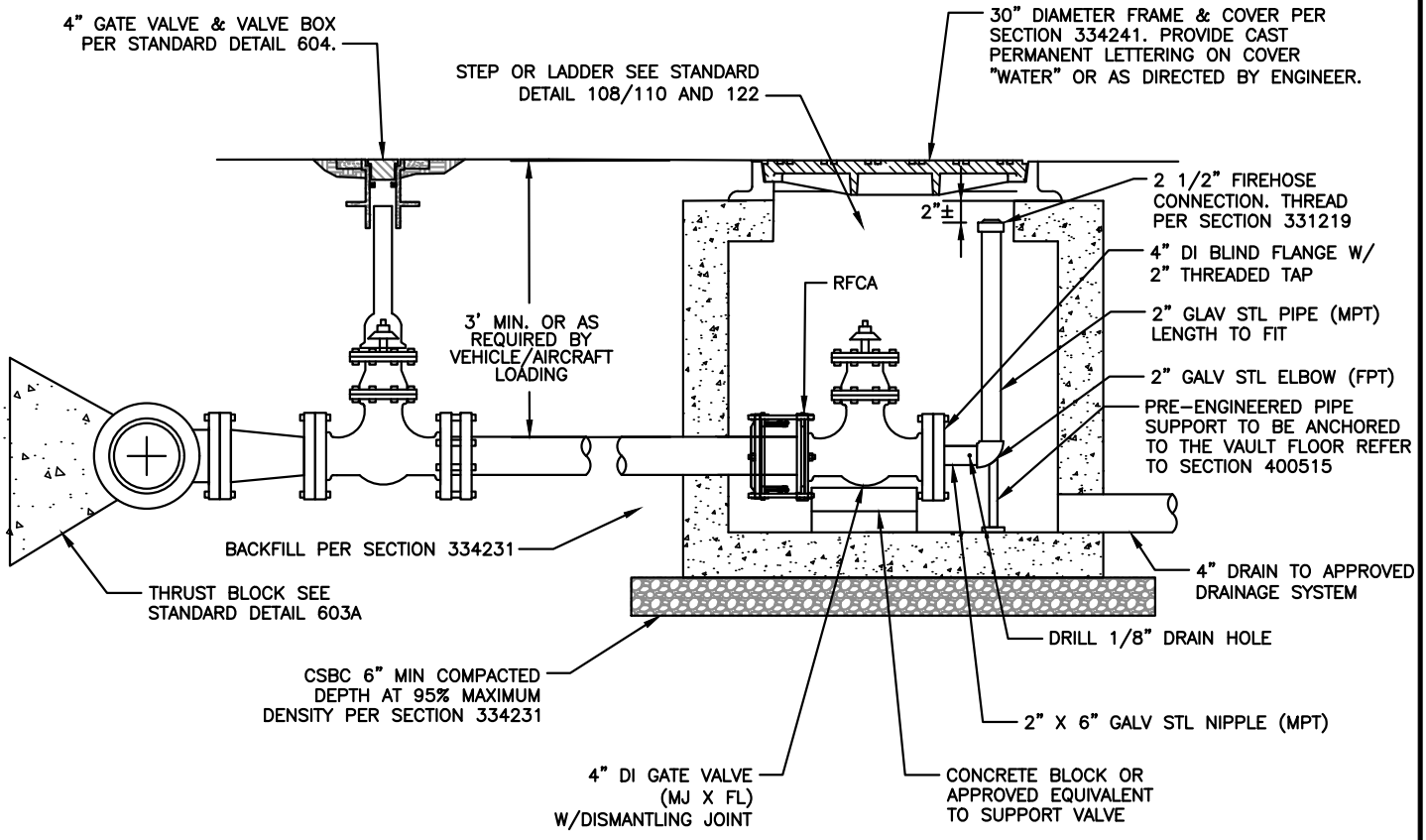
NOTES:

1. THE SIZE OF THE COMBINATION AIR RELEASE / AIR VACUUM VALVE SHALL BE DETERMINED BY THE ENGINEER. COMBINATION AIR RELEASE / AIR VACUUM VALVES LARGER THAN 2" SHALL BE DESIGNED BY THE ENGINEER.
2. LOCATE THE COMBINATION AIR RELEASE / AIR VACUUM VALVE ASSEMBLY AT THE HIGH POINTS OF THE MAIN.
3. BALL VALVE, COPPER PIPE TO VALVE AND VENT PIPING FROM VALVE SHALL BE THE SAME SIZE AS THE COMBINATION AIR RELEASE / AIR VACUUM VALVE.
4. ALL PIPING AND FITTINGS WITHIN VAULT SHALL BE PROVIDED WITH INSULATING JACKETS. ALL PIPE OPENINGS IN VAULT WALLS SHALL BE FILLED WITH NON-SHRINK GROUT.
5. PRECAST UTILITY VAULT AND LID:
   A. VAULTS LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE PRECAST AND DESIGNED FOR FAA LOADS AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION).
   B. VAULTS NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR THE VAULT SHALL BE STAMPED BY A LICENSED PROFESSIONAL STRUCTURAL ENGINEER AND SUBMITTED TO F&I FOR APPROVAL PRIOR TO FABRICATION.
6. HATCHES FOR VAULTS:
   A. HATCHES LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE LOCKING, AIRCRAFT RATED AND DESIGNED TO SUPPORT A MINIMUM 100,000 LB WHEEL LOAD WITH 250 PSI TIRE PRESSURE.
   B. HATCHES NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. HATCH SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED TO POS F&I FOR APPROVAL PRIOR TO FABRICATION.
7. ALL PIPE AND FITTING JOINTS ON THE HORIZONTAL RUN FROM THE WATER MAIN TO THE PRECAST UTILITY VAULT SHALL BE RESTRAINED.
8. ALL PIPING ABOVE GROUND TO BE PAINTED WITH TWO COATS OF YELLOW PAINT.
9. THREADED FRANGIBLE COUPLE REQUIRED NO MORE THAN 4" ABOVE GROUND SURFACE. PROVIDE 90-DEGREE BEND OR ROLL TEE HORIZONTALLY WITH VALVE ON TEE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	COMBINATION AIR RELEASE AND AIR VACUUM VALVE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **607**

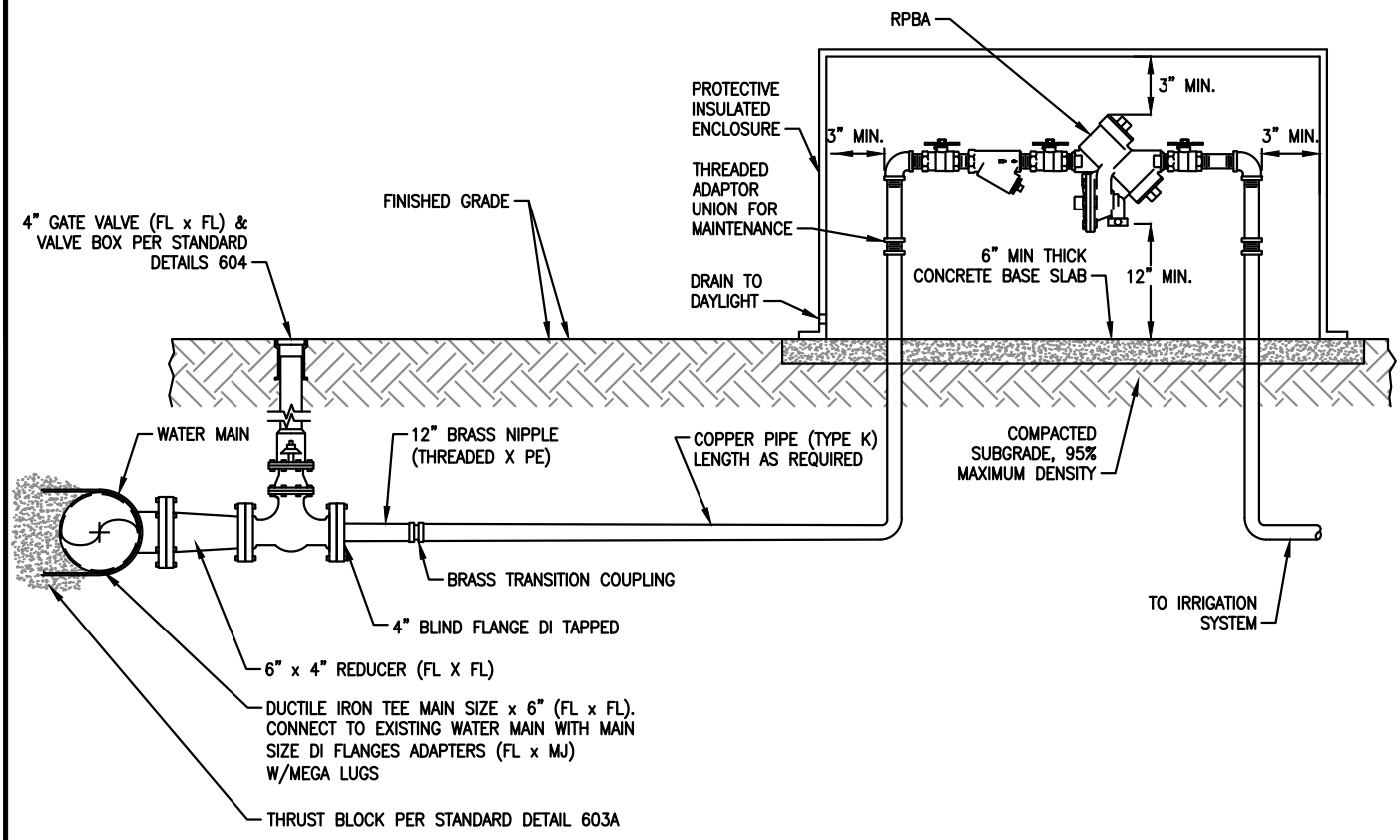


DETAIL 1
WATER BLOW OFF VALVE 608
SCALE: NTS



SECTION 2
WATER BLOW OFF VALVE 608
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WATER BLOW OFF VALVE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **608**



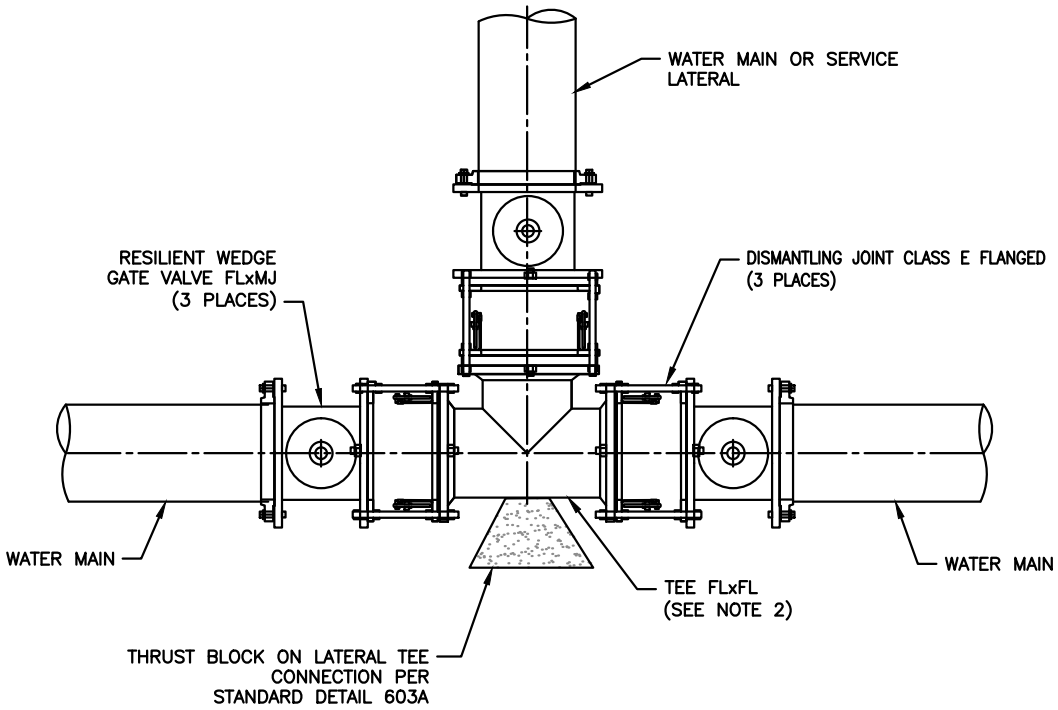
DETAIL 1/609

IRRIGATION CONNECTION
SCALE: NTS

NOTES:

1. THE SIZE OF THE REDUCED PRESSURE VALVE ASSEMBLY (RPBA) SHALL BE DETERMINED BY THE ENGINEER.
2. LOCATE THE RPBA AND PROTECTIVE ENCLOSURE IN LANDSCAPED AREAS AS CLOSE AS FEASIBLE TO THE IRRIGATION SYSTEM.
3. RPBA AND PROTECTIVE ENCLOSURE SHALL BE INSTALLED ABOVE GRADE. INSTALLATION OF RBPA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA.
5. COPPER PIPE TO RPBA AND PIPING FROM RPBA SHALL BE THE SAME SIZE AS THE RPBA.
6. ALL PIPING AND FITTINGS WITHIN PROTECTIVE ENCLOSURE SHALL BE PROVIDED WITH INSULATING JACKETS.
7. ALL PIPE AND FITTING JOINTS ON THE HORIZONTAL RUN FROM THE WATER MAIN SHALL BE RESTRAINED.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	IRRIGATION CONNECTION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **609**

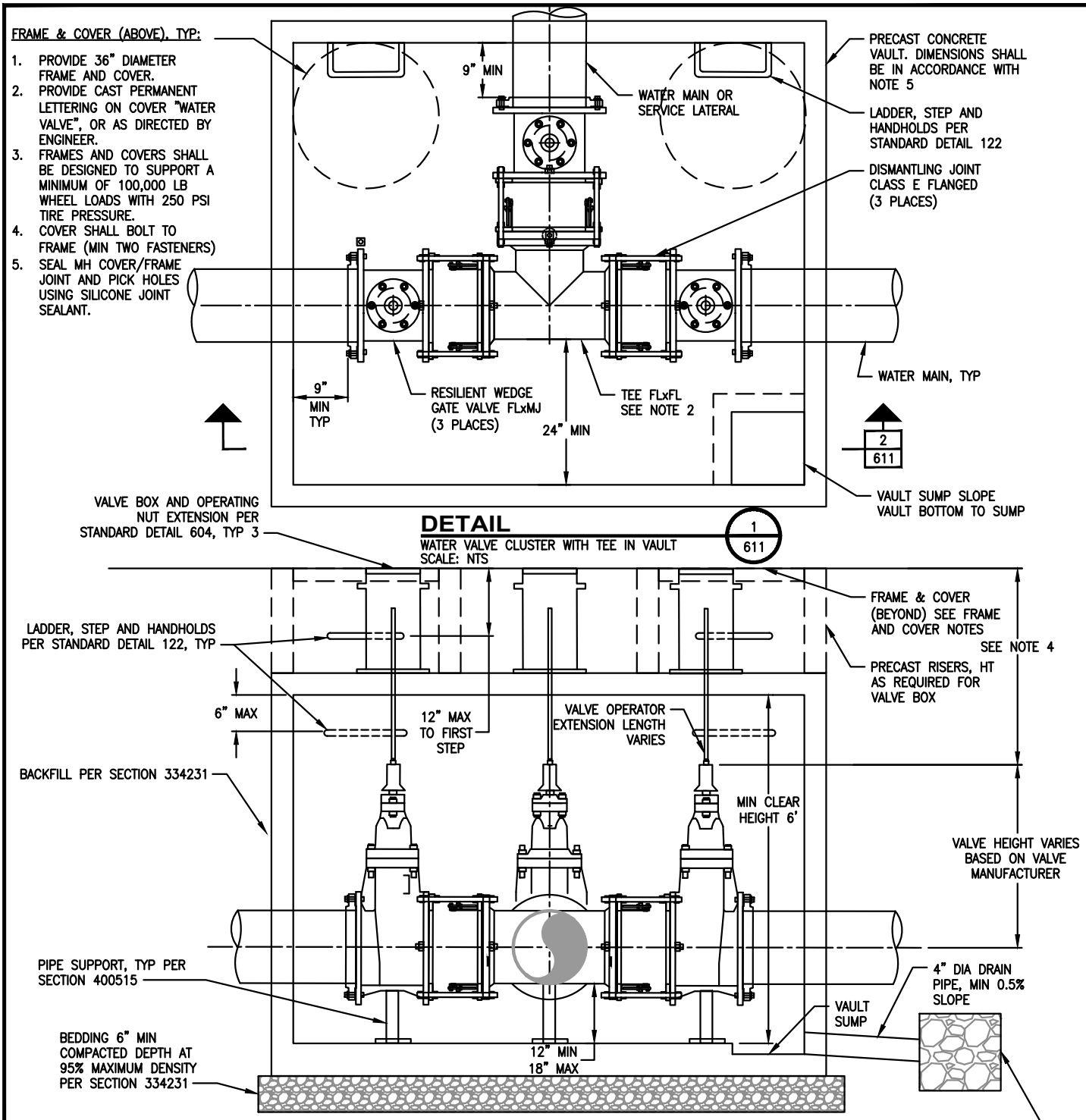


DETAIL 1/610
WATER VALVE CLUSTER WITH TEE
SCALE: NTS

NOTES:

1. ALL FITTINGS SHALL BE DUCTILE IRON, ALL MECHANICAL JOINT FITTINGS SHALL BE RESTRAINED WITH APPROVED MECHANICAL JOINT RESTRAINT.
2. UNBALANCED TEES WITH DIFFERENT PIPE SIZES ON RUN REQUIRE ADDITIONAL THRUST BLOCKING. SEE THRUST BLOCK STANDARD DETAIL 603A FOR ADDITIONAL REQUIREMENTS.
3. ALL FASTENING MATERIAL (BOLTS, NUTS, WASHERS, TIE RODS) SHALL BE EITHER TYPE 304 OR TYPE 316 STAINLESS STEEL.

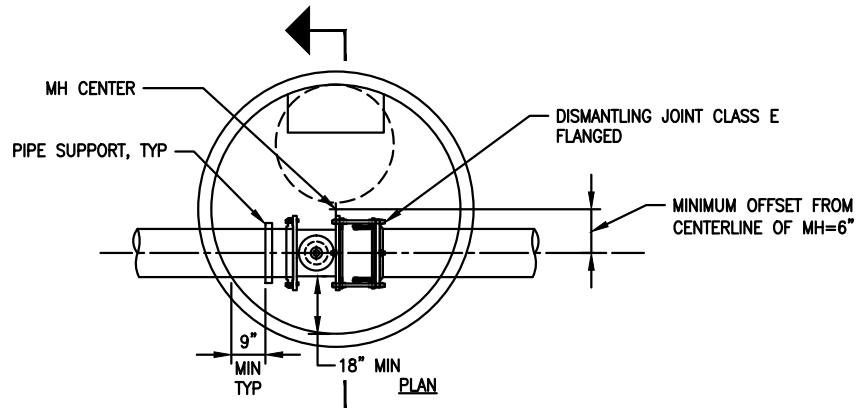
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WATER VALVE CLUSTER WITH TEE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **610**



NOTES:

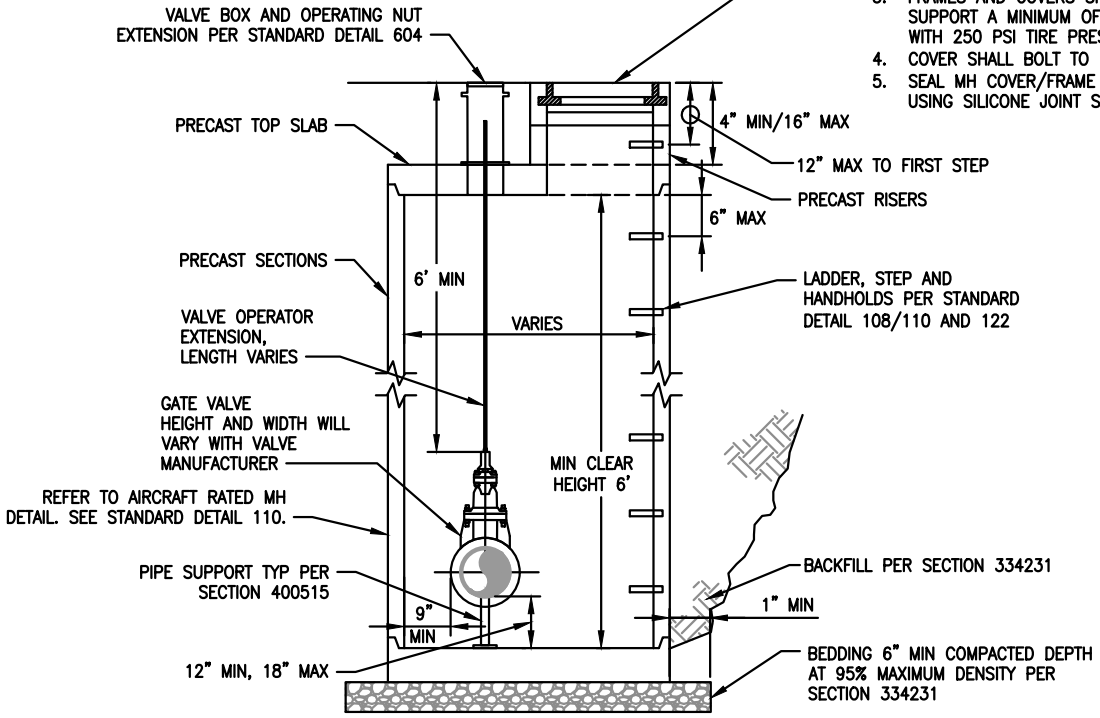
1. ALL FITTINGS SHALL BE RESTRAINED DUCTILE IRON.
2. UNBALANCED TEES WITH DIFFERENT PIPE SIZES MAY REQUIRE ADDITIONAL THRUST RESTRAINT. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
3. ALL FASTENING MATERIAL (BOLTS, NUTS, WASHERS, TIE RODS) SHALL BE EITHER TYPE 304 OR TYPE 316 SS.
4. VALVE VAULT REQUIRED ANY TIME THE LENGTH FROM THE VALVE OPERATING NUT TO GROUND SURFACE EQUALS OR EXCEEDS 6 FEET.
5. VALVE BOX DIMENSIONS SHALL BE IN ACCORDANCE WITH VALVE AND APPURTENANCE LAYOUT PLUS SETBACKS SHOWN ABOVE.
6. PRECAST UTILITY VAULT AND LID:
   A. VAULTS LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE PRECAST AND DESIGNED FOR FAA LOADS AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION).
   B. VAULTS NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR THE VAULT SHALL BE STAMPED BY A LICENSED PROFESSIONAL STRUCTURAL ENGINEER AND SUBMITTED TO F&I FOR APPROVAL PRIOR TO FABRICATION.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	WATER VALVE CLUSTER WITH TEE IN VAULT STANDARD DETAIL NO. **611**



DETAIL 2/612
AIRCRAFT RATED WATER VALVE MANHOLE
SCALE: NTS

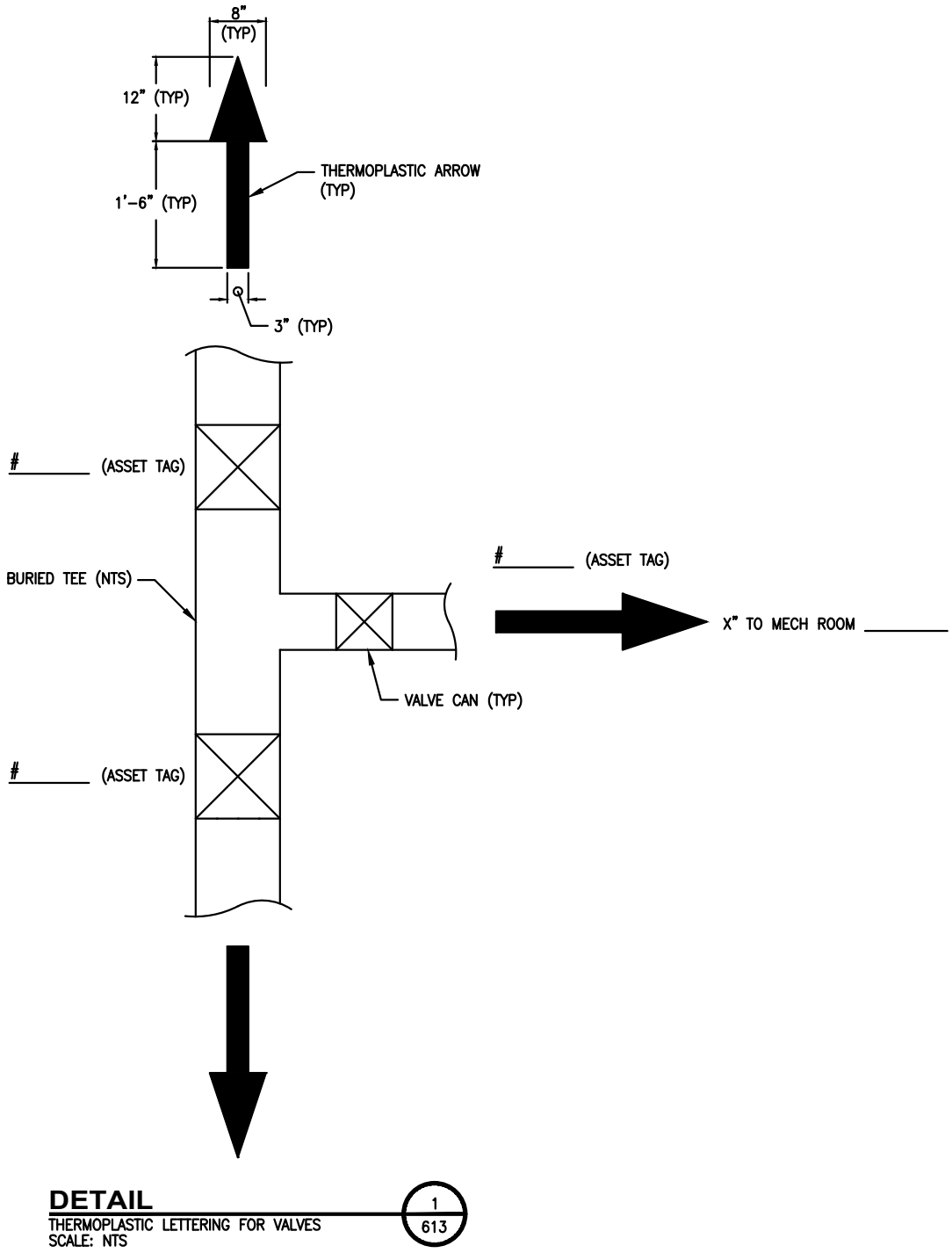
FRAME & COVER:
1. PROVIDE 36" DIAMETER FRAME AND COVER.
2. PROVIDE CAST PERMANENT LETTERING ON COVER, "WATER VALVE" AS DIRECTED BY THE ENGINEER.
3. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
4. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
5. SEAL MH COVER/FRAME JOINT AND PICK HOLES USING SILICONE JOINT SEALANT.



SECTION 2/612
AIRCRAFT RATED WATER VALVE MANHOLE
SCALE: NTS

NOTES:
1. MH DIA WILL VARY BASED ON PIPE AND VALVE DIA.
2. STEPS IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS IN MH'S SHALL HAVE 6" MINIMUM CLEARANCE FROM STRUCTURE WALL.
3. VALVE MH REQUIRED ANY TIME THE LENGTH FROM THE VALVE OPERATING NUT TO GROUND SURFACE EQUALS OR EXCEEDS 6 FEET.
4. PIPE, VALVE AND DISMANTLING JOINT MUST BE CLEAR OF MH FRAME & COVER OPENING. MH OFFSET FROM PIPE CENTERLINE WILL VARY BASED ON NOMINAL PIPE SIZE AND VALVE AND DISMANTLING JOINT MANUFACTURER.
5. MANHOLES LOCATED IN RAMP AIR OPERATIONS AREA (AOA) SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	AIRCRAFT RATED WATER VALVE MANHOLE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **612**

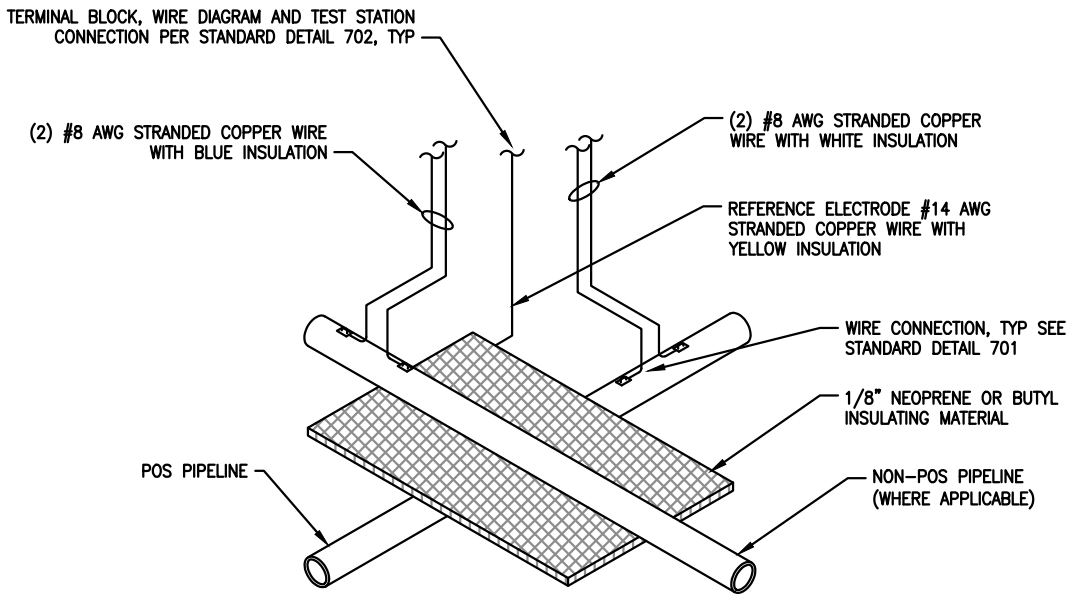


DETAIL 1/613
THERMOPLASTIC LETTERING FOR VALVES
SCALE: NTS

NOTES:

1. LABEL SIZE AND ASSET TAG NUMBER FOR EACH VALVE WITH 4" TALL WHITE THERMOPLASTIC LETTERING.
2. INDICATE EACH PIPE DIRECTION WITH A THERMOPLASTIC ARROW.
3. INDICATE VALVE SIZE, ASSET TAG #, AND MECHANICAL ROOM NUMBER (WHERE APPLICABLE).
4. CONFIRM LABELS AND TEXT IN WRITING WITH F&I PRIOR TO INSTALLATION.
5. THERMOPLASTIC SHALL FOLLOW FAA ITEM P-620.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	THERMOPLASTIC LETTERING FOR VALVES
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **613**



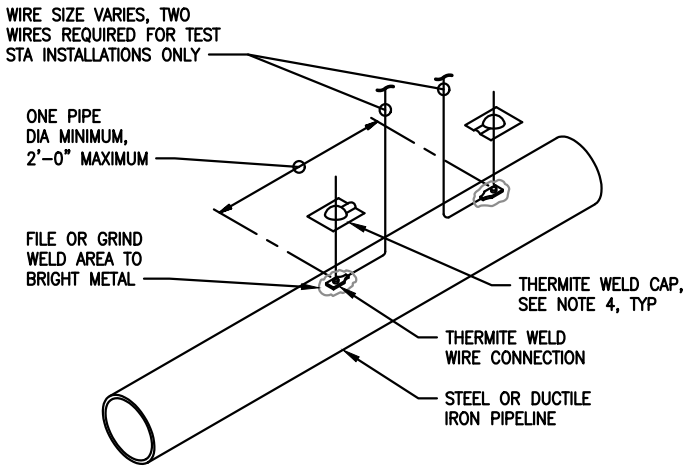
DETAIL 1/700

IINSULATED BLANKET INSTALLATION
SCALE: NTS

NOTES:

1. INSTALL INSULATING BLANKET BETWEEN METALLIC PIPELINES WHEN ONE OR BOTH PIPES HAVE CATHODIC PROTECTION AND THE SEPARATION DISTANCE IS 24" OR LESS.
2. BLANKET SHALL BE 3 TIMES THE PIPE DIAMETER IN THE LARGEST DIMENSION AND EXTEND 2 FEET LARGER THAN THE LARGEST PIPELINE DIAMETER (E.G. 24" PIPE CROSSING AN 18" PIPE WOULD HAVE A 72"L X 48"W BLANKET).
3. ENSURE THE BLANKET IS PLACED ON FLAT BACKFILL FREE OF ROCKS AND DEBRIS TO AVOID PUNCTURE, AND SPATIALLY CENTERED BETWEEN PIPES.
4. PERMANENT REFERENCE ELECTRODES SHALL BE PLACED ON PROJECT PIPELINE SIDE OF BLANKET, 6" TO 12" FROM SPRINGLINE.
5. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.
6. OBTAIN APPROVAL OF NON-POS PIPELINE OWNER PRIOR TO EXCAVATION.
7. WIRE CONNECTIONS TO NON-POS PIPELINE SHALL BE MADE BY NON-POS PIPELINE REPRESENTATIVE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	INSULATED BLANKET INSTALLATION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **700**



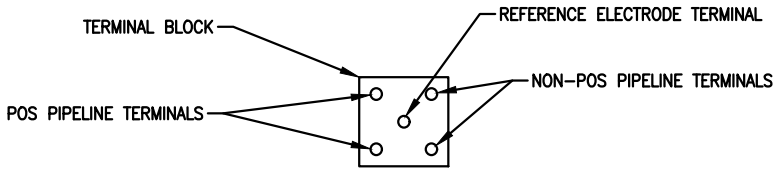
DETAIL 1/701

WIRE CONNECTION FOR STEEL AND DUCTILE IRON PIPE
SCALE: NTS

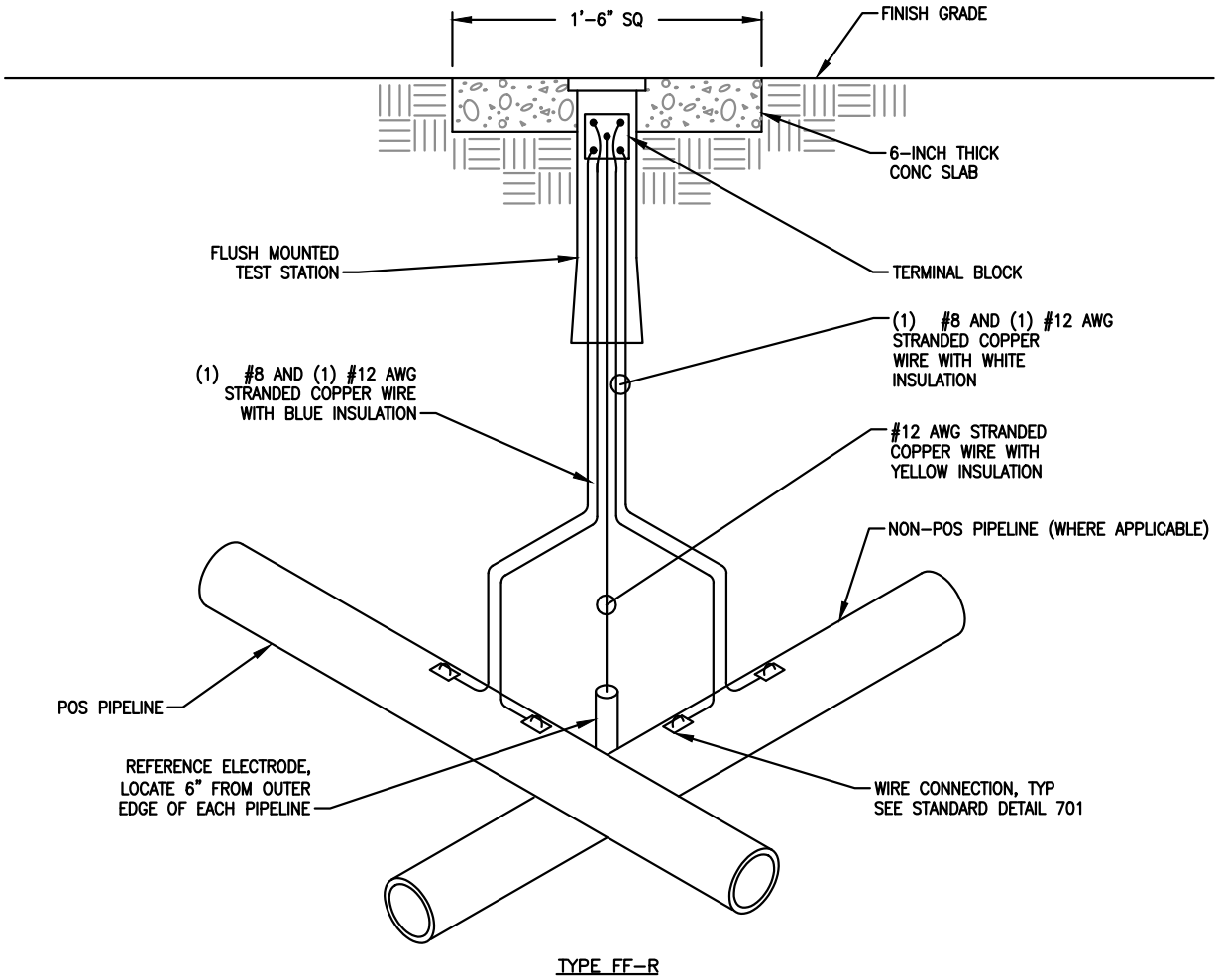
NOTES:

1. COPPER SLEEVE REQUIRED FOR THERMITE WELDING OF #10 AWG AND SMALLER WIRE.
2. USE COPPER SLEEVE ON #2 AWG JOINT BONDING WIRES.
3. WELDER AND CARTRIDGE SIZE VARIES ACCORDING TO WIRE SIZE AND PIPE MATERIAL, CONSULT WELDER MANUFACTURER FOR RECOMMENDED WELDER AND CARTRIDGE.
4. COAT WELD AREA AND FILL RECESS ON THERMITE WELD CAP WITH COLD APPLIED COAL TAR MASTIC AND APPLY CAP TO WELD.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WIRE CONNECTION FOR STEEL AND DUCTILE IRON PIPE
SEA F&I STANDARD DETAILS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO **701**



WIRE DIAGRAM



TYPE FF–R

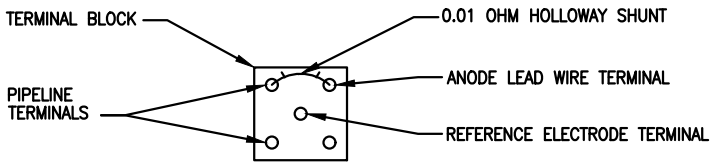
DETAIL 1/702

FLUSH MOUNTED TEST STATION TYPE FF–R
SCALE: NTS

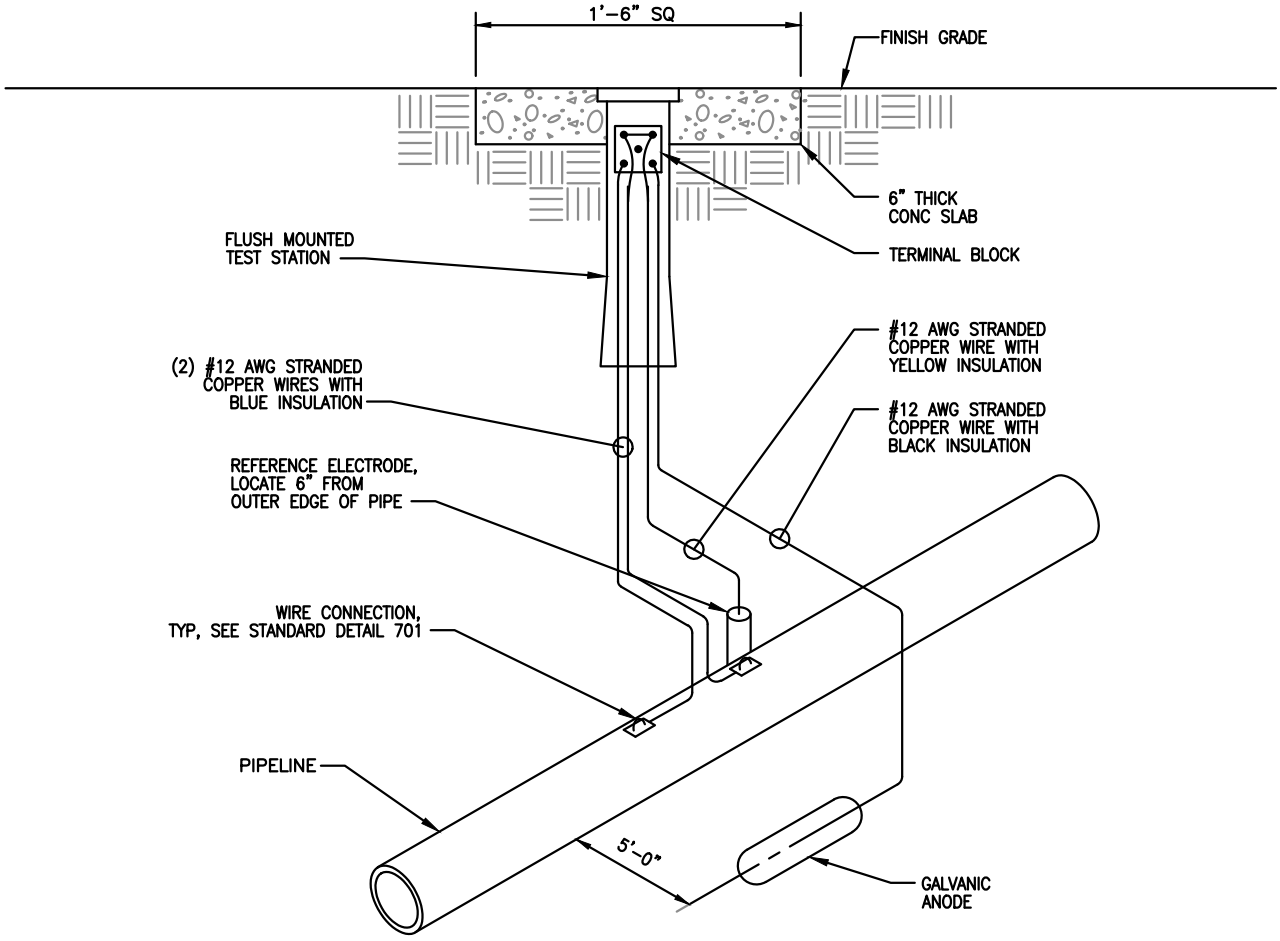
NOTES:

1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'–6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.
2. OBTAIN APPROVAL OF NON–POS PIPELINE OWNER PRIOR TO EXCAVATION.
3. WIRE CONNECTIONS TO NON–POS PIPELINE SHALL BE MADE BY NON–POS PIPELINE REPRESENTATIVE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FF-R
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **702**



WIRE DIAGRAM



TYPE FT-RA

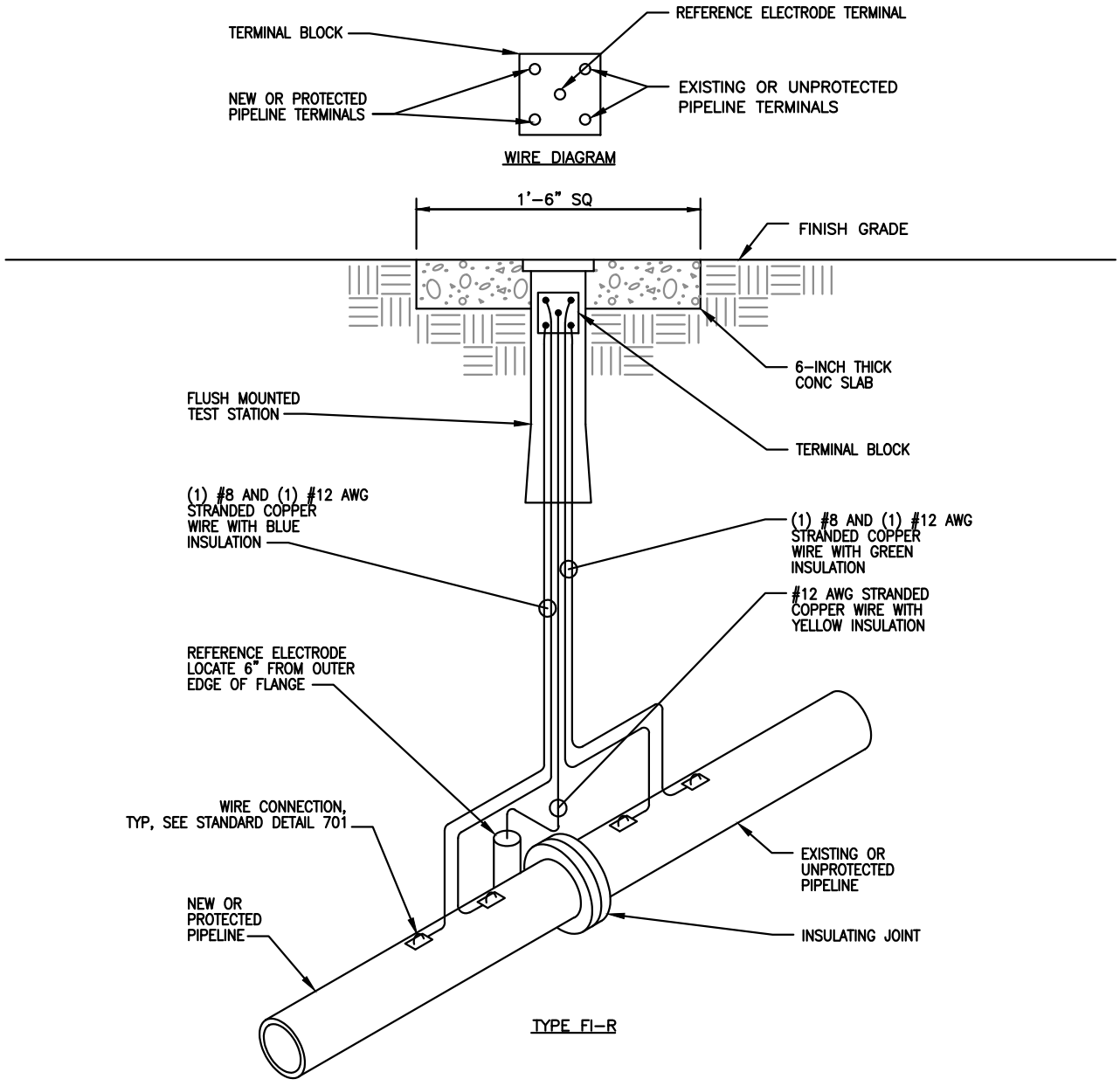
DETAIL 1/703

FLUSH MOUNTED TEST STATION TYPE FT-RA
SCALE: NTS

NOTES:

1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.
2. INSTALL GALVANIC ANODE 1'-0" BELOW PIPE INVERT ELEVATION.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FT-RA
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **703**



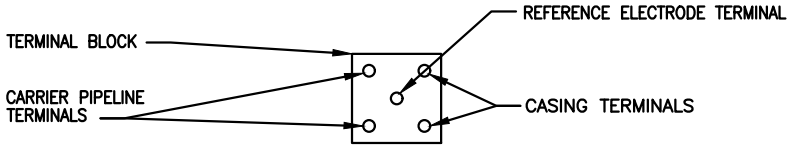
DETAIL 1/704

FLUSH MOUNTED TEST STATION TYPE FI–R
SCALE: NTS

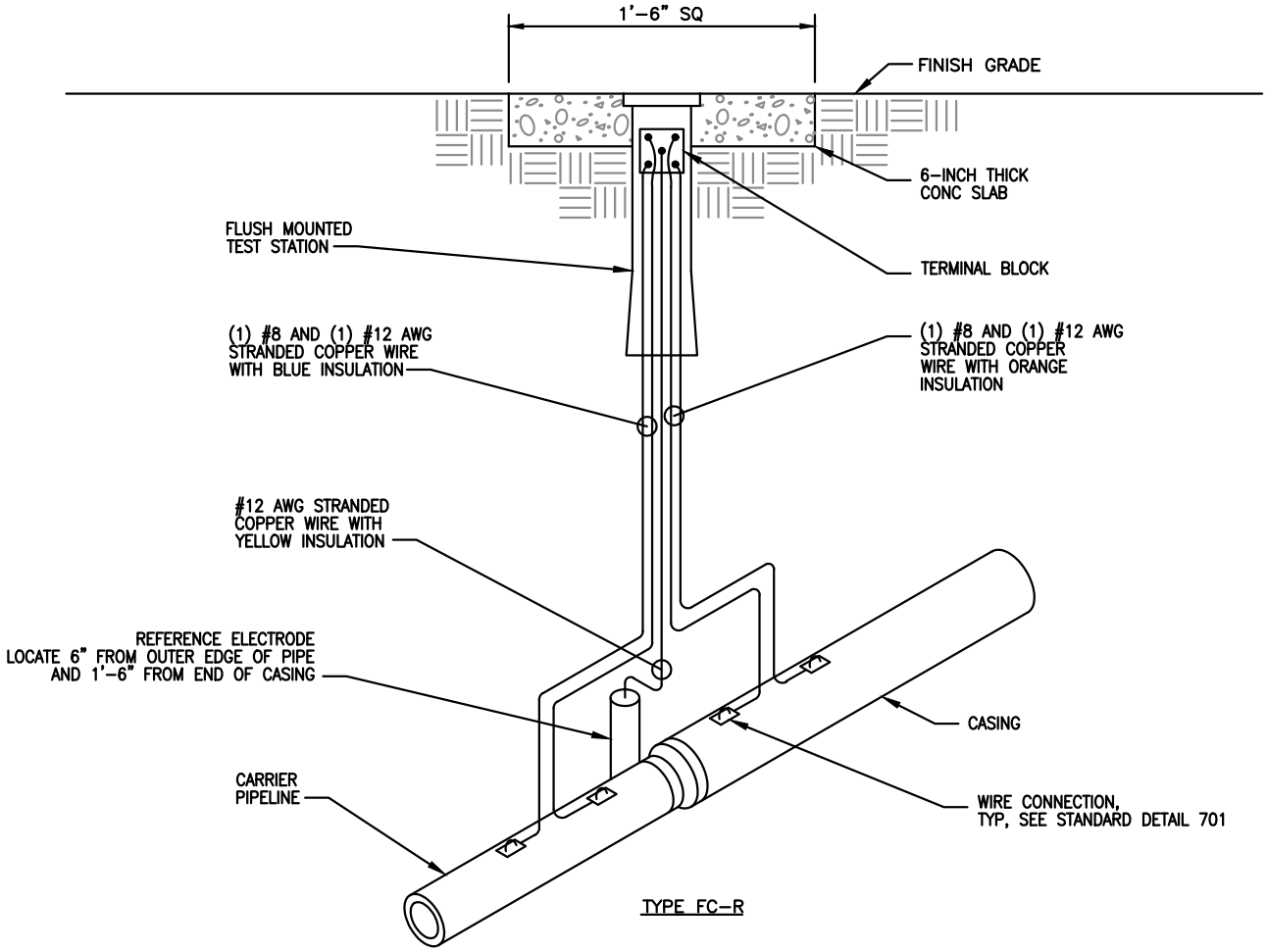
NOTES:

1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'–6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FI-R
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **704**



WIRE DIAGRAM



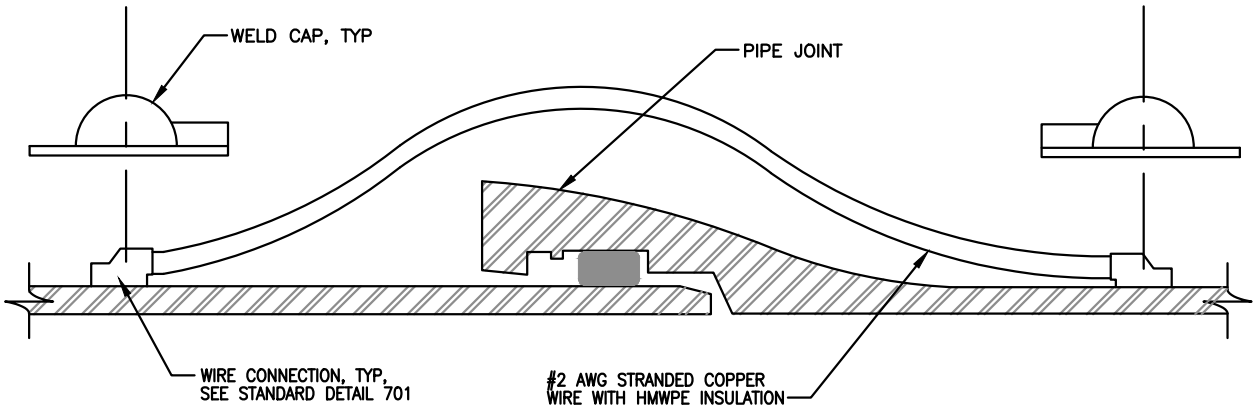
TYPE FC-R

DETAIL 1/705

FLUSH MOUNTED TEST STATION TYPE FC-R
SCALE: NTS

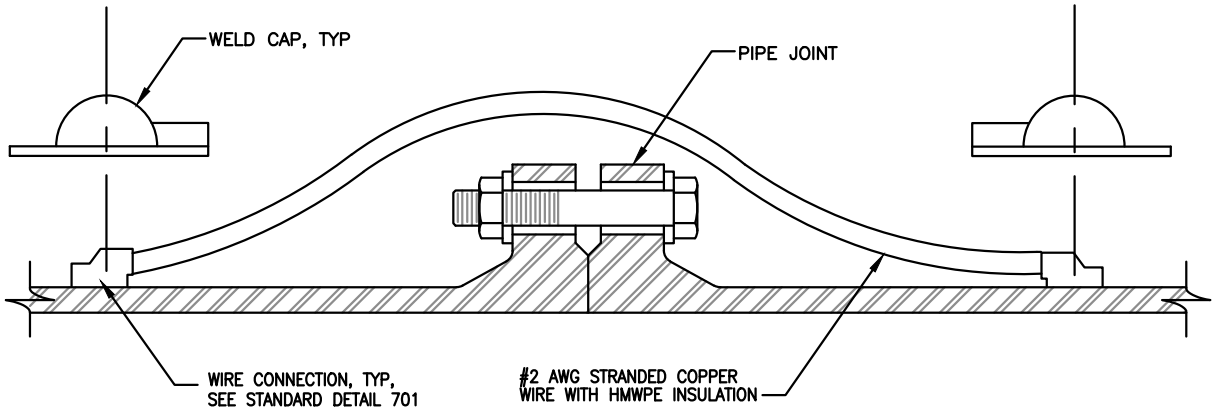
NOTES:
1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FC-R
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **705**



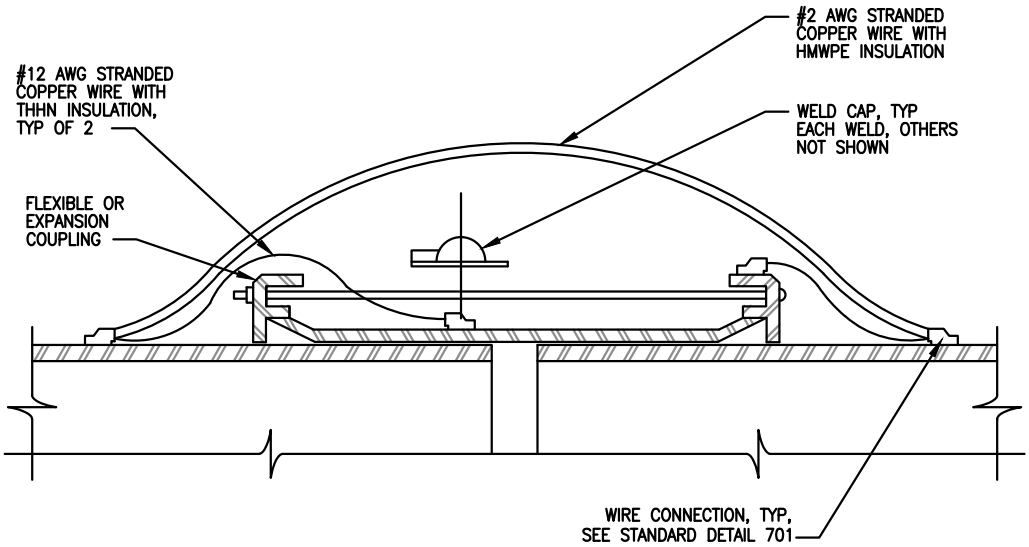
DETAIL 1/706
PUSH-ON JOINT BOND
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PRTECTION PUSH-ON JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **706**



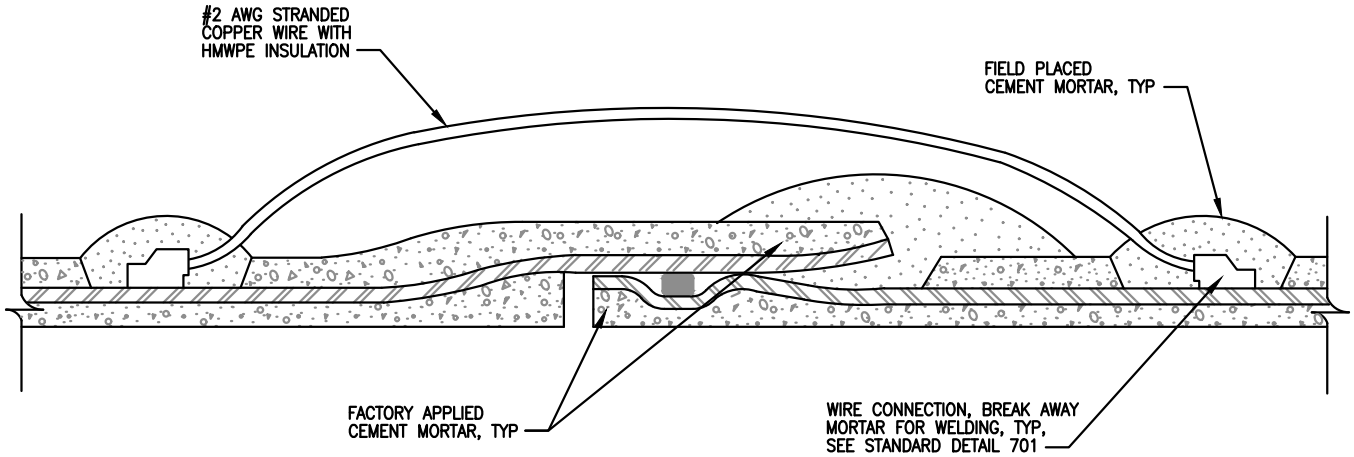
DETAIL 1/707
FLANGED JOINT BOND
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLANGED JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **707**



DETAIL 1/708
FLEXIBLE JOINT BOND
SCALE: NTS

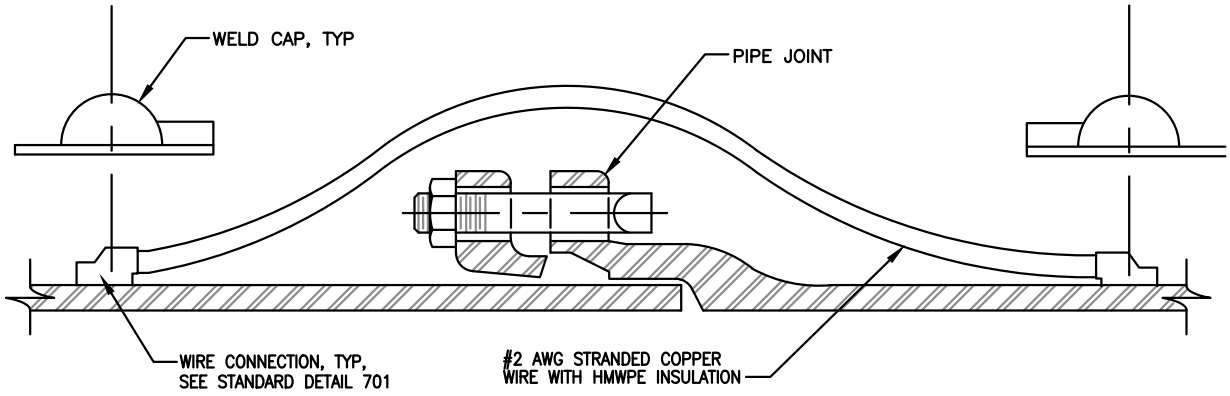
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLEXIBLE JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **708**



DETAIL 1/709

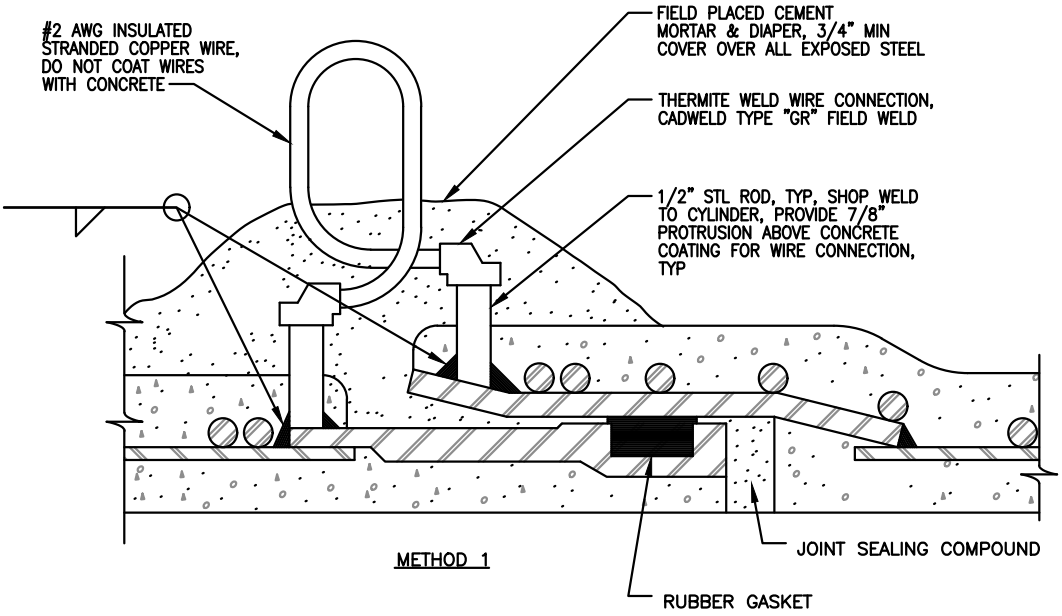
CEMENT COATED STEEL PIPE JOINT BOND
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION CEMENT COATED STEEL JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **709**

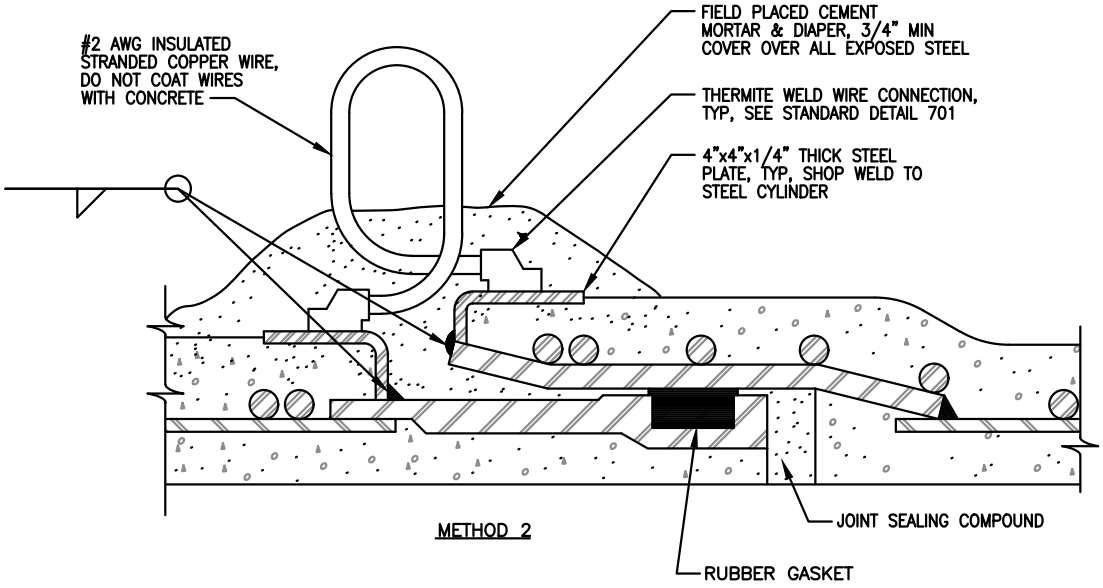


DETAIL 1/710
MECHANICAL JOINT BOND
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION MECHANICAL JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **710**



METHOD 1



METHOD 2

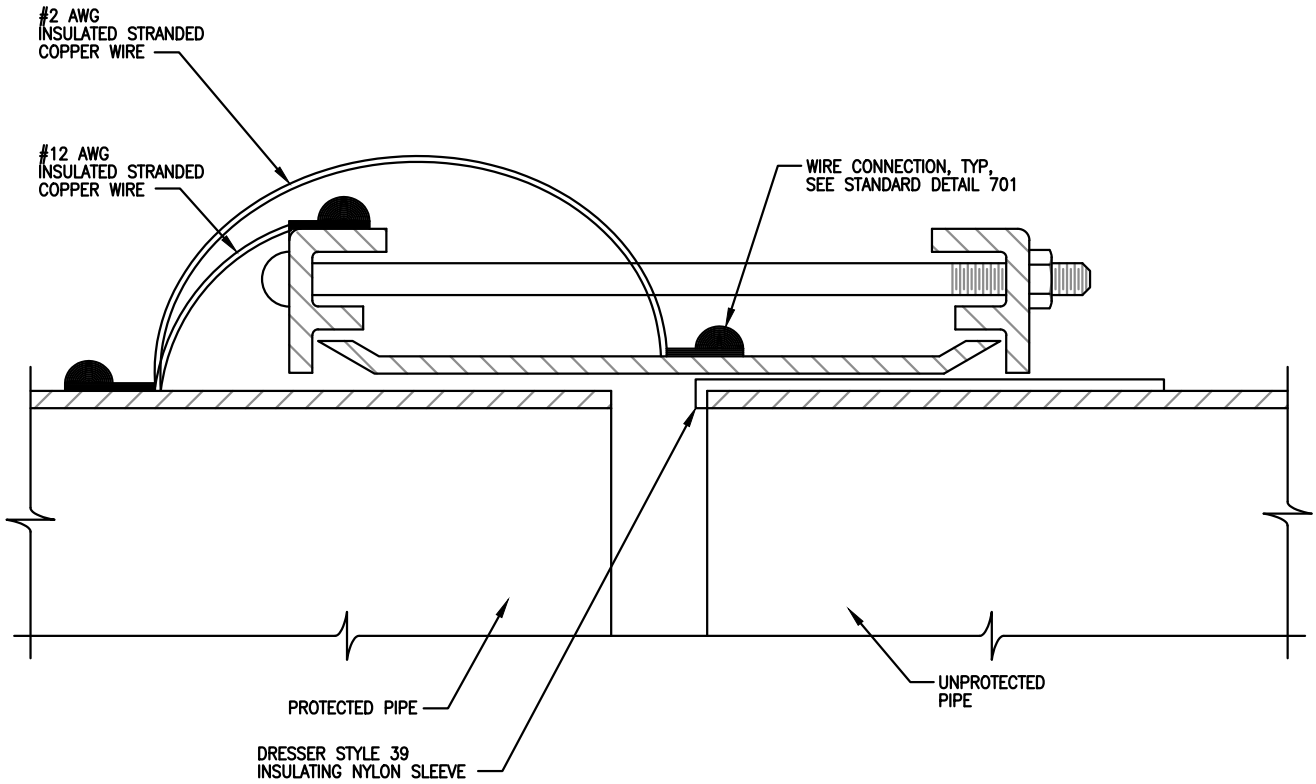
DETAIL 1/711

CONCRETE CYLINDER PIPE JOINT BOND
SCALE: NTS

NOTES:

1. SEE SPECIFICATIONS FOR NUMBER OF BOND WIRES REQUIRED AT EACH PIPE JOINT.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION CONCRETE CYLINDER PIPE JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **711**



DETAIL 1/712
INSULATED FLEXIBLE COUPLING
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION INSULATED FLEX COUP
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **712**