



AVIATION FACILITIES AND INFRASTRUCTURE

CIVIL SYSTEMS STANDARDS

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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.

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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).

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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. Adjusted structure lids and covers shall be replaced with new lids conforming to F&I Civil Standards.
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)

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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

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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	

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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

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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

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UTILITY DEMOLITION AND ABANDONMENT

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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.
- D. Where water main branch lines are demolished, the branch line tee at the main line shall be removed and replaced with a section of pipe matching the main line diameter.

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

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UTILITY DEMOLITION AND ABANDONMENT

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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

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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	1							
	Sewer (DI)	1.5	1					2								
	Sewer (non metal)	2						1								
	IWS/SD (DI)	1.5						2								
	IWS/SD (non-metal)	1.5						1								
	Gas (HDPE)	1						1								
	Jet Fuel	2	2	1	2	1	1	2	1							
	Comm	1						2					1	1.5	1	1.5
	Electrical							2					1.5	1	1.5	1
	Comm (Concrete encased)							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)	10														
	Sewer (non metal)															
	IWS/SD (DI)															
	IWS/SD (non-metal)															
	Gas (HDPE)	5	10				See Note 1									
	Jet Fuel															
	Comm															
	Electrical															
	Comm (Concrete encased)															
	Electrical (Concrete encased)															
*All values in feet.																

Note 1: Contact F&I for clearance requirements

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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

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- 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
3/4"	99-100
1/2"	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 concrete aggregate manufactured from hardened concrete mixtures is allowed for use as crushed surfacing top course. Recycled concrete aggregate used for crushed surfacing top course shall meet the requirements of WSDOT Standard Specifications 9-03.21 (1)C and 9-

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03.21(1)C1. Other recycled material such as Hot Mix Asphalt, 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
$\frac{3}{4}$ 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.

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- B. Under non-paved areas and greater than 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 12 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.

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- 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.

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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.

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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

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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

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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.

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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.

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- 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 H-25/HS-25 traffic rating of 20,000 pounds per wheel and support a minimum proof load of 50,000 pounds (20,000 pounds x 2.5) on a 9-inch by 9-inch square in the center of the casting, 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

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equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) 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 (LRFD) 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.

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- 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.

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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.

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- 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.

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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

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- 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.

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- 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

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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

SECTION 331110

WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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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.
- F. Pipe to be located under taxilanes shall be installed inside a steel casing. Diameter and wall thickness of the casing shall be determined by the design engineer.

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.

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WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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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 331216B 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

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WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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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 ASTM B88 thickness class Type K Copper.
- b. No joints are allowed. End connections shall be compression couplings or pack joints.

3. HDPE

- a. Pipe under 3-inches in diameter shall be high-density polyethylene PE4710 pressure pipe for water mains meeting ANSI/AWWA C901.
- b. No joints are allowed. End connections shall be butt fused or compression couplings with internal stiffeners.

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WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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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 requirements listed in ANSI/AWWA C153/A21.53. Flanged fittings shall conform to ANSI B16.1, class 125 drilling pattern.
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).

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WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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- 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 331216B 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.

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WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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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 suitable for potable water piping and conforming to NSF-61 and 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.

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. RPBA's must be inspected and tested annually during the life of the contract.
- E. RPBA's 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.

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WATER DISTRIBUTION SYSTEM PIPING AND FITTINGS

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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

Civil Water Distribution System Connection Procedure

Temporary Construction Water Connections:

SEA requires a DOH approved RPBA assemblies for temporary construction water connections.

- 1) Provide a DOH approved Reduced Pressure Backflow Assembly (RPBA)
- 2) Obtain F&I Civil and Airport Fire Department approval on use at Fire Hydrant location or blow-off connection to existing watermain.
- 3) Schedule Aviation Maintenance Operating Engineer (Boiler Shop) to test backflow prevention assembly, witness minimum 1% chlorine disinfection swabbing by Contractor and connection to Fire Hydrant. Schedule Aviation Maintenance Field Crew to open fire hydrant.

Notes:

- The assembly cannot be physically altered (adding hose bibs inside the assembly shut off valves)
- The orientation cannot be altered (turning the valve with discharge facing upward or sideways etc.)
- Device removal will require disinfection and retesting upon reinstall
- Boiler Shop will periodically check temporary installations for compliance
- If the Backflow Assembly Tester (BAT) finds the assembly altered during a check, if egregious, they will isolate source and disconnect device

DOH Cross-Connection Control Rules: <https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-355.pdf>

"Approved backflow prevention assembly" means an RPBA, RPDA, DCVA, DCDA, PVBA, or SVBA of make, model, and size that is approved by the department. 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 or other entity acceptable to the department are considered approved by the department.

USC List: <https://fccchr.usc.edu/list.html>

WATER MAIN TESTING FORM

HYDROSTATIC PRESSURE TESTING (AWWA C600)

As a minimum, all water mains shall be tested in accordance with the Hydrostatic Pressure Testing Requirements of ANSI/AWWA C600 and NFPA-24. Polyethylene pipe shall follow AWWA C901 for pressure testing.

- A. **All thrust restraint fittings and concrete blocking shall be installed, inspected, and approved by SEA Aviation Maintenance Field Crew and Fire Department prior to backfill and performing the pressure tests. The Contractor shall not operate any valves on the existing water mains. All valves shall be operated by AVM Field Crew.**
- B. **Test pressure shall be 250 psi for a minimum duration of two hours.** Loss of water pressure during test shall not exceed 5 psi in a 2-hour period. If pressure loss exceeds 5 psi, then the volume of water to refill the line to obtain the starting test pressure shall be measured (this is the allowable leakage). Allowable leakage cannot exceed the standard as determined below.
- C. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet. Pressure testing against existing active water system valves is not acceptable. All hydrant valves shall be open so that the hydrants are included in the pressure test.
- D. The pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to SEA. When filling from the existing water system, a DOH approved RPBA will be required for the connection. The pump, pipe connection, and all necessary apparatus including the gauges shall be furnished by the contractor. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the contractor shall open fire hydrants at such points so the air can be expelled as the line is filled with water.
- E. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the contractor shall repair the joints, retighten the bolts, relay the pipe, or replace the pipe until the leak is eliminated-- regardless of total leakage as shown by the hydrostatic test.
- F. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the contractor's expense. All pipe and fitting must have a pressure rating higher than the test pressure.
- G. Lines which fail to meet test requirements shall be repaired and retested as necessary until test requirements are complied with.
- H. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{SD \sqrt{P}}{148,000}$$

L = Allowable Leakage (gph)
 S = Length of Pipe (ft)
 D = Pipe Diameter (in)
 P = Test Pressure (psi)

AWWA C600 Table 6A - Allowable Leakage Per 1,000 Feet of Pipeline* in GAL/HR

Avg. Test Pressure psi	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"
250 psi	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13

DISINFECTION OF WATER MAINS (AWWA C651)

- A. All water mains shall be disinfected and tested per ANSI/AWWA C651 – Disinfecting Water Mains and coordinated with SEA Aviation Maintenance (AVM) and F&I Civil Engineering Group.
- B. **FILL: Fill main with water chlorinated to a minimum of 25mg/L, which shall remain in the pipe for at least a 24-hour contact time. Test a minimum of 10mg/L of detectable free chlorine after 24-hr holding period.**
Contractor to schedule SEA AVM Boiler Room to test and record chlorine levels. Filling from the existing water system requires an approved reduced pressure backflow prevention assembly (RPBA), see SEA temporary water connection requirements.
- C. **FLUSH:** Flush and poly pig with a chlorine saturated foam block 2" larger than pipe diameter at a minimum of 2.5 ft/sec. Flushing shall continue until chlorine residuals level is below 1.5 mg/L. Chlorinated water shall be discharged at a rate that won't overload the system to the Industrial Wastewater System (IWS), or after dechlorinating to the Sanitary Sewer System. If there is not an approved discharge location, the Contractor is responsible for collecting and disposing of the chlorinated water. Obtain approval from F&I Civil and schedule with Field Crew prior to discharging.
- D. **SAMPLE:** Contractor to schedule AVM Boiler Room to collect water purity samples for Bacteriological Test. Sampling can only be conducted between Monday through Friday, 7:00 AM thru 11:59 AM. Allow 3 to 5 working days for results from purity test to be obtained from SPU Lab. If test passes final connection can be completed, if not disinfection procedures are to be repeated until a passing test result is obtained.
- E. **FINAL CONNECTIONS TO EXISTING WATERMAINS:** If the total length of the connection is less than 20 feet and one length of pipe, the pipe and fittings required for the connection may be spray disinfected or swabbed with a minimum one percent solution of chlorine just before being installed. Contractor to schedule AVM Boiler Room to witness swabbing.
- F. **INSPECT:** Field Crew opens valves to pressurize system and conducts visual inspection for leaks at point of connection prior to backfill.

HYDROSTATIC PRESSURE TEST FORM
TO BE COMPLETED BY SEA AVM FIELD CREW ONLY

Project: _____ Contractor: _____ Field Crew: _____

Date: _____ Location of Mains Tested: _____

	LENGTH (FT)	DIAMETER (IN)	TEST PRESSURE (MIN. 250PSI)	ALLOWABLE LEAKAGE (GAL/HR)
SECTION				
SECTION				
SECTION				
2-HR TOTAL ALLOWABLE LEAKAGE				GAL

Test Start: ½ Hour Pressure: _____ Refill amount (in gallons): _____

 1 Hour Pressure: _____ Refill amount (in gallons): _____

 1-½ Hour Pressure: _____ Refill amount (in gallons): _____

 2 Hour Pressure: _____ Refill amount (in gallons): _____

TOTAL LEAKAGE _____ GALLONS ☐ PASSED ☐ FAILED

COMMENTS:

DISINFECTION TEST FORM

Disinfection Start Date/Time: _____ Chlorine Residual: _____ mg/L

Disinfection End Date/Time: _____ Chlorine Residual: _____ mg/L

Flushed and Sampled By: _____

Sample Date: _____

Bacteriological Results / Date: _____

Date of Connection: _____

COMMENTS:

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. 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.
 - 2. 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.
 - 3. Grooved Piping System Compatible Valves: Allowed only for temporary piping and selected pumping assemblies with prior approval by Port of Seattle Facilities and Infrastructure.
 - 4. The following valves are not allowed: Butterfly Valves.
 - 5. Provide independent supports as required at concentrated loads from valves and flanges.
 - 6. Valve diameter shall match size of adjacent pipe.
 - 7. Valves in vaults 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.

SECTION 331216 WATER VALVES

- 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.

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- 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: 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 covering resilient seated gate valve for water supply service.
2. Rated for 250 psi maximum working pressure and 500 psi static test pressure.
3. The valves shall have a ductile iron body, bonnet, and O-ring plate. The wedge shall be totally encapsulated with rubber.
4. The sealing rubber shall be permanently bonded to the wedge per ASTM D429.
5. Valves shall be supplied with O-ring seals at all pressure retaining joints. No fat gaskets shall be allowed.
6. The 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.
7. Stems shall be cast copper alloy with integral collars in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of wedge and of stem (in NRS valves).
8. Stems shall have two O-rings located above thrust collar and one O-ring below. Stem O-rings shall be replaceable with valve fully opened and subjected to full pressure. The stems on 4" – 20" shall also have two low torque thrust bearings located above and below the stem collar to reduce friction during operation.

SECTION 331216 WATER VALVES

9. Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area. Valves 4" and larger shall accept a full size tapping cutter.
10. The body, bonnet and O-ring plate shall be fusion-bond epoxy coated, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 Certified.
11. Each valve shall have maker's name, pressure rating, and year in which it was manufactured cast in the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of AWWA C515 (and UL/FM where applicable).
12. 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.
13. 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.

SECTION 331216 WATER VALVES

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.

SECTION 331216 WATER VALVES

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.
2. For curb stop valves, curb boxes shall be either all cast iron parts, or cast iron base and lid with steel upper section, all epoxy coated. Curb box lids shall have the word "WATER" cast in raised letters and have two (2) pick holes.

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.

3. Valve extension stems for curb stop valves shall be stainless steel.

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

SECTION 331216B
WATER COMBINATION AIR VALVE

Operated by the Port of Seattle

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 neck 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.

SECTION 331216B
WATER COMBINATION AIR VALVE

Operated by the Port of Seattle

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.

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WATER COMBINATION AIR VALVE

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- 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.

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WATER COMBINATION AIR VALVE

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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.
6. Requirements for 1-inch combined air release and air vacuum valves at landside and unpaved areas shall be in accordance with STIA F&I Standard Details – Appendix A.

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,

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WATER COMBINATION AIR VALVE

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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.

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WATER COMBINATION AIR VALVE

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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

SECTION 331219 FIRE HYDRANTS

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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.

SECTION 331219 FIRE HYDRANTS

- 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.

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- 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 - 5-1/4" MVO 129S, 3-Way Model
 - 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 1/4" 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 alloy 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 ¾" 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 O-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

SECTION 333100

SANITARY SEWER SYSTEM (SSS) REQUIREMENTS

Operated by the Port of Seattle

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 50% 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

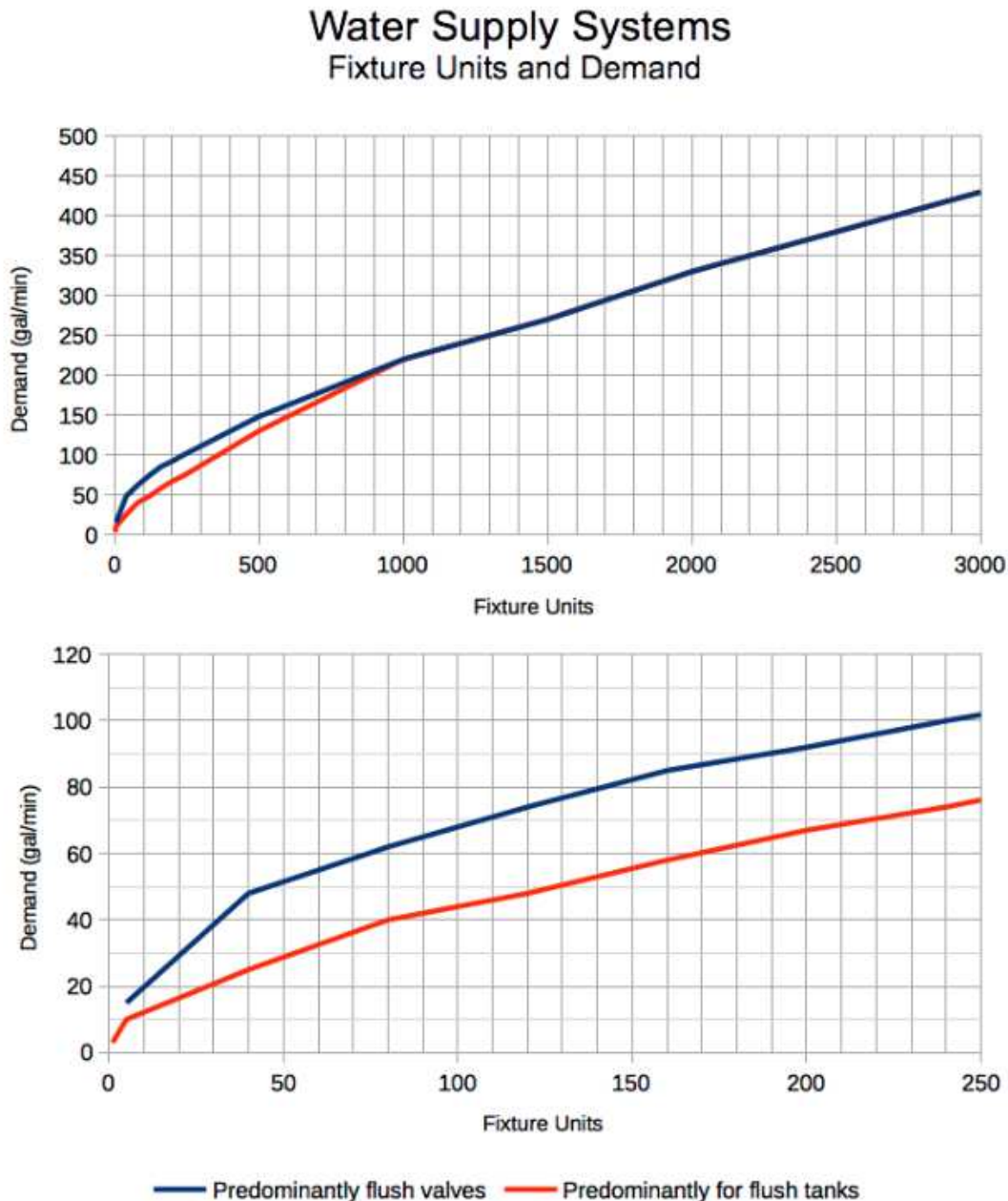
Fixture	Fixture Units
Water Closet	6
Water Closet <1.6 GPF	3
Urinal	5
Lavatory	1
Sink, bar	2
Sink, kit	3
Sink, mop	3
Sink, service	3
Drinking Fountain	1
Floor Drain	2
Dishwasher	3
Clotheswasher	2
Floor Sink	8
Shower	2

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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.

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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

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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.

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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 except ductile iron shall be 3-feet below finished grade. Where the cover is below 3 feet, the design engineer shall determine the required ductile iron pipe thickness class. 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.

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- 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.
- M. Pipe to be located under taxilanes shall be installed inside a steel casing. Diameter and wall thickness of the casing shall be determined by the design engineer.

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

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- 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 – AIRCRAFT OPERATIONS 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.

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- B. Polyvinyl Chloride (PVC) Sewer Pipe:
 - 1. AWWA C900-16 DR25.
 - 2. Joints: Push-on joint meeting ASTM D3139.
 - 3. Gaskets: Shall meet the requirements of ASTM F477.
 - 4. Manufacturing quality control testing shall meet the requirements of AWWA C900-16.
 - 5. Bends shall match pipe material.

2.02 SANITARY SEWER PIPE – ALL OTHER AREAS

- A. Sanitary sewers located at least 10-feet (horizontal) from paved area shall be either 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 35 and have a pipe stiffness of 46 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 C900-16.
- B. PVC Fittings: AWWA C907
- C. Joints: Shall be push-on joints meeting ASTM D3139.
- 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.

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- 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.

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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

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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. Pipe between the building and the first grease interceptor vault shall be Epoxy Coated and Lined Cast Iron Soil Pipe and Fittings in conformance with ASTM A74 and EN 877.
 - 2. Pipe and fittings between the grease interceptor vaults and downstream of the second vault shall be C900 PVC per STIA F&I Civil Systems Standards Section 333111, Sanitary Sewer Piping.
- 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

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- 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

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- 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 to top of subgrade. 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.
- G. Pipe to be located under taxilanes shall be installed inside a steel casing. Diameter and wall thickness of the casing shall be determined by the design engineer.

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

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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 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. 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:

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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

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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

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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

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- 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. (UNDERDRAINS, ROOF DOWNSPOUTS, AND VAULT DRAINS)

- 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.

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- 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 PCCP 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 asphalt-paved or 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 26 and have a pipe stiffness of 115 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

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- 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 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-

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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

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- 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. IWS Pipe for Force Mains (Ductile Iron)
 - 1. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application). All pipe shall be restrained joint pipe.

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2. Lining: Cement mortar lining meeting AWWA C104
3. Asphaltic Coated: AWWA C151
4. Gaskets for IWS pipes shall be made of elastomer nitrile (NBR) and meet the requirements of AWWA C111
5. Manufacturing quality control testing shall meet the requirements of ASTM A746
6. Joints:
 - a. Restrained Joints - Manufactured proprietary joint that mechanically restrains pipe to adjoining pipe. Manufacturers and Products:
 1. American Cast Iron Pipe; Flex-Ring, Field Flex-Ring, and Lok-Ring.
 2. Pacific States Pipe; Thrust-Lock.
 3. U.S. Pipe; TR Flex and HP Lok.
 - b. Mechanical joints, AWWA C110 and AWWA C111.
 1. 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.
 2. Use only in areas where adjoining to fixed points where laying length is determined in field.
 3. Prior to purchase and installation, type and application of this joint shall be approved by Engineer.
 - c. Use of set screws for restraint or field-lock gaskets shall not be allowed.
7. Fittings:
 - a. 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.
 - b. Rubber Gasket Joints Including Mechanical Joints, and Flanged Joints: In accordance with AWWA C111/A21.11.
 - c. Mechanical Joint Fittings: In accordance with AWWA C110/A21.10 and AWWA C153/A21.53.
- B. Storm Drainage and Sewer Pipe for Force Mains (PVC)
 1. PVC pipe and fittings: AWWA C900-16, DR 14. All pipe shall be restrained joint pipe.

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2. Rubber gaskets shall conform to ASTM F477.
 3. Manufacturing quality control testing shall meet the requirements of AWWA C900-16.
 4. Joints:
 - a. Joints shall meet the requirements of ASTM D3139.
 - b. Restrained Joints - Manufactured proprietary joint that mechanically restrains pipe to adjoining pipe. Manufacturers and Products:
 1. EBAA Iron 1900 Serrated Restraint Harness.
 2. SIGMA Corporation, PV-Lok Serrated Bell Joint Restraint.
 - c. Use of set screws for restraint shall not be allowed.
 5. Fittings:
 - a. Fittings shall meet the requirements of AWWA C900-16.
- C. Storm Drainage and Sewer Pipe for Force Mains (HDPE)
1. HDPE pipe and fittings: AWWA C906, DR 9. HDPE shall conform to the outside diameter dimensions of ductile iron pipe (DIOD or DIPS) or iron pipe (IPS).
 2. Manufacturing quality control testing shall meet the requirements of AWWA C906.
 3. Joints: HDPE joints shall be thermally butt-fused and meet the requirements of ASTM F2620.
 4. Fittings:
 - a. Solid wall HDPE, shall have a dimension ratio (DR) of 9, conform to the outside diameter dimensions of ductile iron pipe (DIOD or DIPS) iron pipe or (IPS), and conform to the requirements of AWWA C906.
 - b. HDPE connections to ductile iron pipe fittings shall be accomplished with an HDPE flange adapter and ductile iron back-up ring per AWWA C906.
- D. 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:

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- 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.
- E. 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.
- F. Sewer, Storm, and IWS force main design shall include analyses for if airvac valves are needed. Airvac valves shall be installed at high-points in the force main pipeline.

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.

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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.

- 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

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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.

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- 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

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- 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.

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- 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

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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 polyolefin, 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.

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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-foot 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

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- 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 Zinc (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 one 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.

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- 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 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 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, support a minimum proof load of 200,000 pounds on a 9-inch by 9-inch square, shall have a minimum frame bearing width of 2 inches, and be one of the following products or approved equivalent:
 - 1. ACO PowerDrain Series S200K and S300K
 - 2. East Jordan 6901 Bolted Extra Heavy Duty Airport Trench Drain Assembly
 - 3. 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

SECTION 334236 CHANNEL DRAINS

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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 H-25/HS-25 traffic rating of 20,000 pounds per wheel and support a minimum proof load of 50,000 pounds (20,000 pounds x 2.5) on a 9-inch by 9-inch square in the center of the casting, 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

SECTION 334241 FRAMES, COVERS, AND GRATES

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- 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.

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

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

END OF SECTION

SECTION 334419 OIL WATER SEPARATOR VAULTS

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PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

- A. API Baffle Style Oil Water Separator Vault Systems shall be designed in accordance with 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. Coalescing Plate Oil Water Separator Vault Systems shall be designed in accordance with Section BMP T11.11 in the Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SWMMWW).
- C. 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

SECTION 334419 OIL WATER SEPARATOR VAULTS

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- 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
- J. Washington State Department of Ecology (DOE) 2019 Stormwater Management Manual for Western Washington (SWMMWW) Section BMP T11.11.

PART 2 PRODUCTS

2.01 OIL-WATER SEPARATOR VAULT

- A. Oil-water separator vault shall be of the configuration per the plans and shall be either an American Petroleum Institute (API) Baffle style or Coalescing Plate style dependent on project requirements, see standard details. It shall be sized to treat the design flow per section BMP T11.11 of the SWMMWW and manufacturer guidance to treat the quality design flowrate.
- B. Pre-cast concrete vault shall consist of a vault with piping, oil retaining baffle(s) or coalescing plates, ventilation pipes, hexagonal flow plates, access cover(s) and frames. It shall be gas and watertight. High flow bypasses shall be installed upstream and downstream of the vault to redirect flows greater than the design flow. A shutoff valve and riser shall be installed downstream of the vault to prevent oil discharges during maintenance and to provide emergency shutoff in case of a spill. 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, ha

SECTION 334419 OIL WATER SEPARATOR VAULTS

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- D. rdstands, 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.
- E. 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.
- 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 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.
- G. All structural calculations for the vault shall include the depth of cover over the vault.
- H. Structural calculations for the oil-water separator vault shall be completed by a Washington state licensed engineer.
- I. 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
- J. Excavation and backfill shall be per STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill
- K. Finished floor of vault shall not exceed 12-ft from finished grade.
- L. 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 GENERAL BIORETENTION AND BIOFILTRATION DESIGN REQUIREMENTS

- A. All bioretention and biofiltration facilities and soil amendments shall be designed in conformance with the Seattle Tacoma International Airport (STIA) Stormwater Management Manual for Port Aviation Division, Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SWMMWW), and STIA Low Impact Development (LID) Guideline.
- B. All bioretention, biofiltration, and compost-amended BMPs must be sited in conformance with the STIA LID Guideline document.

1.02 BIORETENTION DESIGN REQUIREMENTS

- A. Soils and infiltration testing shall be performed by a soil engineer/professional in accordance with the STIA stormwater manual.
- B. 3-foot minimum depth between bottom of bioretention and top of groundwater or hydraulically restrictive layer unless approved by the Port.
- C. 4-inch max ponding depth
- D. Facility must drain within 48 hours
- E. Constructed with underdrain
- F. Vegetation consistent with STIA Wildlife Hazard Management Plan (WHMP)
- G. 6-inch minimum freeboard (measured from the overflow elevation to the top of bioretention facility). Overflow systems will be determined by the Engineer.
- H. 1-foot minimum bottom width and 3H:1V max vegetated side slopes.
- I. 18-inch bioretention soil mix depth and design mix in accordance with Section BMP T7.30 of the SWMMWW.
- J. Use Port-developed models and parameters for areas specified in the STIA stormwater manual in approved continuous models.
- K. Follow STIA Low Impact Development (LID) Guideline and Ecology's manual (site suitability, soil/compost mix, curb cuts, sizing, underdrain).

1.03 COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS) BIOFILTRATION DESIGN REQUIREMENTS

- A. Compost amended vegetated filter strips (CAVFS) shall be designed using Sections BMP T7.40 and T9.40 of the SWMMWW and extended CAVFS shall be designed following the STIA LID guidelines.
- B. 8-inches of compost amended soil in accordance with Section BMP T7.40 of the SWMMWW.
- C. In on-airfield areas, plant grass and incorporate only 2 inches of compost into the upper 4 inches of soil for extended CAVFS.

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- D. For extended CAVFS along runways, lengths are typically 100 feet or greater (3 to 4 times greater than length requirements in Section BMP T9.40 of the SWMMWW).
- E. Within air-field areas, soil should be compacted to no less than 95% proctor to meet FAA requirements.
- F. 1-inch maximum water depth for all CAVFS.
- G. Designed for a 9-minute minimum hydraulic residence time at the water quality design flow rate and 0.5 foot per second maximum velocity per Section BMP T9.40 of the SWMMWW.
- H. 5% maximum longitudinal slope, 2% lateral slope, and 150-foot maximum drainage flowpath of the CAVFS contributing area.

1.04 SOIL AMENDMENT AND DEPTH DESIGN REQUIREMENTS

- A. All soil areas disturbed or compacted during construction, and not covered by buildings or pavement, must be amended with compost as described below.
- B. 8-inches of compost amended soil in accordance with Section BMP T5.13 of SWMMWW.
- C. Within one foot of pavement edge, curbs, and sidewalks, soil should be compacted to approximately 90% proctor to ensure a firm surface.
- D. Within air-field areas, soil should be compacted to no less than 95% proctor to meet FAA requirements.

1.05 SUBMITTALS

Submit materials data for all product listed below in accordance with of Section 013300 - Submittals.

Submit testing requirement results as defined below.

1.06 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO) applicable provisions
- B. American Society for Testing Materials (ASTM) applicable provisions
- C. Seattle Tacoma International Airport (STIA) Stormwater Management Manual for Port Aviation Division applicable sections
- D. Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SWMMWW) applicable sections
- E. Seattle Tacoma Internal Airport (STIA) Low Impact Development Guideline applicable sections
- F. Seattle Tacoma International Airport (STIA) Wildlife Hazard Management Plan (WHMP) applicable sections

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PART 2 PRODUCTS

2.01 BIORETENTION

A. Bioretention Soil Mix

Bioretention Soil Mix shall be a well-blended homogeneous mixture of 60 to 65 percent by volume of Bioretention Drain Rock and 35 to 40 percent by volume of Bioretention Compost as detailed below.

The Bioretention Soil Mix shall be tested to confirm that it meets the following criteria:

Parameter	Method	Requirement
Cation Exchange Capacity	EPA 9081	≥ 5 meq CEC/100 g dry soil
Organic Matter Content	ASTM D 2974 or TMECC 05.07A	5-8% (by dry weight)
Permeability Rate	ASTM D 2434 (using 2012 SWMMWW procedure on BSM 85% compacted per ASTM D 1557)	Initial infiltration rate between 6 inches and 12 inches per hour.

1. Drain Rock:

Drain Rock for Bioretention Soil Mix shall be free of wood, waste, coating, or any other deleterious material, and all aggregate passing the No. 200 sieve must be non-plastic. Drain rock shall consist of crushed, processed, or naturally occurring granular material. Drain Rock shall not consist of recycled granular material. It must be analyzed by an accredited lab using the sieve sizes shown below to meet the following gradation using ASTM D 422:

Sieve Size	Percent Passing (By Weight)
3/4"	100
No. 4	28-56
No. 8	20– 50
No. 50	3 – 12
No. 200	0-1
Abrasion (Max.) %	35

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2. Compost to Aggregate Ratio, Organic Matter Content, and Cation Exchange Capacity for Default BSM
 1. Compost to aggregate ratio: 60-65 percent drain rock, 35 – 40 percent compost by volume.
 2. Organic matter content: 5 – 8 percent by weight.
 3. Cation Exchange Capacity (CEC) must be > 5 milliequivalents/100 g dry soil Note: Soil mixes meeting the above specifications do not have to be tested for CEC. They will readily meet the minimum CEC.
3. Compost for Default BSM
 1. To ensure that the BSM will support healthy plant growth and root development, contribute to biofiltration of pollutants, and not restrict infiltration when used in the proportions cited herein, the following compost standards are required.
 2. Meets the definition of “composted material” in [WAC 173-350-100](#) and complies with testing parameters and other standards in [WAC 173-350-220](#).
 3. Produced at a composting facility that is permitted by the jurisdictional health authority. Permitted compost facilities in Washington are included in a spreadsheet titled *Washington composting facilities and material types – 2017* at the following web address:

<https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost>
 4. The compost product must originate a minimum of 65 percent by volume from recycled plant waste comprised of “yard debris,” “crop residues,” and “bulking agents” as those terms are defined in [WAC 173-350-100](#). A maximum of 35 percent by volume of “post-consumer food waste” as defined in [WAC 173-350-100](#), but not including biosolids or manure, may be substituted for recycled plant waste.
 5. Stable (low oxygen use and CO₂ generation) and mature (capable of supporting plant growth) by tests shown below. This is critical to plant success in bioretention soil mixes.
 6. Moisture content range: no visible free water or dust produced when handling the material.

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7. Tested in accordance with the U.S. Composting Council “Test Method for the Examination of Compost and Composting” (TMECC), as established in the Composting Council’s “Seal of Testing Assurance” (STA) program. Most Washington compost facilities now use these tests.
8. Screened to the following size gradations for Fine Compost when tested in accordance with TMECC test method 02.02-B, Sample Sieving for Aggregate Size Classification.”
9. Fine Compost shall meet the following gradation by dry weight
 - (1) Minimum percent passing 2”: 100%
 - (2) Minimum percent passing 1”: 99%
 - (3) Minimum percent passing 5/8”: 90%
 - (4) Minimum percent passing 1/4”: 75%
10. pH between 6.0 and 8.5 (TMECC 04.11-A). “Physical contaminants” (as defined in [WAC 173-350-100](#)) content less than 1% by weight (TMECC 03.08-A) total, not to exceed 0.25 percent film plastic by dry weight.
11. Minimum organic matter content of 40% (TMECC 05.07-A “Loss on Ignition)
12. Soluble salt content less than 4.0 dS/m (mmhos/cm) (TMECC 04.10-A “Electrical Conductivity, 1:5 Slurry Method, Mass Basis”)
13. Maturity indicators from a cucumber bioassay (TMECC 05.05-A “Seedling Emergence and Relative Growth) must be greater than 80%for both emergence and vigor”)
14. Stability of 7 mg CO₂-C/g OM/day or below (TMECC 05.08-B “Carbon Dioxide Evolution Rate”)
15. Carbon to nitrogen ratio (TMECC 05.02A “Carbon to Nitrogen Ratio” which uses 04.01 “Organic Carbon” and 04.02D “Total Nitrogen by Oxidation”) of less than 25:1. The C:N ratio may be up to 35:1 for plantings composed entirely of Puget Sound Lowland native species and up to 40:1 for coarse compost to be used as a surface mulch (not in a soil mix).

B. Underdrain

1. Perforated polyvinyl chloride underdrain pipe and fittings must be either ASTM D2241 SDR 21 (Class 200) or ASTM D1785

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Schedule 40. ASTM D2241. There shall be 4 rows of slotted perforations evenly spaced around the circumference of the pipe. The slotted perforations must be 0.064-in wide by 1-in long and spaced 0.3-inches apart on center.

2. The ends of the underdrain pipe, not connected to downstream catch basin, shall be fitted with a removable PVC cap or cleanout.

C. Bioretention Weir

1. Well-mixed 6-8" diameter Streambed Aggregate

D. Bioretention Presettling Zone

1. Class 3000 Cement Concrete
2. Drain Rock
 1. Drain Rock for Bioretention Presetting zone consist of crushed, partially crushed, or naturally occurring granular material specified below:

Sieve Size	Percent Passing (By Weight)
3/4"	100
No. 4	28-56
No. 8	20– 50
No. 50	3 – 12
No. 200	0-1
Abrasion (Max.) %	35

3. Well-mixed 6-8" diameter Streambed Aggregate
 1. Aggregates for streambed construction shall be washed, naturally formed, round to sub angular hard, strong, sound, durable, fracture free pieces of igneous and metamorphic rock. Aggregate shall be free of soft, weathered materials and seams of soft rock, shall not contain any wood and other waste, and shall be free of any coating.
 2. The Contractor shall submit certified test reports indicating streambed aggregate complies with the following requirements:
 - (1) All sand size aggregate (passing a U.S. No. 4 sieve and retained on a US No. 200 sieve) shall meet the following requirements:

Specific Gravity	AASHTO T84	Minimum 2.65
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- (2) All gravel (passing a 3 inch sieve and retained on a U.S. No. 4 sieve) and cobble (passing a 12 inch sieve and retained on a 3 inch sieve) aggregate shall meet the same requirements for sand size aggregate and the following additional requirements:

Soundness	ASTM C 88	Not greater than 5% loss
L.A. Abrasion	AASHTO T 96	Max 20% loss at 500 revolutions

3. Gradations:

Streambed Aggregate	
Sieve Size	Percent Passing
8 inch	95-100
3" square	45-60
1 ½" square	30-40
¾" square	10-20
U.S. No. 4	0-3

The portion passing the U.S. No.4 sieve size shall have a minimum sand equivalent of 60

4. Geotextile for Separation

- E. Curb cuts shall be constructed as directed by the Engineer. 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.
- F. Geotextile for Separation
1. Drainage geosynthetic fabric shall be a non-woven geosynthetic conforming to the requirements in 33 46 16, for Construction Geotextile for Underground Drainage, Moderate Survivability, Class B.

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2.02 CAVFS and Extended CAVFS:

2.02.1 Medium Compost

Compost per Section 2.01-A.3

2.02.2 Topsoil A

Topsoil Type A shall meet the following requirements:

1. Cation exchange capacity (CEC) of Topsoil Type A shall be a minimum of 5 milliequivalents CEC/100 g dry soil (U.S. EPA Method 9081).
2. Organic content greater than 8-percent but less than 15-percent as measured on a dry weight basis using AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition.

Topsoil Type A shall be 60-percent to 70-percent Sandy Loam and 40-percent to 30-percent Fine Compost by volume. Sandy Loam shall be as defined by the US Department of Agriculture Soil Classification System.

The Contractor shall submit a Particle Size Analysis as a Type 1 Working Drawing from an independent accredited soils testing laboratory indicating the Material source and compliance with all Topsoil Type A specifications. The laboratory analysis shall be with a sample size of no less than 2 pounds.

2.03 SOIL AMENDMENT:

1. A topsoil layer with a minimum organic matter content of 10% dry weight in planting beds, and 5% organic matter content in turf areas, and a pH from 6.0 to 8.0 or matching the pH of the undisturbed soil. The topsoil layer shall have a minimum depth of eight inches except where tree roots limit the depth of incorporation of amendments needed to meet the criteria. Subsoils below the topsoil layer should be scarified at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible.
2. Mulch planting beds with 2 inches of organic material.
3. Use compost and other materials that meet the following organic content requirements:
 1. The organic content for “pre-approved” amendment rates can be met only using compost meeting the Compost for Default Bioretention Soil Media (BSM) in Section 2.01.A.3 with the exception that the compost may have up to 35% biosolids or manure.

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2. The compost must also have an organic matter content of 40% to 65%, and a carbon to nitrogen ratio below 25:1.
3. The carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 SOIL INFILTRATION TESTING

- A. In order to demonstrate suitable infiltration capability for bioretention, the underlying soil of bioretention facilities shall be tested according to the STIA stormwater manual. Contractor shall submit testing plan to engineer.

END OF SECTION

SECTION 400515B PIPING SUPPORT SYSTEMS

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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.

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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.

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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:

SECTION 400515B PIPING SUPPORT SYSTEMS

Operated by the Port of Seattle

- 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

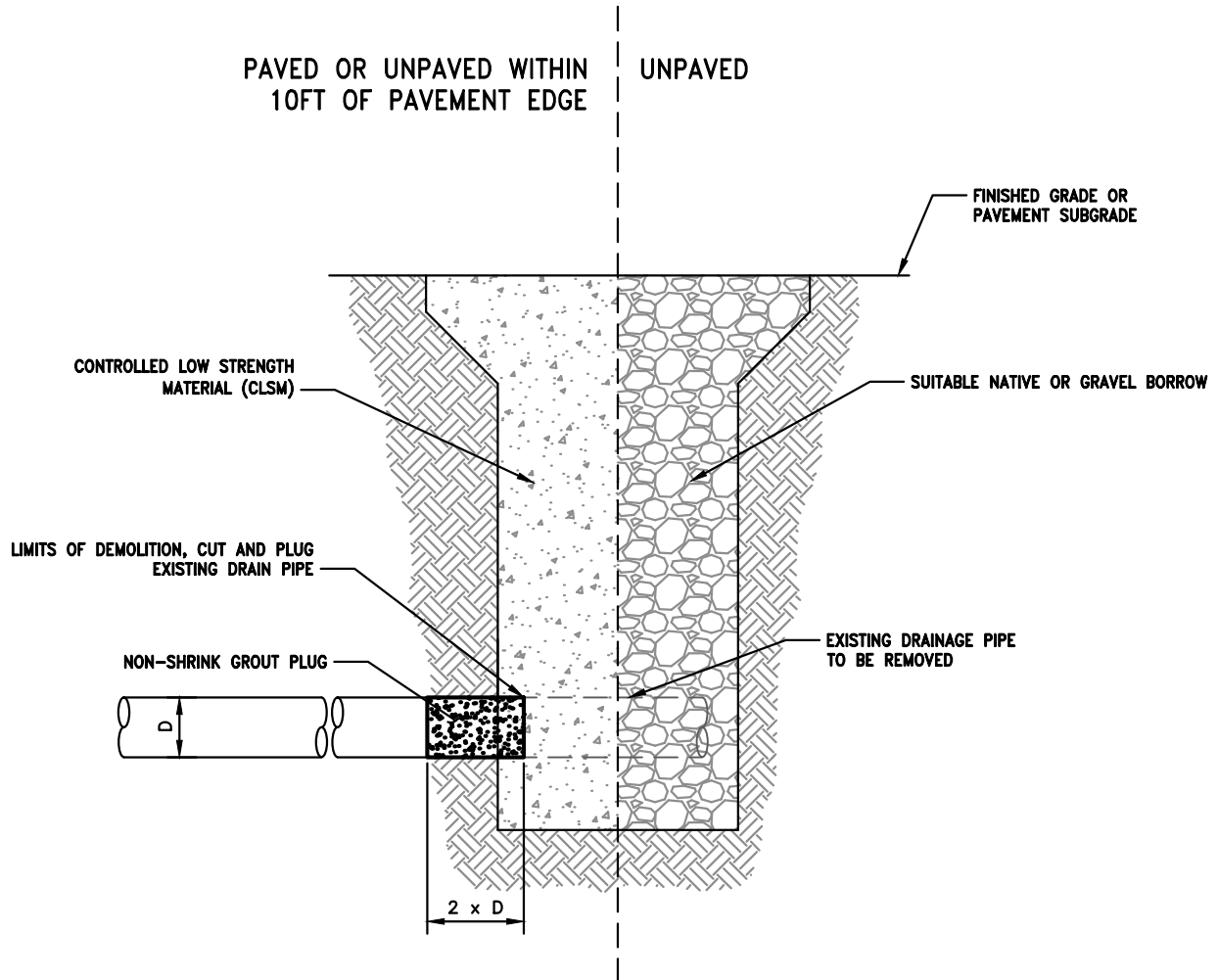
STANDARD DETAILS

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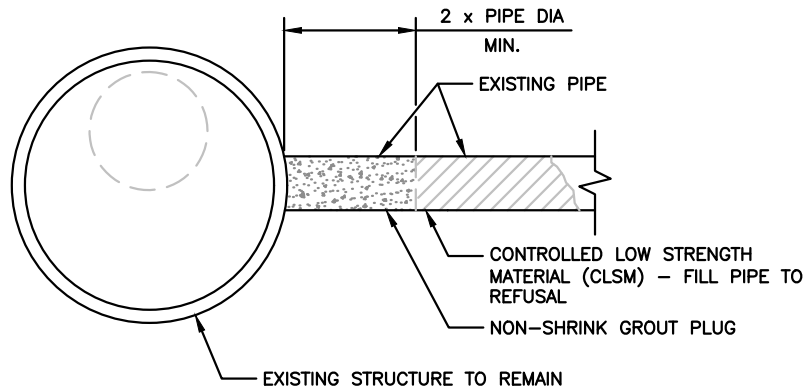


DETAIL
TYPICAL UTILITY DEMOLITION
SCALE: NTS

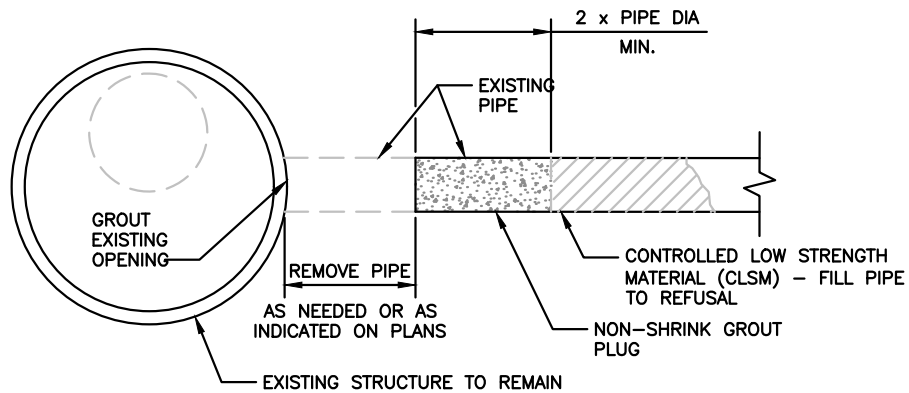
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001

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.



PLAN VIEW (OPTION 1)



PLAN VIEW (OPTION 2)

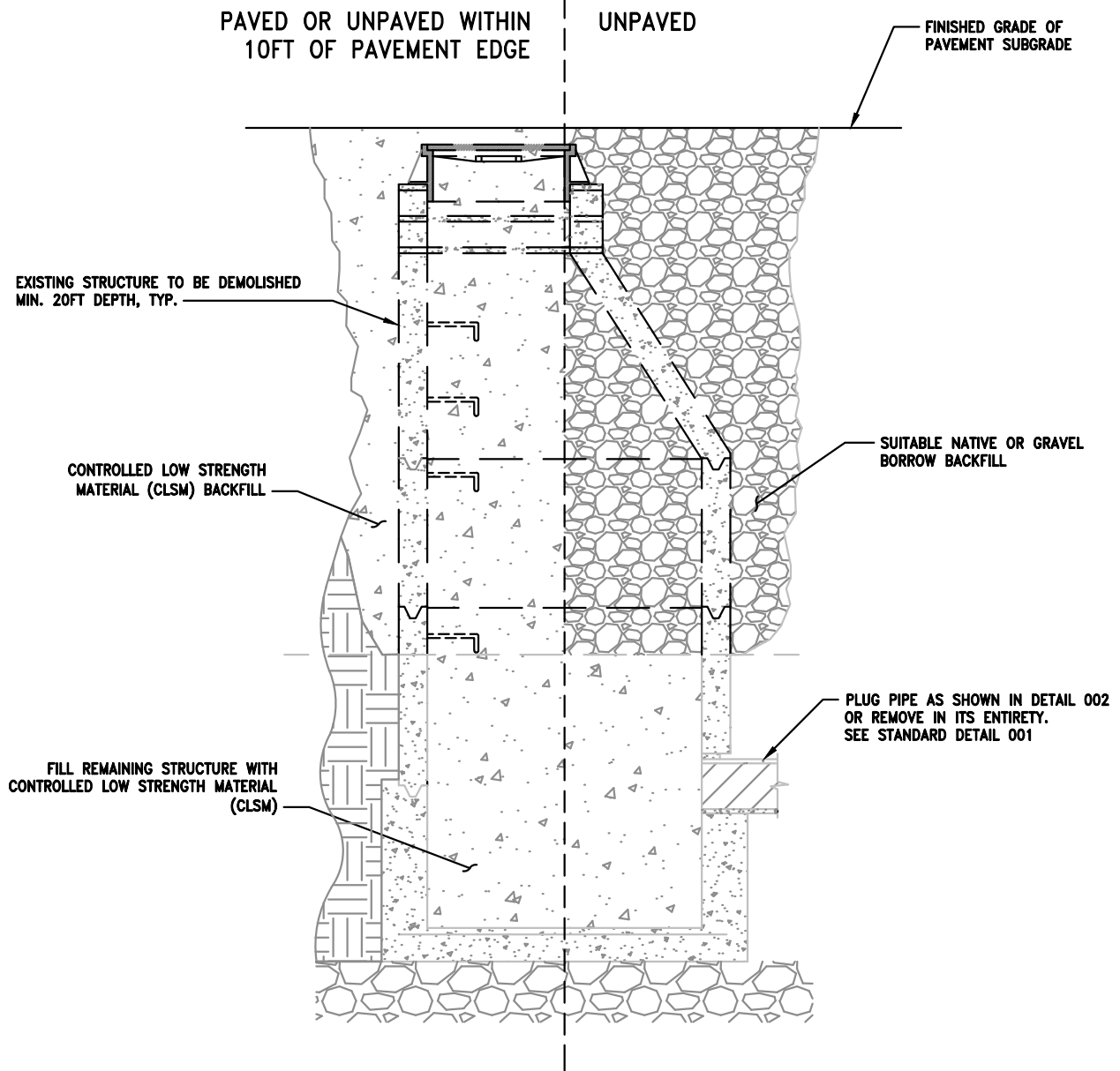
DETAIL

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.



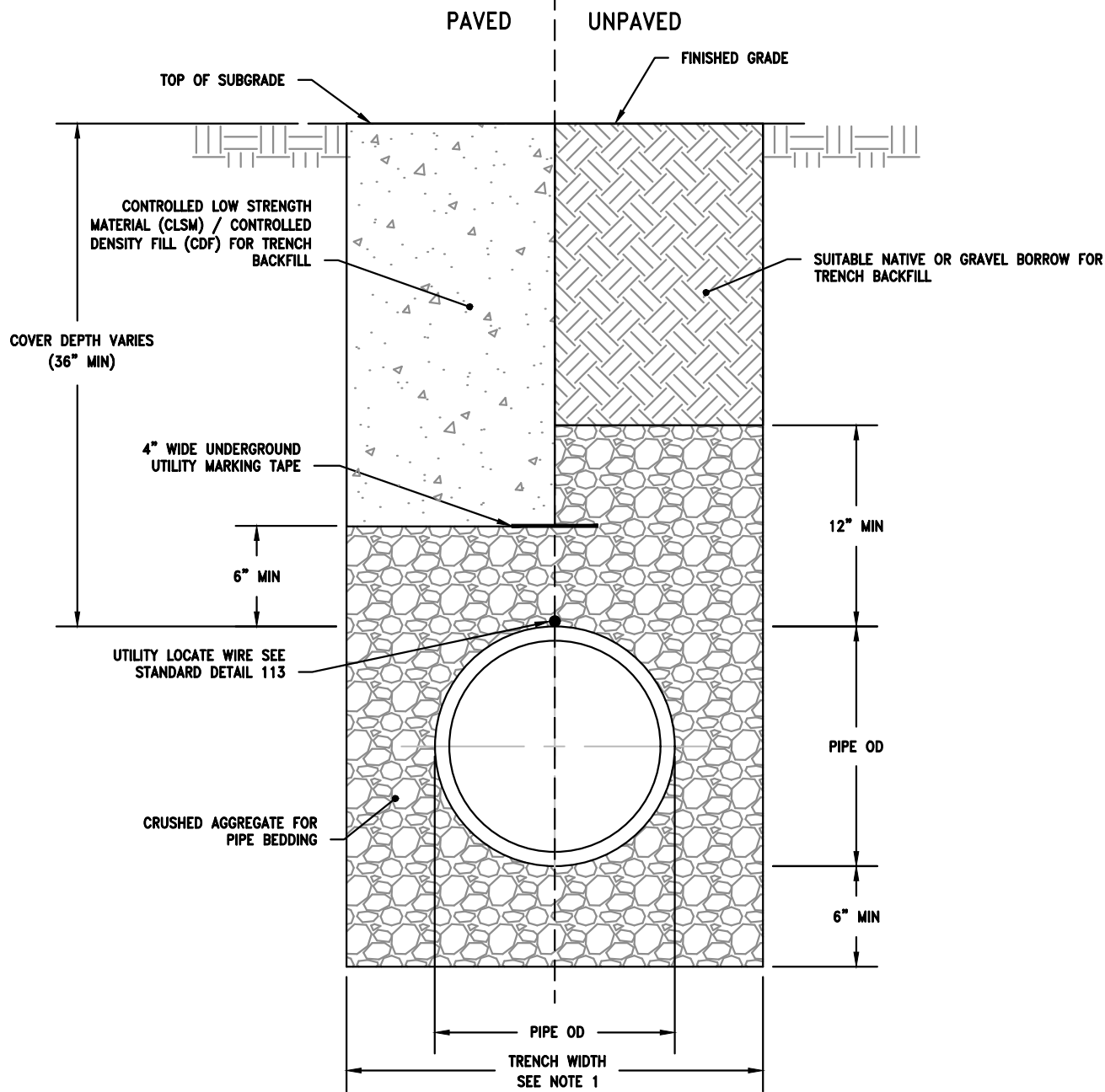
NOTES:

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

MANHOLE ABANDONMENT
SCALE: NTS



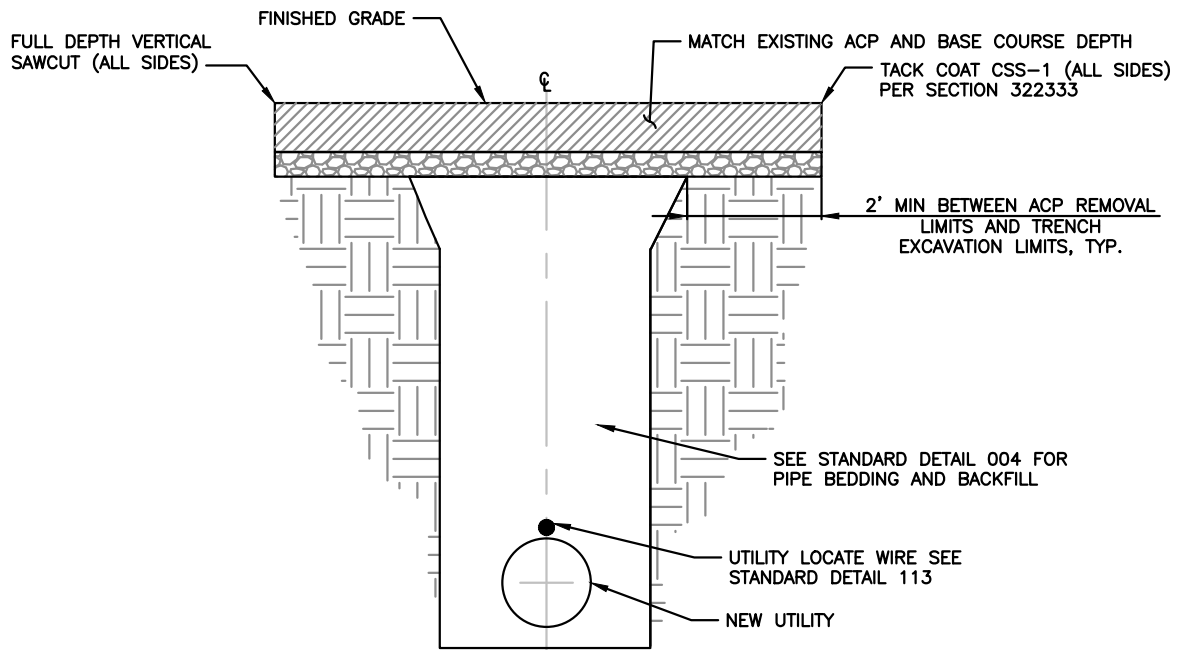


SECTION
 PIPE BEDDING AND TRENCH BACKFILL
 SCALE: NTS

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004

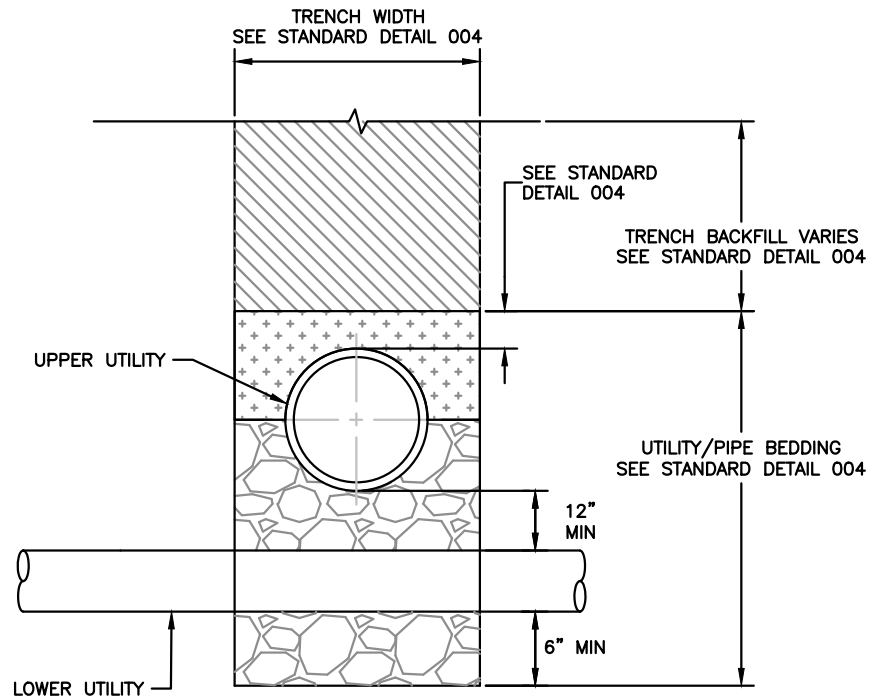
NOTES:

1. PIPE TRENCH WIDTH SHALL BE:
 FOR OD \geq 18" : $(1.5 \times \text{I.D.}) + 18"$
 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.

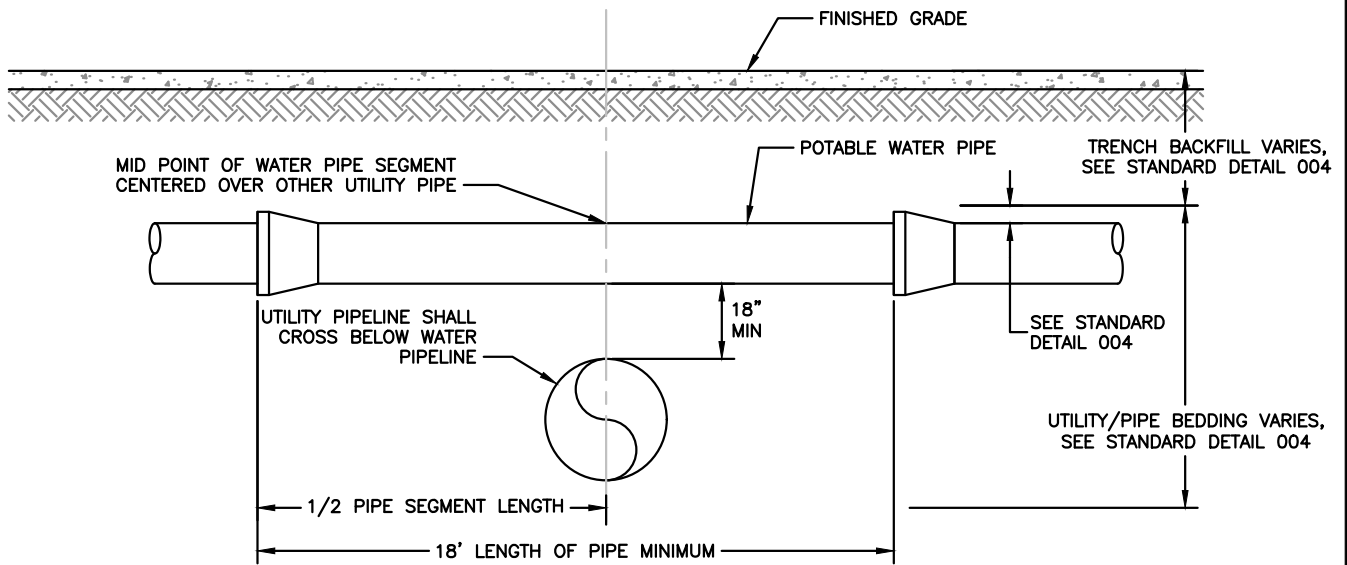


SECTION
ACP TRENCH PATCH
SCALE: NTS

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005



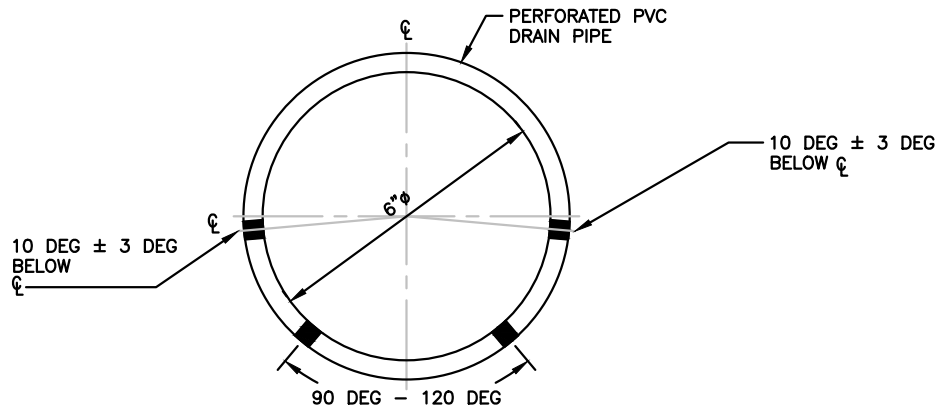
DETAIL
TYPICAL UTILITY CROSSINGS (EXCLUDING WATER) 1
006
SCALE: NTS



DETAIL
WATER PIPE CROSSING 2
006
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.



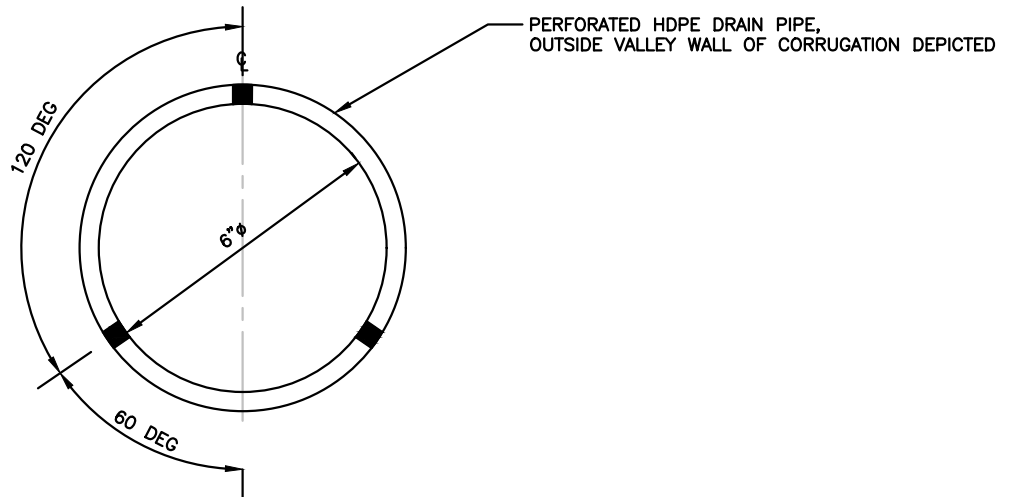
DETAIL

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.



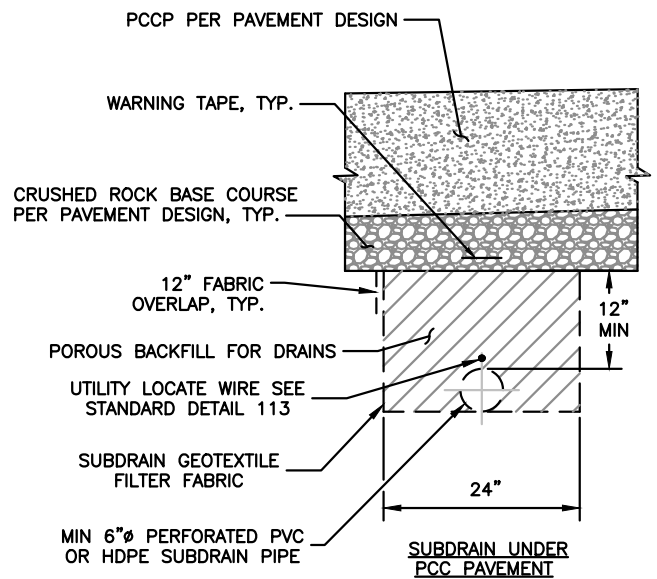
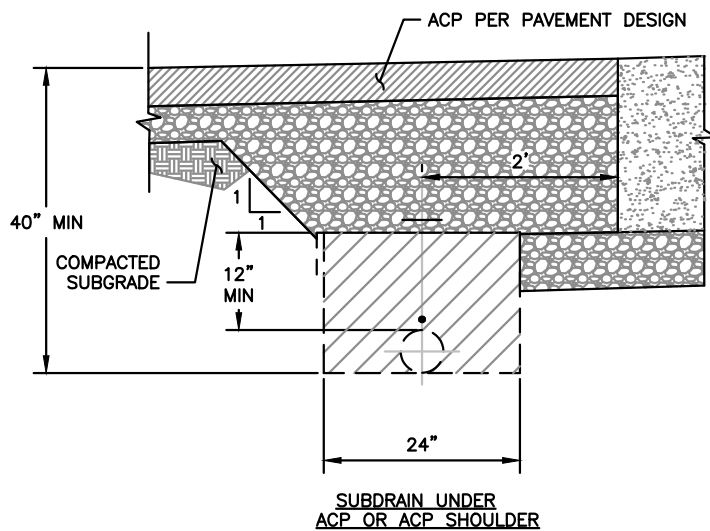
DETAIL

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.



SECTION

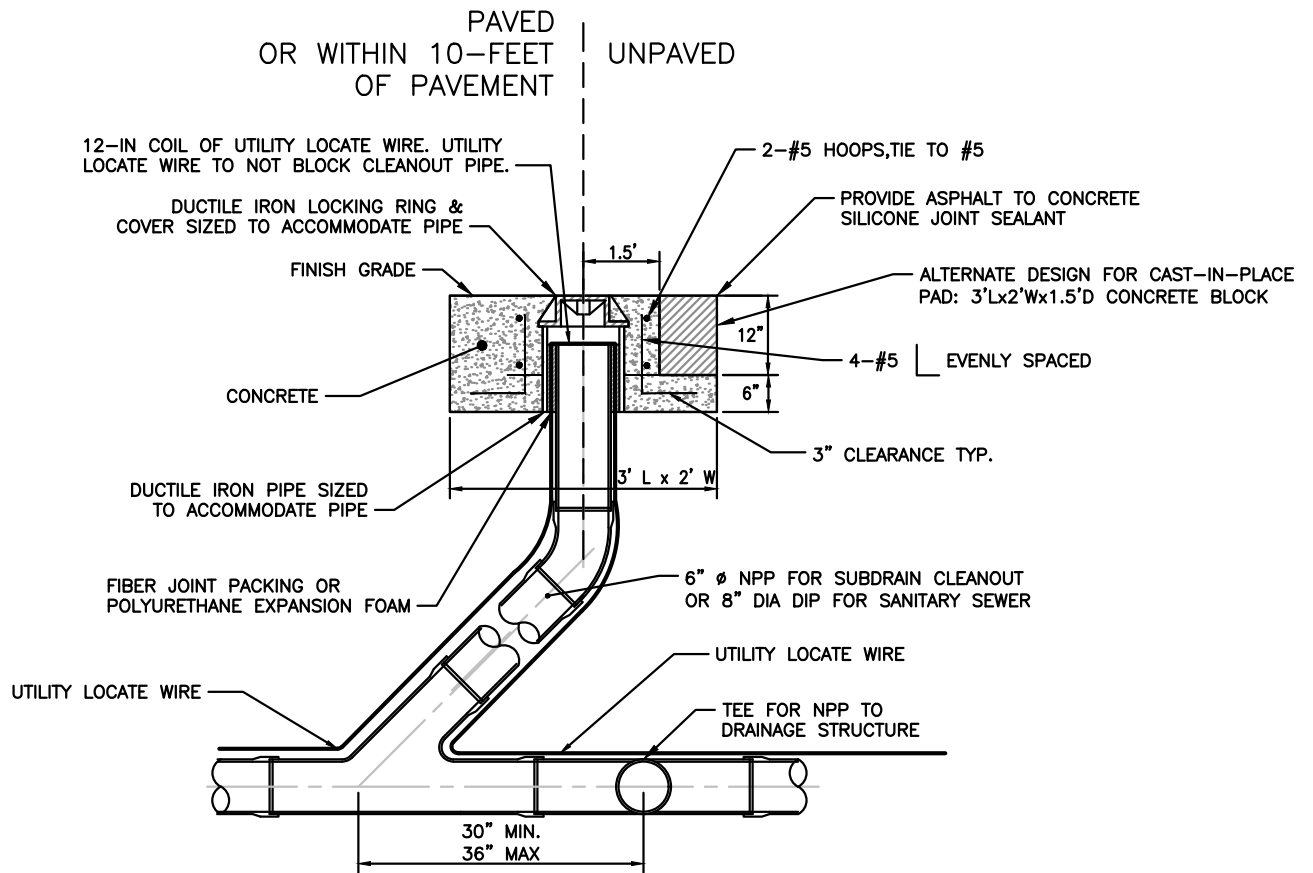
SUBDRAIN SYSTEM UNDER PAVEMENT
SCALE: NTS

1

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.

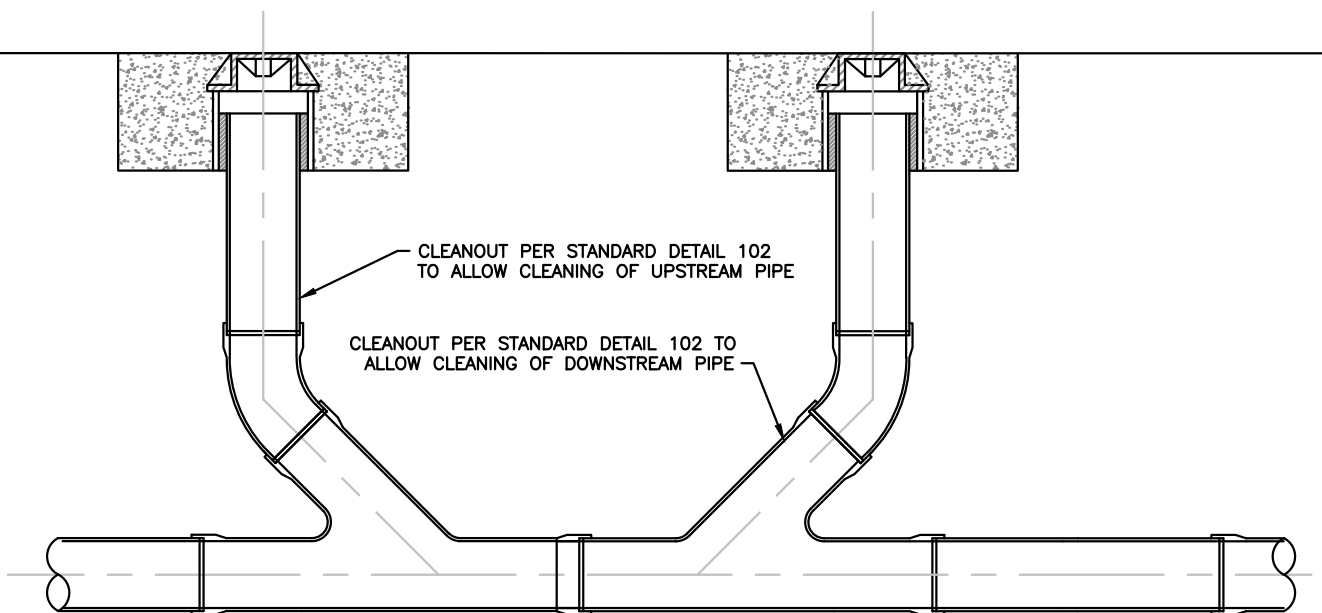


DETAIL
TYPICAL CLEANOUT
SCALE: NTS

1
102

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.

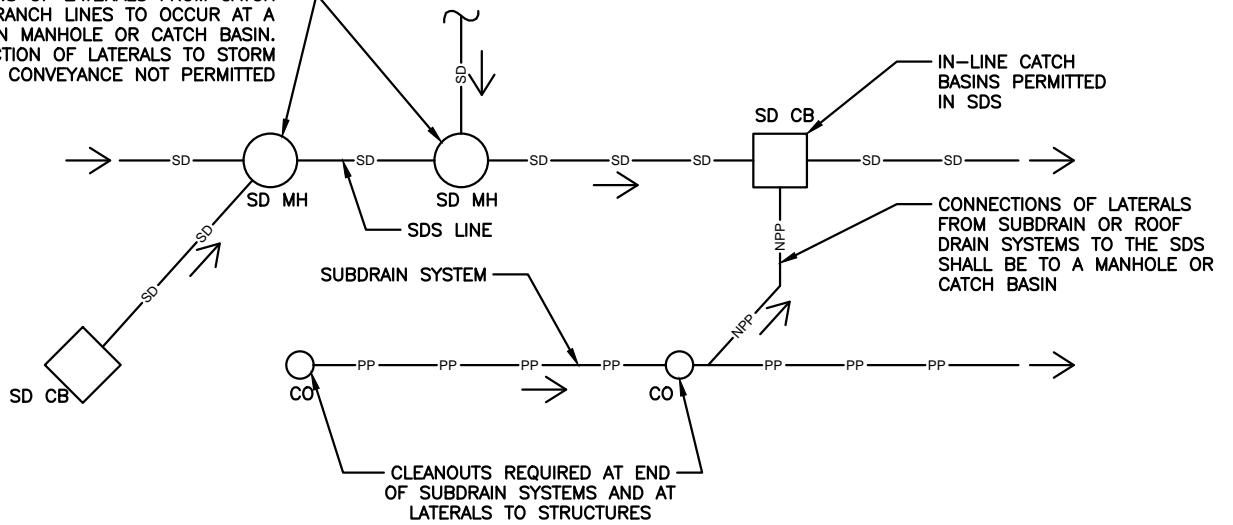


DETAIL
 TYPICAL DOUBLE CLEANOUT
 SCALE: NTS

1
103

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

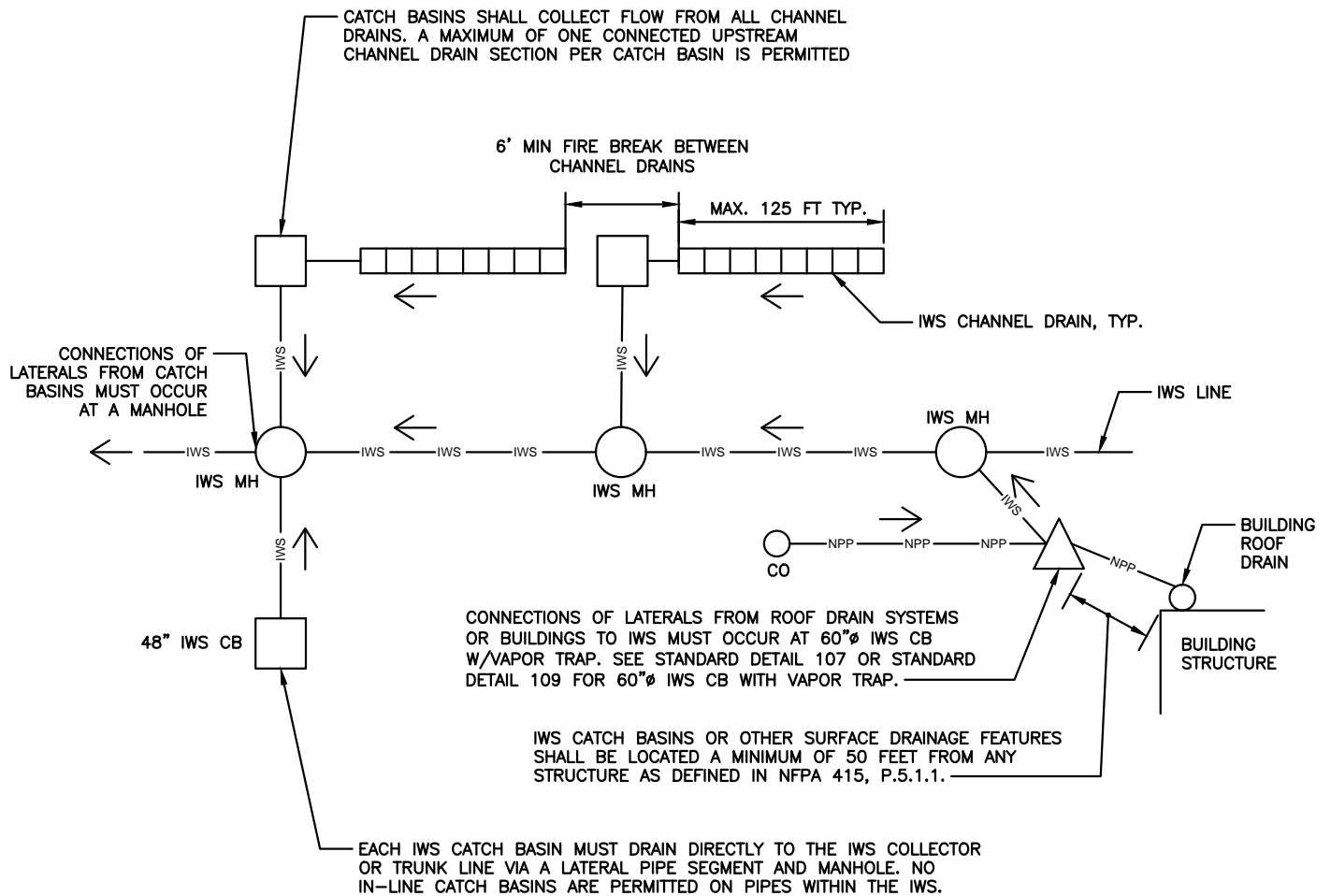
CONNECTIONS OF LATERALS FROM CATCH BASINS OR BRANCH LINES TO OCCUR AT A STORM DRAIN MANHOLE OR CATCH BASIN. DIRECT CONNECTION OF LATERALS TO STORM DRAINAGE CONVEYANCE NOT PERMITTED



DETAIL

TYPICAL STORM DRAINAGE SYSTEM (SDS) LAYOUT
SCALE: NTS

1
104



TYPICAL INDUSTRIAL WASTEWATER SYSTEM (IWS) LAYOUT

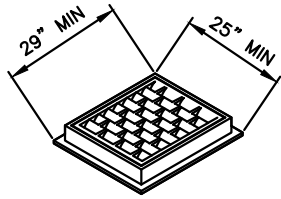
DETAIL

TYPICAL INDUSTRIAL WASTE SYSTEM (IWS) LAYOUT
SCALE: NTS

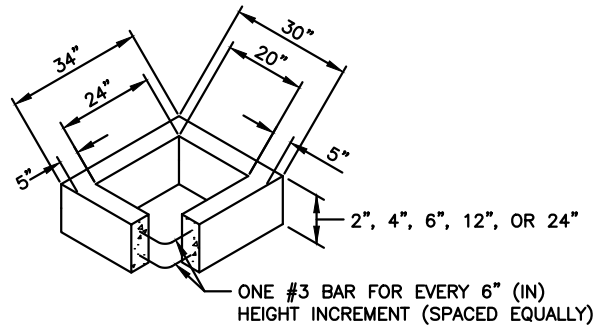


NOTE:

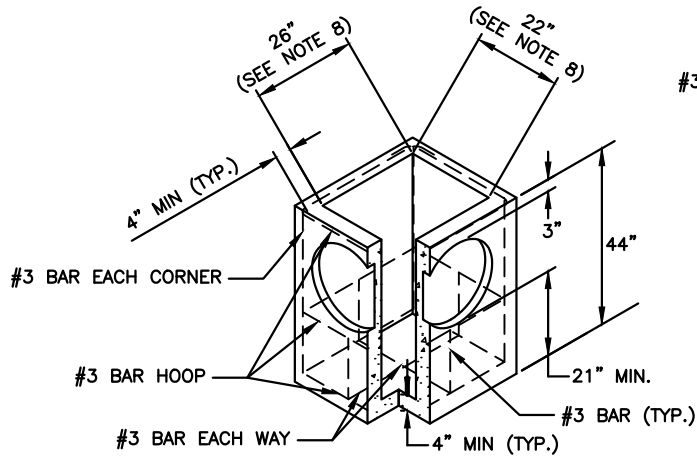
1. FOR ADDITIONAL REQUIREMENTS GOVERNING DRAINAGE ON RAMPS WHERE AIRCRAFT FUELING OCCURS, SEE NFPA 415, CHAPTER 5.



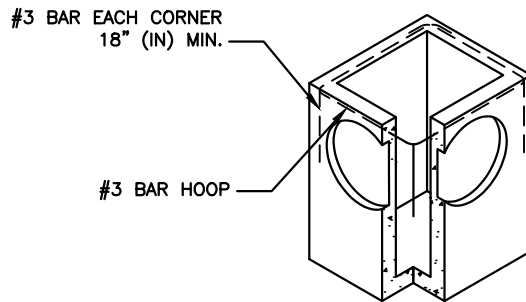
FRAME AND VANED GRATE



RECTANGULAR ADJUSTMENT SECTION



PRECAST BASE SECTION



(SEE NOTE 2)
ALTERNATIVE PRECAST BASE SECTION

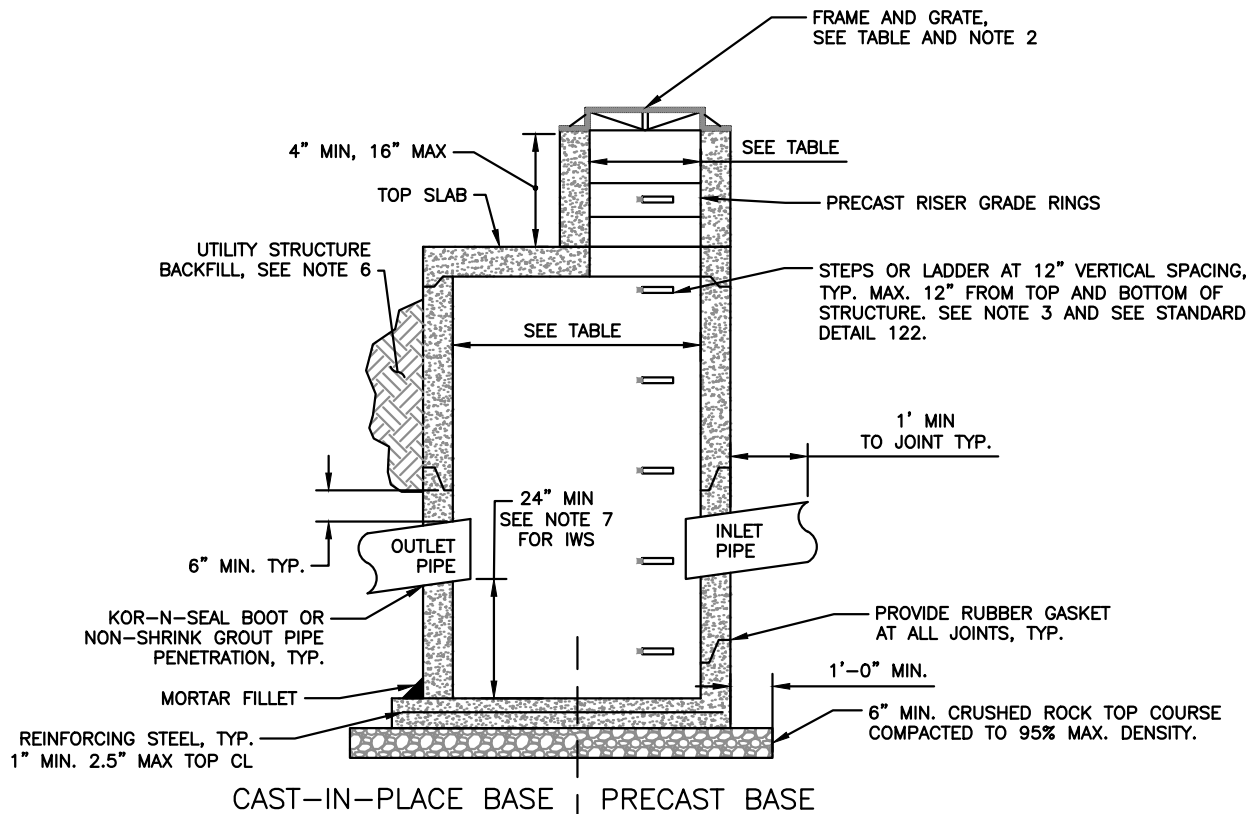
DETAIL

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).



SECTION

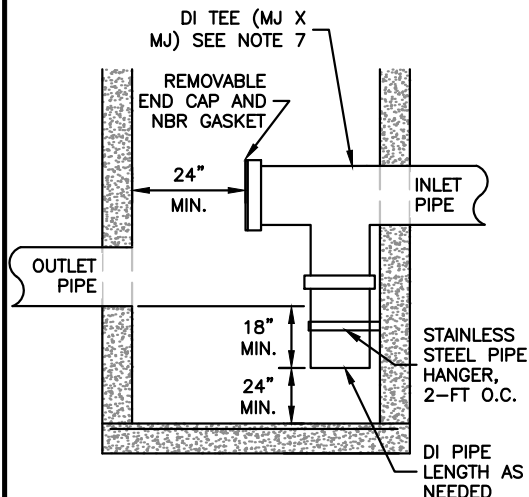
TRAFFIC RATED CATCH BASIN
SCALE: NTS

1

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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

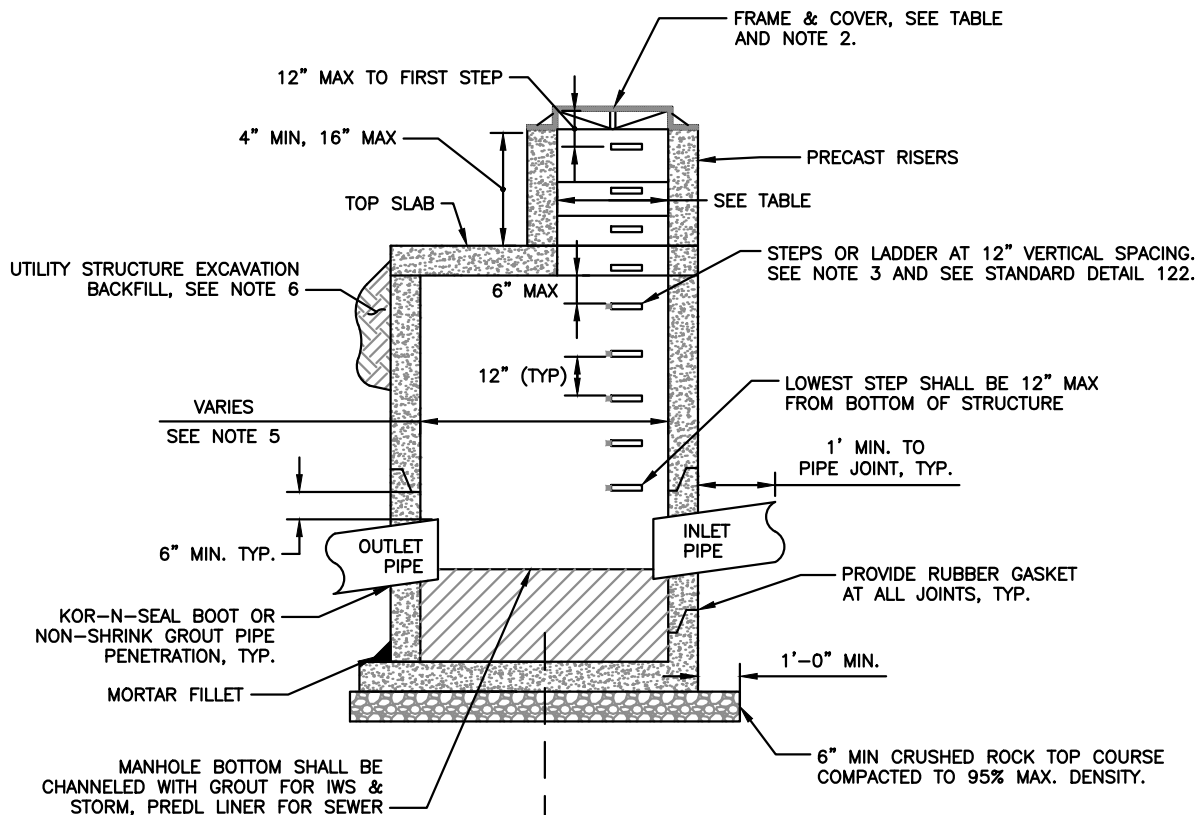
IWS VAPOR TRAP
SCALE: NTS

2

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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.



CAST-IN-PLACE BASE | PRECAST BASE

SECTION

TRAFFIC RATED MANHOLE
SCALE: NTS

1

108

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.

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"

SEA Seattle-Tacoma
International
Airport

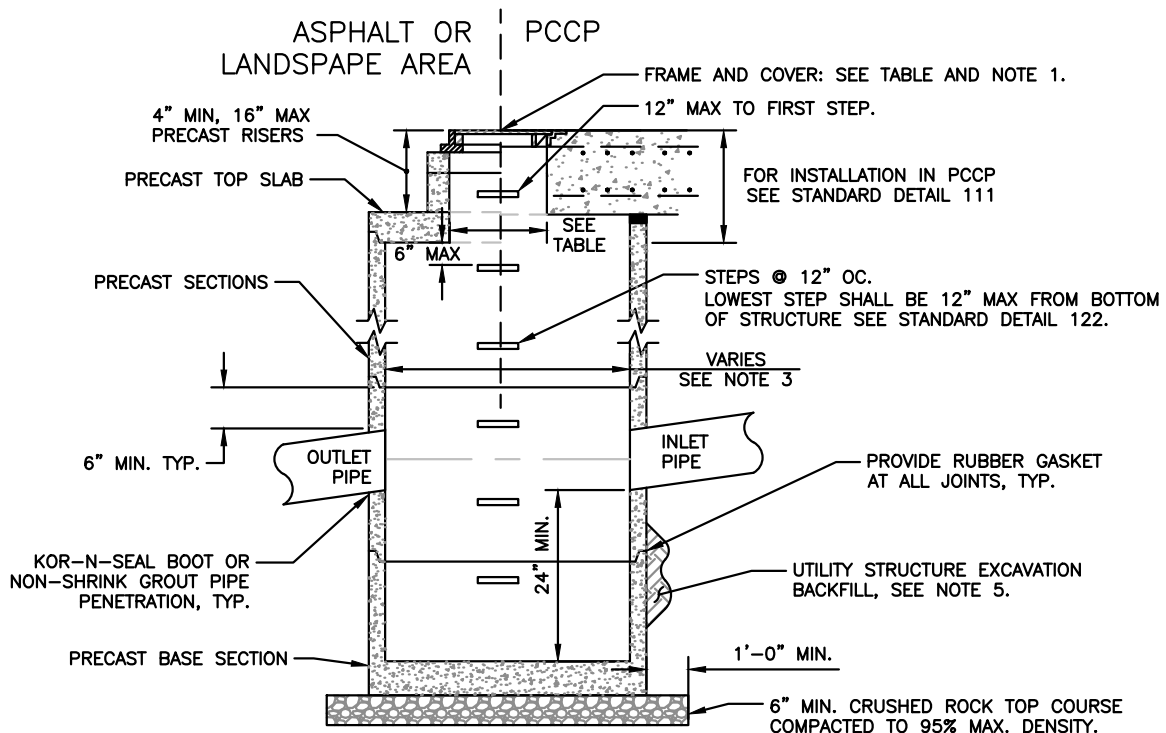
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2020

TRAFFIC RATED MANHOLE

STANDARD DETAIL NO. **108**

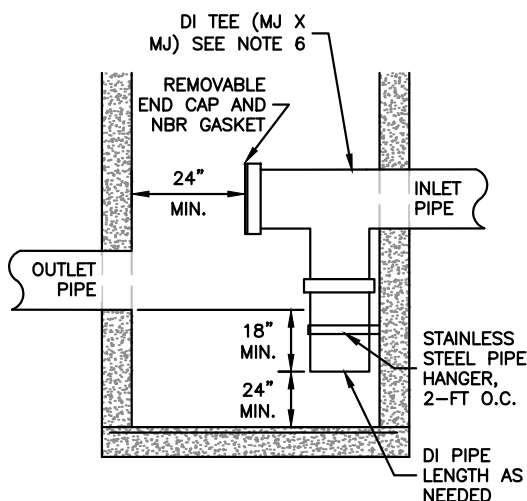


SECTION
AIRCRAFT RATED CATCH BASIN
SCALE: NTS

1

109

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

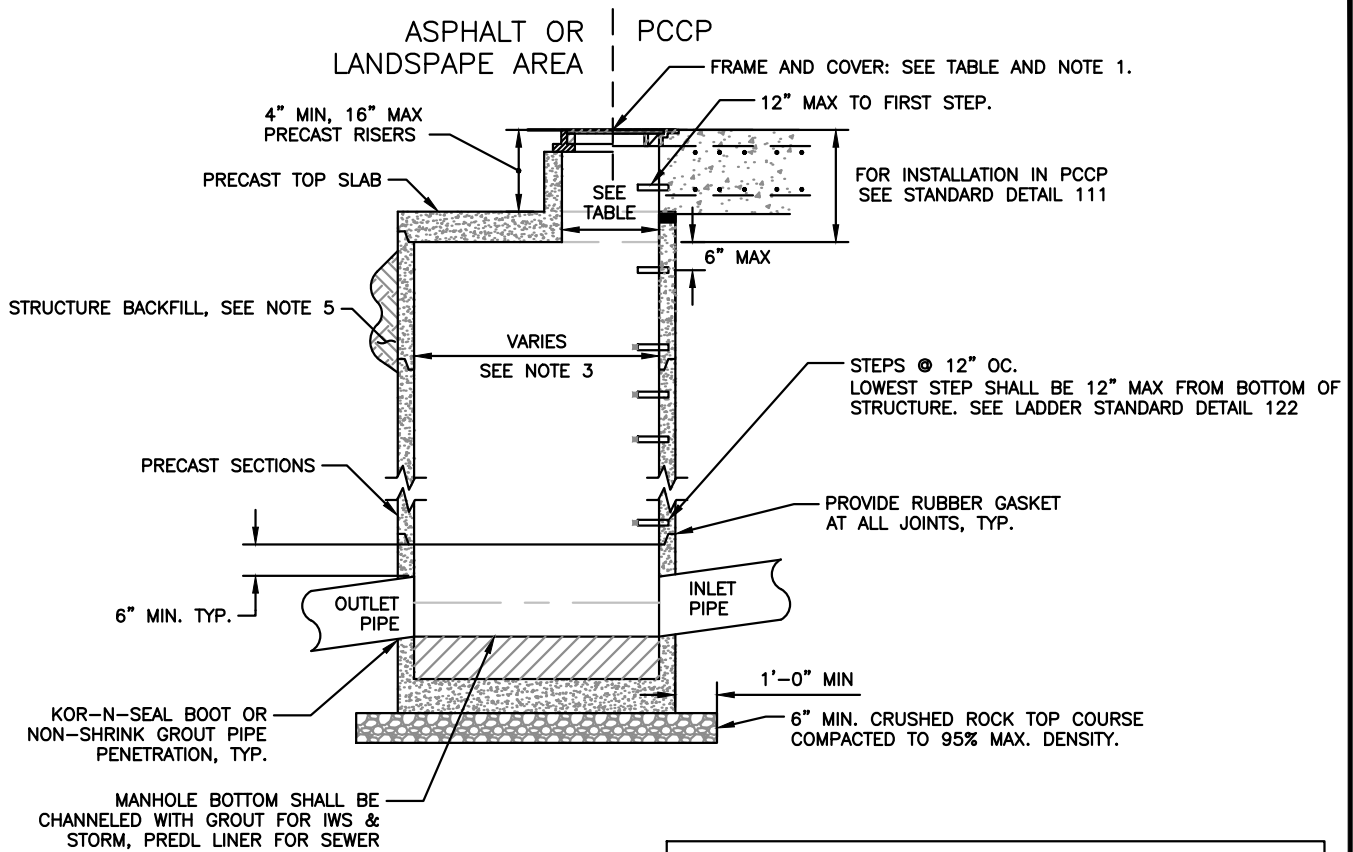
IWS VAPOR TRAP
SCALE: NTS

2

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NOTES:

- FRAME & GRATE:**
 - FRAMES AND GRATES SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
 - GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS).
 - PROVIDE CAST PERMANENT LETTERING GRATE, EITHER "STORM" OR "IWS" ON THE GRATE AS DIRECTED BY THE ENGINEER ON ALL CB'S.
- 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.
- SIZES TO BE INDICATED ON PLANS BASED ON DESIGN REQUIREMENTS.
- 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.
- BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
 - UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
 - UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL PER SPEC SECTION 334231.
- 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.



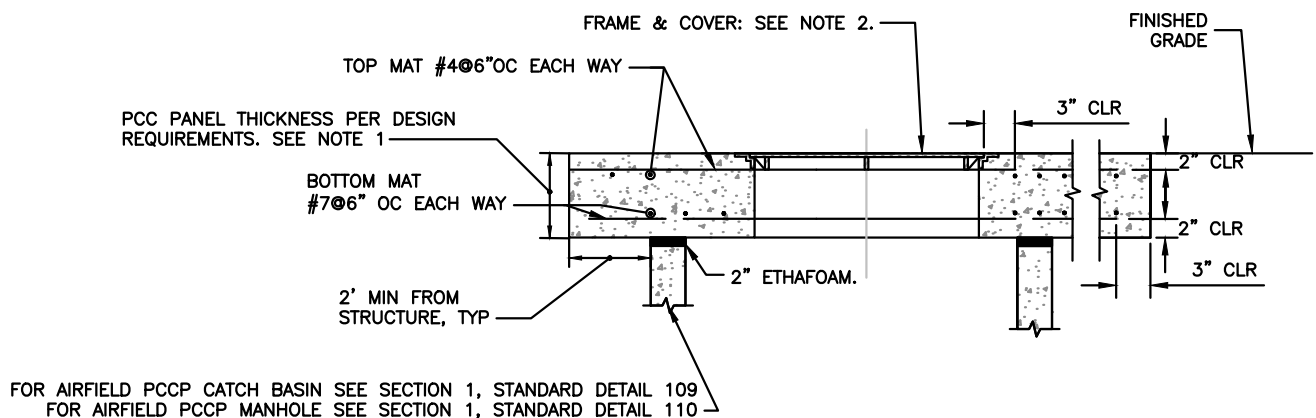
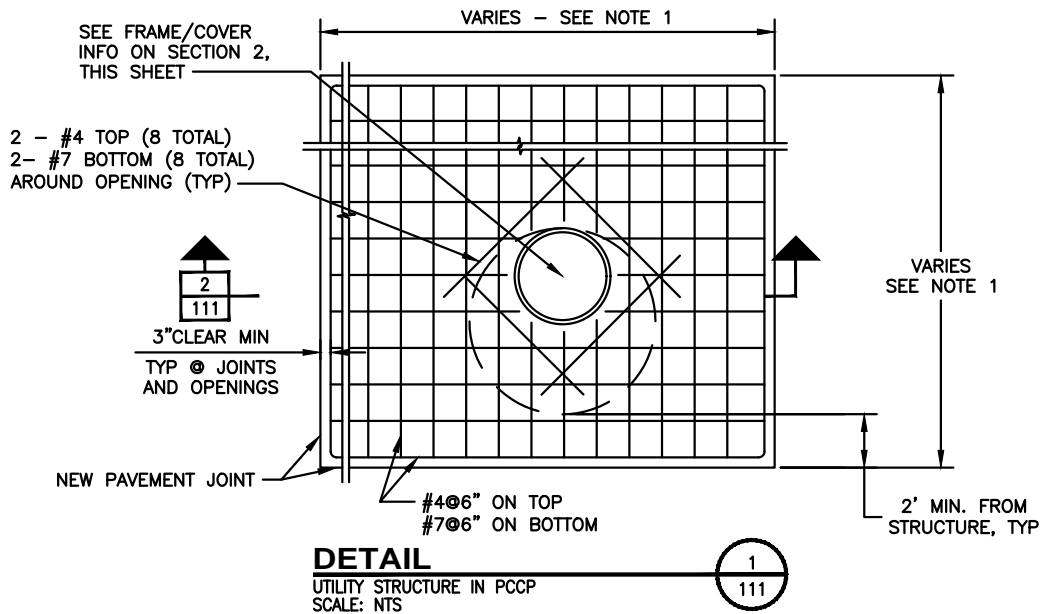
SECTION
AIRCRAFT RATED MANHOLE
SCALE: NTS

1
110

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:

- FRAME AND COVER:
 - PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "SEWER," "STORM," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
 - FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
 - COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
 - SEAL SDS MH COVER/FRAME JOINT AND PICK HOLES OF ALL SDS MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
 - 36" FRAME AND COVER SHOULD INCLUDE LID LIFT-ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
- 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.
- SIZES TO BE INDICATED BY THE PLANS BASED ON DESIGN REQUIREMENTS.
- 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.
- BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
 - UNDER PAVEMENTS OR WITHIN 10- FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
 - UNDER NON-PAVED AREAS AT LEAST 10- FEET OR MORE FROM ANY PAVEMENTS, BACKFILL WITH "GRAVEL BORROW" (PER SPEC SECTION 334231).
- 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.



SECTION

UTILITY STRUCTURE IN PCCP

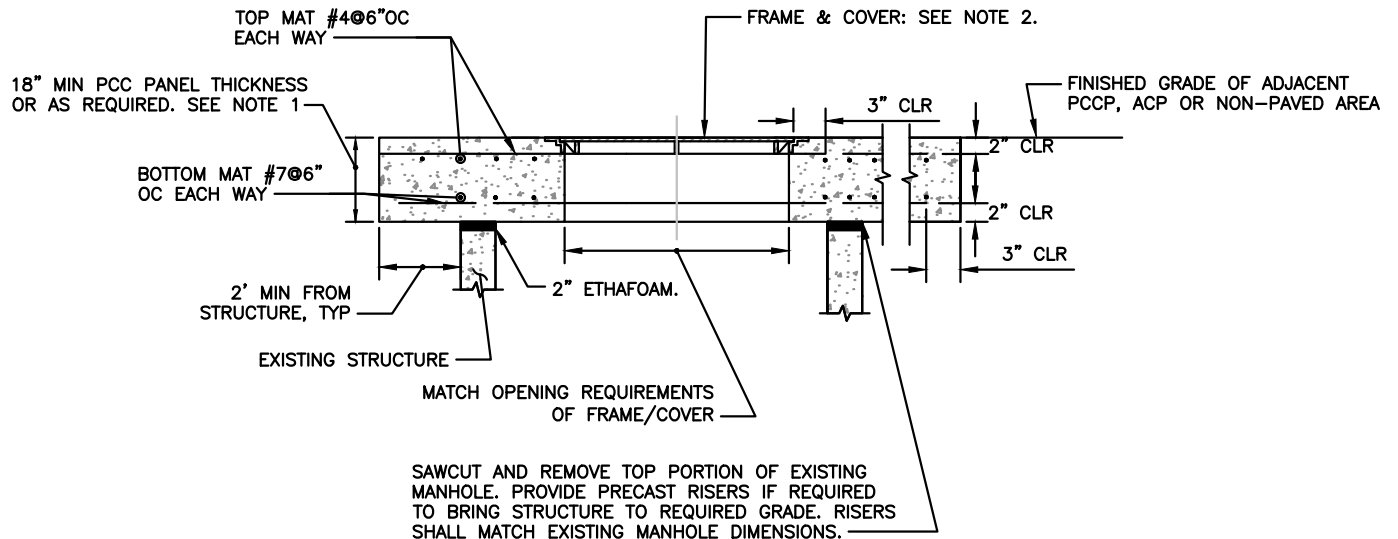
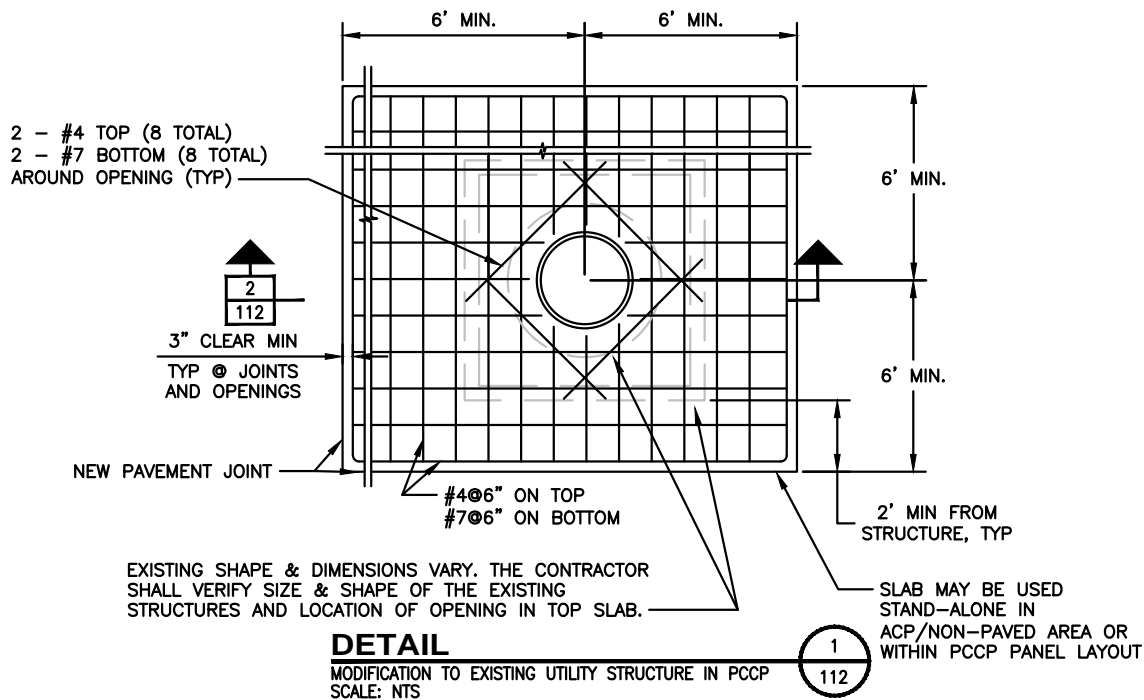
SCALE: NTS

2

111

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.



SECTION

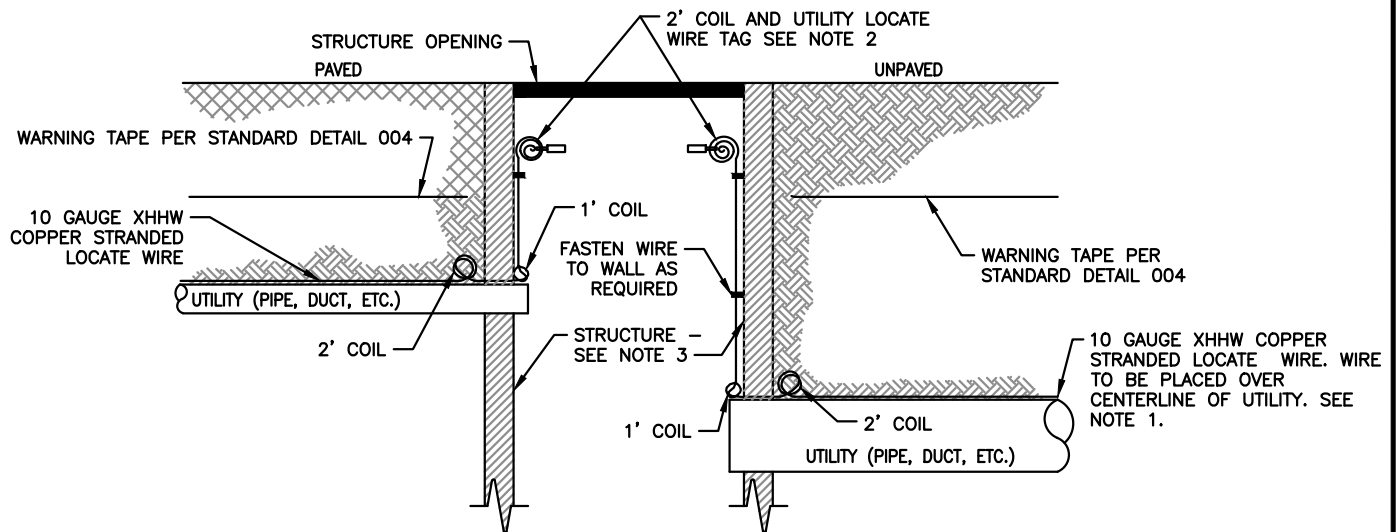
MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP

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.



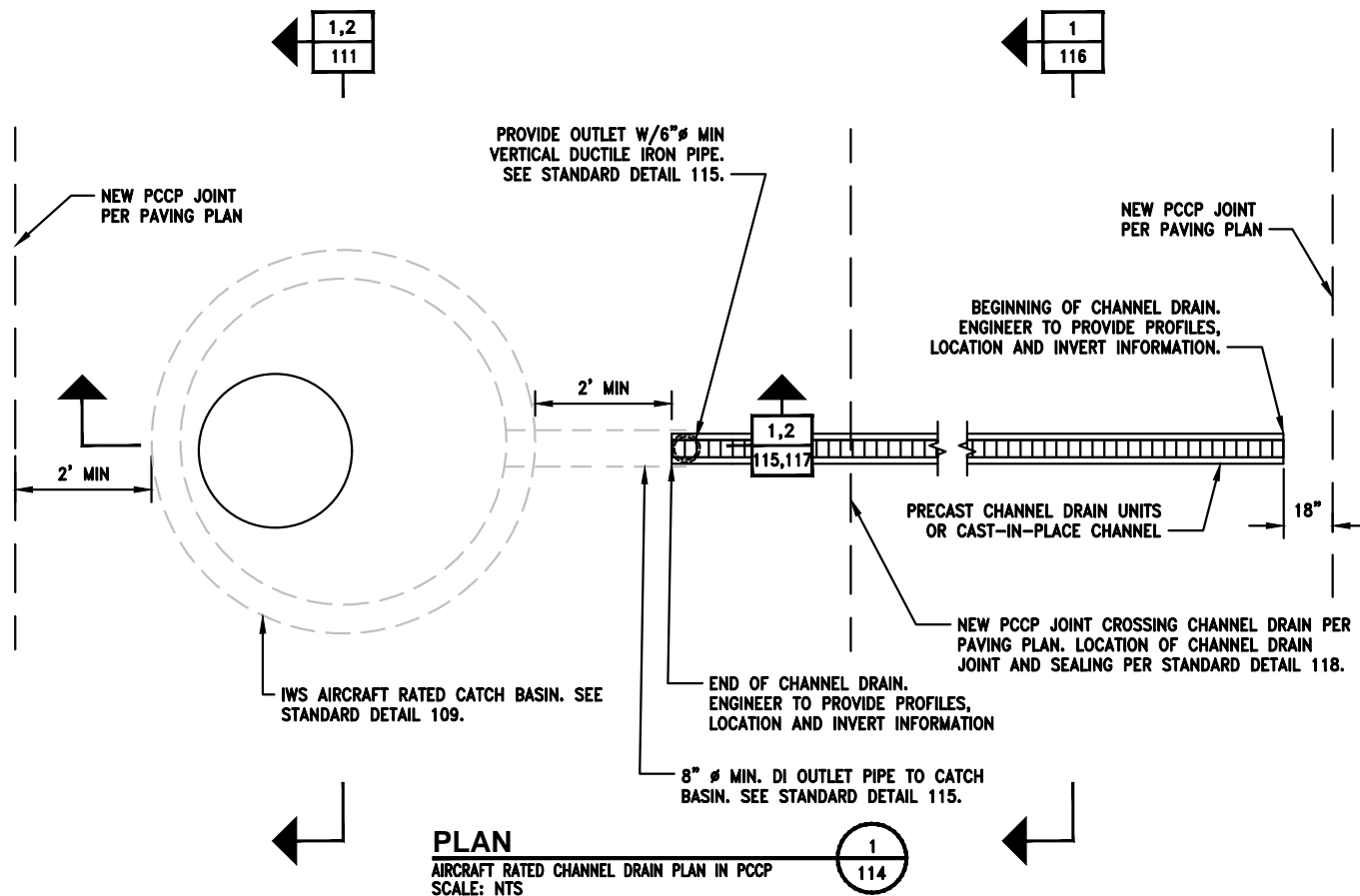
DETAIL

TYPICAL UTILITY LOCATE DETAIL
SCALE: NTS

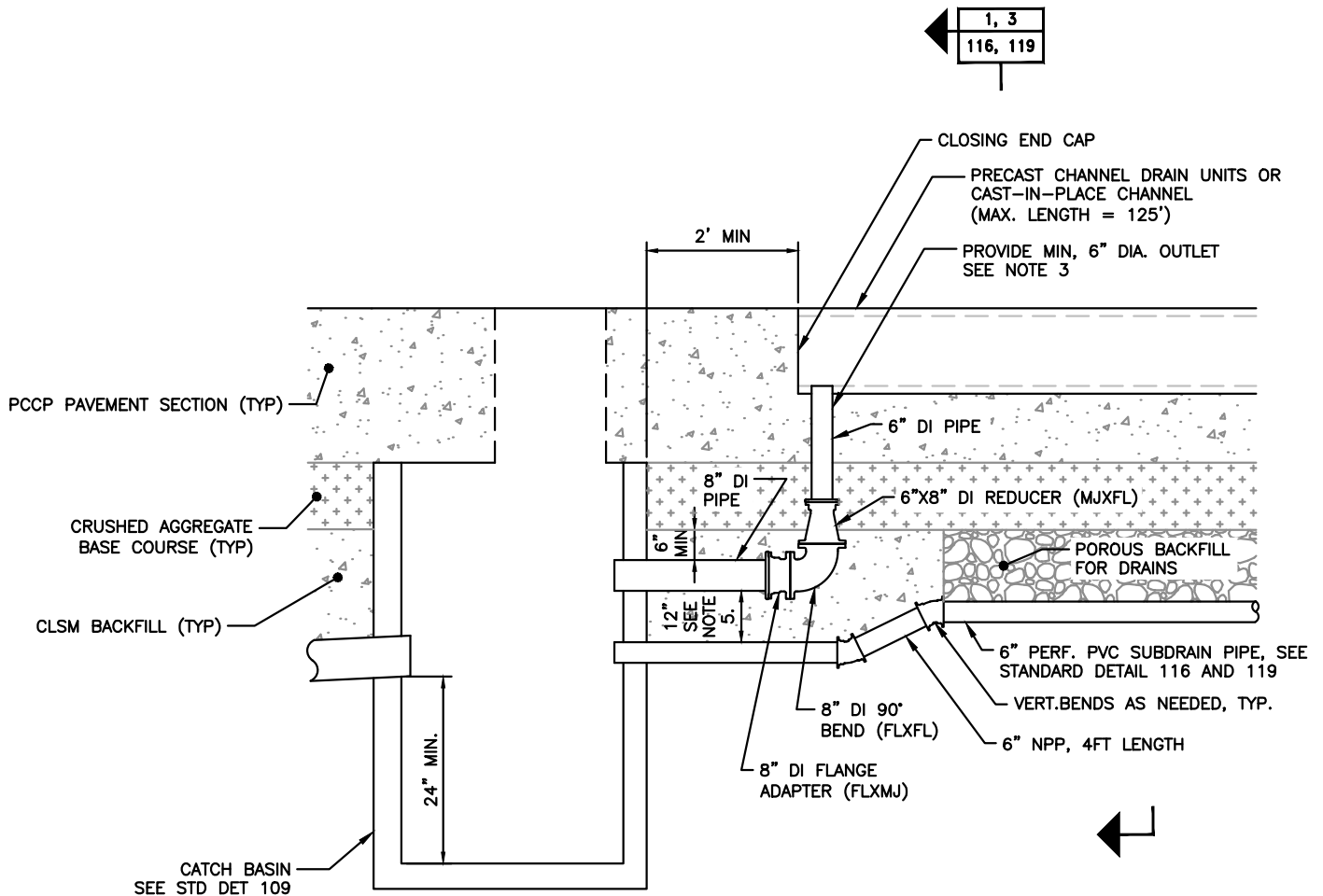
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113

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.



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



SECTION

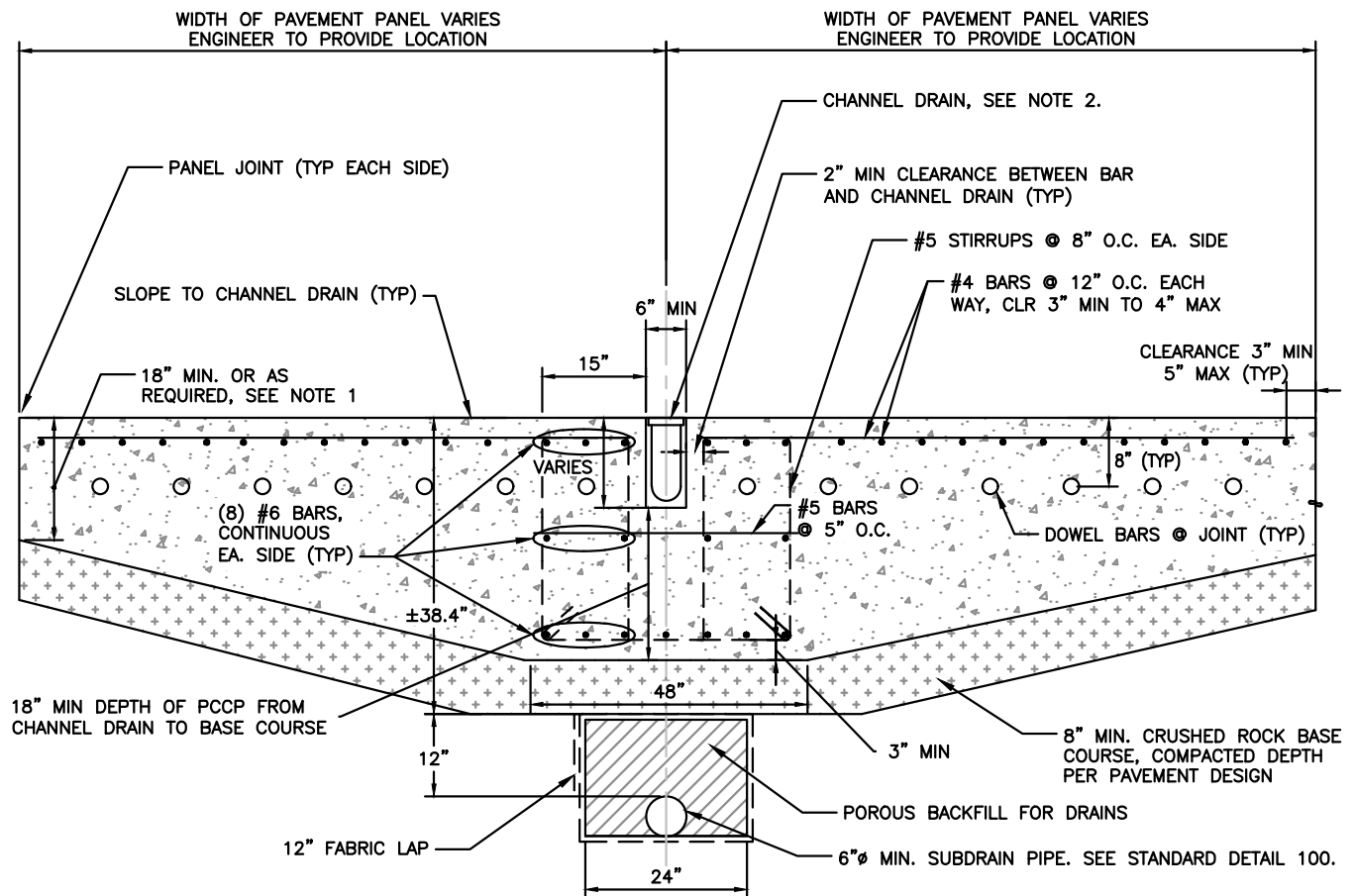
CHANNEL DRAIN CONNECTION PROFILE
SCALE: NTS

1

115

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. CHANNEL DRAIN, OUTLET PIPE AND FITTINGS SHALL BE SIZED TO CONVEY THE DESIGN FLOW.
4. NON-PERFORATED PIPE (NPP) SHALL BE DUCTILE IRON OR PVC FOR 4FT CONNECTION FROM SUBDRAIN TO CATCH BASIN.
5. CLEARANCE SHALL BE 12" EXCEPT WHERE OTHERWISE NOTED. 6" MINIMUM, UNLESS OTHERWISE SHOWN ON DRAWINGS WITH ETHAFOAM PAD BETWEEN PIPES.



SECTION

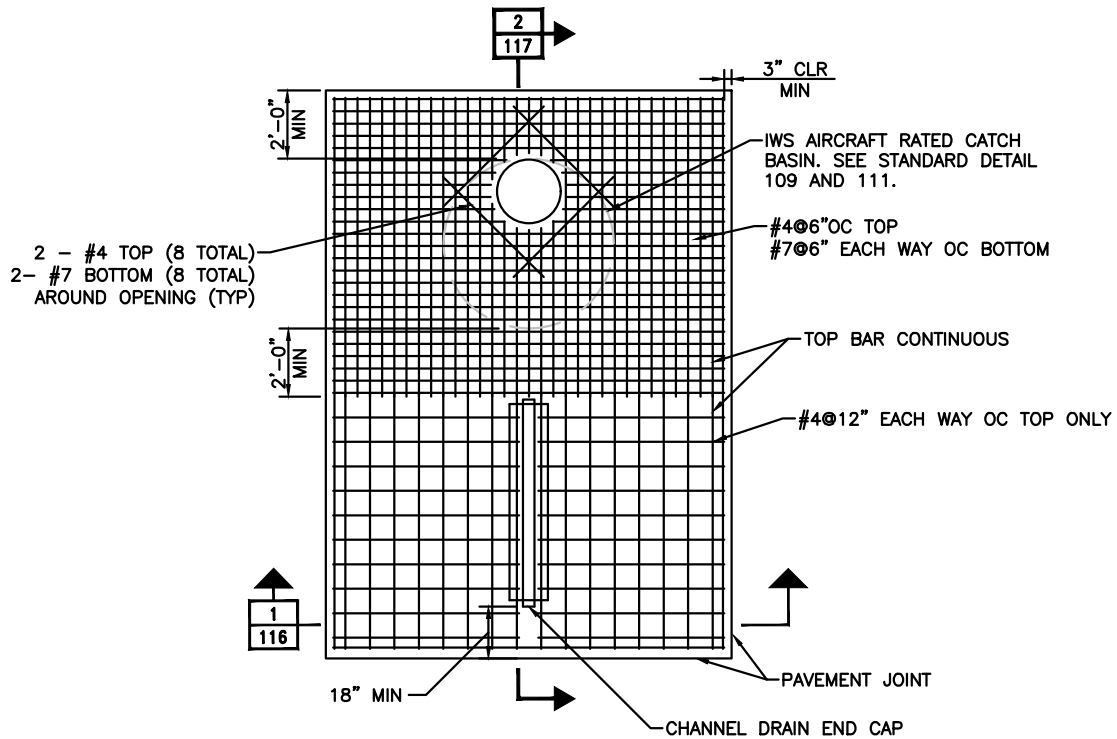
AIRCRAFT RATED CHANNEL DRAIN SECTION IN PCCP
SCALE: NTS

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116

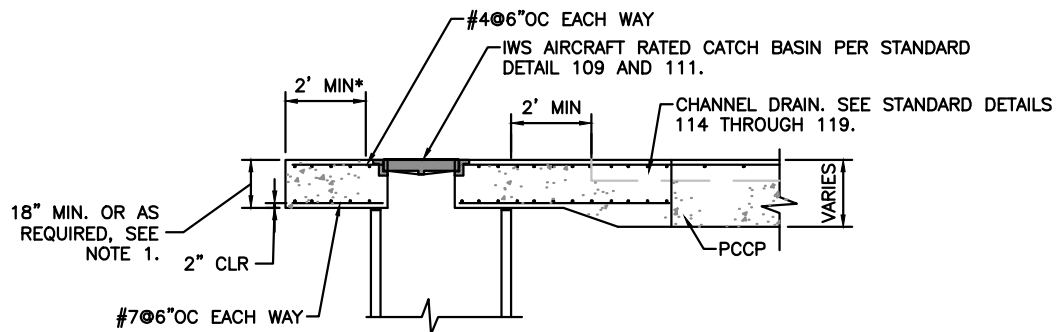
NOTES:

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 UNIT OR CAST-IN-PLACE CHANNEL WITH FRAME AND GRATE (10" MIN INTERIOR DEPTH). WIDTH SHALL BE SIZED TO CONVEY DESIGN FLOW, MIN 6" WIDE. ELEVATION AND INVERT INDICATED ON PROFILE. 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. DESIGN ENGINEER TO REVIEW AND CONFIRM REBAR SIZES AND SPACING ARE ADEQUATE TO SUPPORT SITE CONDITIONS.



DETAIL

AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP
SCALE: NTS



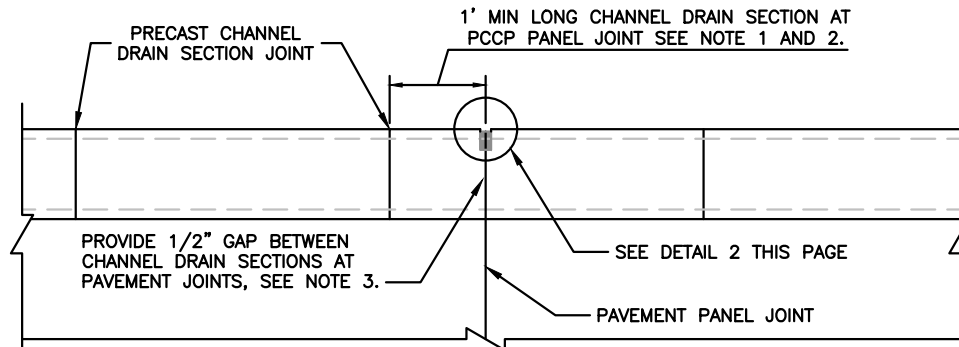
SECTION

AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP
SCALE: NTS



NOTES:

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 MOST DEMANDING LOADING REQUIREMENTS OF AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

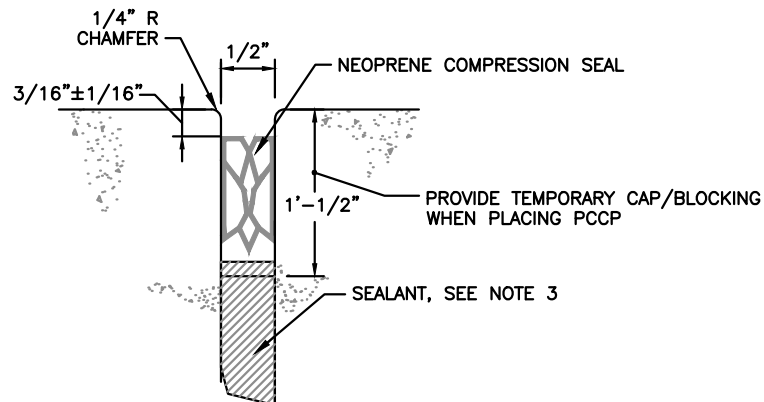


SECTION

CHANNEL DRAIN SYSTEM IN PCCP - SECTION
SCALE: NTS

1

118



DETAIL

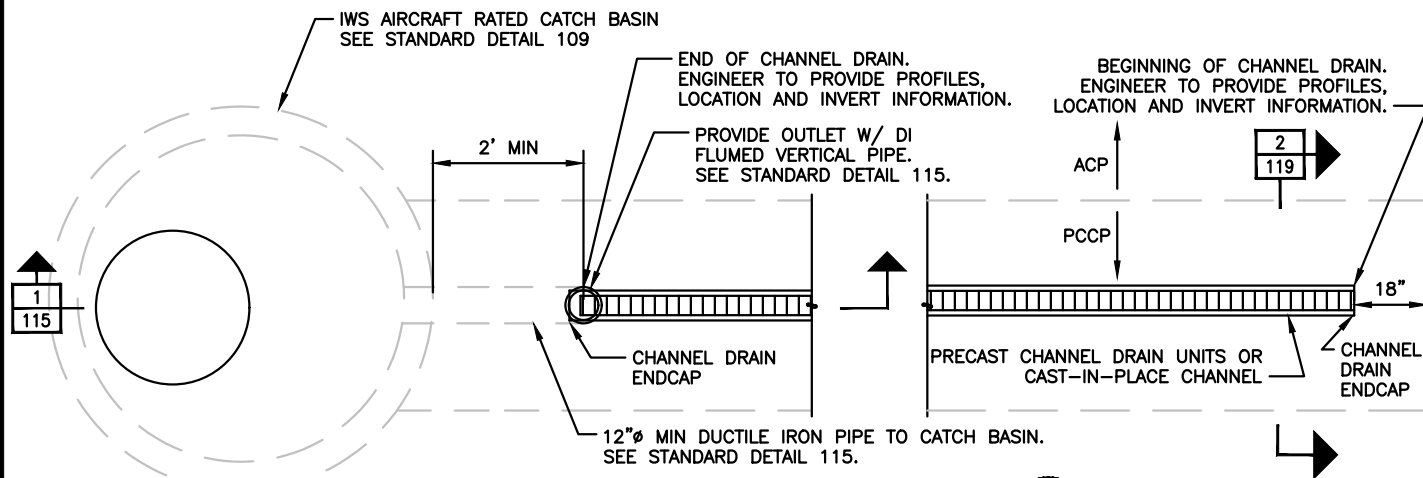
AIRCRAFT RATED CHANNEL DRAIN JOINT DETAILS
SCALE: NTS

2

118

NOTES:

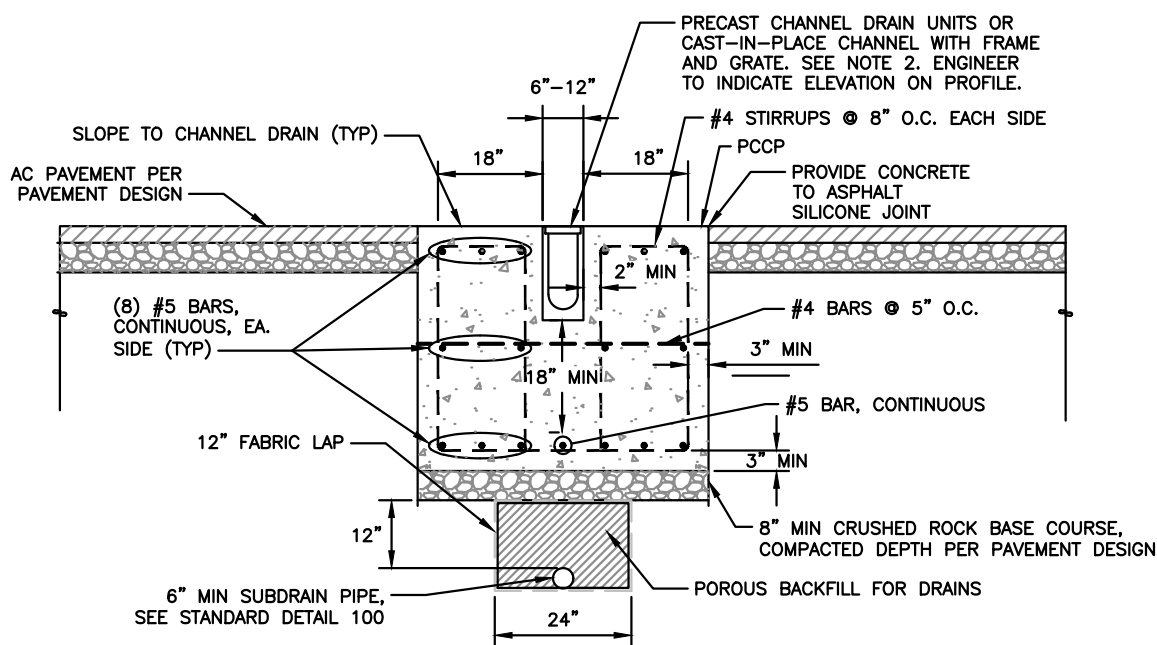
1. IF USING PRECAST CHANNEL DRAIN UNITS, LAYOUT CHANNEL DRAIN SECTION JOINTS SUCH THAT NO CHANNEL DRAIN JOINT IS CLOSER THAN 1' TO THE PAVEMENT JOINT. CUT FRAME AND UNIT AT PANEL JOINT.
2. IF USING CAST-IN-PLACE CHANNEL DRAIN FRAME SYSTEM, FRAME SHALL BE LAID OUT SO THAT WHEN CUT AT PCC PANEL JOINT, 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.



DETAIL

TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP - PLAN VIEW
SCALE: NTS

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119



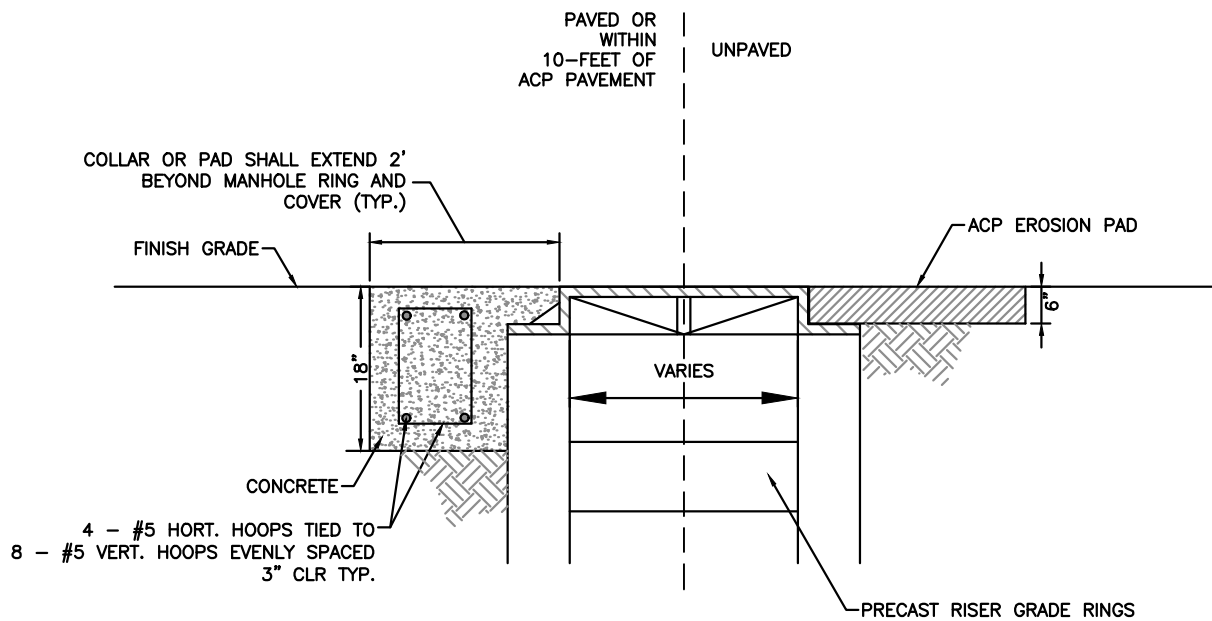
SECTION

TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP
SCALE: NTS

2
119

NOTES:

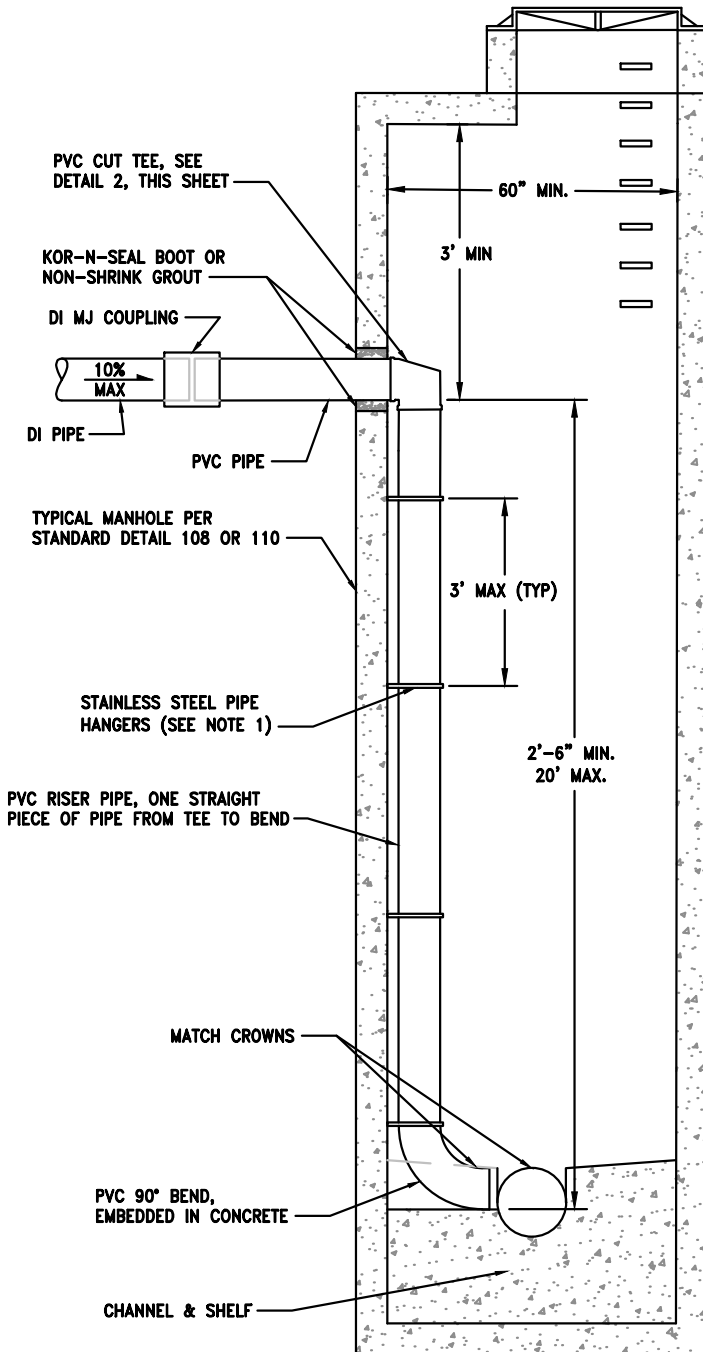
1. REINFORCEMENT SHOWN IS MINIMUM FOR AREAS WITHIN THE AOA, BUT OUTSIDE OF AIRCRAFT MOVEMENT AREA (AMA). PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE VEHICLES UTILIZING THE PAVEMENT. SPECIAL CONSIDERATION SHOULD BE GIVEN TO AREAS INTENDED FOR 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.



DETAIL

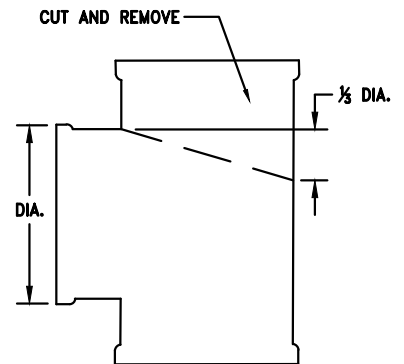
STRUCTURE CONCRETE COLLAR
SCALE: NTS





DETAIL
INSIDE DROP CONNECTION
SCALE: NTS

1
121

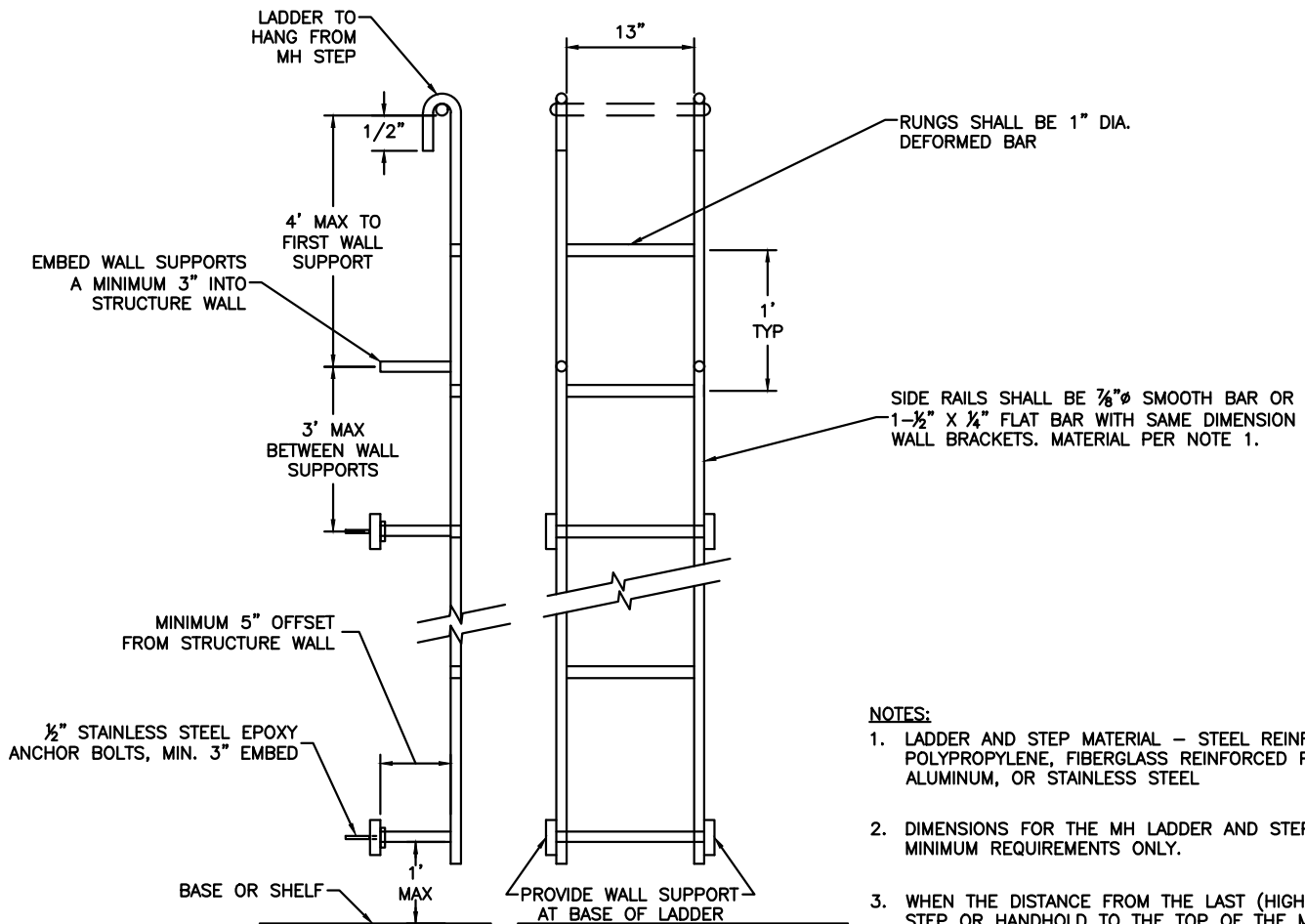
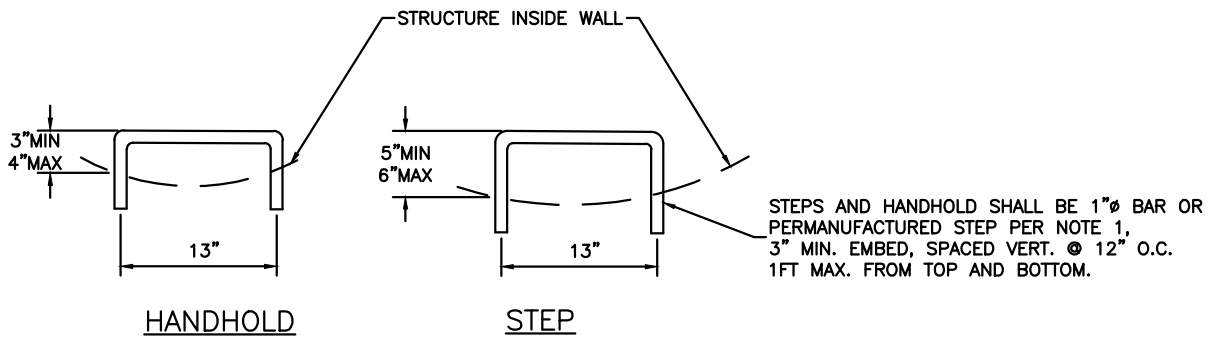


DETAIL
TEE MODIFICATION DETAIL
SCALE: NTS

2
121

NOTES:

1. PROVIDE PIPE MANUFACTURER RECOMMENDATION FOR PIPE HANGER AND CONCRETE ANCHORAGE TO F&I FOR APPROVAL.
2. MINIMUM MANHOLE SIZE IS 60" INTERNAL DIAMETER.
3. AWWA C900 PVC PIPE AND AWWA C907 PVC FITTINGS, SIZE TO MATCH INLET PIPE, 18" MAXIMUM PIPE DIAMETER.
4. CONSTRUCT CHANNEL WITH CLASS 3000 CONCRETE TO PIPE DIAMETER, AND SHELF TO THE CROWN OF PIPE. PROVIDE SMOOTH FINISH.



NOTES:

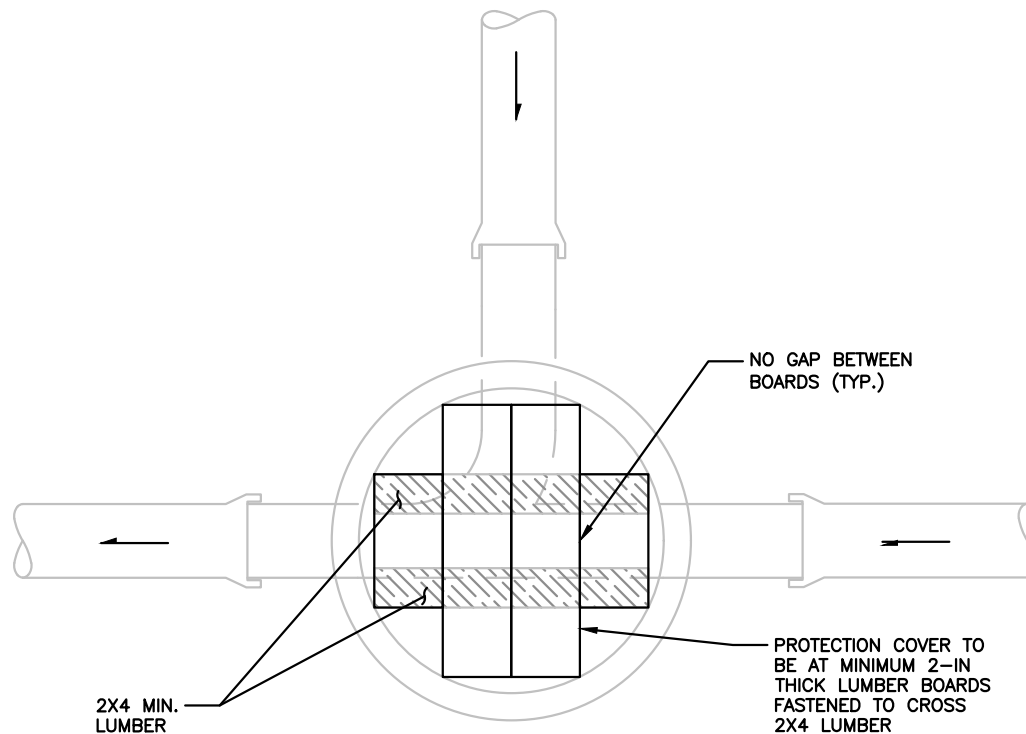
1. LADDER AND STEP MATERIAL – STEEL REINFORCED POLYPROPYLENE, FIBERGLASS REINFORCED PLASTIC, ALUMINUM, OR STAINLESS STEEL
2. DIMENSIONS FOR THE MH LADDER AND STEP ARE MINIMUM REQUIREMENTS ONLY.
3. WHEN THE DISTANCE FROM THE LAST (HIGHEST) STEP OR HANDHOLD TO THE TOP OF THE MH FRAME EXCEEDS 12" A HANDHOLD MUST BE INSTALLED MID-WAY IN THE 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.
6. STEPS AND LADDER SUPPORTS SHALL BE CAST IN WALLS WHEN SECTIONS ARE MANUFACTURED, OR INSTALLED WITH DRILLED HOLES AND CEMENTED IN PLACE WITH EPOXY.

DETAIL

STRUCTURE LADDER, STEP AND HANDHOLD
SCALE: NTS

1

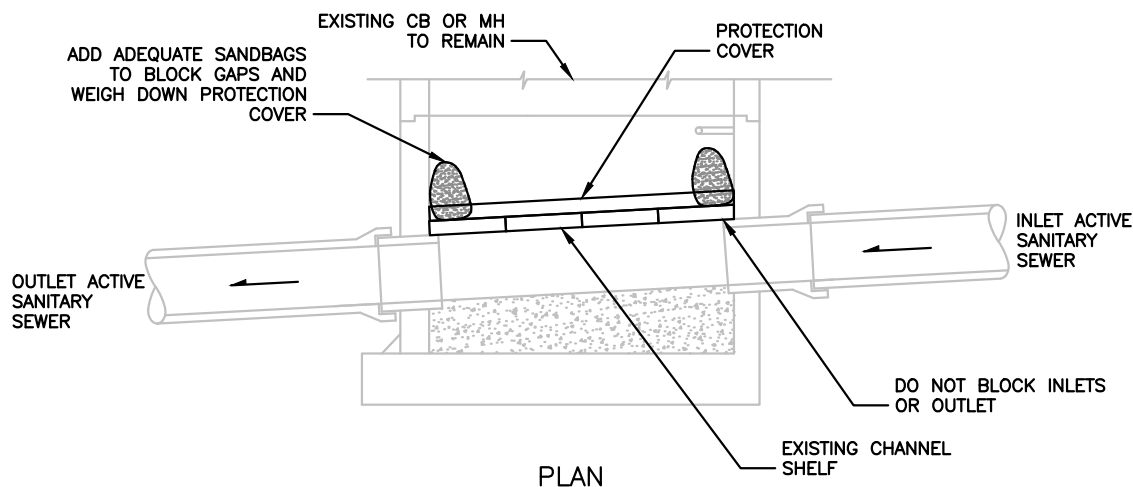
122



SECTION

MINIMAL PROTECTION OF ACTIVE SANITARY SEWER
SCALE: NTS

1
123



PLAN

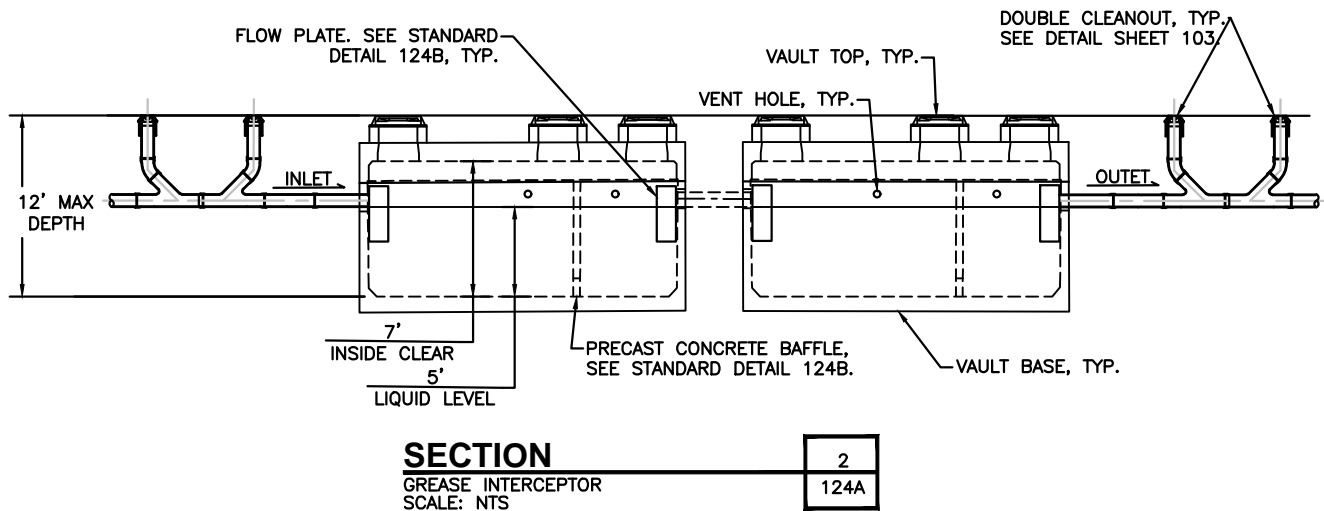
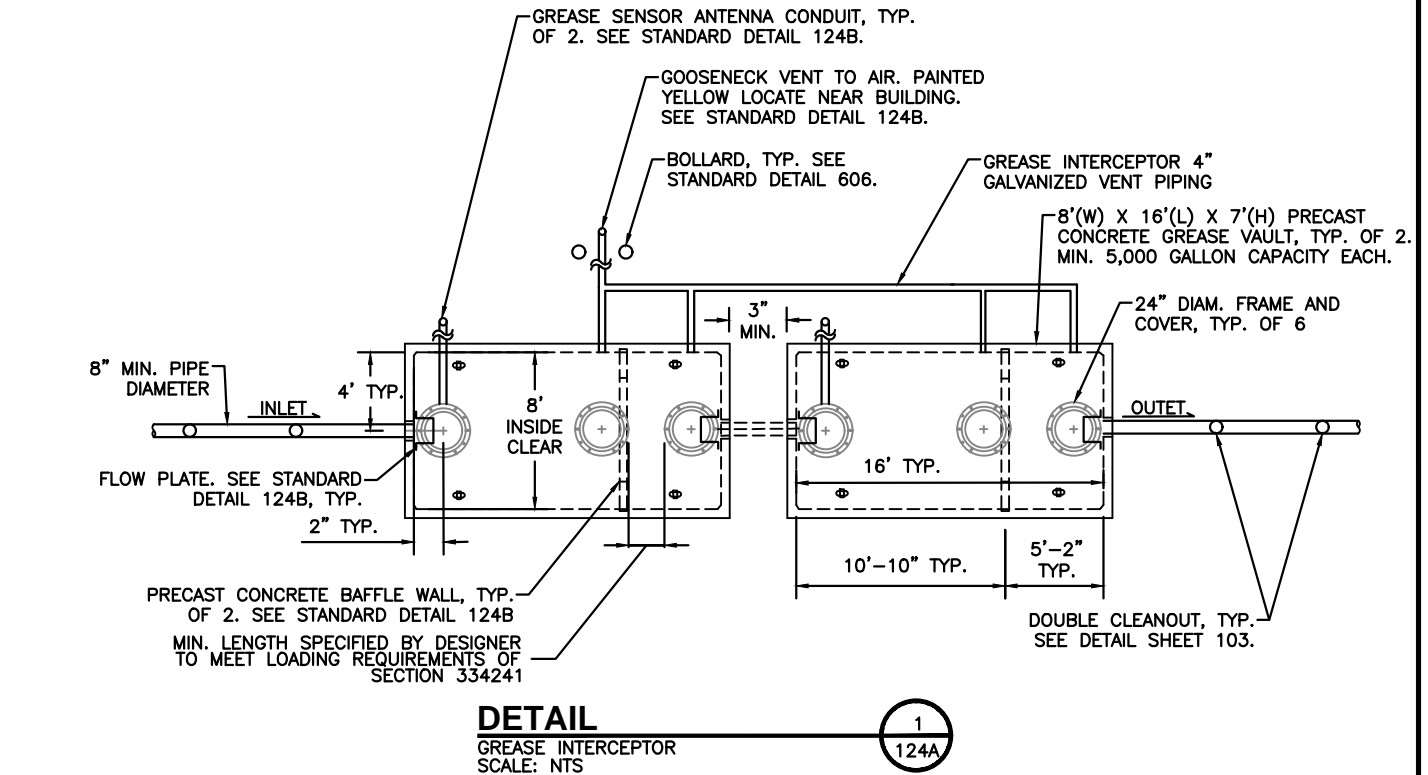
DETAIL

MINIMAL PROTECTION OF ACTIVE SANITARY SEWER
SCALE: NTS

2
123

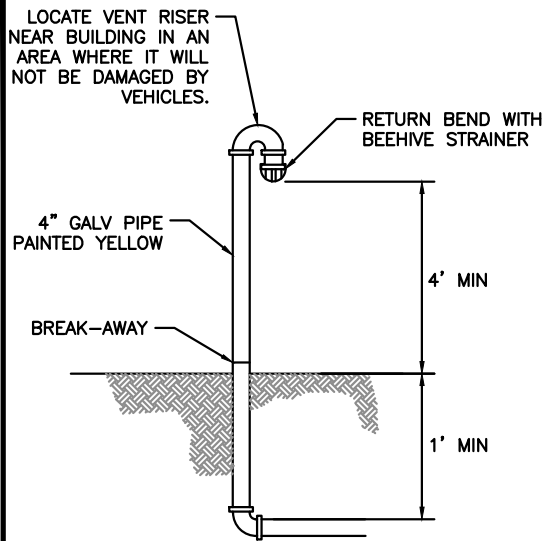
NOTES:

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.



NOTES:

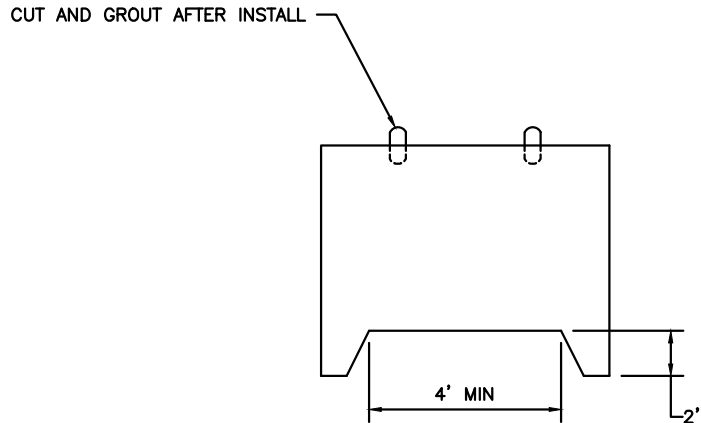
- GREASE INTERCEPTOR LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
- ONLY GRAY WATER SHALL ENTER THE GREASE INTERCEPTOR. BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
- FRAME AND COVER:
 - PROVIDE CAST PERMANENT "SEWER" LETTERING ON COVER,
 - WITHIN THE AOA FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
 - OUTSIDE THE AOA, FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF HS-25 LOADING.
 - COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
 - FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
- DETAIL ABOVE IS FOR MINIMUM GREASE INTERCEPTOR SIZING. VAULT SHALL BE UP-SIZED AS NEEDED TO ACCOMMODATE CALCULATED FLOWS.
- VAULT
 - 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.
 - OUTSIDE THE AOA, THE VAULT SHALL BE DESIGNED FOR HS-25 LOADING
- 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.
- 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.
- ALL RINGS AND COVERS SHALL BE AIR AND GAS TIGHT BOLT-LOCKING (TYP), RATED PER SECTION 334241.
- FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.



DETAIL

GOOSENECK VENT
SCALE: NTS

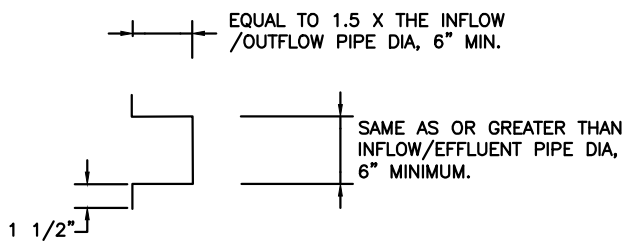
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124B



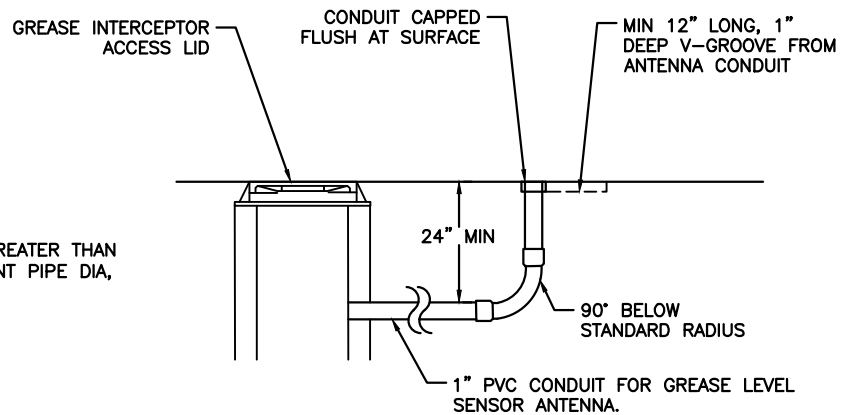
DETAIL

PRECAST CONCRETE BAFFLE
SCALE: NTS

2
124B



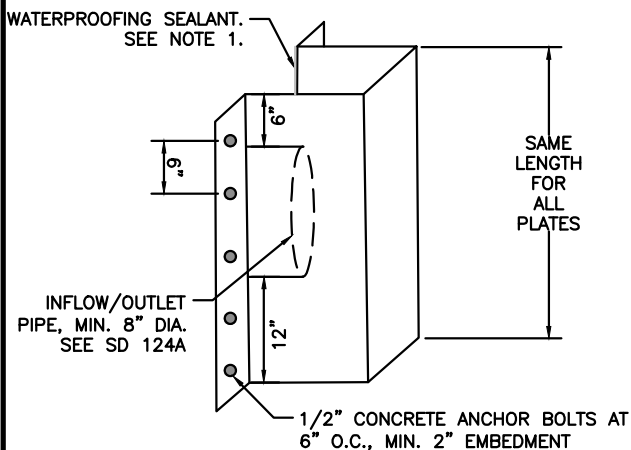
TOP VIEW



DETAIL

GREASE SENSOR ANTENNA CONDUIT
SCALE: NTS

4
124B



ISOMETRIC VIEW

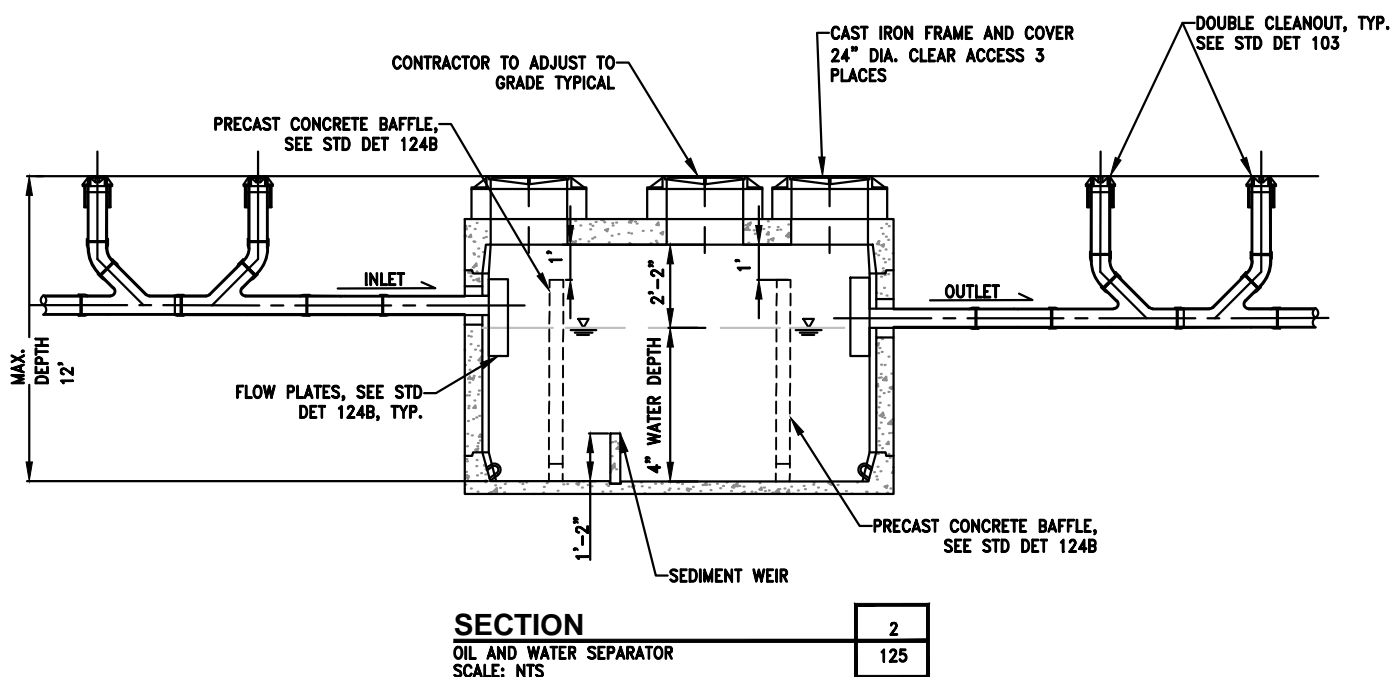
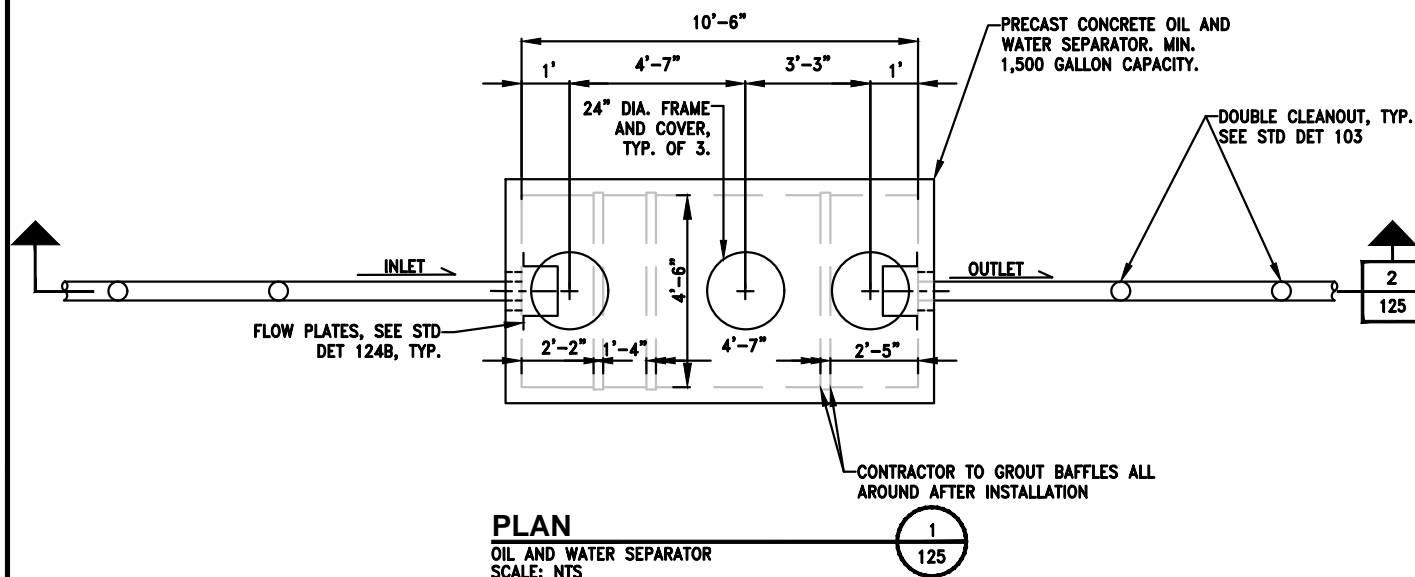
DETAIL

FLOW PLATE
SCALE: NTS

3
124B

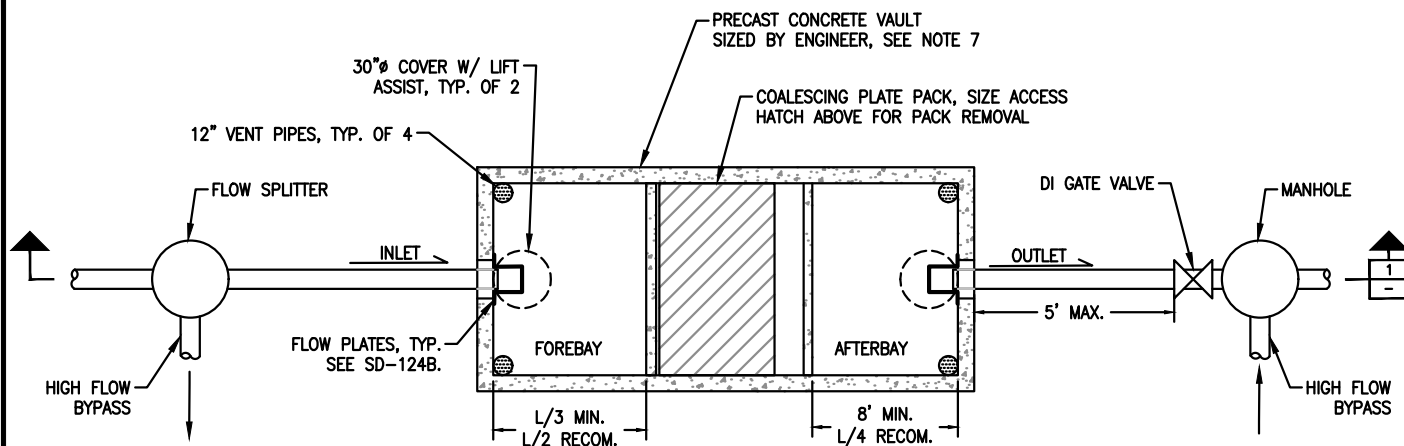
NOTES:

1. FLOW PLATE LINED WITH POLYURETHANE WATERPROOFING SEALANT WHERE CONTACTING GREASE INTERCEPTOR WALL.
2. FLOW PLATE MADE OF 5MM MIN AUSTENITIC STAINLESS STEEL.
3. ANCHOR BOLTS MADE OF AUSTENITIC STAINLESS STEEL.



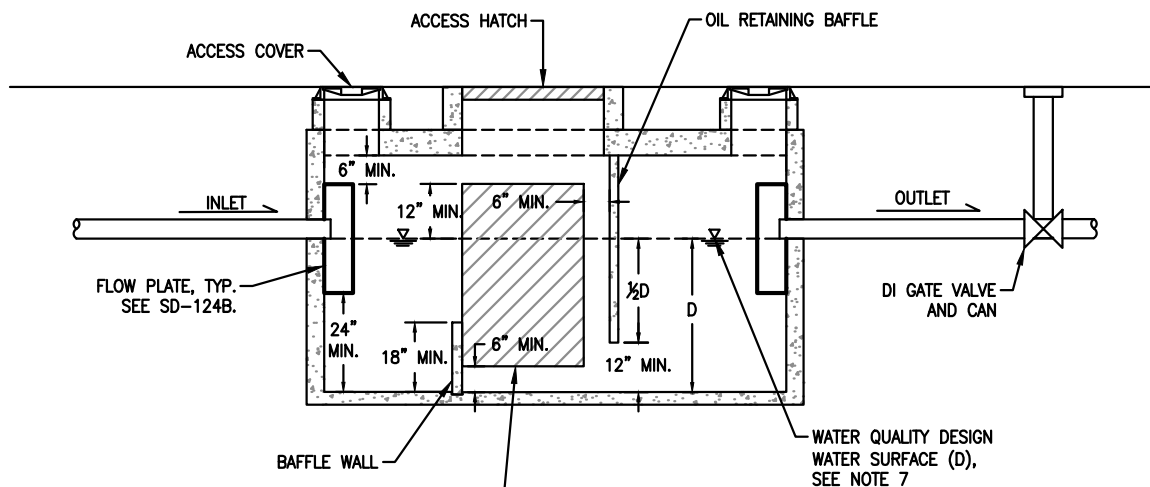
NOTES:

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.



DETAIL

OIL WATER SEPARATOR - COALESCING PLATE
SCALE: NTS



COALESCING PLATE PACK W/ STAINLESS STEEL SUPPORT FRAME.
CONFIGURATION OF THE CENTER BAY SHALL BE MODIFIED DEPENDING
ON THE FILTER MEDIA TYPE FOR MAXIMUM OIL REMOVAL EFFICIENCY

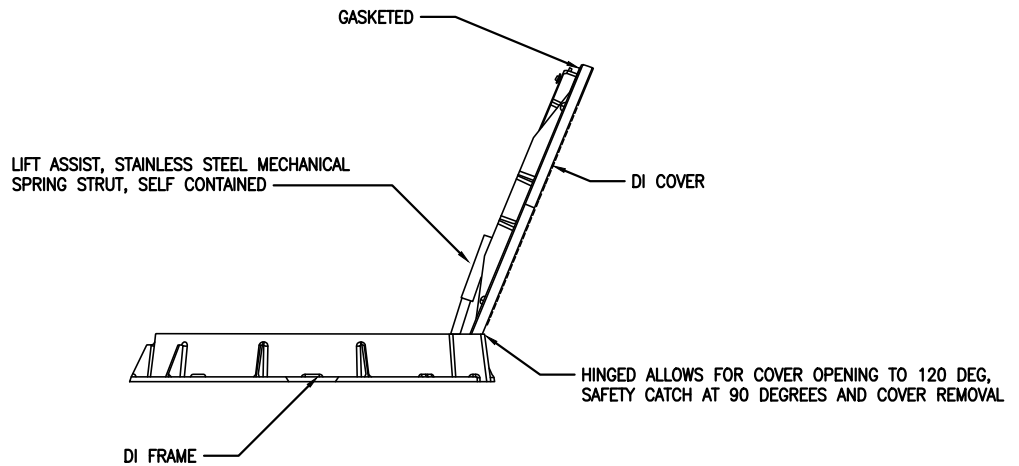
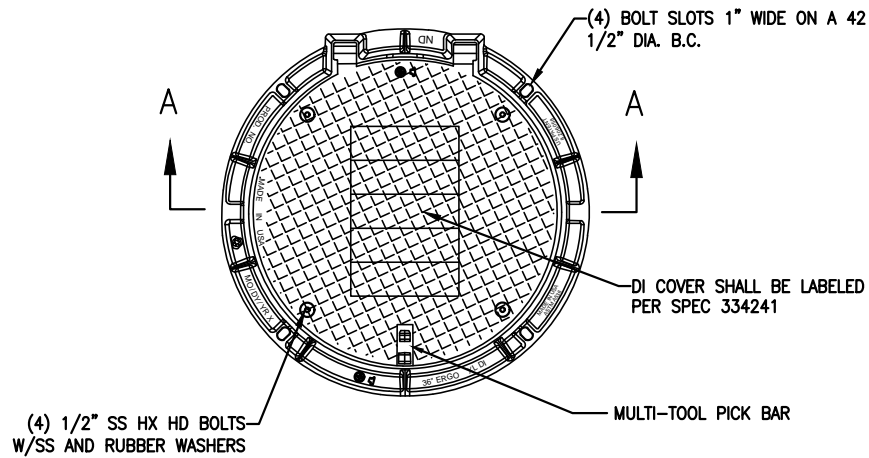
SECTION

OIL WATER SEPARATOR - COALESCING PLATE
SCALE: NTS



NOTES:

1. VAULT LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
2. FRAME AND COVER:
 - a. PROVIDE CAST PERMANENT "STORM" OR "IWS" LETTERING ON COVER, DEPENDING ON THE UTILITY SYSTEM.
 - 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 150/5320-6G 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. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
7. VAULT SHALL BE SIZED FOLLOWING DESIGN PROCEDURE AND REQUIREMENTS IN SECTION BMP T11.11 OF THE 2019 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON (SWMWW).
8. INLET AND OUTLET INVERTS ARE BASED ON THE WATER DESIGN WATER QUALITY SURFACE. BOTH THE INLET AND OUTLET FLOW PLATES SHOULD EXTEND AT LEAST 1' ABOVE AND BELOW THE WATER QUALITY DESIGN WATER SURFACE.



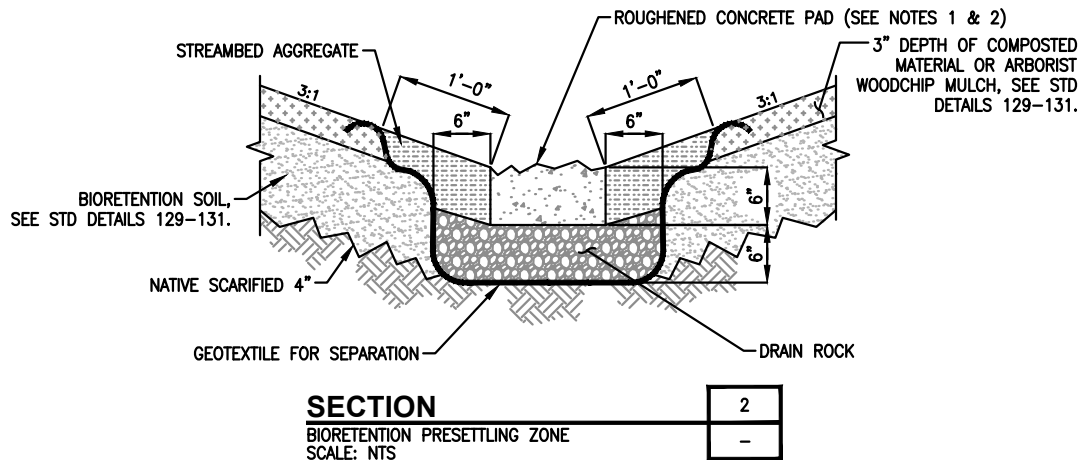
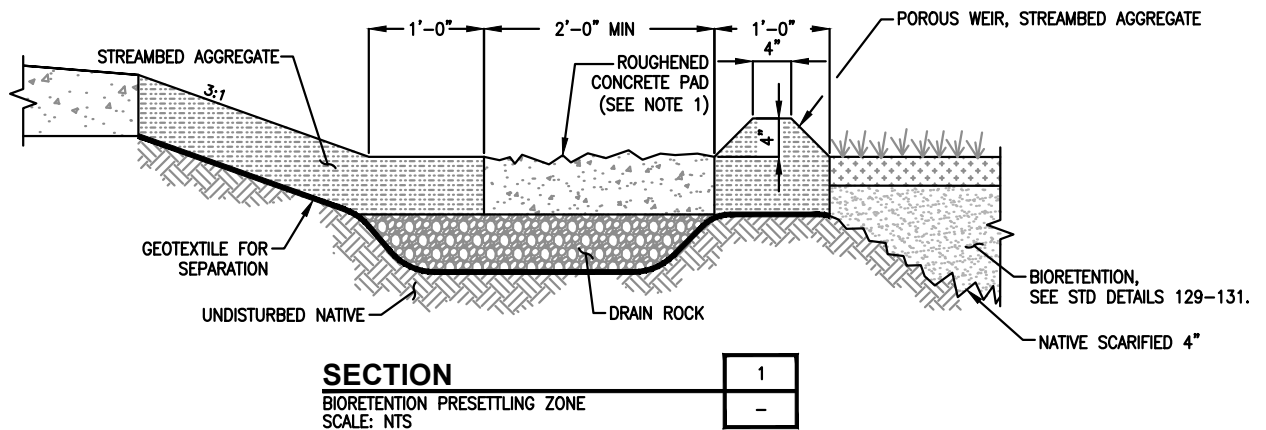
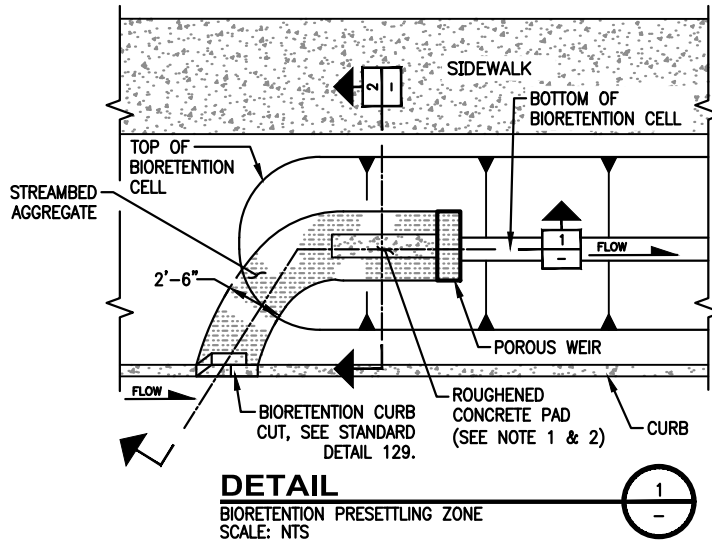
DETAIL

LID ASSIST DEVICE
SCALE: NTS



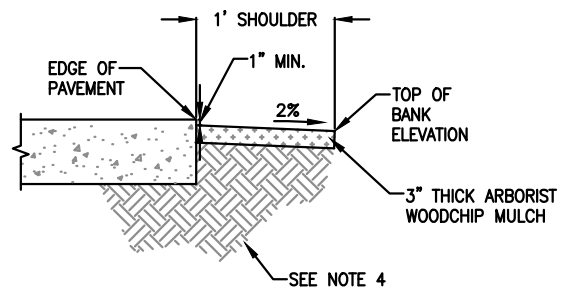
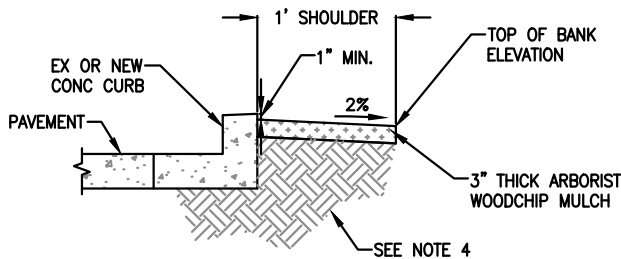
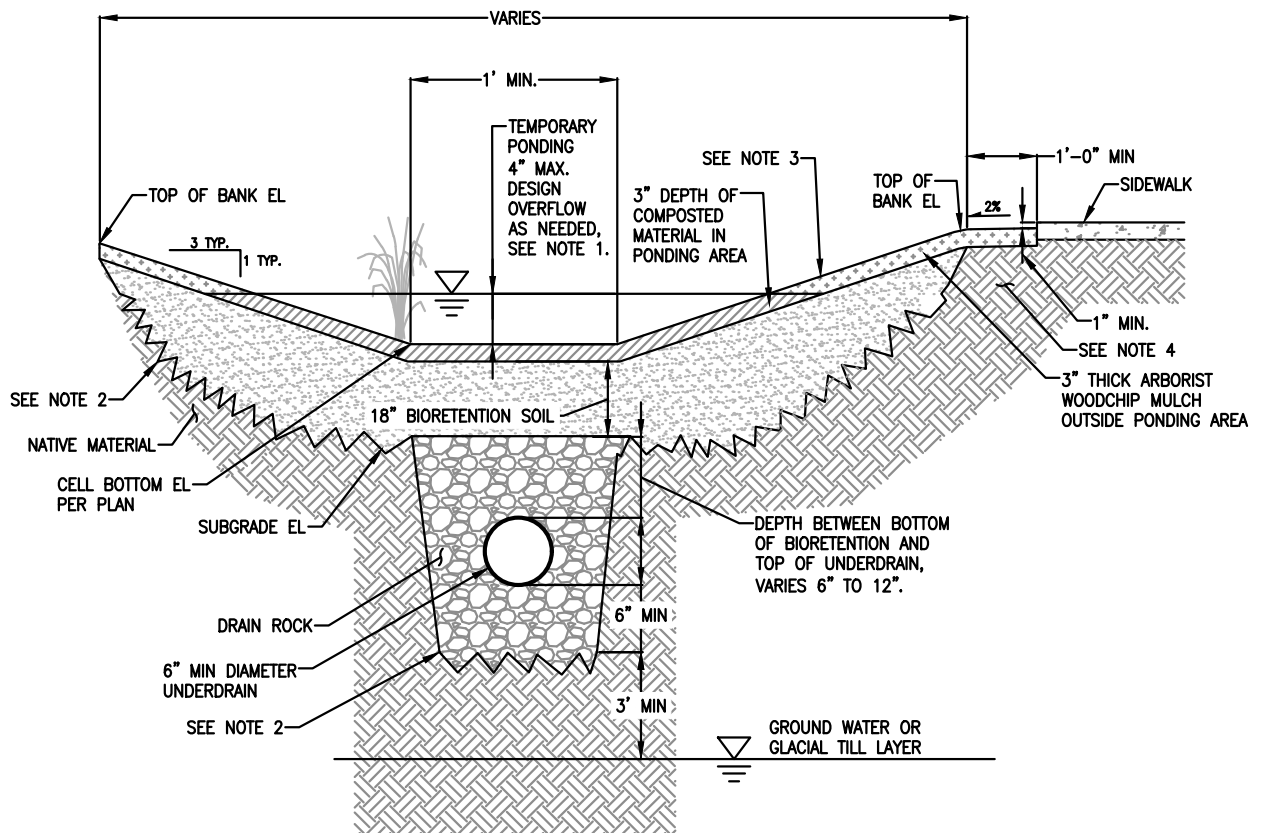
NOTES:

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.



NOTES:

1. ROUGHENED CONCRETE PAD MUST BE MIN 2' LONG & 2.5 SF OR 5.0 SF.
2. ROUGHENED CONCRETE PAD MUST BE CONSTRUCTED WITH CLASS 3000 CEMENT CONCRETE EMBED WELL MIXED 6"-8" STREAMBED AGGREGATE INTO CONCRETE SURFACE TO CREATE ROUGHNESS. 50% MIN OF THE SURFACE MUST HAVE PROTRUDING AGGREGATE.



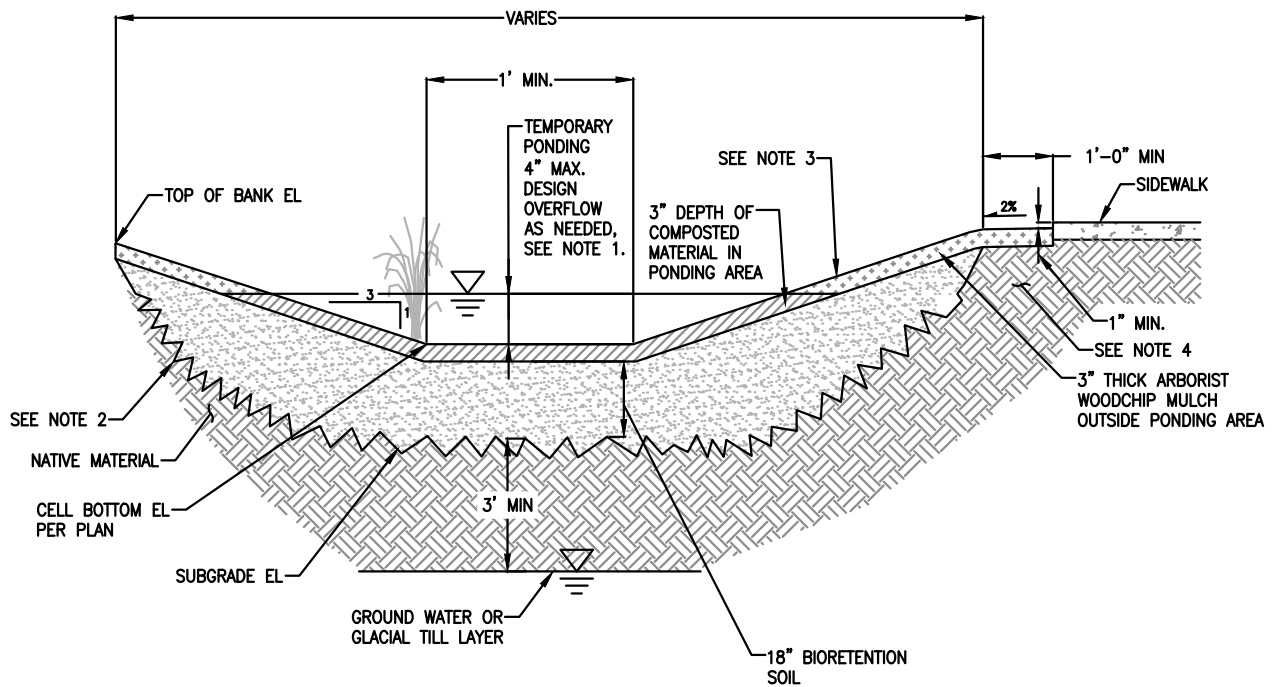
DETAIL

INFILTRATING BIORETENTION
WITH UNDERDRAIN (LANDSIDE ONLY)
SCALE: NTS



NOTES:

1. BIORETENTION OVERFLOW ELEVATIONS MUST BE SET BELOW SIDEWALK ELEVATION.
2. SCARIFY SUBGRADE TO A MINIMUM DEPTH OF 3 INCHES IN THE AREA SUBJECT TO TEMPORARY PONDING BEFORE BIORETENTION SOIL INSTALLATION.
3. CELL MUST BE PLANTED WITH VEGETATION CONSISTENT WITH STIA WILDLIFE HAZARD MANAGEMENT PLAN (WHMP).
4. SOIL UNDER SHOULDERS OR PAVED AREAS MUST BE UNDISTURBED NATIVE SOIL OR APPROVED FILL COMPACTED TO 95% DENSITY.
5. REFER TO PORT OF SEATTLE STORMWATER MANAGEMENT MANUAL, CHAPTER 4. BMP AND FACILITY SELECTION PROCESS FOR PERMANENT STORMWATER CONTROL PLANS AND THE PORT OF SEATTLE LOW IMPACT DEVELOPMENT GUIDELINE FOR SELECTING TYPE OF BIORETENTION BMP TO USE FOR DESIGN.



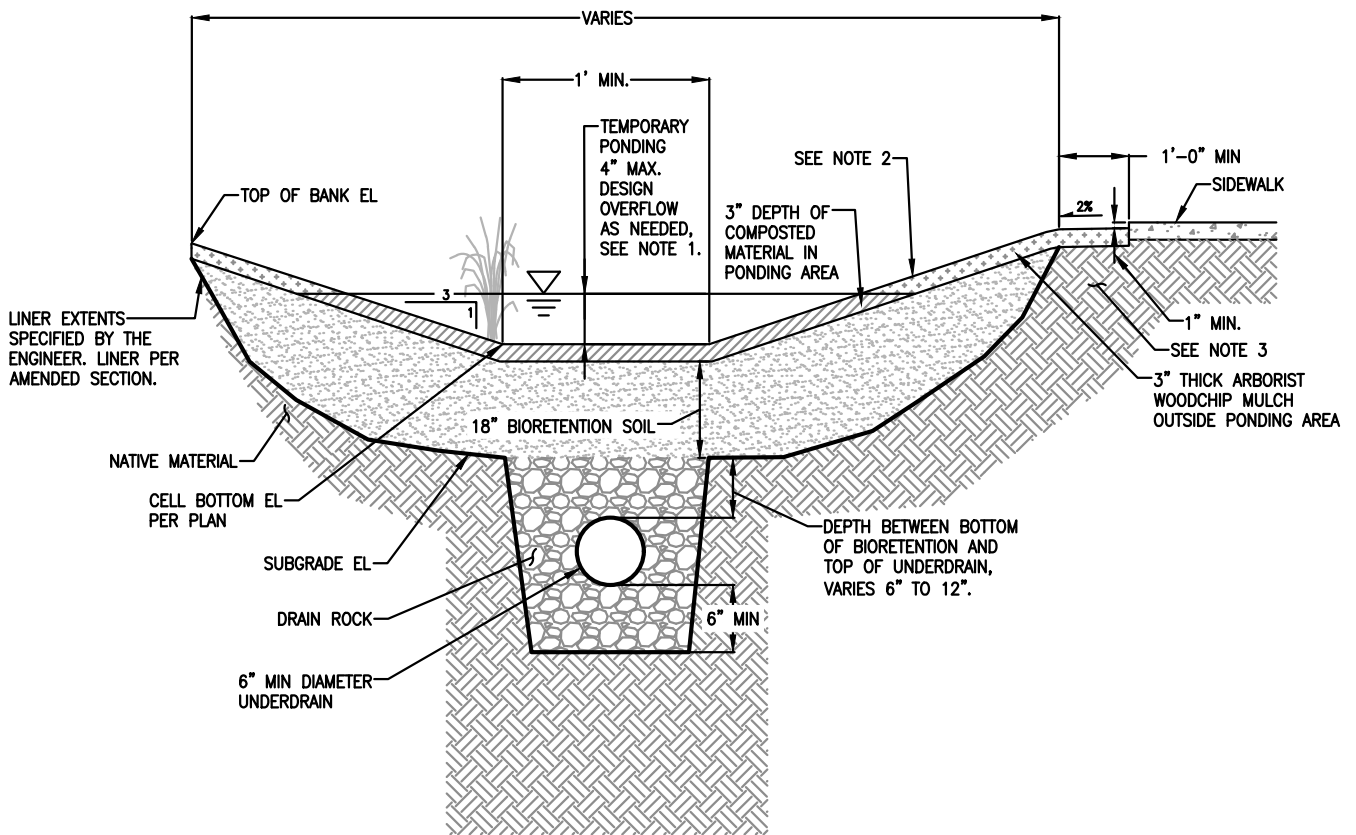
DETAIL

INFILTRATING BIORETENTION (LANDSIDE ONLY)
SCALE: NTS



NOTES:

1. BIORETENTION OVERFLOW ELEVATIONS MUST BE SET BELOW SIDEWALK ELEVATION.
2. SCARIFY SUBGRADE TO A MINIMUM DEPTH OF 3 INCHES IN THE AREA SUBJECT TO TEMPORARY PONDING BEFORE BIORETENTION SOIL INSTALLATION.
3. CELL MUST BE PLANTED WITH VEGETATION CONSISTENT WITH STIA WILDLIFE HAZARD MANAGEMENT PLAN (WHMP).
4. SOIL UNDER SHOULDERS OR PAVED AREAS MUST BE UNDISTURBED NATIVE SOIL OR APPROVED FILL COMPACTED TO 95% DENSITY.
5. ALSO SEE STANDARD DETAIL 128 AND 129 (A&B) FOR INTERFERENCE WITH ROADWAY.
6. REFER TO PORT OF SEATTLE STORMWATER MANAGEMENT MANUAL, CHAPTER 4. BMP AND FACILITY SELECTION PROCESS FOR PERMANENT STORMWATER CONTROL PLANS AND THE PORT OF SEATTLE LOW IMPACT DEVELOPMENT GUIDELINE FOR SELECTING TYPE OF BIORETENTION BMP TO USE FOR DESIGN.



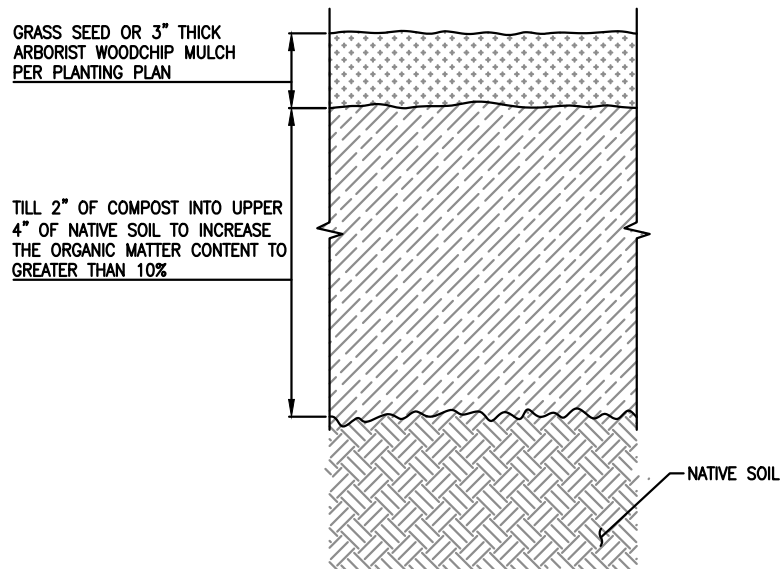
DETAIL

NON-INFILTRATING BIORETENTION
WITH UNDERDRAIN (LANDSIDE ONLY)
SCALE: NTS



NOTES:

- BIORETENTION OVERFLOW ELEVATIONS MUST BE SET BELOW SIDEWALK ELEVATION.
- CELL MUST BE PLANTED WITH VEGETATION CONSISTENT WITH STIA WILDLIFE HAZARD MANAGEMENT PLAN (WHMP).
- SOIL UNDER SHOULDERS OR PAVED AREAS MUST BE UNDISTURBED NATIVE SOIL OR APPROVED FILL COMPACTED TO 95% DENSITY.
- ALSO SEE STANDARD DETAIL 128 AND 129 (A&B) FOR INTERFERENCE WITH ROADWAY.
- REFER TO PORT OF SEATTLE STORMWATER MANAGEMENT MANUAL, CHAPTER 4. BMP AND FACILITY SELECTION PROCESS FOR PERMANENT STORMWATER CONTROL PLANS AND THE PORT OF SEATTLE LOW IMPACT DEVELOPMENT GUIDELINE FOR SELECTING TYPE OF BIORETENTION BMP TO USE FOR DESIGN.

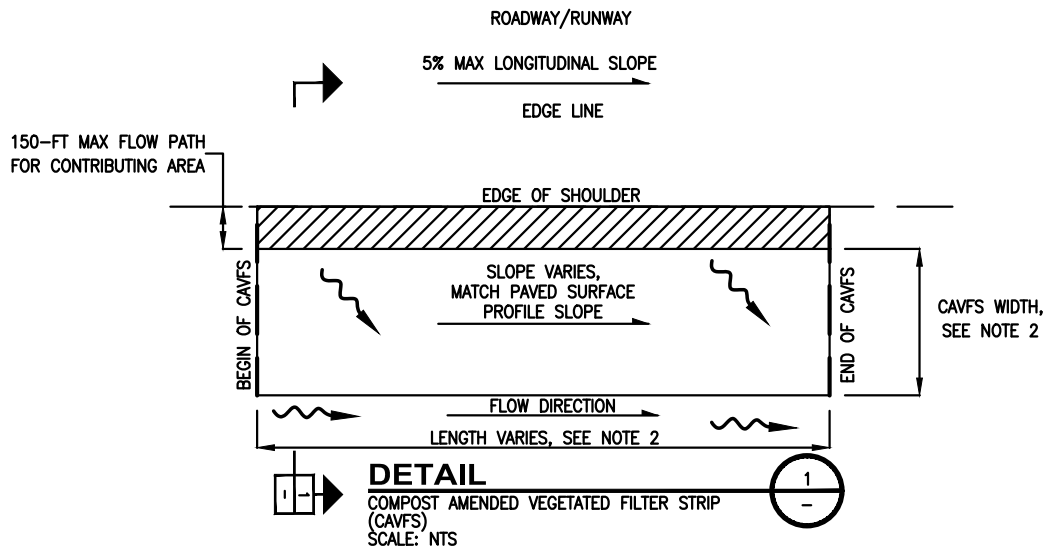
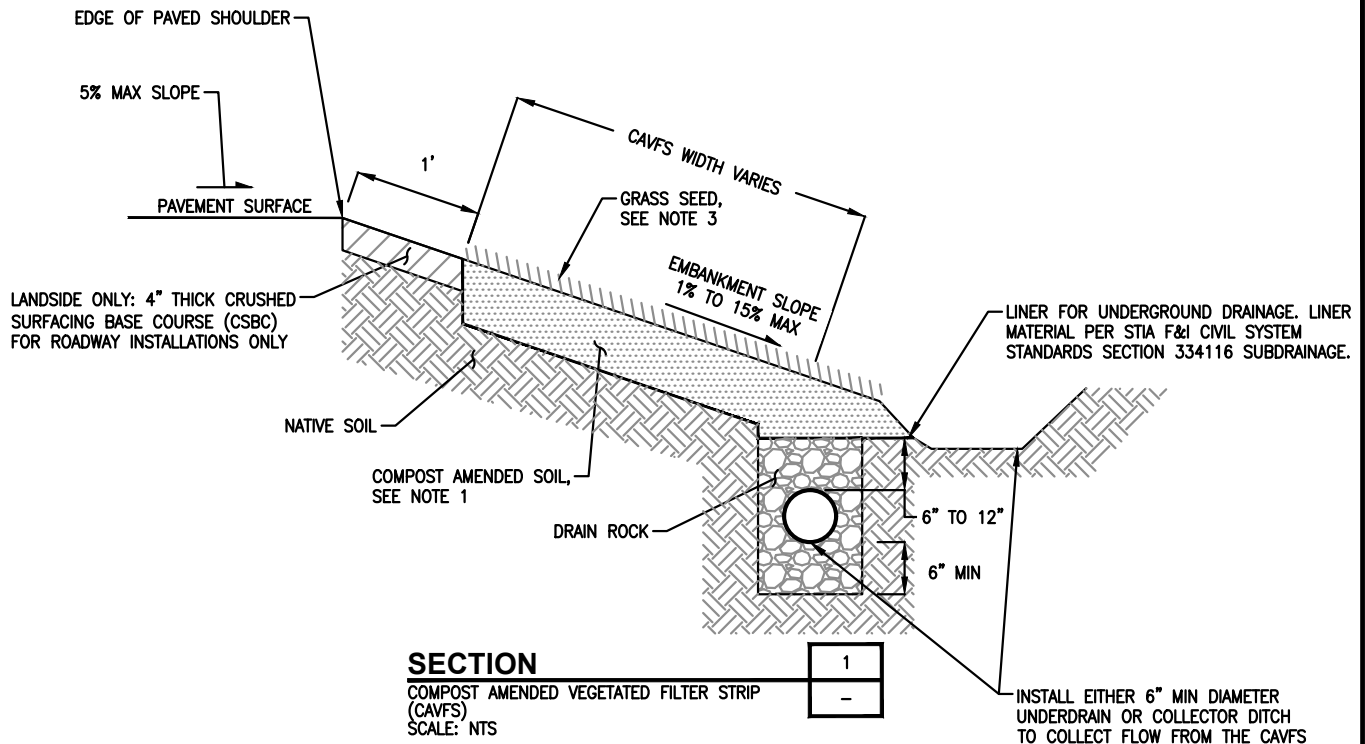


DETAIL
SOIL AMENDMENT
SCALE: NTS



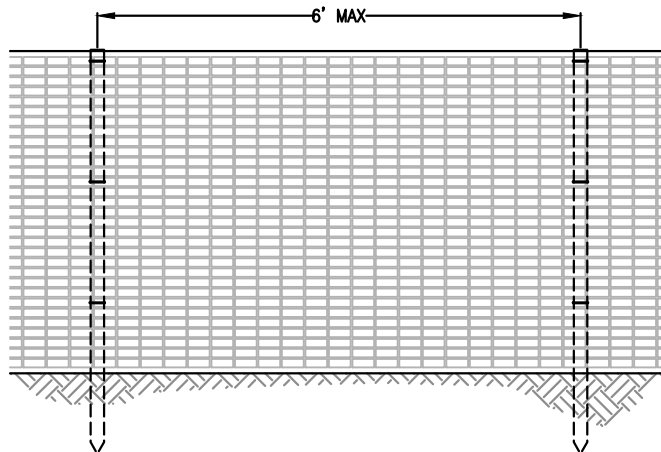
NOTES:

1. ALL SOIL AREAS DISTURBED OR COMPACTED DURING CONSTRUCTION, AND NOT COVERED BY BUILDINGS OR PAVEMENT, MUST BE AMENDED WITH COMPOST AS DESCRIBED BELOW.
2. PLANT GRASS SEED PER T-901 SEEDING OF FAA AC 150/5370-10H OR ARBORIST WOODCHIP MULCH PER STIA F&I CIVIL SYSTEM STANDARDS SECTION 338000 COMPOST AMENDED BMPS SECTION 2.03.
3. SETBACKS:
 - a. TO PREVENT UNEVEN SETTLING, NO SOIL AMENDMENT WITHIN 3 FEET OF UTILITY INFRASTRUCTURES (POLES, VAULTS, METERS ETC.)
 - b. WITHIN ONE FOOT OF PAVEMENT EDGE, CURBS AND SIDEWALKS SOIL SHOULD BE COMPACTED TO APPROXIMATELY 90% PROCTOR TO ENSURE A FIRM SURFACE.
 - c. WITHIN RUNWAY SAFETY AREAS, UNDERLYING SOIL SHOULD BE COMPACTED TO NO LESS THAN 95% TO MEET FAA REQUIREMENTS.



NOTES

- SOIL AMENDMENT:
 - FOR AIRSIDE INSTALLATIONS:
TILL 2" OF COMPOST INTO UPPER 4" OF UNCOMPACTED NATIVE SOIL TO INCREASE ORGANIC MATTER CONTENT TO 10% OR GREATER PER STD DETAIL 132.
 - FOR LANDSIDE INSTALLATIONS ADJACENT TO A ROAD:
SHALL BE PER STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON: TILL 1.75 INCHES OF COMPOSTED MATERIAL INTO 6.25 INCHES OF NATIVE SOIL (A TOTAL AMENDED DEPTH OF ABOUT 9.5 INCHES), FOR A SETTLED DEPTH OF 8 INCHES. WATER OR ROLL TO COMPACT SOIL TO 85% MAXIMUM.
- WIDTHS ARE DESIGNED IN ACCORDANCE WITH SECTION BMP T7.40 T9.40 EXCEPT FOR EXTENDED CAVFS ALONG RUNWAYS. FOR EXTENDED CAVFS, WIDTHS ARE TYPICALLY 100 FEET OR GREATER (3 TO 4 TIMES GREATER THAN WIDTHS REQUIREMENTS IN THE SWMMWW).
- PLANT GRASS SEED PER T-901 SEEDING OF FAA AC 150/5370-10H.



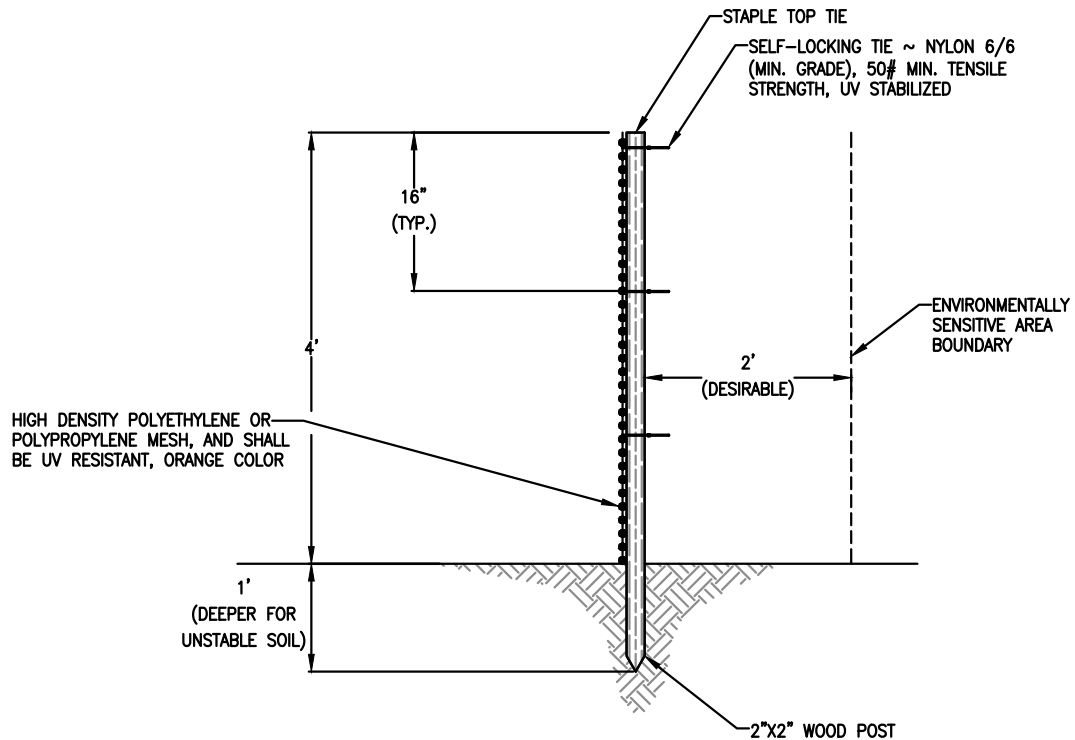
NOTES

1. POST SHALL HAVE SUFFICIENT STRENGTH AND DURABILITY TO SUPPORT THE FENCE THROUGH THE LIFE OF THE PROJECT.

SECTION

HIGH VISIBILITY FENCE (LANDSIDE ONLY)
SCALE: NTS

1
-



DETAIL

HIGH VISIBILITY FENCE (LANDSIDE ONLY)
SCALE: NTS

1
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SPECIAL CONSTRUCTION REQUIREMENTS (TRENCHING/ EXCAVATION)

ZONE A (INTERIOR CRITICAL ROOT ZONE)

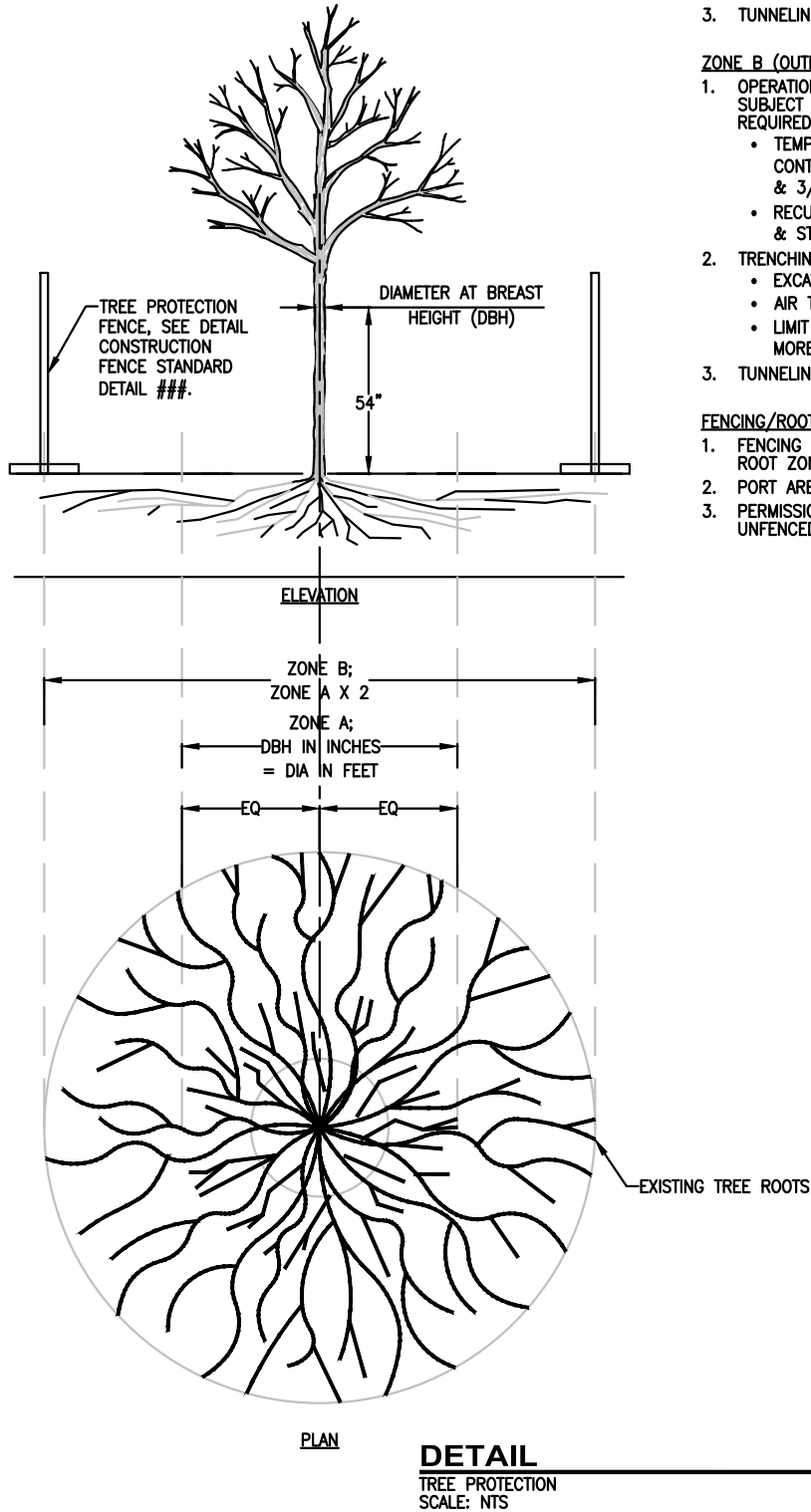
1. NO DISTURBANCE ALLOWED WITHOUT SITE-SPECIFIC INSPECTION AND APPROVAL OF METHODS TO MINIMIZE ROOT DAMAGE
2. SEVERANCE OF ROOTS LARGER THAN 2" DIA REQUIRES ENGINEER'S AND A PORT ARBORIST'S APPROVAL.
3. TUNNELING REQUIRED TO INSTALL LINES 3'-0" BELOW GRADE OR DEEPER

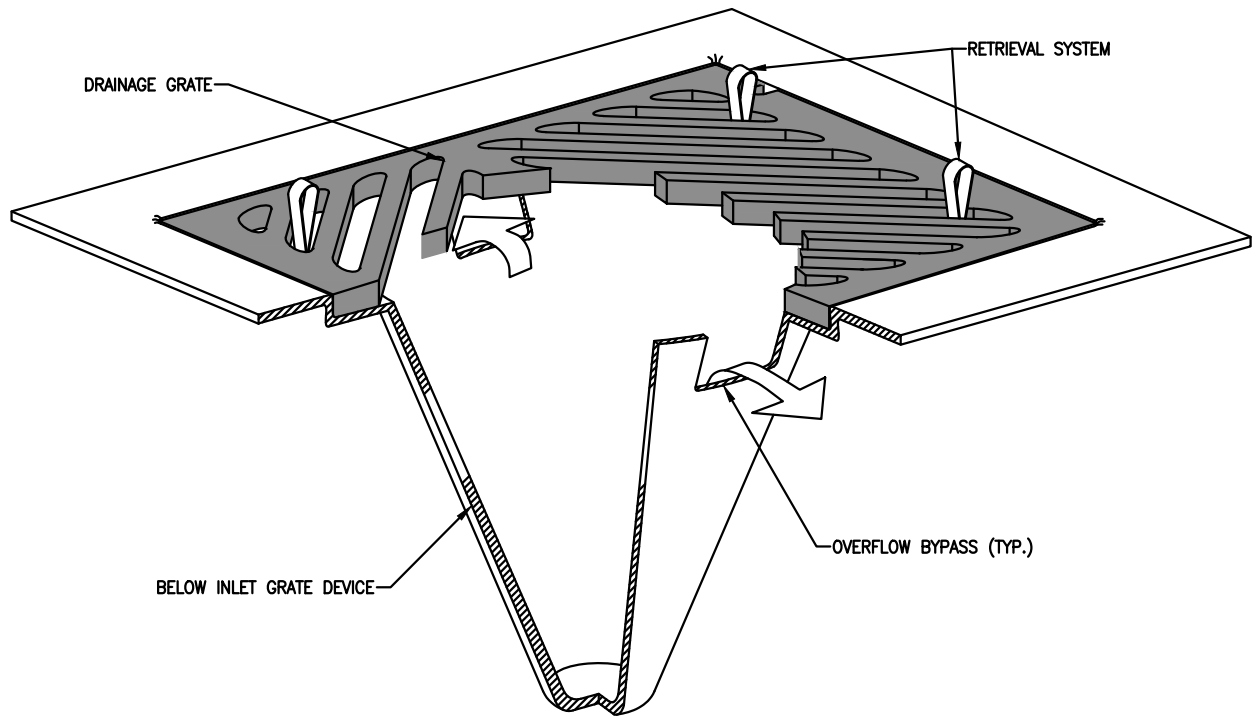
ZONE B (OUTER CRITICAL ROOT ZONE)

1. OPERATION OF HEAVY EQUIPMENT AND/OR STOCKPILING OF MATERIALS SUBJECT TO PORT ARBORIST'S APPROVAL. SURFACE PROTECTION MEASURES REQUIRED:
 - TEMPORARY ACCESS FOR ONLY EQUIPMENT WITH < 10 PSI GROUND CONTACT PRESSURE: ARBORIST WOODCHIP MULCH LAYER, 6"-8" DEPTH, & 3/4" PLYWOOD SHEETS
 - RECURRING ACCESS: ARBORIST WOODCHIP MULCH LAYER, 6"-8" DEPTH, & STEEL PLATES
2. TRENCHING ALLOWED WITH PRIOR PORT ARBORIST'S APPROVAL AS FOLLOWS:
 - EXCAVATION BY HAND;
 - AIR TRENCHING OR VACUUM EXCAVATION;
 - LIMIT TRENCHING WIDTH. DO NOT DISTURB ZONE A; MAINTAIN 2/3 OR MORE OF ZONE B IN UNDISTURBED CONDITION;
3. TUNNELING MAY BE REQUIRED FOR TRENCHES DEEPER THAN 3'-0"

FENCING/ROOT PROTECTION

1. FENCING TO BE PROVIDED AND MAINTAINED AT LIMITS OF OUTER CRITICAL ROOT ZONE.
2. PORT ARBORIST'S APPROVAL REQUIRED FOR USE/ ACCESS WITHIN ZONE B.
3. PERMISSION FOR USE/ ACCESS REQUIRES SURFACE PROTECTION FOR ALL UNFENCED, UNPAVED SURFACES WITHIN CRITICAL ROOT ZONE.





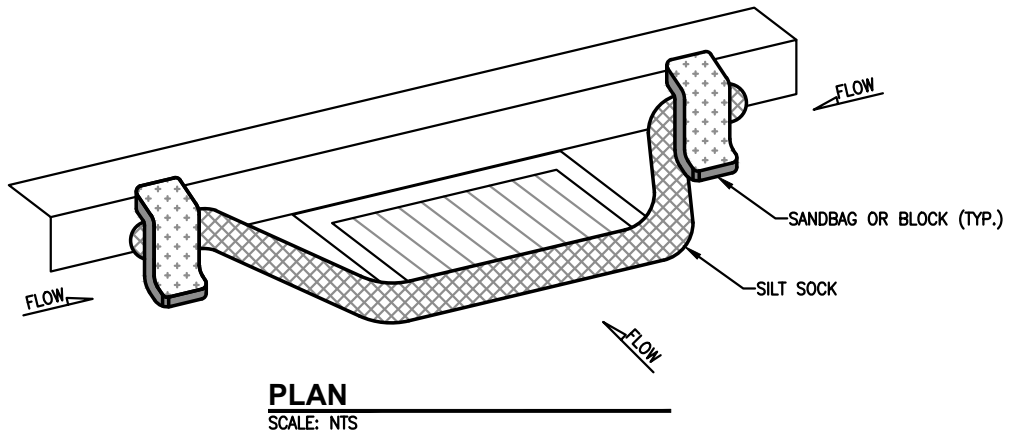
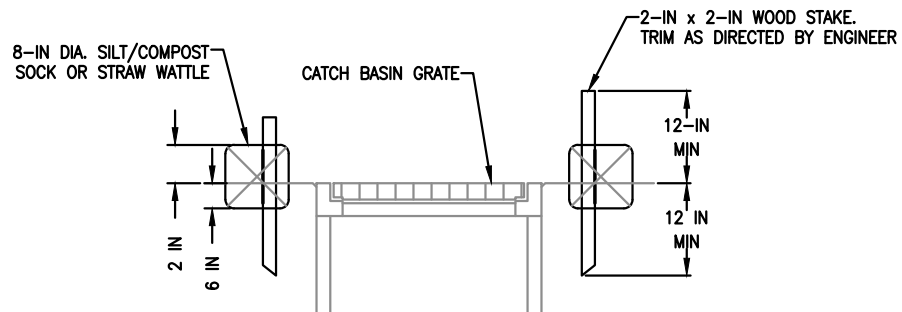
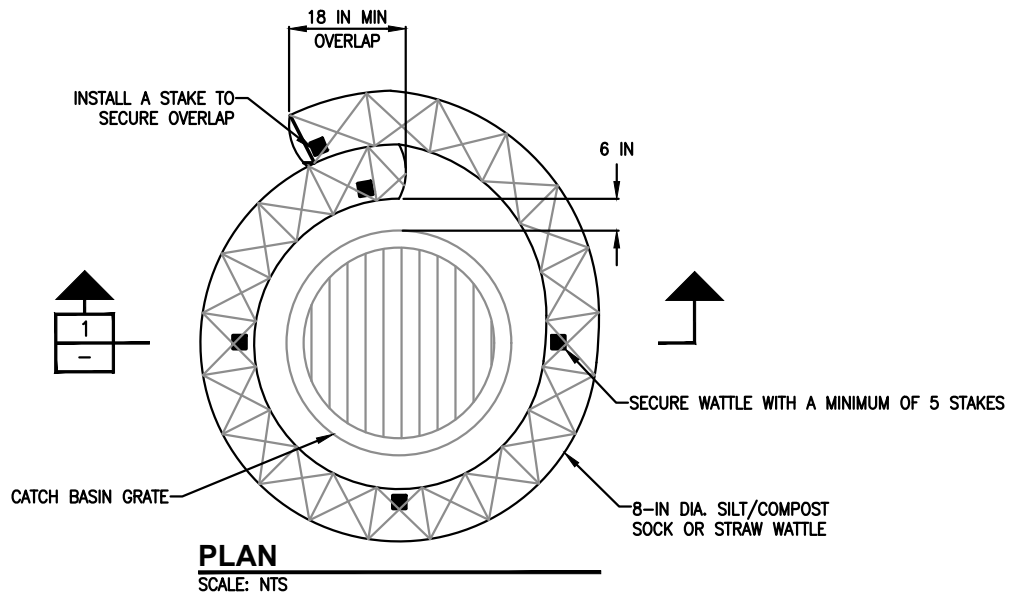
DETAIL

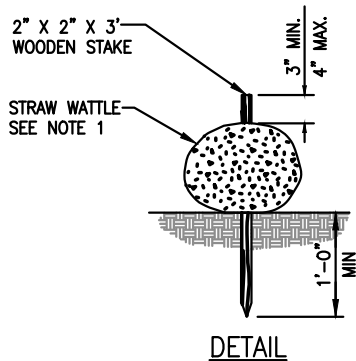
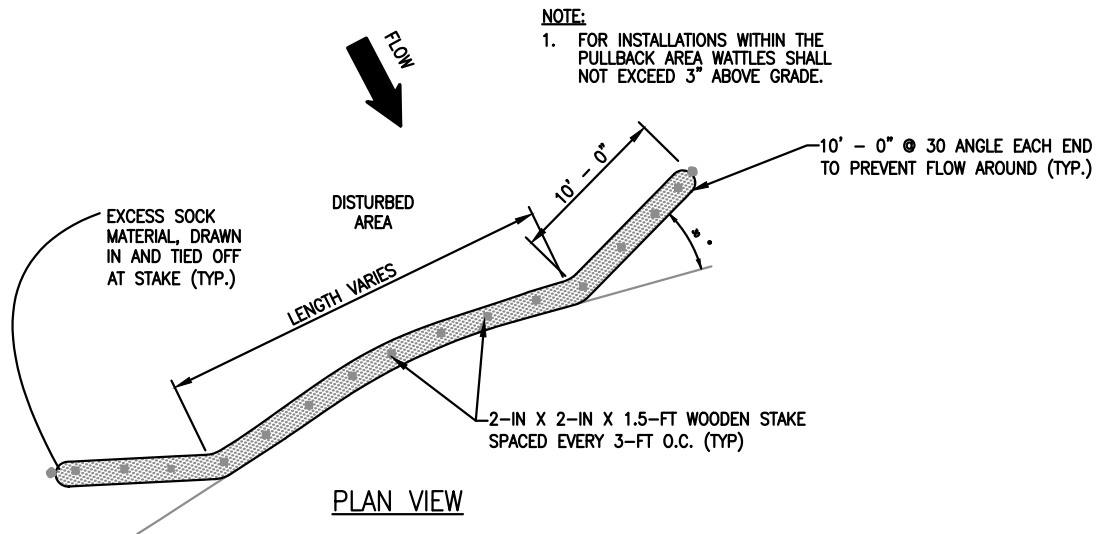
STRUCTURE INLET PROTECTION
SCALE: NTS



NOTES

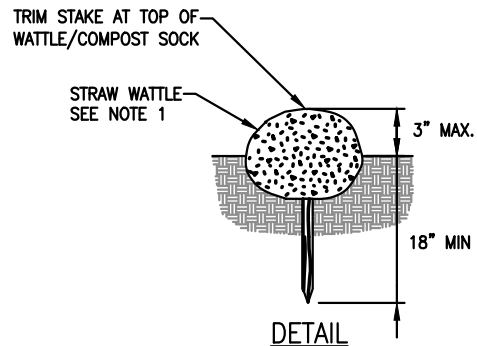
1. SIZE THE BELOW INLET GRATE DEVICE (BIGD) FOR THE STORM WATER STRUCTURE IT WILL SERVICE.
2. THE BIGD SHALL HAVE A BUILT-IN HIGH-FLOW RELIEF SYSTEM (OVERFLOW BYPASS).
3. THE RETRIEVAL SYSTEM MUST ALLOW REMOVAL OF THE BIGD WITHOUT SPILLING THE COLLECTED MATERIAL.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH TESC SPECIFICATION 3.03 A.5.





DETAIL
STRAW WATTLE/COMPOST SOCK (LANDSIDE ONLY)
SCALE: NTS

1
-

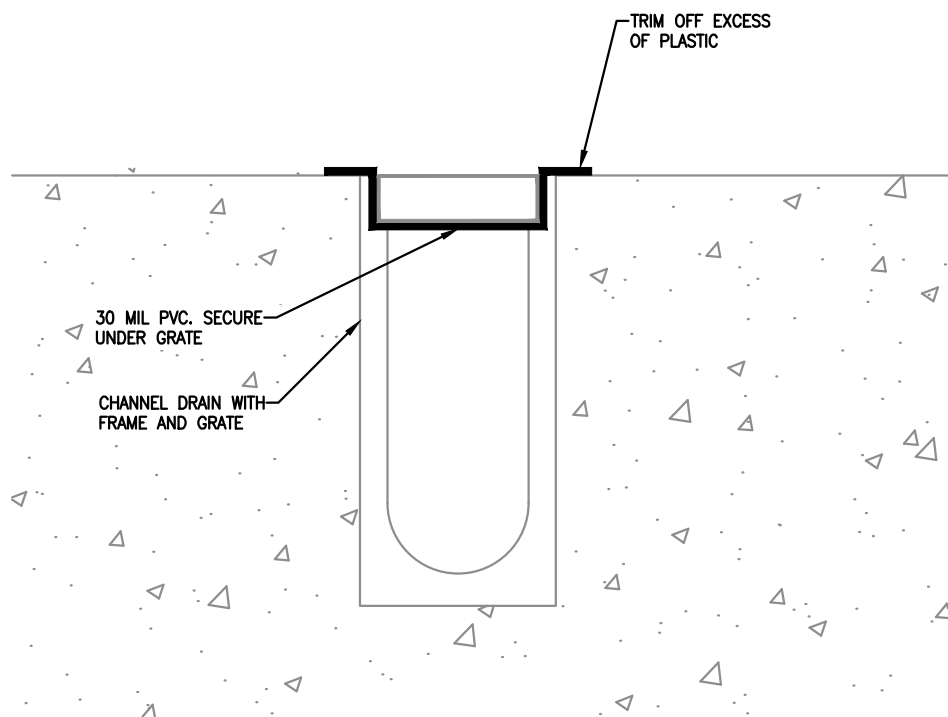


DETAIL
STRAW WATTLE/COMPOST SOCK (AIRSIDE ONLY)
SCALE: NTS

2
-

NOTES:

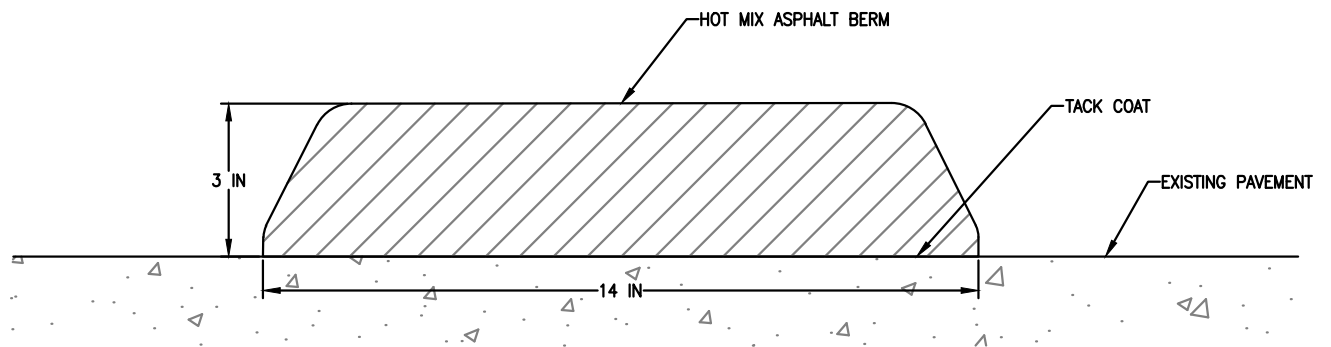
1. COMPOST SOCK SHALL BE IN ACCORDANCE WITH TESC SPECIFICATION 2.04.F. COMPOST SOCK SHALL BE A MINIMUM OF 10" IN DIAMETER OR SIZED TO SUIT CONDITIONS AS SPECIFIED BY THE ENGINEER.
2. ALWAYS INSTALL COMPOST SOCK PERPENDICULAR TO SLOPE AND ALONG CONTOUR LINES.
3. REMOVE SEDIMENT FROM THE UP SLOPE SIDE OF THE COMPOST SOCK WHEN ACCUMULATION HAS REACHED 1/2 OF THE EFFECTIVE HEIGHT OF THE STRAW WATTLE.
4. WEIGH DOWN COMPOST SOCK ON PAVED AREAS USING SAND BAGS PLACED PERPENDICULAR ACROSS THE COMPOST SOCK. SAND BAGS SHALL BE USED WHERE COMPOST SOCK ARE ADJACENT TO ONE ANOTHER AND ON 5-FT INTERVALS.



DETAIL

CHANNEL DRAIN PROTECTION
SCALE: NTS

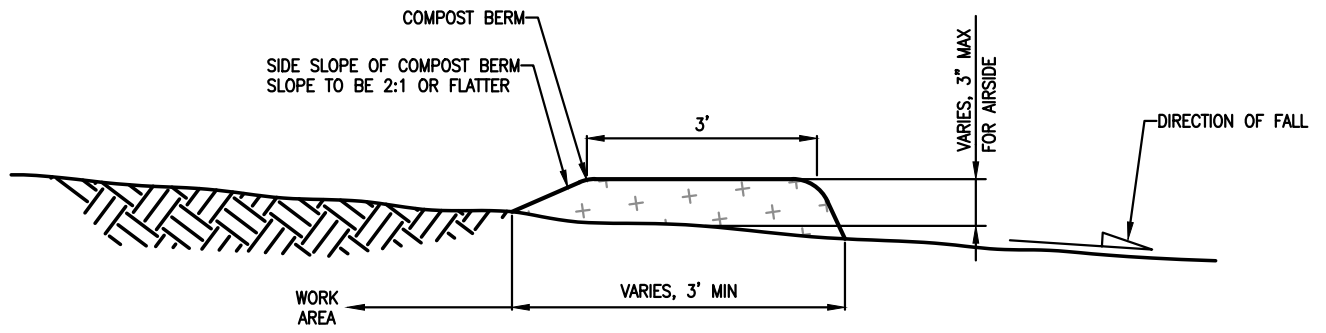




DETAIL

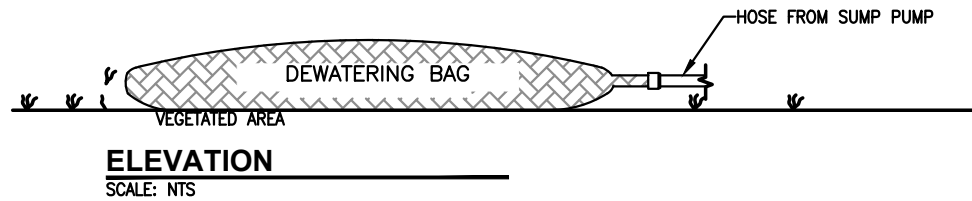
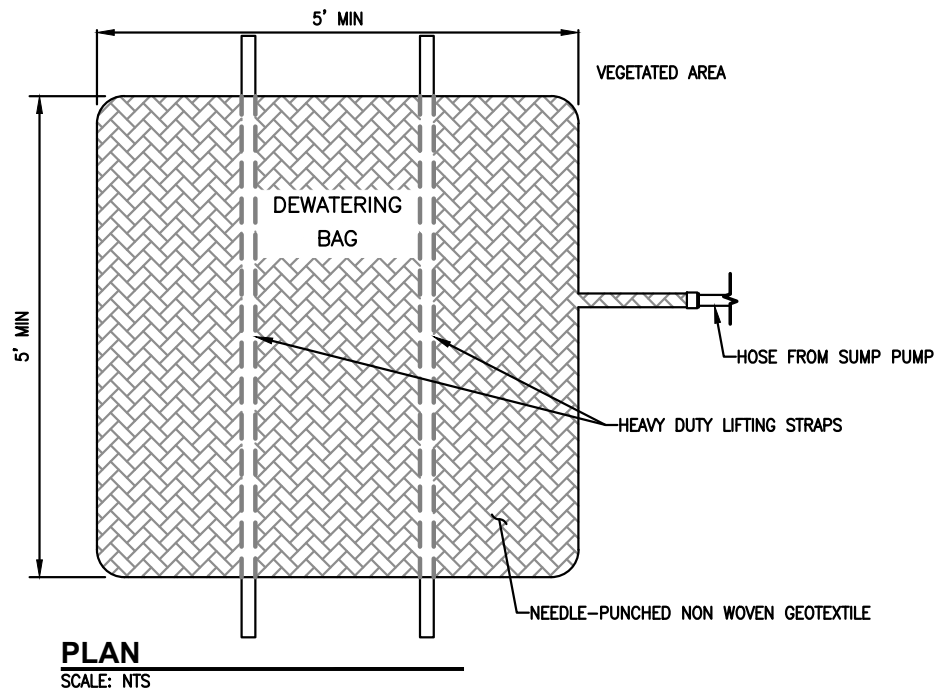
HMA BERM
SCALE: NTS





DETAIL
COMPOST BERM
SCALE: NTS





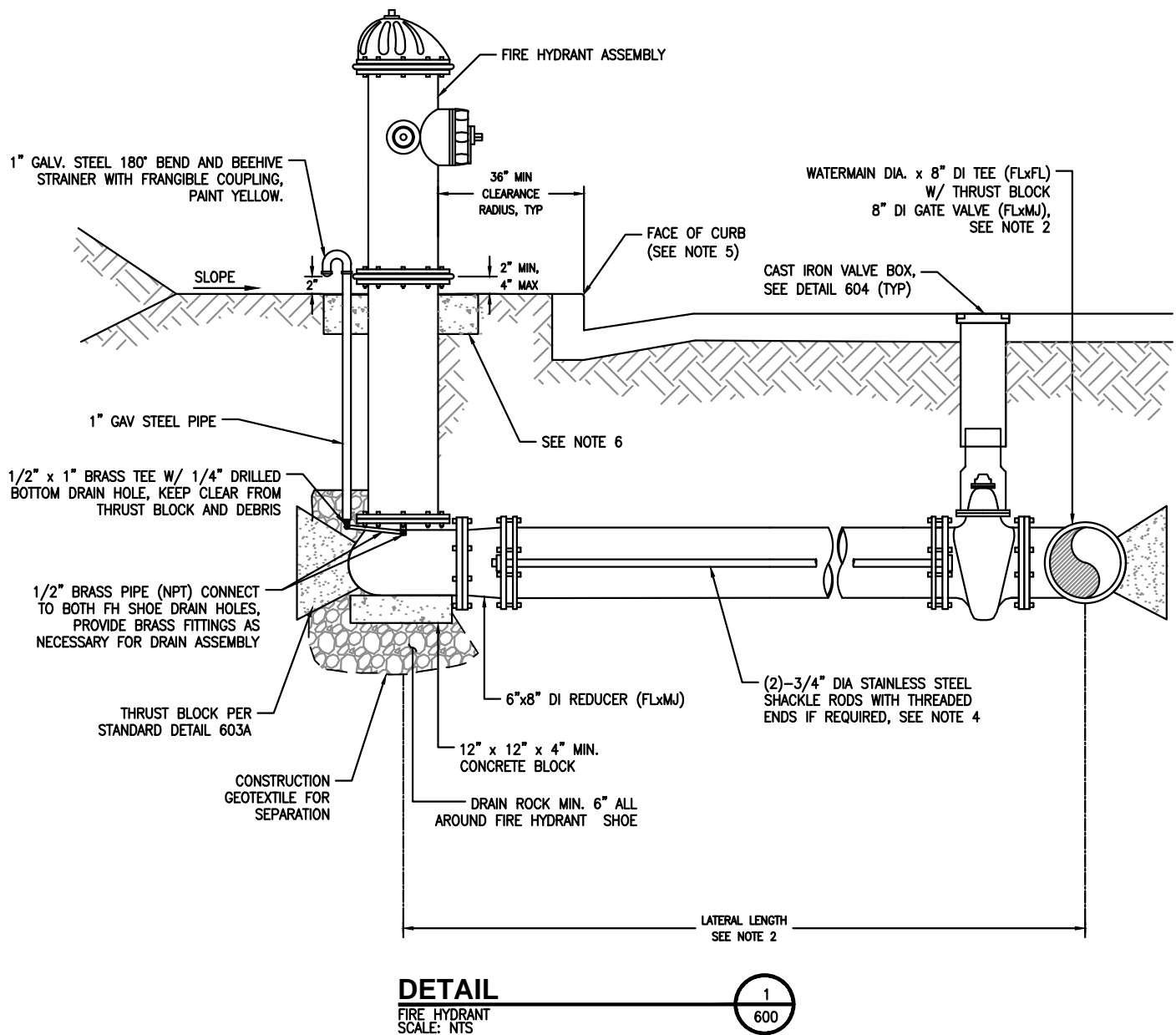
NOTE:

REFER TO SPECIFICATION SECTION 01 57 13 FOR DEWATERING BAG SPECIFICATIONS

DETAIL

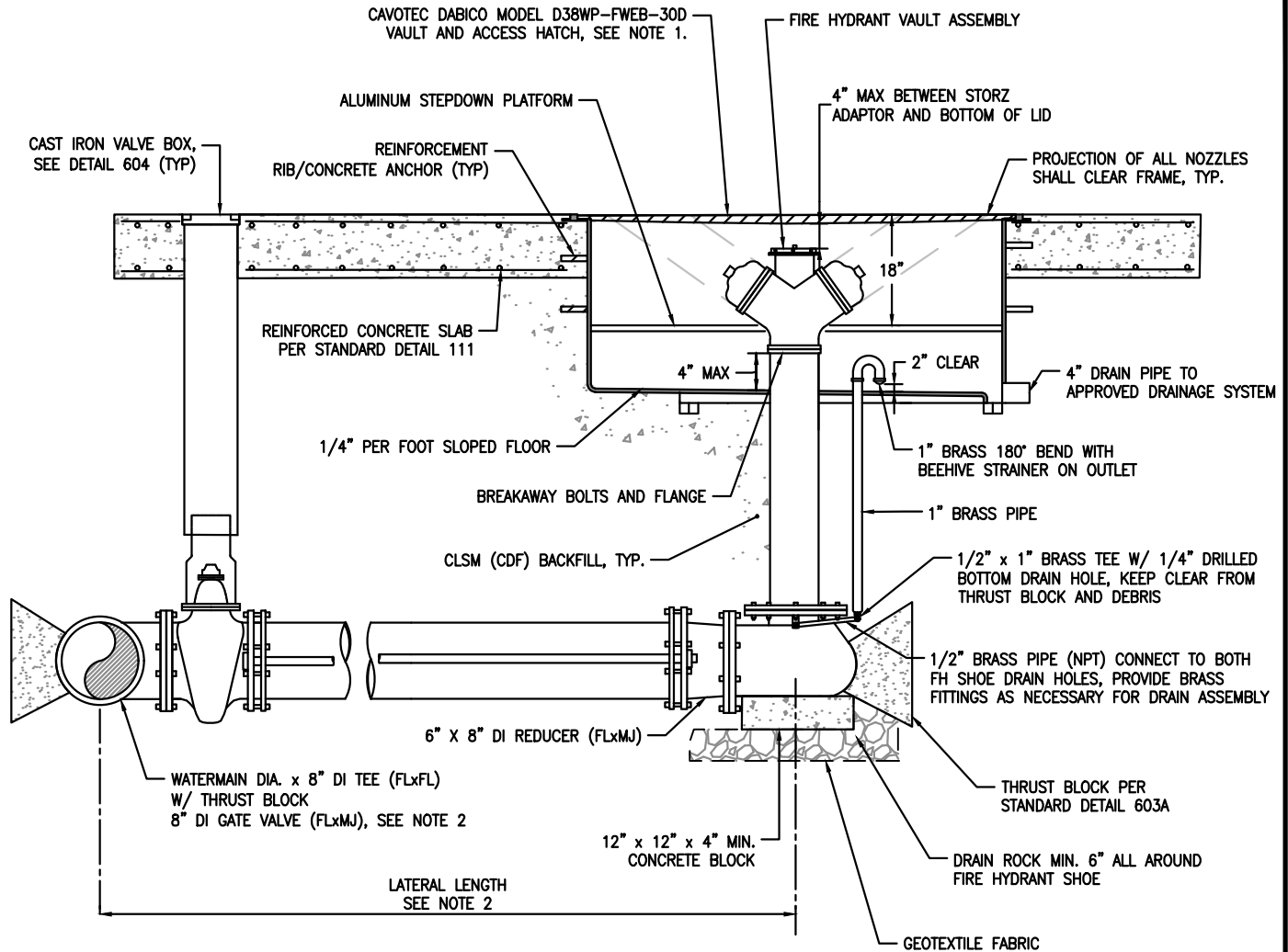
DEWATERING BAG
SCALE: NTS





NOTES:

1. SEE SECTION 33 12 19 FOR FIRE HYDRANT ASSEMBLY PRODUCTS.
2. IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH A 8" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN. IF LATERAL LENGTH IS >10', INSTALL A SECOND LINE-SIZED GATE VALVE (MJ X MJ) 4' MIN. TO 10' MAX. FROM FIRE HYDRANT.
3. ALL JOINTS SHALL BE RESTRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT OR APPROVED EQUAL.
4. SHACKLE RODS CAN BE UTILIZED IN LIEU OF THRUST BLOCK AT HYDRANT.
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. IN UNPAVED AREAS INSTALL A 3' X 3' X 4" THICK CONCRETE PAD. PAD NOT DRAWN TO SCALE.
7. FIRE HYDRANT SHALL BE PAINTED RED WITH REFLECTORIZED SILVER TOP, SEE SECTION 331219, FIRE HYDRANTS.



DETAIL

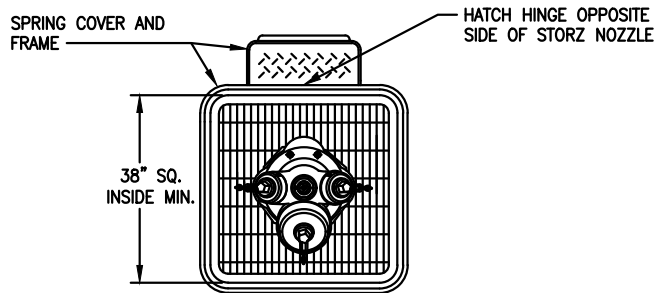
FLUSH HYDRANT ASSEMBLY AND VAULT
SCALE: NTS

1

602A

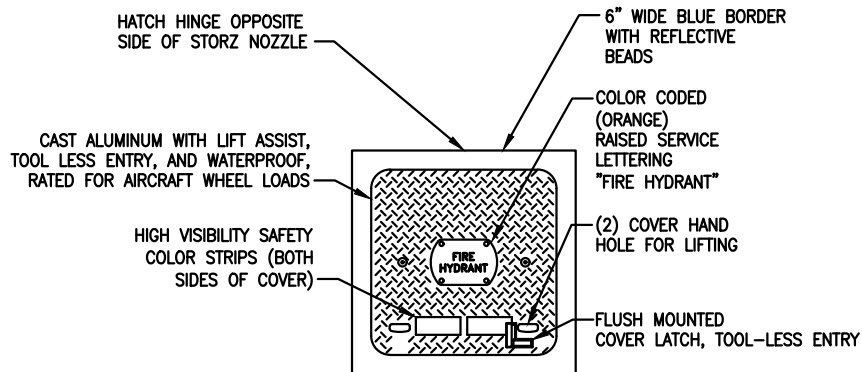
NOTES:

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. IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH A 8" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN. IF LATERAL LENGTH IS >10', INSTALL A SECOND LINE-SIZED GATE VALVE (MJ X MJ) 4' MIN. TO 10' MAX. FROM FIRE HYDRANT.
3. 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.
4. SHACKLE RODS CAN BE UTILIZED IN LIEU OF THRUST BLOCKS.



DETAIL

VAULT ACCESS PIT ASSEMBLY
COVER REMOVED
SCALE: NTS

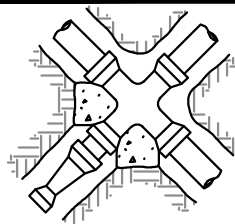


DETAIL

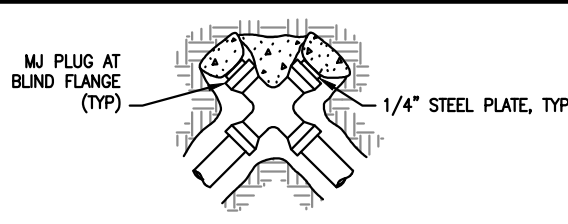
TORSION ACTUATED WATERPROOF COVER
SCALE: NTS



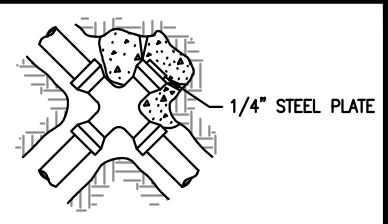
SEE NOTES ON SHEET 602A.



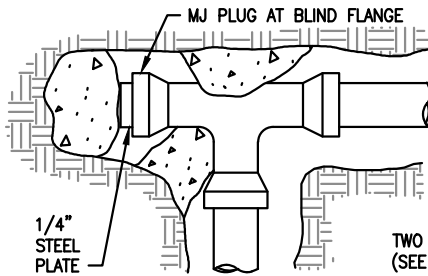
UNBALANCED CROSS
(USE COLUMN A)



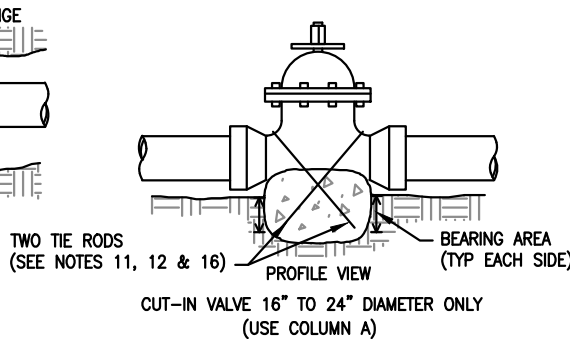
PLUGGED CROSS
(USE COLUMN B)



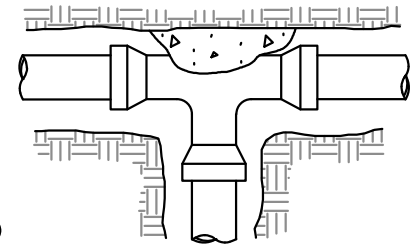
PLUGGED CROSS
(USE COLUMN A)



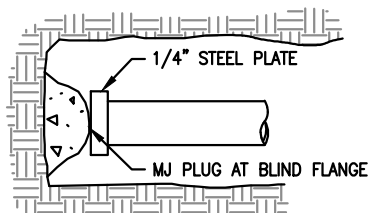
PLUGGED TEE
(USE COLUMN B)



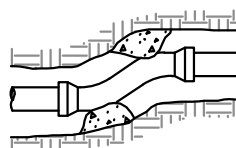
CUT-IN VALVE 16" TO 24" DIAMETER ONLY
(USE COLUMN A)



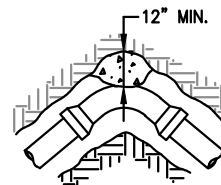
TEE
(SEE NOTE 15)



DEAD END



OFFSET
(USE COLUMNS B~E)



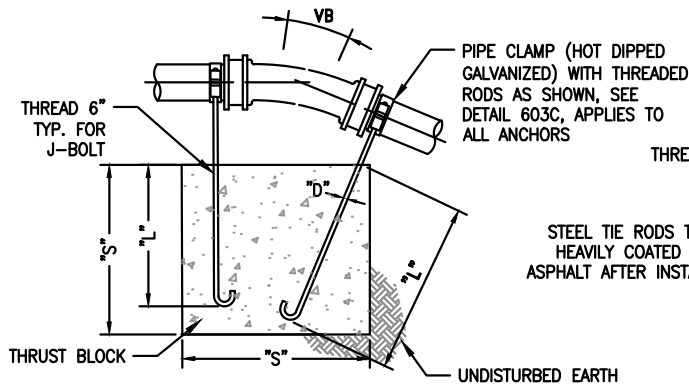
BEND

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

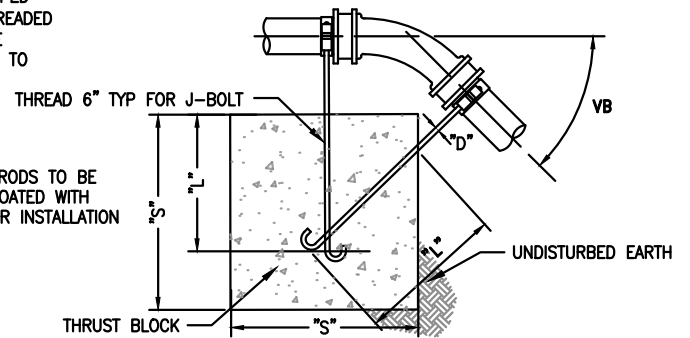
TABLE 1 THRUST BLOCK REQUIREMENTS—HORIZONTAL BEARING

PIPE SIZE (INCHES)	A		B		C		D		E	
	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
18	74,663	56.0	105,588	79.2	57,145	42.9	29,133	21.8	14,638	11.0
24	130,698	98.0	184,835	138.6	100,033	75.0	50,995	38.2	25,623	19.2

- *MINIMUM BEARING AREA AGAINST UNDISTURBED SOIL (BASED ON SAFE SOIL BEARING OF 2000 PSF)
- BEARING AREA OF CONCRETE THRUST BLOCKS SHOWN IN TABLE 1 BASED ON 250 9. PSI PRESSURE AND SAFE SOIL BEARING LOAD OF 2,000 POUNDS PER SQUARE FOOT.
 - 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 24" DIAMETER AND FOR PRESSURE AND SOIL TYPES DIFFERENT THAN SHOWN SHALL BE DETERMINED BY THE ENGINEER.
 - SIZE OF THRUST BLOCKS TO BE PER NFPA 24 AND USE A SAFETY FACTOR OF 1.5.
 - CONCRETE BLOCKING (CLASS 3000) SHALL BE CAST IN PLACE AGAINST UNDISTURBED NATIVE EARTH.
 - CONCRETE THRUST BLOCK AREAS SHALL BE CENTERED ON PIPE.
 - 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.
 - CONTRACTOR SHALL INSTALL BLOCKING ADEQUATE TO WITHSTAND FULL TEST PRESSURE UNDER ALL CONDITIONS OF SERVICE.
 - PLACE SHEET PLASTIC OVER NUTS AND BOLTS PRIOR TO CONCRETE POUR USING
 - ALL POURED THRUST BLOCKS SHALL BE BACKFILLED AFTER MIN. 1 DAY. PRESSURE TESTING SHALL OCCUR AFTER CONCRETE HAS REACHED NOMINAL COMPRESSIVE STRENGTH.
 - WHERE POURED-IN-PLACE BLOCKING IS REQUIRED AT A POINT OF CONNECTION TO AN EXISTING WATERMAIN, THE BLOCKING SHALL BE INSTALLED PRIOR TO CONNECTION.
 - TIE RODS TO BE DESIGNED BY STRUCTURAL ENGINEER.
 - TEMPORARY BLOCKING, IF USED, SHALL BE APPROVED BY THE ENGINEER.
 - THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS.
 - 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.
 - THRUST BLOCKS ARE REQUIRED FOR CUT-IN VALVES 16" TO 24" IN DIAMETER 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.
 - THRUST CALCULATED USING THE OUTSIDE DIAMETER OF DUCTILE IRON PIPE PER NFPA 24.



STEEL TIE RODS TO BE HEAVILY COATED WITH ASPHALT AFTER INSTALLATION



11 1/4° THRU 22 1/2°
VERTICAL BENDS

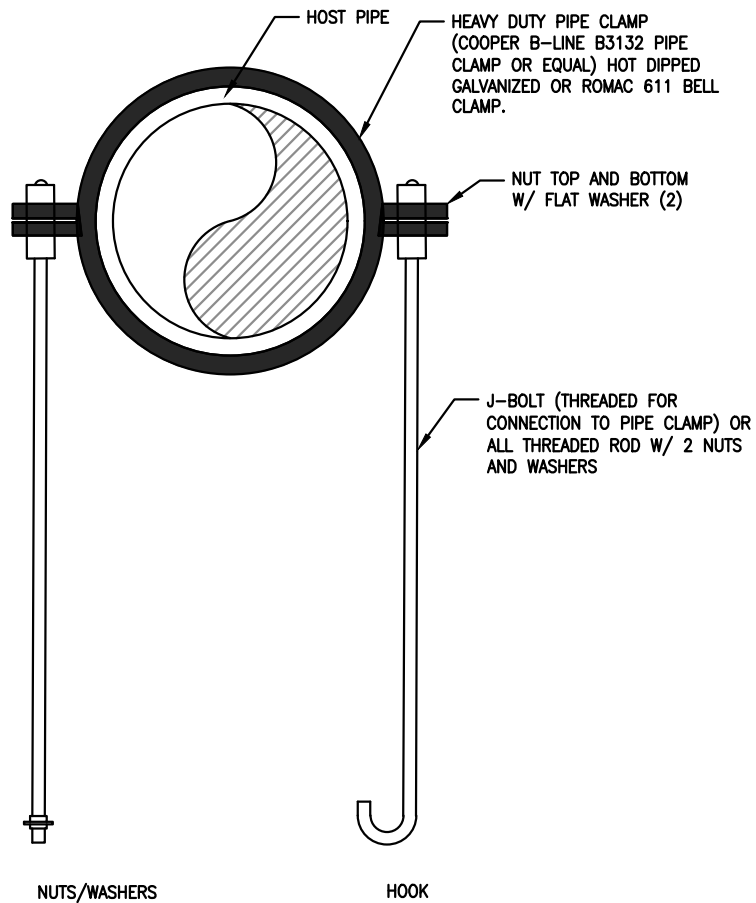
PIPE SIZE DIA (INCHES)	TEST PRESSURE (PSI)	VERTICAL BEND, VB (DEGREES)	NO OF CU FT OF CONCRETE BLOCKING	SIDE OF CUBE, "S" (FEET)	DIAMETER OF TIE RODS, "D" (INCHES)	DEPTH OF RODS IN CONCRETE, "L" (INCHES)
4	250	11 1/4	6	1.8	5/8	17
		22 1/2	12	2.3		
6		11 1/4	14	2.4		
		22 1/2	27	3.0		
8		11 1/4	25	2.9		
		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	3/4	20
		22 1/2	108	4.8		
14		11 1/4	75	4.2		
		22 1/2	147	5.3		
16		11 1/4	98	4.6	5/8	17
		22 1/2	192	5.8	7/8	24
18		11 1/4	124	5.0	3/4	23
		22 1/2	243	6.2	1	30
24		11 1/4	221	6.0	1 1/8	42
		22 1/2	433	7.6	1 3/8	48

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	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
18			450	7.7	1-1/4	33
24			800	9.3	1-5/8	42

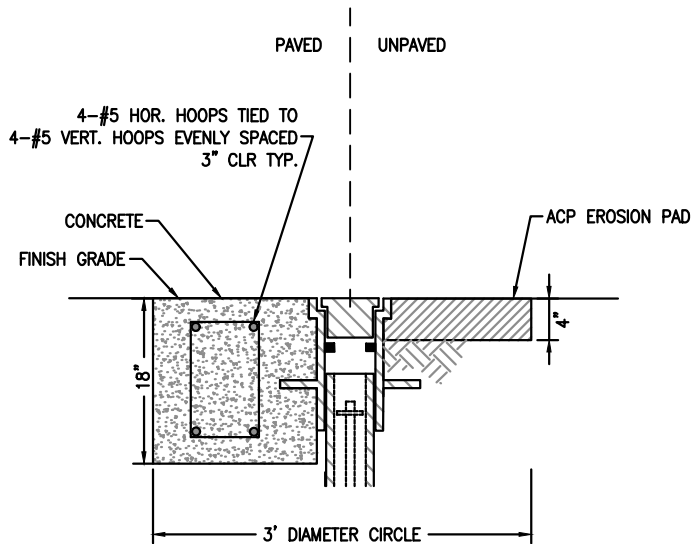
NOTES

1. LOCATION AND SIZE OF BLOCKING FOR PIPE LARGER THAN 24" 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. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS, PER STANDARD DETAIL 603A.



NOTES

1. J-BOLT OR ALL THREADED ROD. DIAMETER PER BEND AND PIPE DIAMETER IN DIMENSION TABLE IN DETAIL 603B.
2. TIGHTEN TOP NUTS TO TENSION BOLTS.
3. TIGHTEN LOWER NUTS TO COMPRESS CLAMP SNUG.
4. TIE RODS SHALL BE STEEL, ASTM A-307 WITH 36 KSI YIELD STRENGTH.

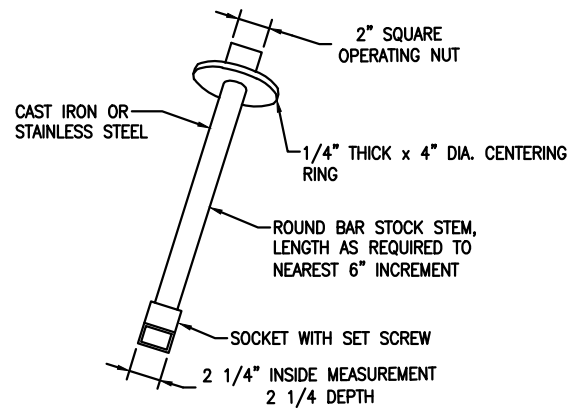


DETAIL

CAST-IN-PLACE CONCRETE COLLAR
SCALE: NTS

1

604

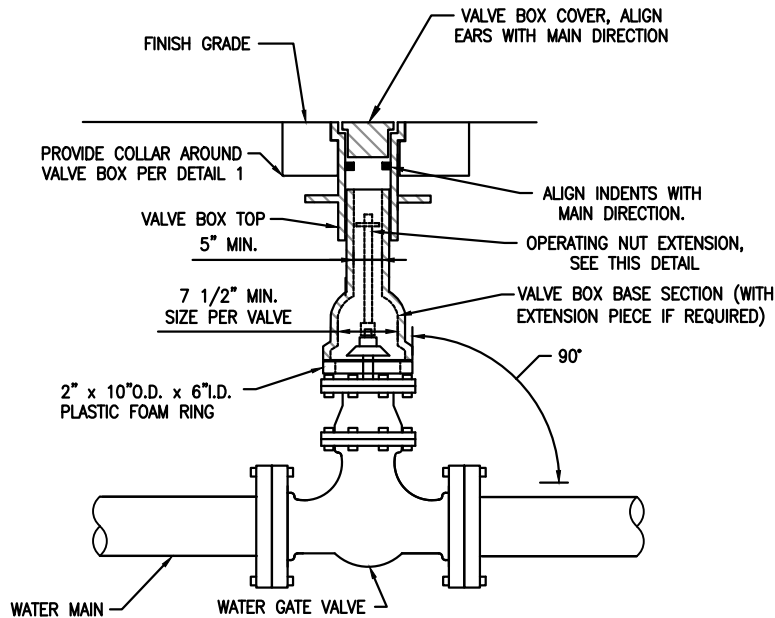


DETAIL

OPERATING NUT EXTENSION
SCALE: NTS

2

604



SECTION

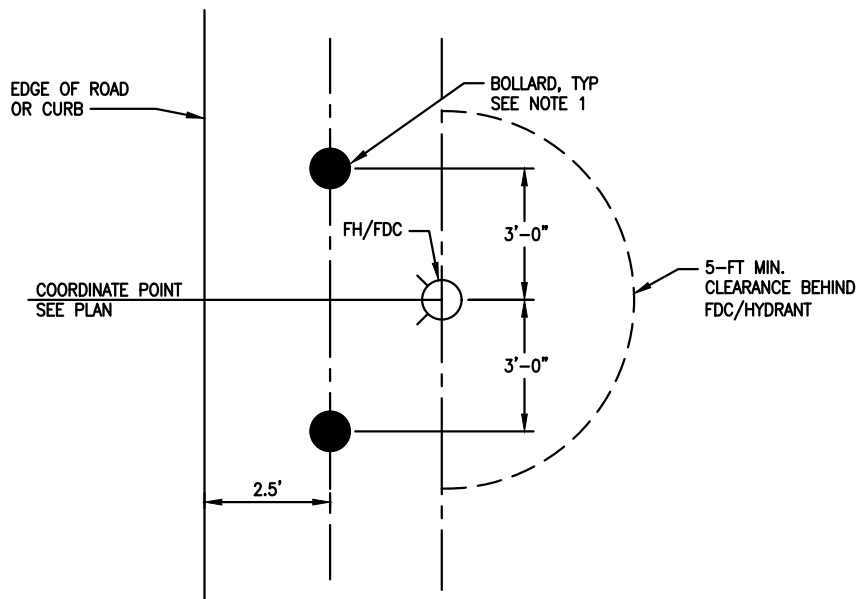
VALVE BOX
SCALE: NTS

3

604

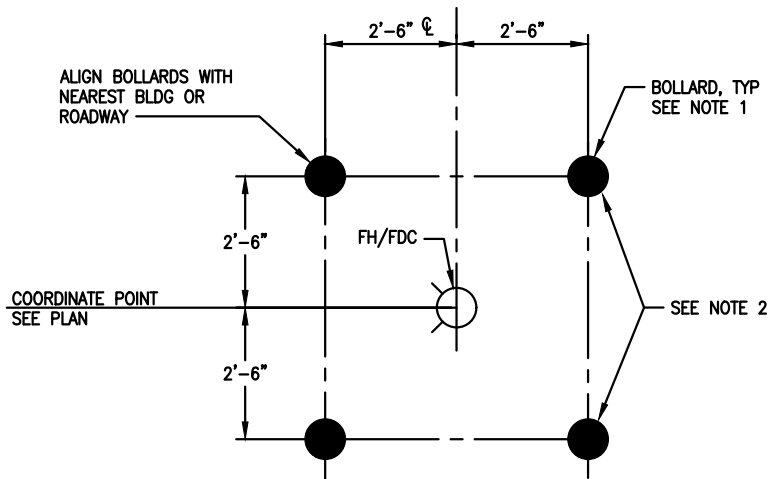
NOTES:

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.



DETAIL

BOLLARD LOCATIONS ADJACENT TO ROADWAY
SCALE: NTS



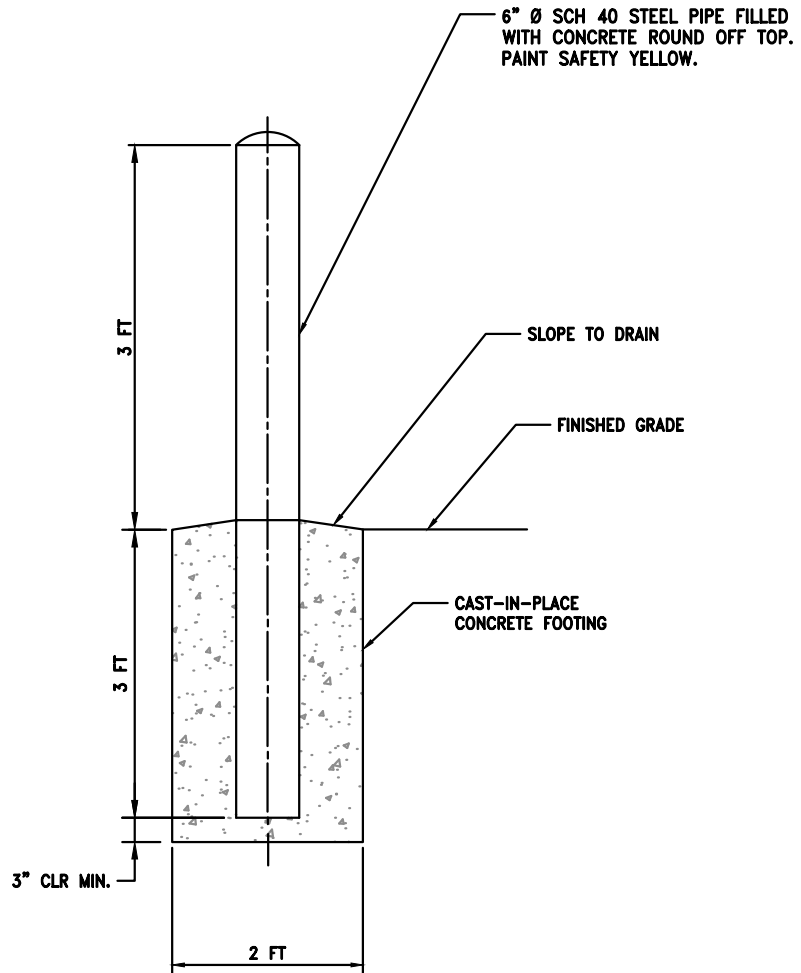
DETAIL

HYDRANT AND FDC BOLLARD LOCATION PLAN
SCALE: NTS



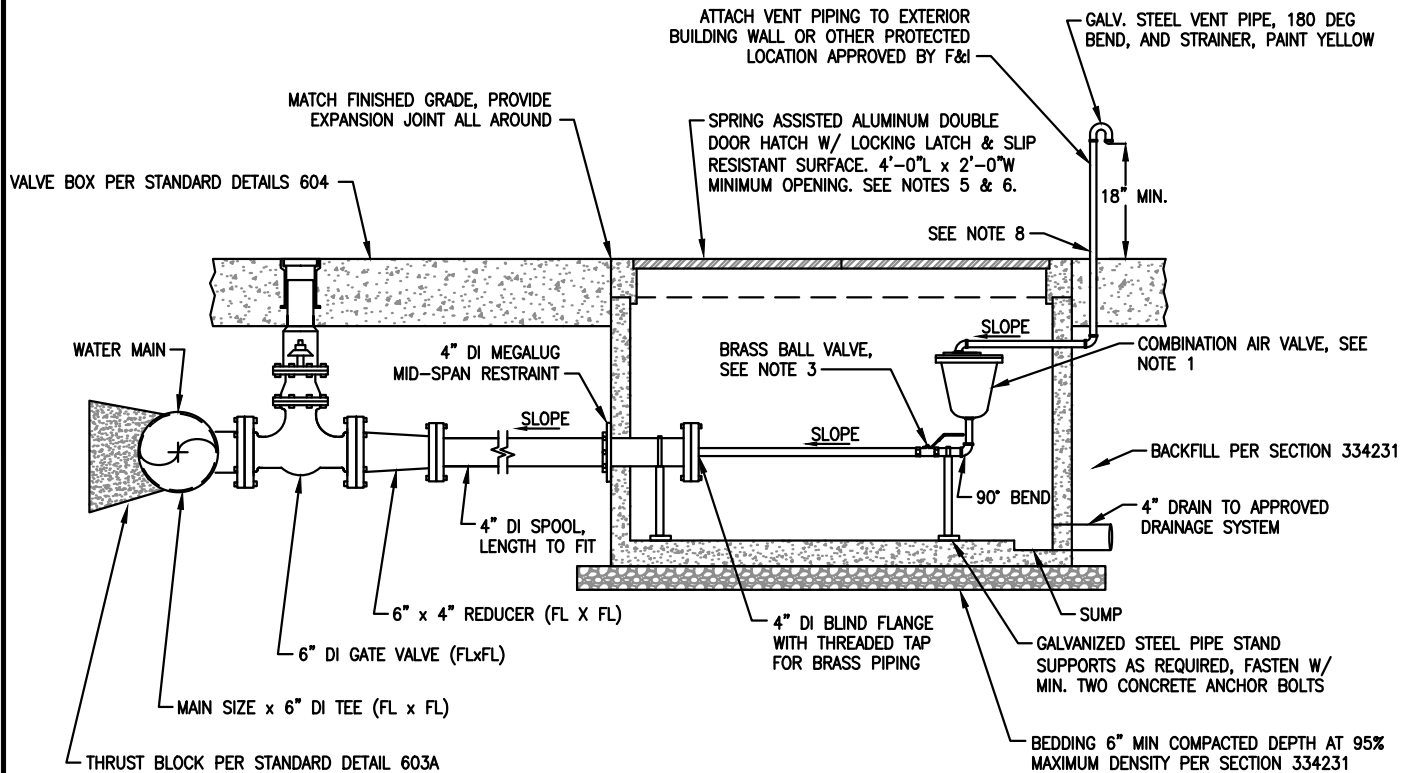
NOTES:

1. BOLLARD LOCATIONS SHALL BE APPROVED BY POS F&I PRIOR TO INSTALLATION.
2. BOLLARDS SHALL BE IN ACCORDANCE WITH STANDARD DETAIL 606.



DETAIL
BOLLARD
SCALE: NTS





DETAIL

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. BRASS PIPE, FITTINGS AND BALL VALVE TO AIR VALVE AND GALV. STEEL VENT PIPING FROM AIR VALVE SHALL BE THE SAME SIZE AS THE COMBINATION AIR RELEASE / AIR VACUUM VALVE.
4. ALL VAULT PIPE PENETRATIONS SHALL BE SEALED WITH NON-SHRINK GROUT OR LINK-SEAL MECHANICAL SEALS.
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 PIPING ABOVE GROUND TO BE PAINTED WITH TWO COATS OF YELLOW PAINT.
8. THREADED FRANGIBLE COUPLE REQUIRED NO MORE THAN 4" ABOVE GROUND SURFACE. PROVIDE 90-DEGREE BEND OR ROLL TEE HORIZONTALLY WITH VALVE ON TEE.

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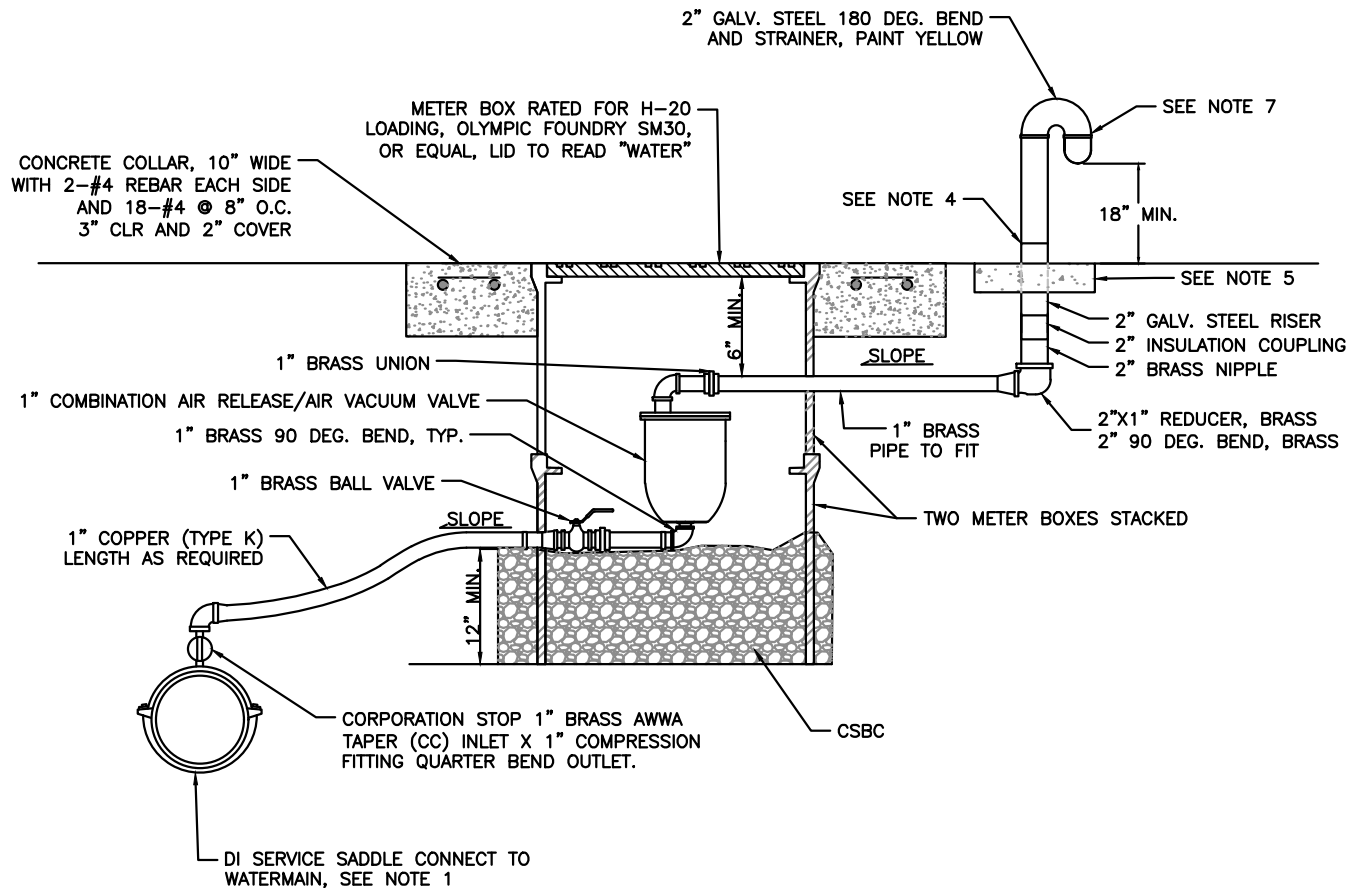
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2022

COMBINATION AIR VALVE

STANDARD DETAIL NO. **607A**



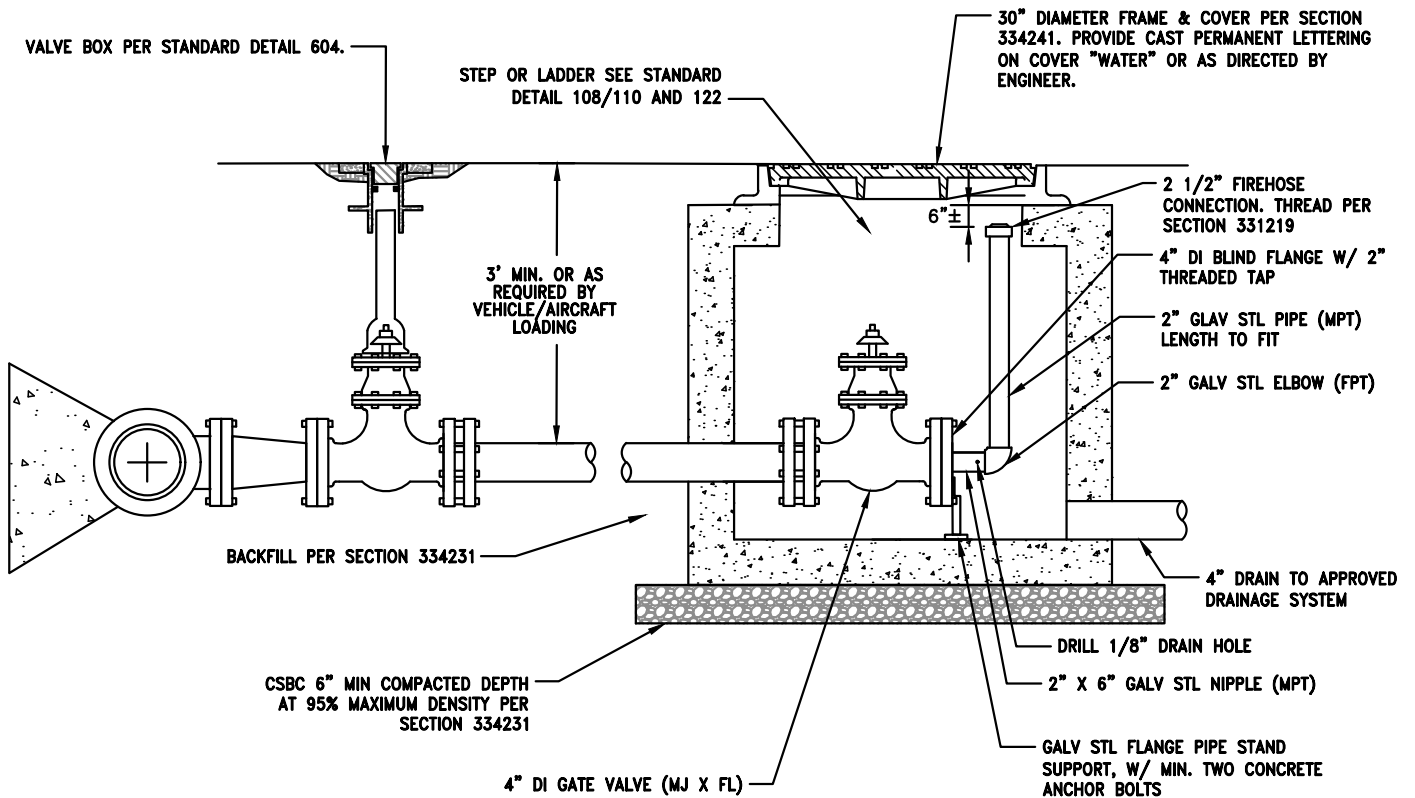
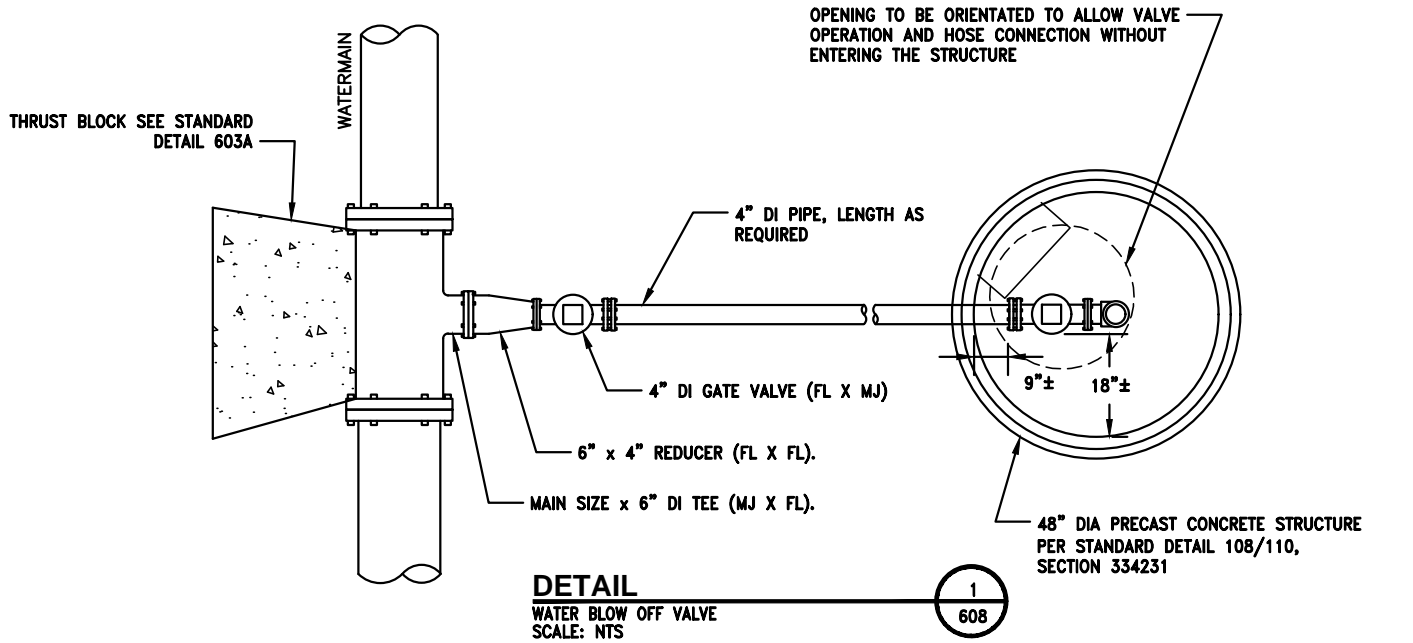
DETAIL

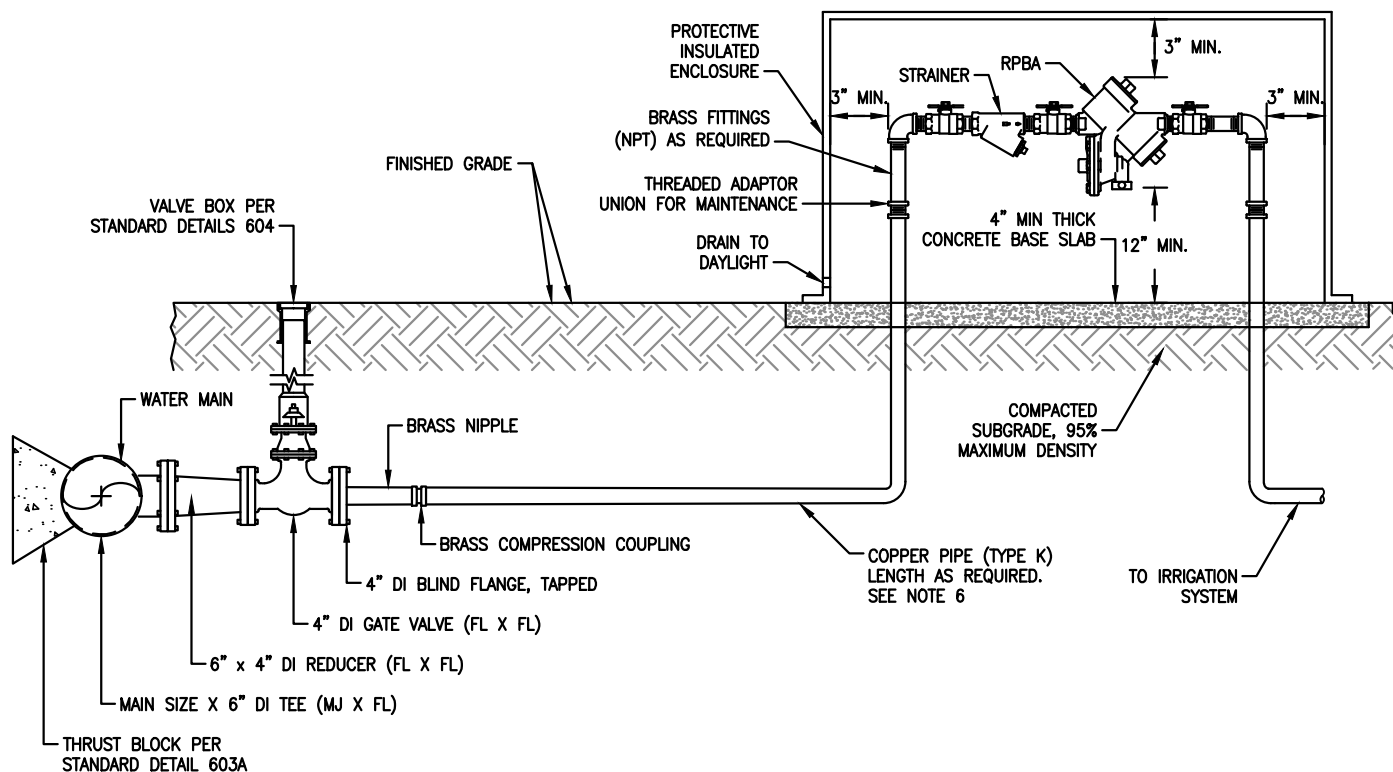
1" TRAFFIC RATED COMBINATION AIR RELEASE AND AIR VACUUM VALVE
SCALE: NTS



NOTES:

- SERVICE SADDLE SHALL BE EPOXY OR NYLON COATED HIGH TENSILE DI WITH DOUBLE STAINLESS STEEL STRAP, RATED TO 250 PSI WORKING PRESSURE, 1" AWWA TAPER (CC) TAP.
- LOCATE THE COMBINATION AIR RELEASE / AIR VACUUM ASSEMBLY AT THE HIGH POINTS OF THE MAIN.
- ALL PIPING ABOVE GROUND TO BE PAINTED WITH TWO COATS OF YELLOW PAINT.
- THREADED FRANGIBLE COUPLE REQUIRED NO MORE THAN 4" ABOVE GROUND SURFACE. PROVIDE 90-DEGREE BEND OR ROLL TEE HORIZONTALLY WITH VALVE ON TEE.
- INSTALL 2' RADIUS BY 4" THICK CONCRETE PAD.
- INSTALLATION FOR LANDSLIDE USE AND IN UNPAVED AREAS ONLY.
- LOCATE AIR VENT AT A LOCATION PROTECTED FROM DAMAGE FROM VEHICLES OR WORK ACTIVITY.





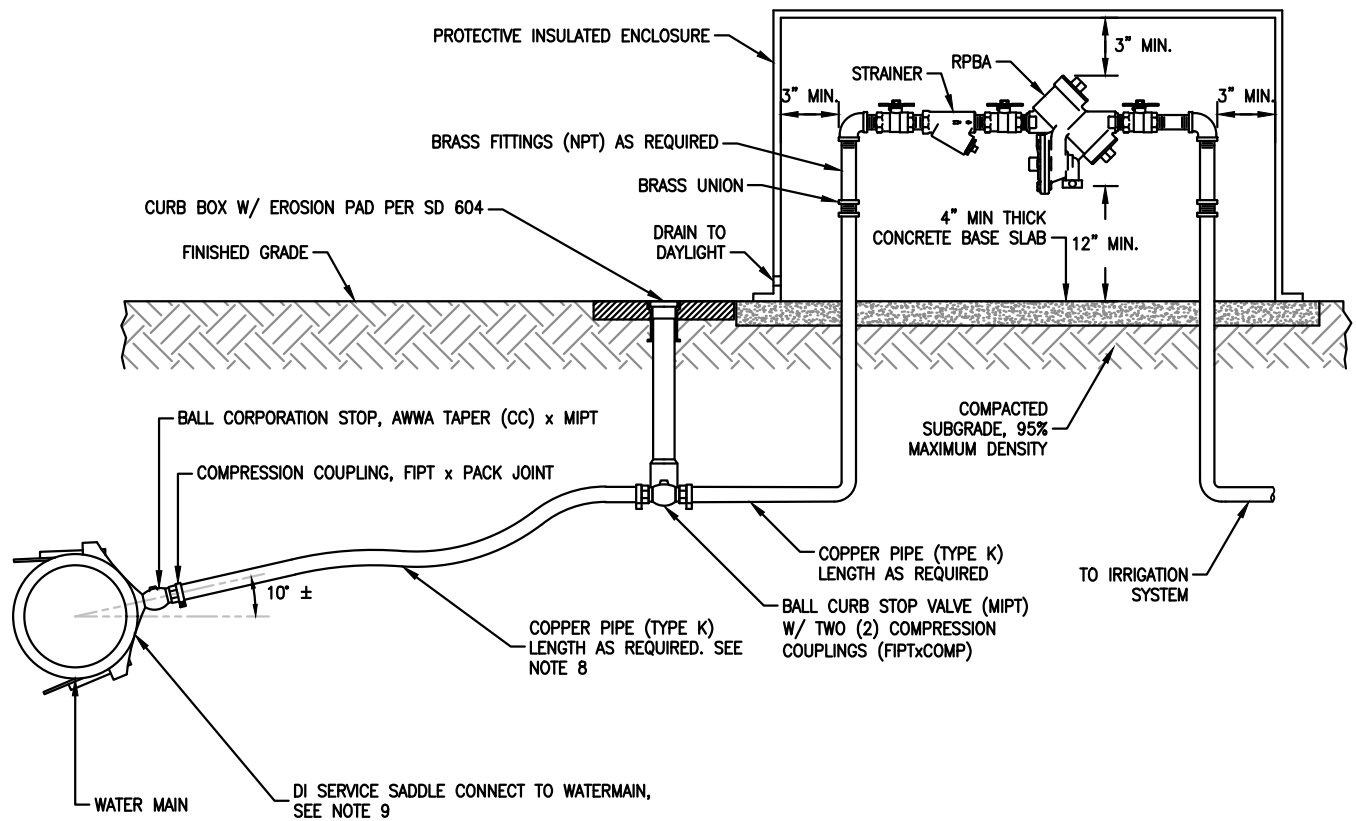
DETAIL

IRRIGATION CONNECTION
SCALE: NTS

1
609A

NOTES:

1. THE SIZE OF THE IRRIGATION SERVICE AND REDUCED PRESSURE BACKFLOW 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 RPBA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE INSULATED PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA. INSULATION R-VALUE TO THE ENCLOSURE SHALL BE R13.
5. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.
6. IF LENGTH OF PIPE RUN IS OVER 50 FEET, PIPE MATERIAL SHALL BE HDPE RATED TO 250 PSI WITH NO JOINTS



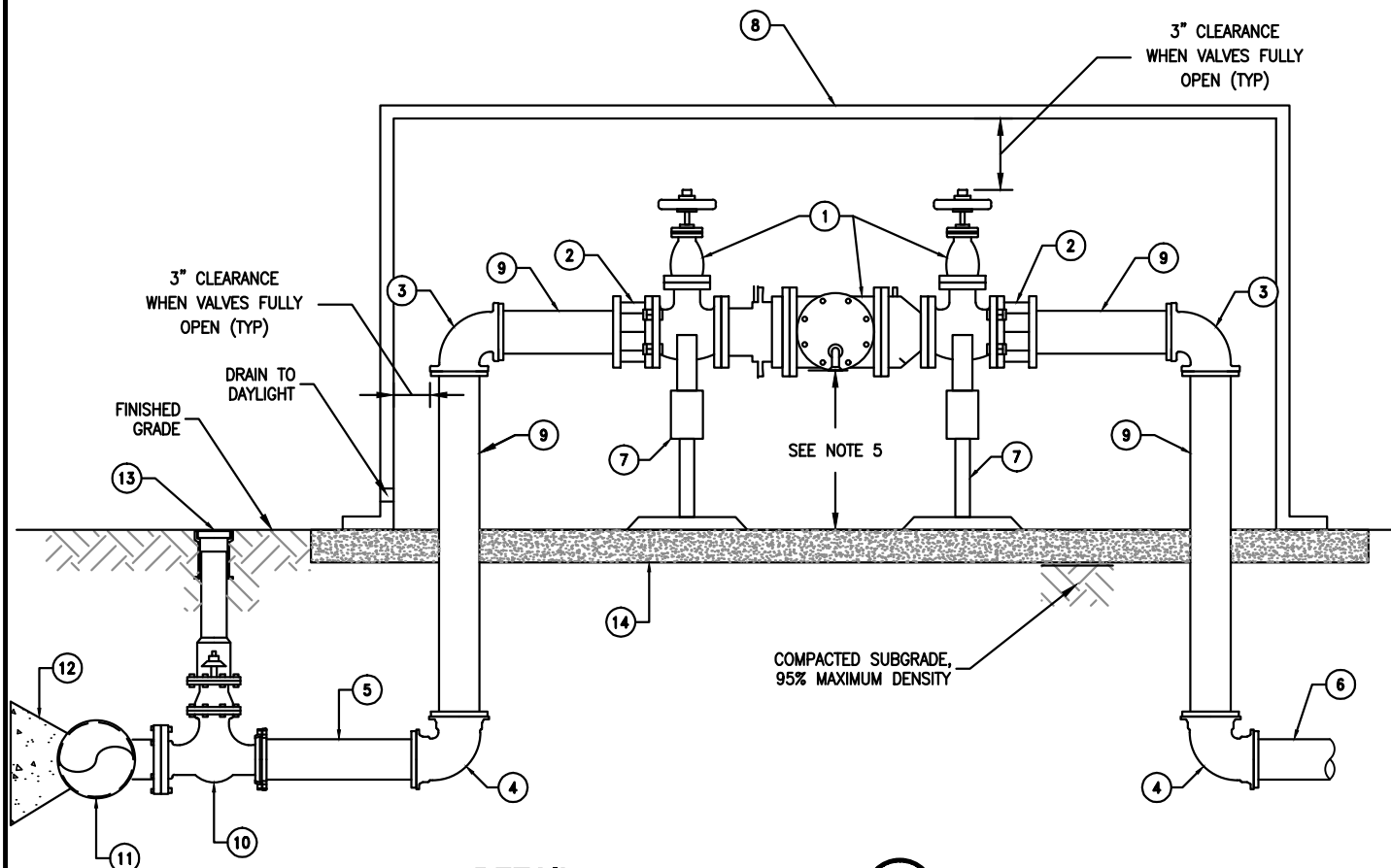
DETAIL

IRRIGATION CONNECTION
SCALE: NTS



NOTES:

1. THE SIZE OF THE IRRIGATION SERVICE AND REDUCED PRESSURE BACKFLOW 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 RPBA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE INSULATED PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA. INSULATION R-VALUE OF THE ENCLOSURE SHALL BE R13
5. CORPORATION STOP AND COUPLING SHALL BE BRASS, SIZE TO MATCH IRRIGATION SERVICE.
6. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.
7. ALL FITTINGS SHALL BE BRASS, UNLESS OTHERWISE SHOWN.
8. IF LENGTH OF PIPE RUN IS OVER 50 FT, PIPE MATERIAL SHALL BE HDPE RATED TO 250 PSI WITH NO JOINTS
9. SERVICE SADDLE SHALL BE EPOXY OR NYLON COATED HIGH TENSILE D.I. WITH DOUBLE STAINLESS STEEL STRAP AND AWWA TAPER (CC) TAP, RATED TO 250 PSI.



DETAIL

IRRIGATION CONNECTION
SCALE: NTS

1
609C

KEYED NOTES (ALL SIZES SHALL EQUAL IRRIGATION SERVICE SIZE, EXCEPT WHERE OTHERWISE NOTED):

- ① STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED GATE VALVES AND (4) RESILIENT SEATED TEST COCKS. FACE TEST COCKS IN AN ACCESSIBLE POSITION.
- ② DI FLANGE COUPLING ADAPTER, RESTRAINED.
- ③ DI 90 DEGREE BEND (FL X FL).
- ④ DI 90 DEGREE BEND (MJ X MJ) WITH RESTRAINED JOINT ON EACH SIDE.
- ⑤ DI PIPE, RESTRAINED JOINTS FROM GATE VALVE AT MAIN TO VERTICAL BEND BELOW ASSEMBLY.
- ⑥ DI PIPE, RESTRAINED JOINTS FROM VERTICAL BEND BELOW ASSEMBLY. PROVIDE ADEQUATE DISTANCE OF RESTRAINED JOINTS TO PROVIDE RESTRAINT AGAINST HORIZONTAL THRUST AT VERTICAL BEND. IF CANNOT PROVIDE ADEQUATE LENGTH OF RESTRAINED JOINT PIPE, PROVIDE A CONCRETE THRUST BLOCK AT BEND FOR HORIZONTAL THRUST PER STANDARD DETAIL 603A.
- ⑦ ADJUSTABLE PIPE STANCHION BOLTED TO CONCRETE SLAB.
- ⑧ PROTECTIVE INSULATED ENCLOSURE.
- ⑨ DI SPOOL (PE X FL), PLAIN END TO BE RESTRAINED AT THE FITTING (LENGTH TO FIT).
- ⑩ DI GATE VALVE (FL X MJ), WITH RESTRAINED JOINT ON MJ END.
- ⑪ DI TEE (MJ X FL), MAIN LINE SIZE BY IRRIGATION SIZE ON FLANGED OUTLET END. MINIMUM 6" OUTLET SIDE ON TEE. FOR 4" IRRIGATION SERVICE FOLLOW TEE WITH A 6" X 4" DUCTILE IRON REDUCER (FL X FL).
- ⑫ CONCRETE THRUST BLOCK PER STANDARD DETAIL 603A.
- ⑬ VALVE BOX PER STANDARD DETAIL 604.
- ⑭ CONCRETE BASE SLAB, MINIMUM 4" THICK.

NOTES:

1. THE SIZE OF THE IRRIGATION SERVICE AND REDUCED PRESSURE BACKFLOW 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 RPBA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE INSULATED PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA. INSULATION R-VALUE OF THE ENCLOSURE SHALL BE R13.
5. ALLOW 12" PLUS NOMINAL DIAMETER OF ASSEMBLY CLEARANCE BELOW RELIEF PORT FOR REPAIR. ALSO PROVIDE 12" MINIMUM AIR GAP CLEARANCE FROM TOP OF THE ENCLOSURE DRAIN TO DAYLIGHT.
6. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.

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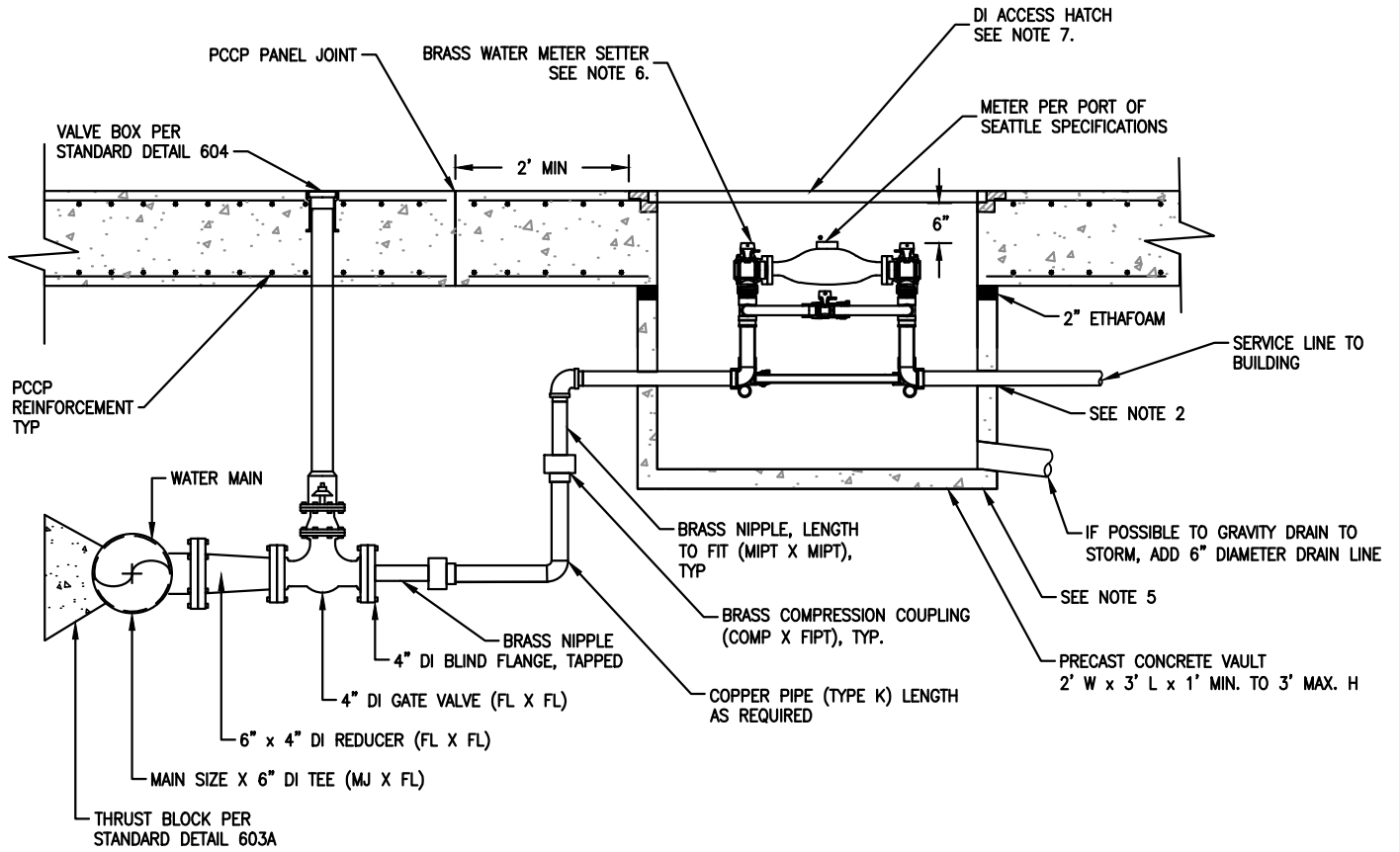
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2022

IRRIGATION CONNECTION -
4" AND LARGER

STANDARD DETAIL NO. **609C**



DETAIL

WATER SERVICE CONNECTION
SCALE: NTS

1

609D

NOTES:

1. THE SIZE OF THE WATER SERVICE SHALL BE DETERMINED BY THE ENGINEER.
2. ALL PIPE PENETRATIONS TO VAULT SHALL BE SEALED WITH NON-SHRINK GROUT OR LINK-SEAL MECHANICAL SEALS.
3. MINIMUM CLEARANCE BETWEEN METER/METER SETTER AND VAULT WALL SHALL BE 4"
4. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN
5. WHEREVER POSSIBLE WATER METER SHALL BE LOCATED OUTSIDE OF AIRCRAFT AND TRAFFIC LOADED AREAS. LOCATION SHALL BE COORDINATED WITH THE PORT.
6. METER SETTER SHALL BE BRASS AND COPPER, WITH ANGLE BALL VALVE ON EACH SIDE OF METER CONNECTION, INTEGRAL FULL FLOW BYPASS, AND FEMALE IRON PIPE THREAD AT SETTER INLET AND OUTLET. 1-1/2" AND 2" STYLE SHOWN.
7. ACCESS HATCH SHALL BE D.I. AIRCRAFT RATED FRAME AND COVER WITH 24" X 36" CLEAR OPENING AND HINGED WITH MECHANICAL LIFT ASSIST AND GASKET. EQUAL TO EAST JORDAN (EJ) MODEL 8192. COVER SHALL READ "WATER".

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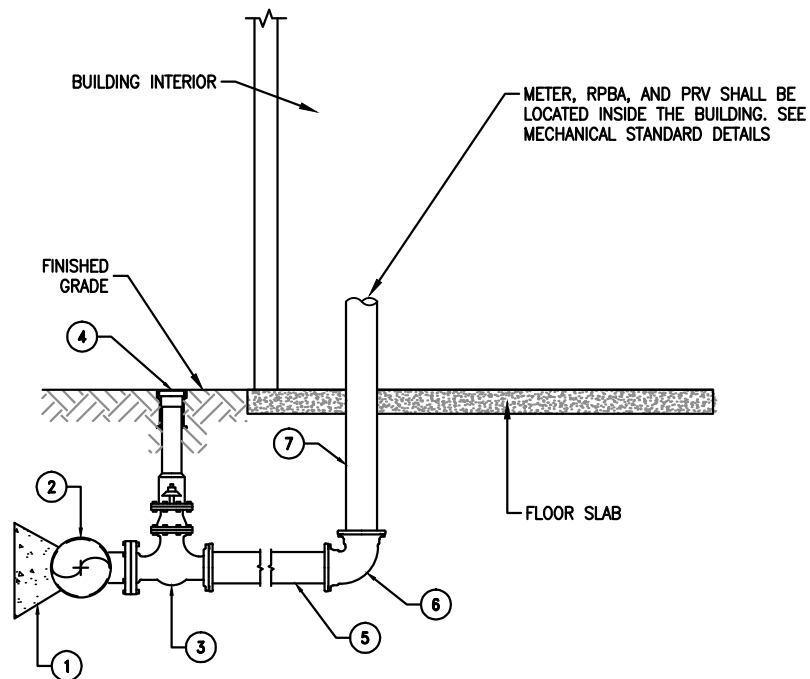
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2022

WATER SERVICE CONNECTION (2" AND SMALLER IN PCCP AREAS)

STANDARD DETAIL NO. **609D**



DETAIL
IRRIGATION CONNECTION
SCALE: NTS

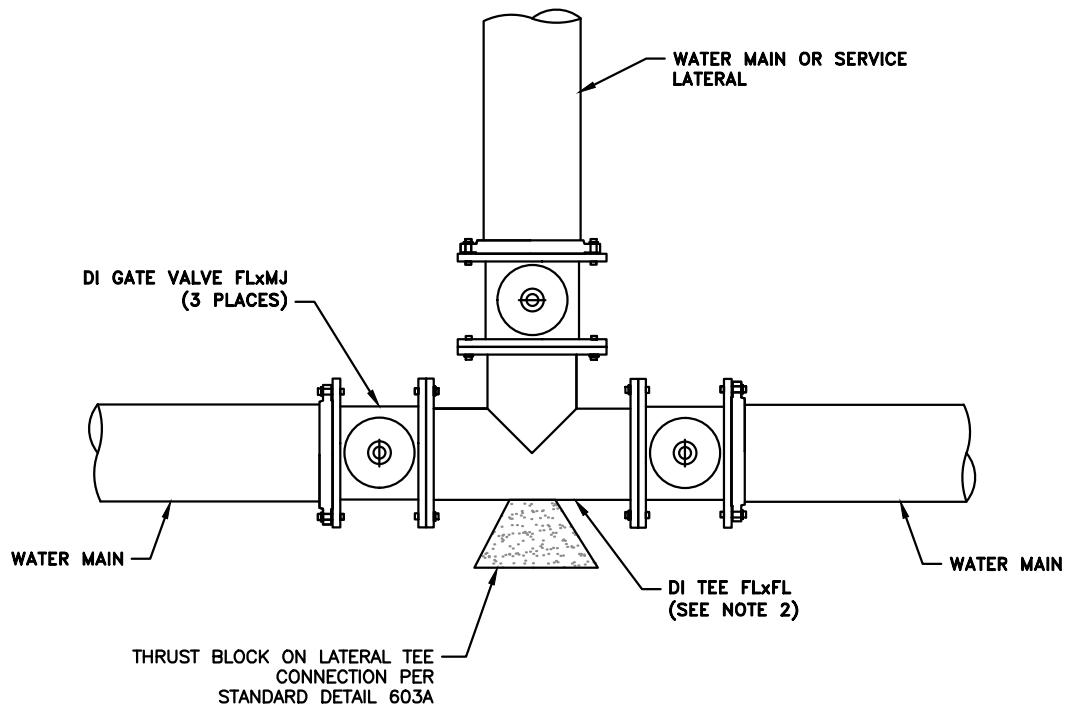
1
609E

KEYED NOTES (ALL SIZES SHALL EQUAL WATER SERVICE SIZE, EXCEPT WHERE OTHERWISE NOTED):

- ① CONCRETE THRUST BLOCK PER STANDARD DETAIL 603A.
- ② DI TEE (MJ X FL), MAIN LINE SIZE BY WATER SERVICE SIZE. MINIMUM 6" DIA BRANCH ON TEE. FOR 4" OR 3" SERVICE FOLLOW TEE WITH A 6" X 4", OR 6" X 3" DI REDUCER (FL X FL).
- ③ DI GATE VALVE (FL X MJ), WITH RESTRAINED JOINT ON MJ END.
- ④ VALVE BOX PER STANDARD DETAIL 604.
- ⑤ DI PIPE, RESTRAINED JOINTS FROM GATE VALVE AT MAIN TO VERTICAL BEND BELOW FLOOR SLAB.
- ⑥ DI 90 DEGREE BEND (MJ X MJ) WITH RESTRAINED JOINT ON EACH SIDE.
- ⑦ DI PIPE (PE X PE), PLAIN ENDS TO BE RESTRAINED AT EACH FITTING (LENGTH TO FIT).

NOTES:

1. THE SIZE OF THE WATER SERVICE SHALL BE DETERMINED BY THE ENGINEER.
2. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.



DETAIL

WATER VALVE CLUSTER WITH TEE
SCALE: NTS

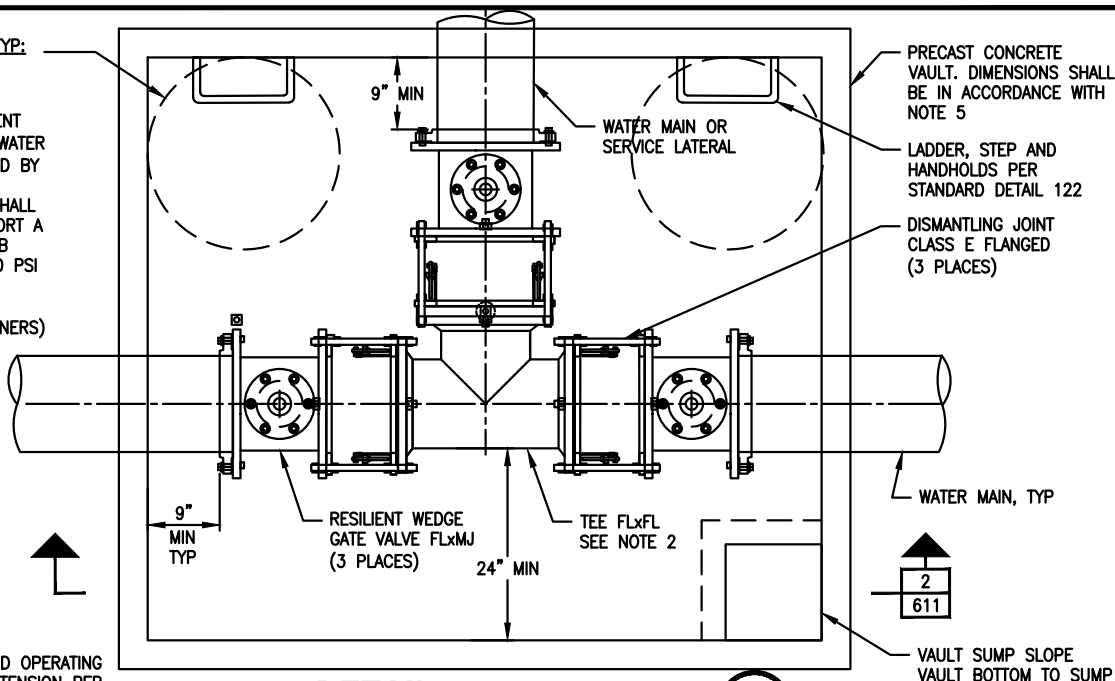


NOTES:

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.

FRAME & COVER (ABOVE), TYP:

1. PROVIDE 36" DIAMETER FRAME AND COVER.
2. PROVIDE CAST PERMANENT LETTERING ON COVER "WATER VALVE", OR AS DIRECTED BY 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.

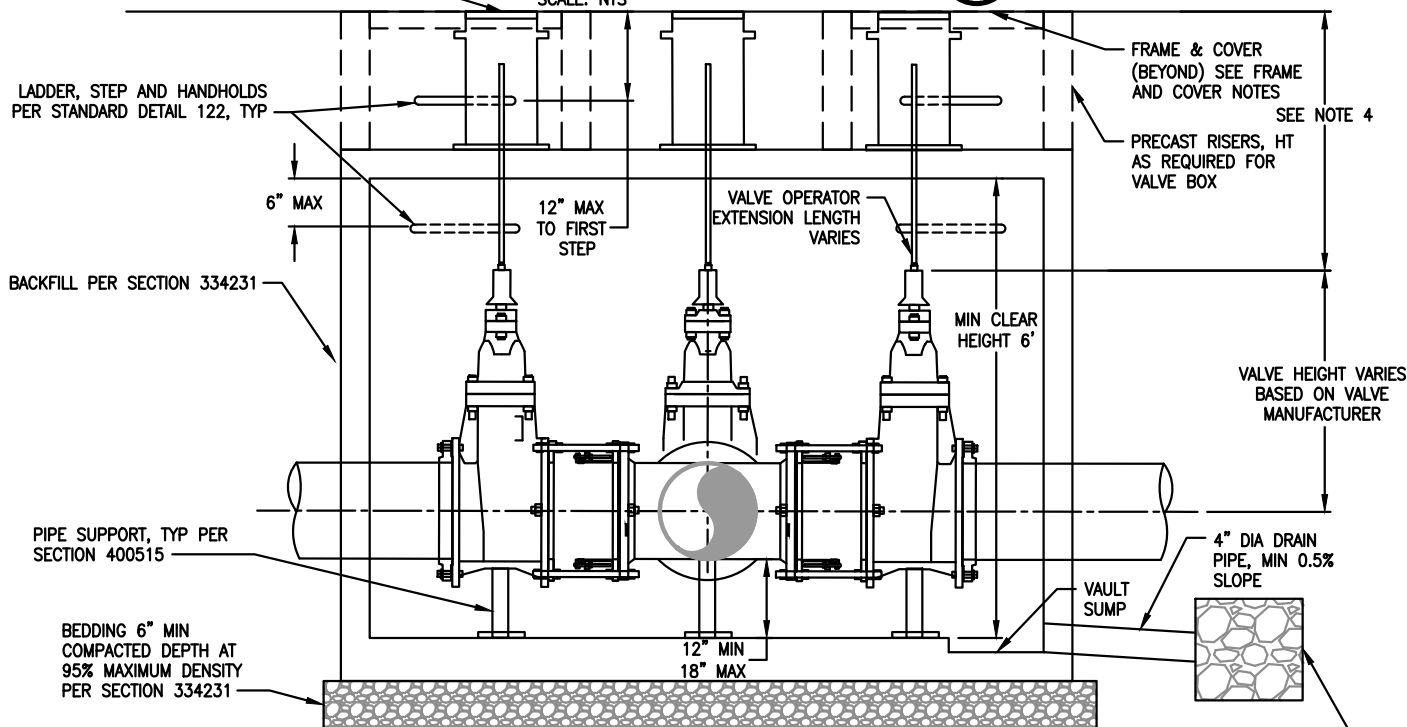


VALVE BOX AND OPERATING NUT EXTENSION PER STANDARD DETAIL 604, TYP 3

DETAIL

WATER VALVE CLUSTER WITH TEE IN VAULT
SCALE: NTS

1
611



SECTION

WATER VALVE CLUSTER WITH TEE IN VAULT
SCALE: NTS

2

611

CONNECT TO F&I APPROVED DRAINAGE SYSTEM. WHEN NOT FEASIBLE
CONNECT TO 2 CUBIC FEET CRUSHED DRAIN ROCK WRAPPED IN
CONSTRUCTION GEOTEXTILE FOR SEPARATION PER SECTION 331219

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.

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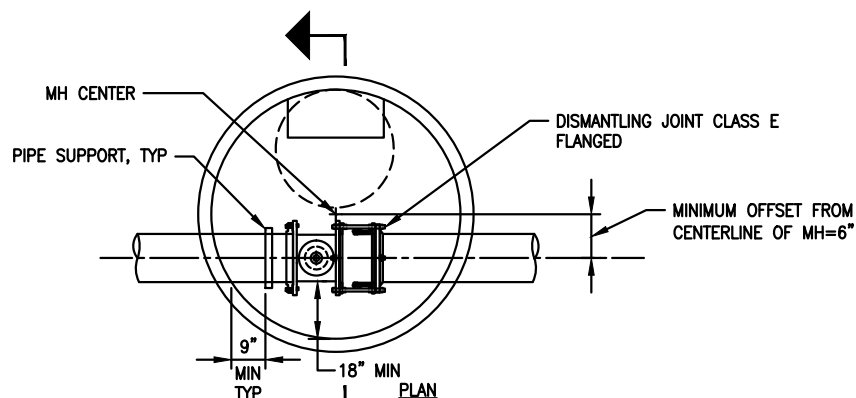
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2020

WATER VALVE CLUSTER WITH TEE IN VAULT

STANDARD DETAIL NO. **611**



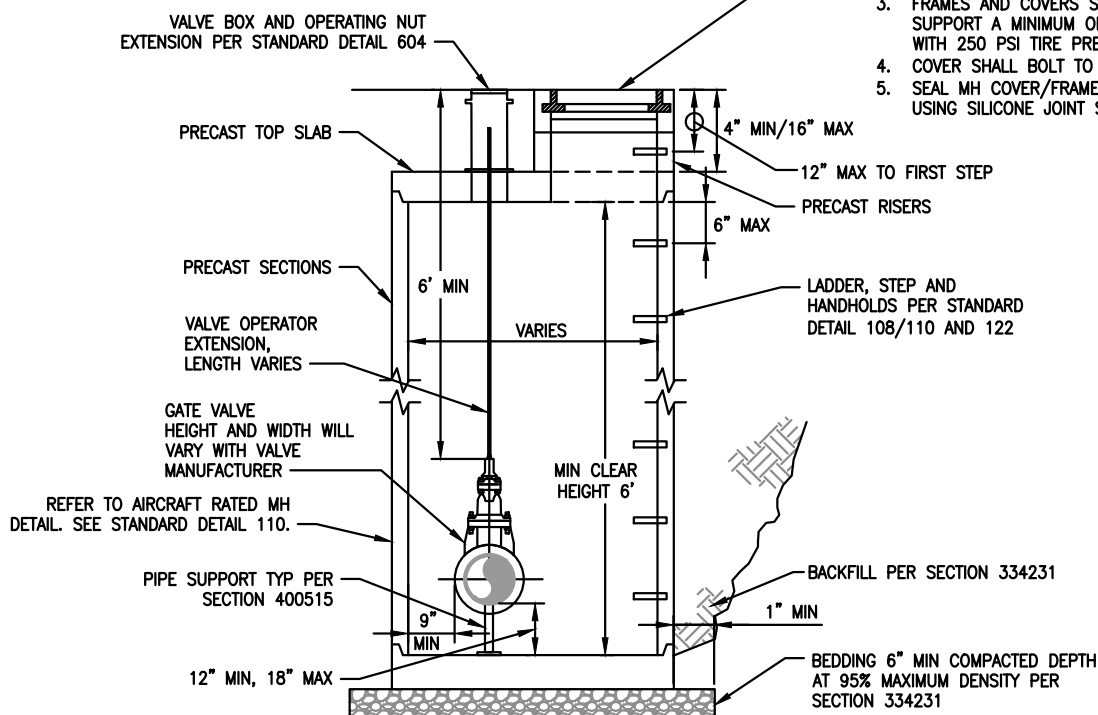
DETAIL

AIRCRAFT RATED WATER VALVE MANHOLE
SCALE: NTS

1
612

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

AIRCRAFT RATED WATER VALVE MANHOLE
SCALE: NTS

2

612

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.

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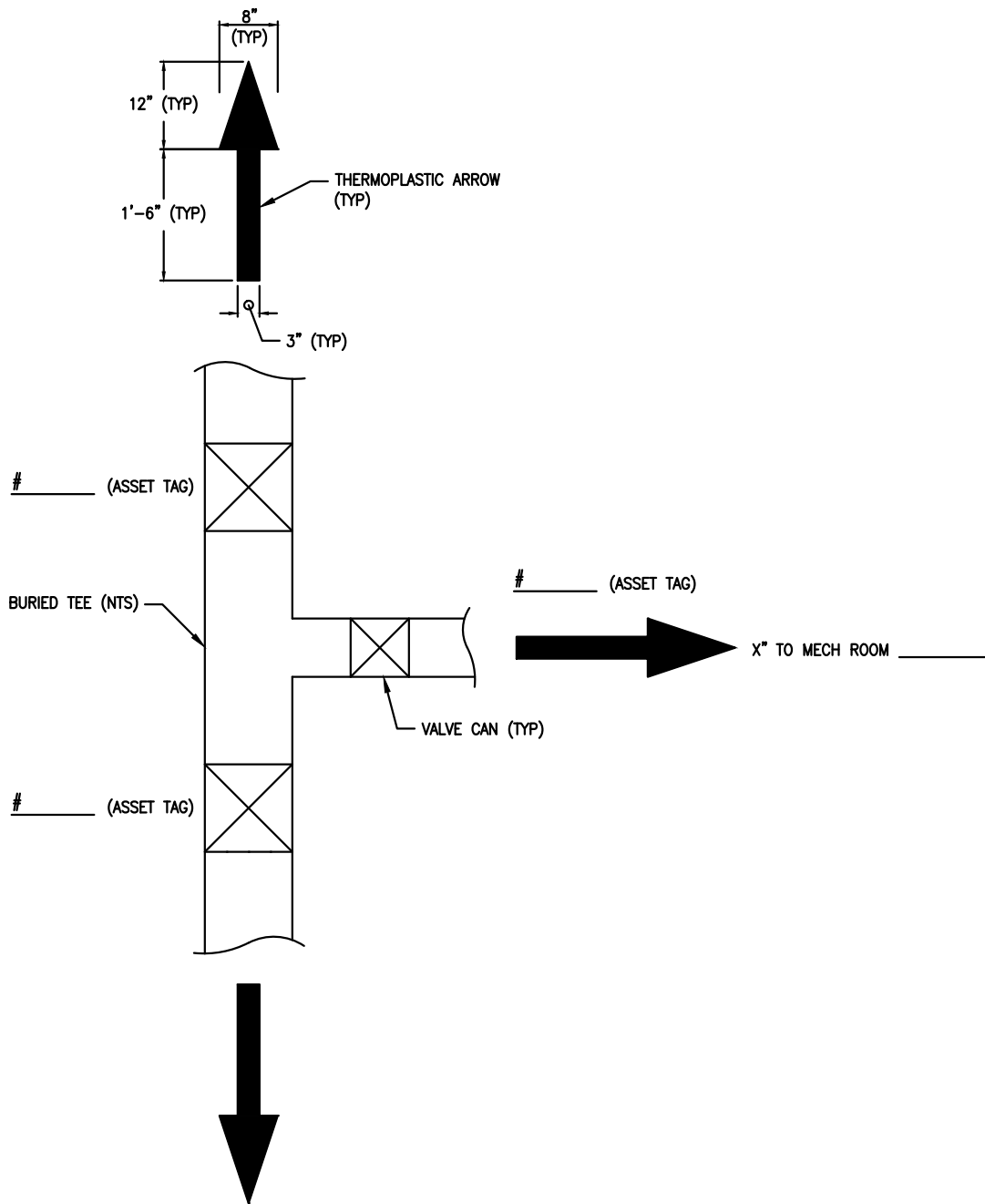
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2020

AIRCRAFT RATED
WATER VALVE MANHOLE

STANDARD DETAIL NO. **612**



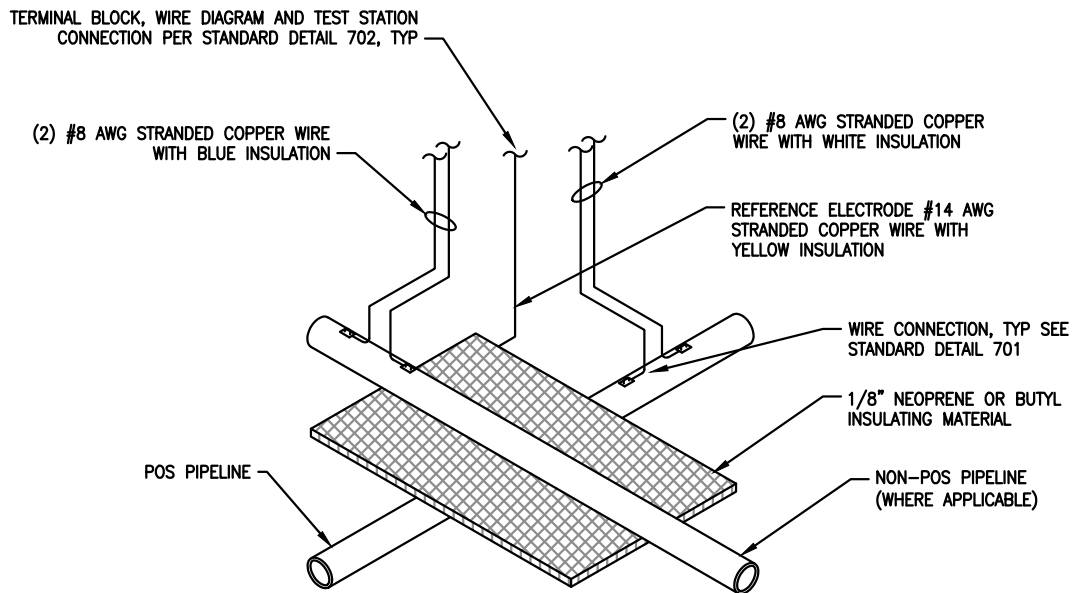
DETAIL

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.



DETAIL

INSULATED BLANKET INSTALLATION
SCALE: NTS



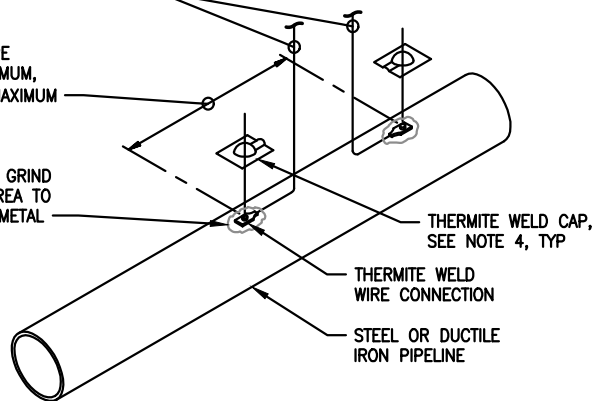
NOTES:

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.

WIRE SIZE VARIES, TWO
WIRES REQUIRED FOR TEST
STA INSTALLATIONS ONLY

ONE PIPE
DIA MINIMUM,
2'-0" MAXIMUM

FILE OR GRIND
WELD AREA TO
BRIGHT METAL



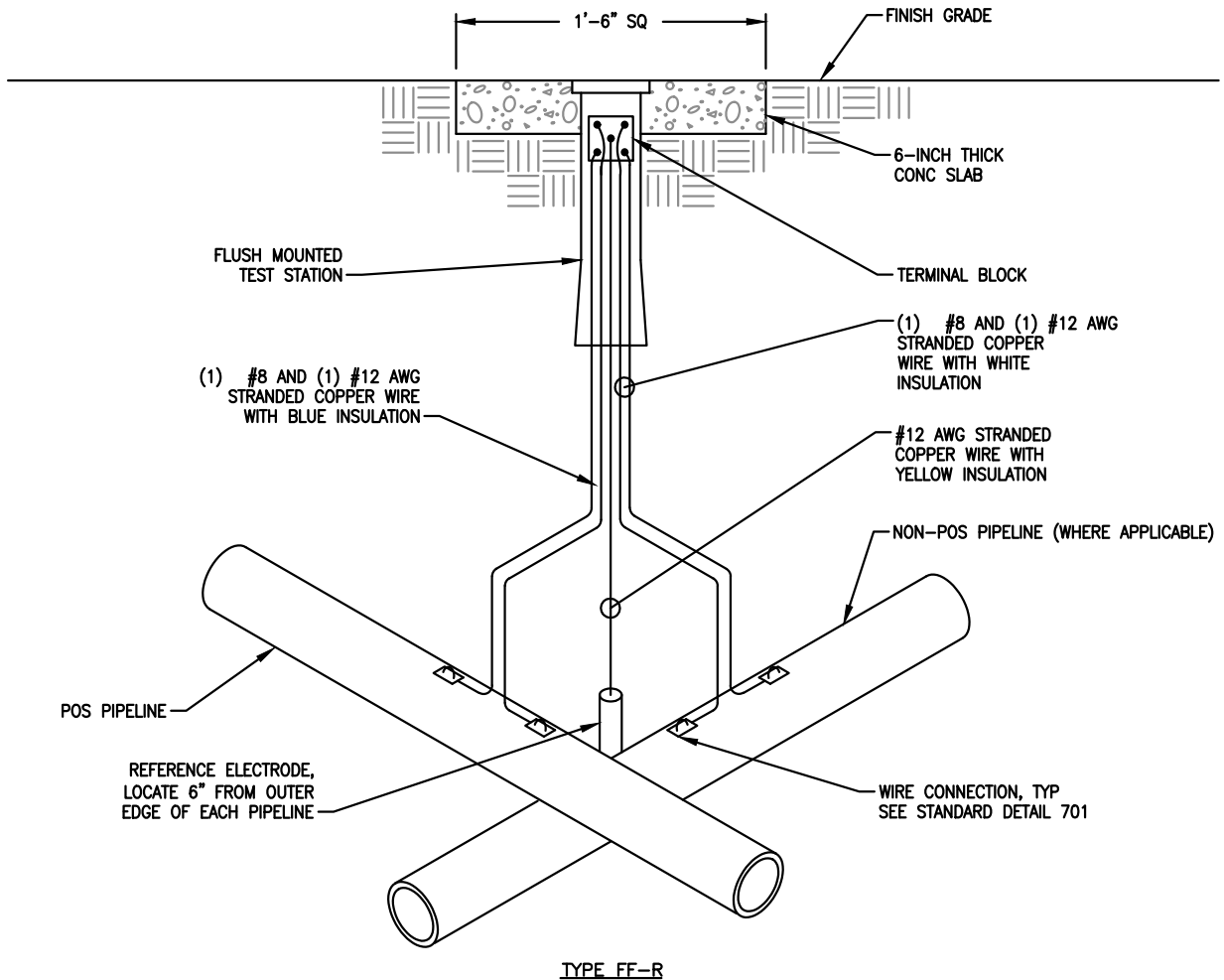
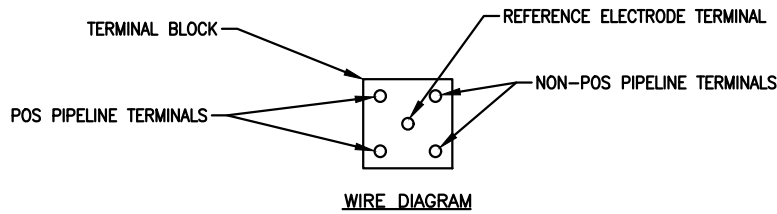
DETAIL

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.



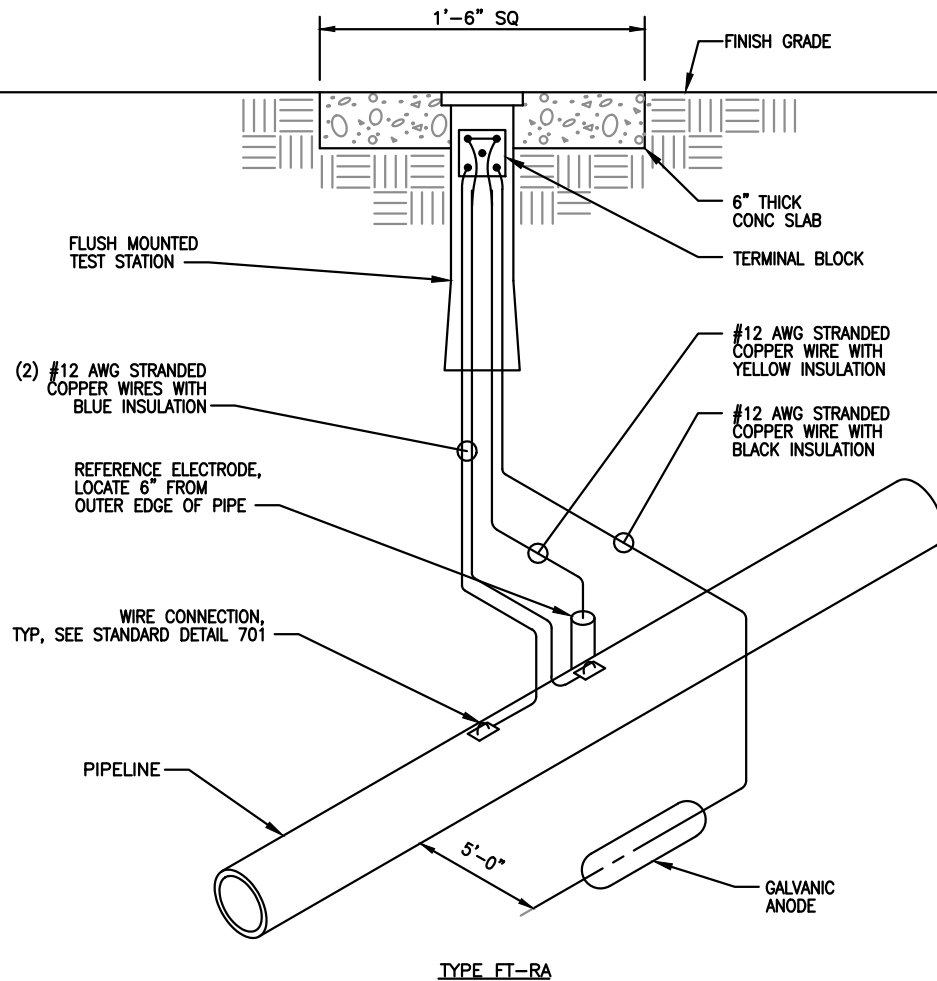
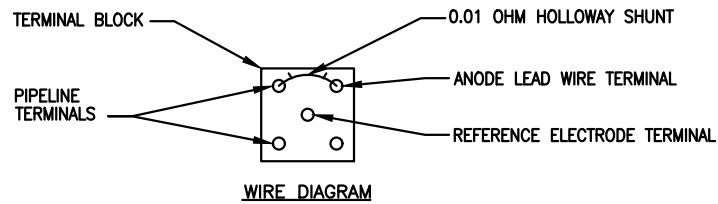
DETAIL

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.



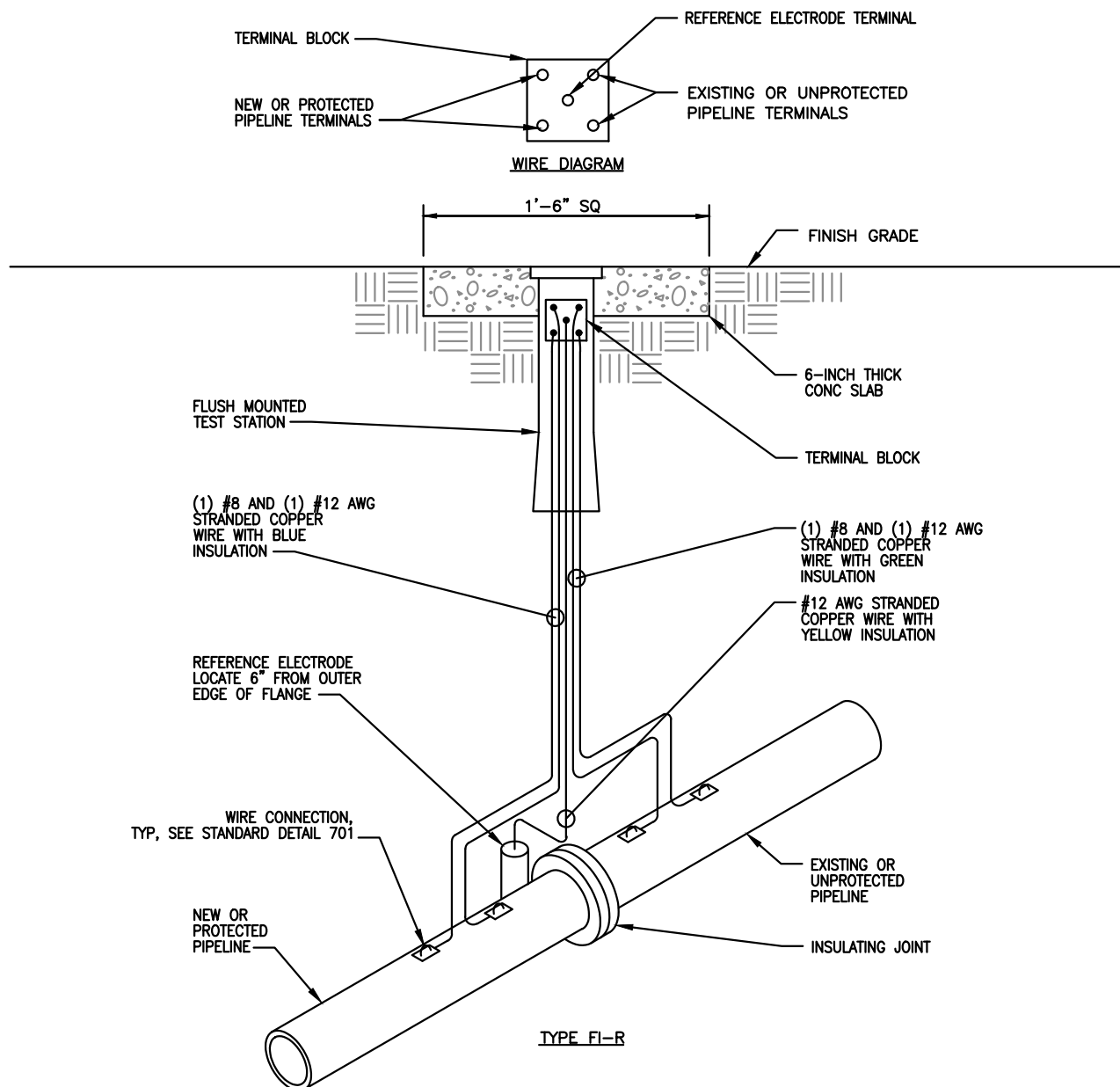
DETAIL

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.



DETAIL

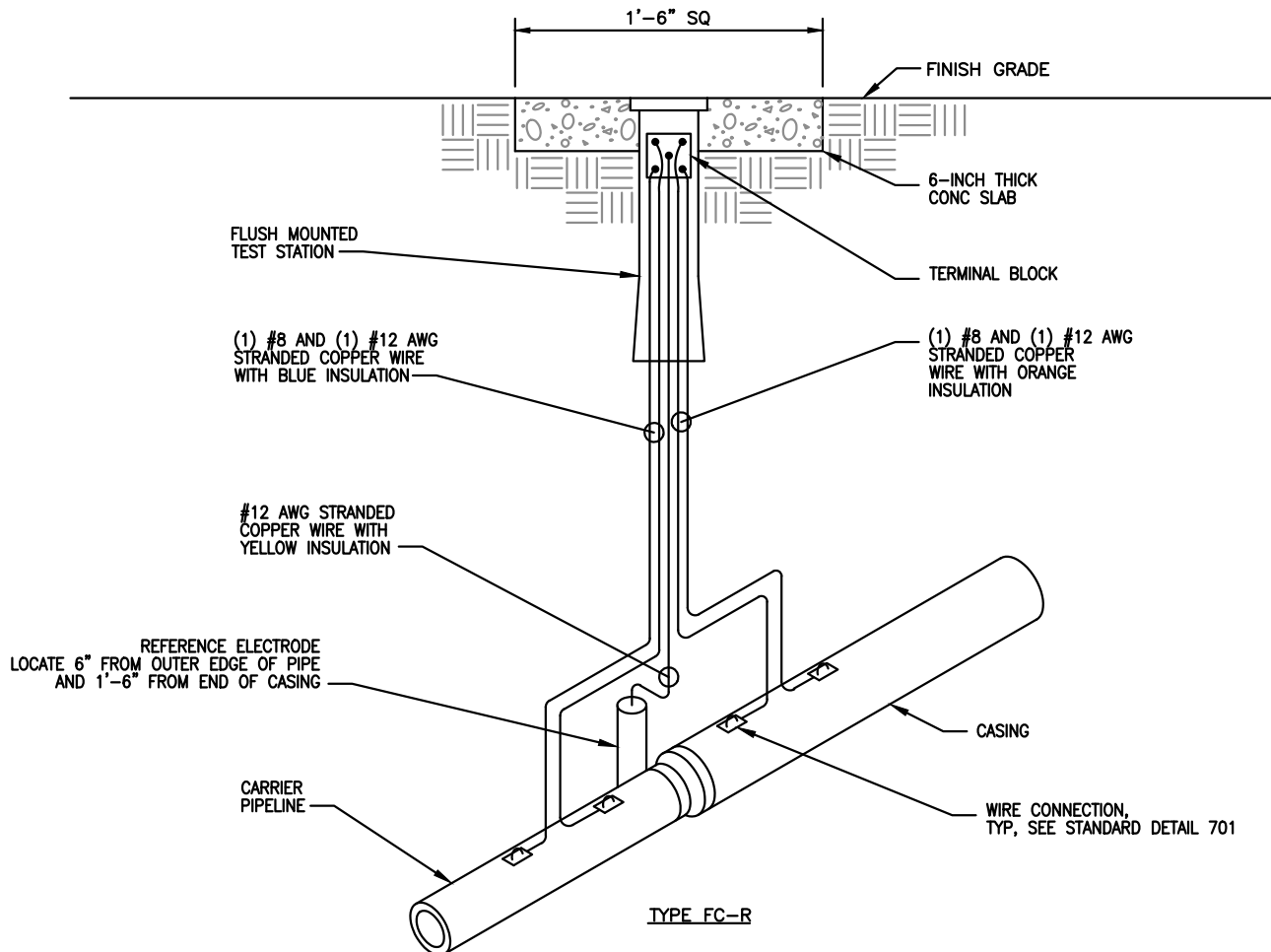
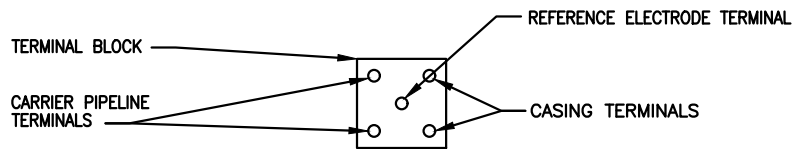
FLUSH MOUNTED TEST STATION TYPE FI-R
SCALE: NTS

1

704

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.



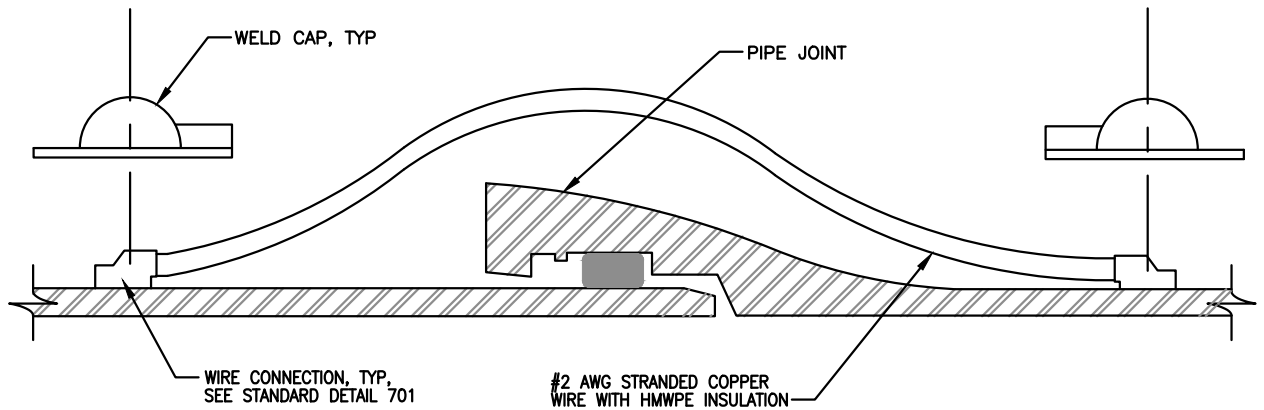
DETAIL

FLUSH MOUNTED TEST STATION TYPE FC-R
SCALE: NTS



NOTES:

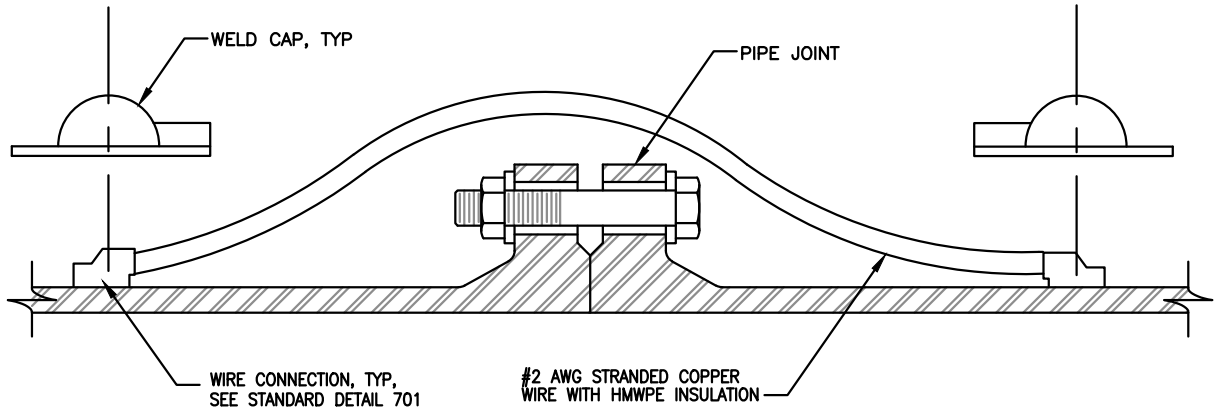
1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.



DETAIL

PUSH-ON JOINT BOND
SCALE: NTS





DETAIL

FLANGED JOINT BOND
SCALE: NTS



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Airport

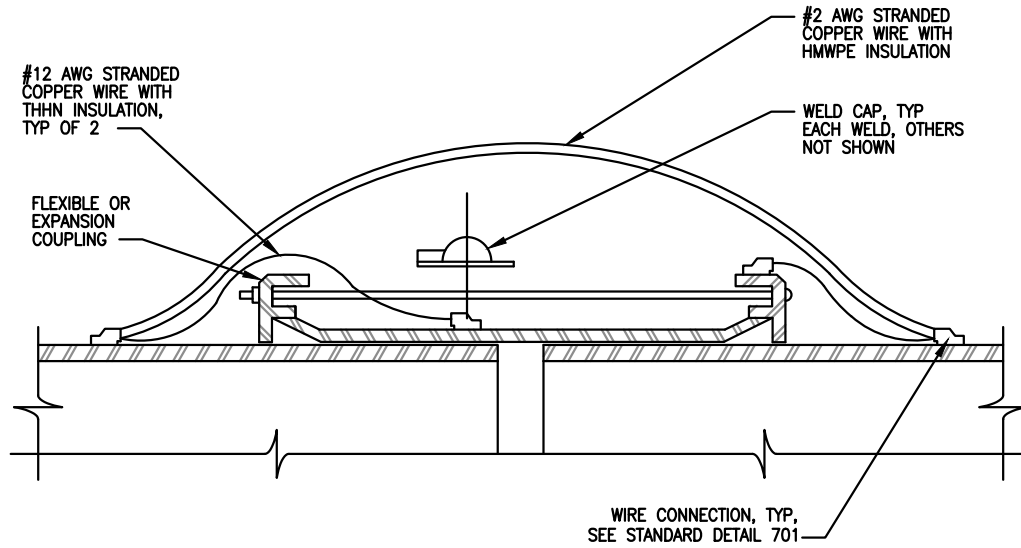
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2020

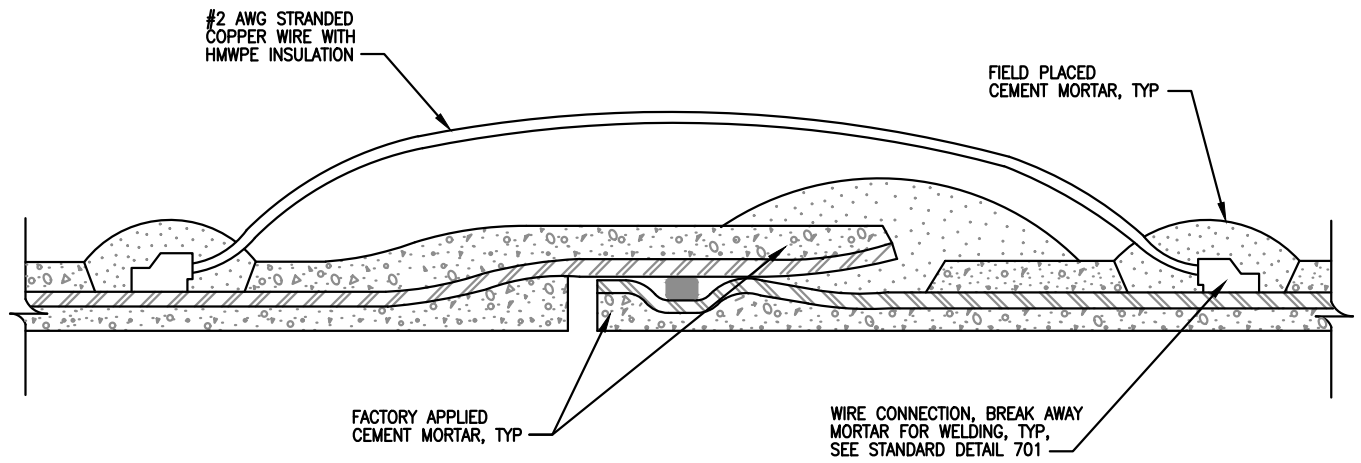
CATHODIC PROTECTION
FLANGED JOINT BOND

STANDARD DETAIL NO. **707**



DETAIL
FLEXIBLE JOINT BOND
SCALE: NTS

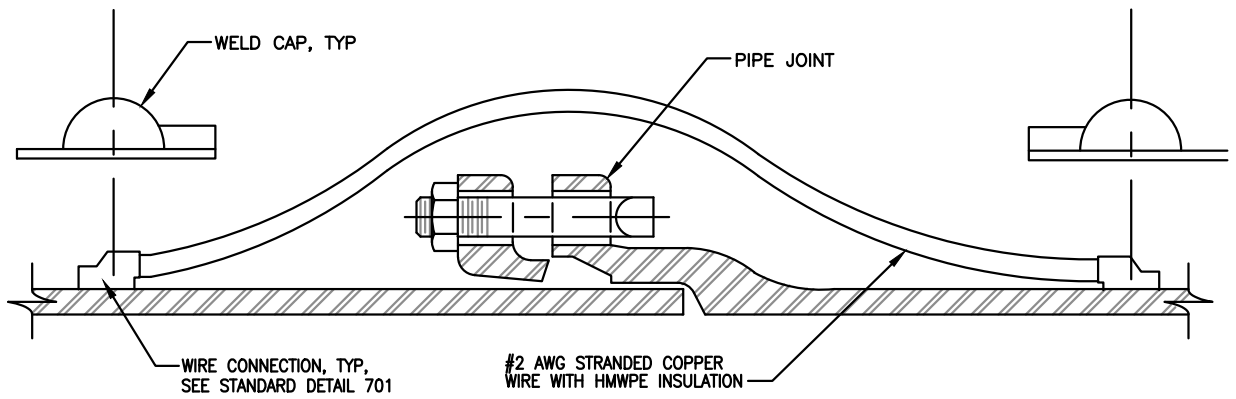




DETAIL

CEMENT COATED STEEL PIPE JOINT BOND
SCALE: NTS

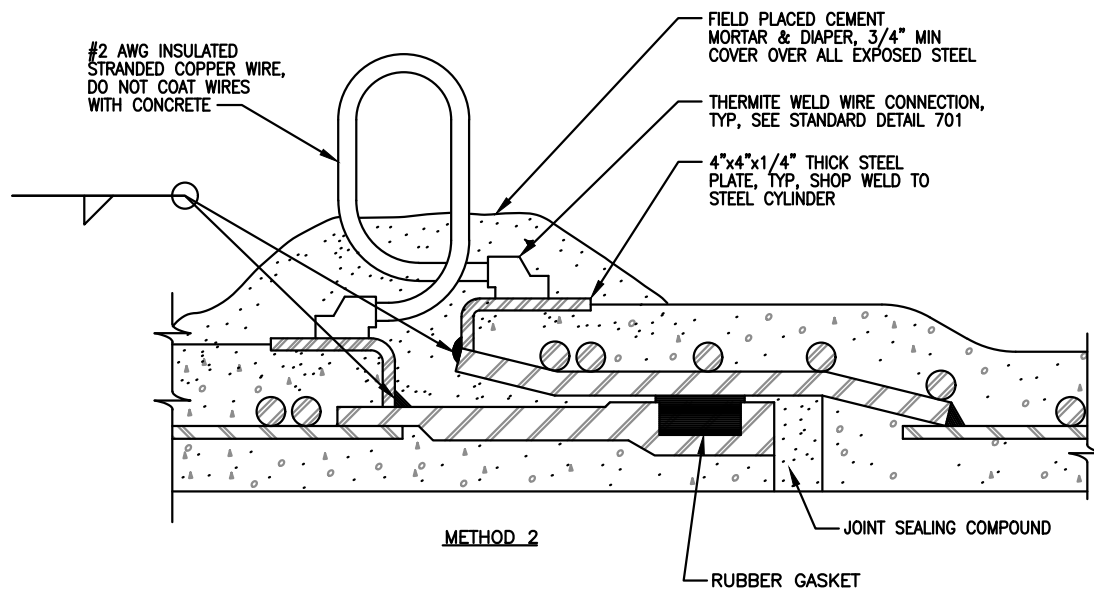
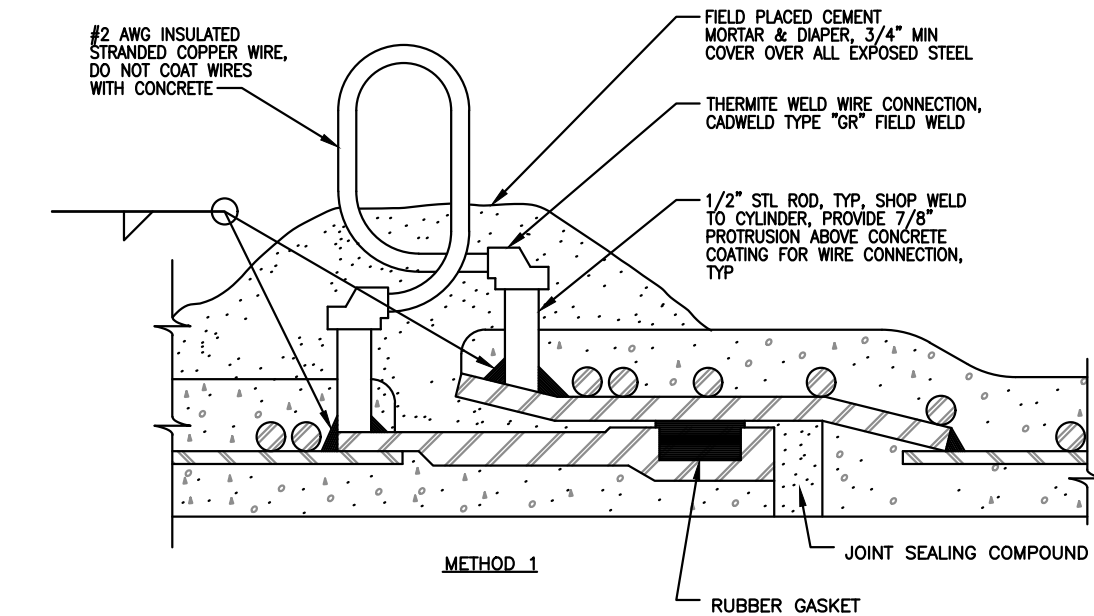




DETAIL

MECHANICAL JOINT BOND
SCALE: NTS





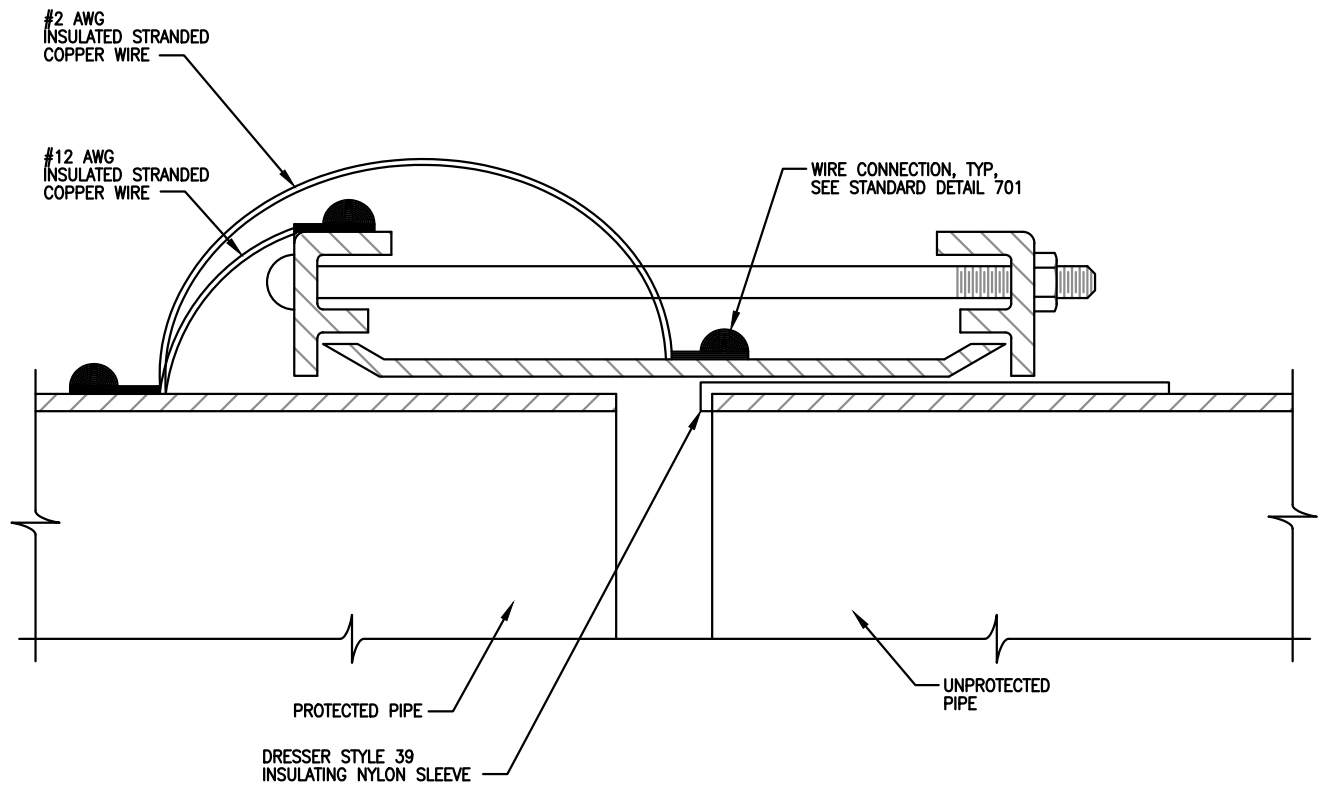
DETAIL

CONCRETE CYLINDER PIPE JOINT BOND
SCALE: NTS



NOTES:

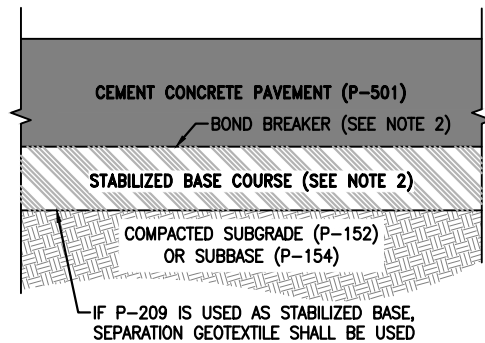
1. SEE SPECIFICATIONS FOR NUMBER OF BOND WIRES REQUIRED AT EACH PIPE JOINT.



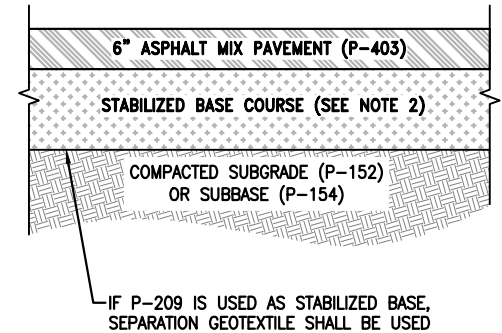
DETAIL

INSULATED FLEXIBLE COUPLING
SCALE: NTS

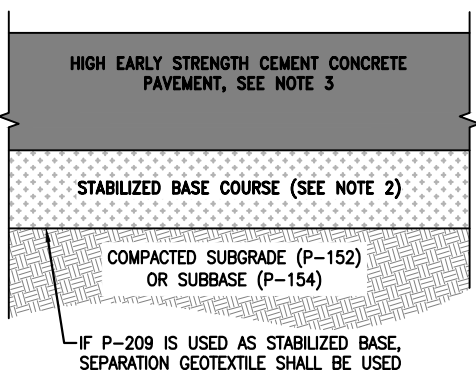




SECTION	1
NEW CONCRETE RUNWAY, TAXIWAY, OR APRON PAVEMENT SECTION	-
SCALE: NTS	



SECTION	2
ASPHALT AIRFIELD SHOULDER PAVEMENT SECTION	-
SCALE: NTS	



SECTION	3
CONCRETE INDIVIDUAL PANEL REPLACEMENT PAVEMENT SECTION - ACCELERATED CONSTRUCTION	-
SCALE: NTS	

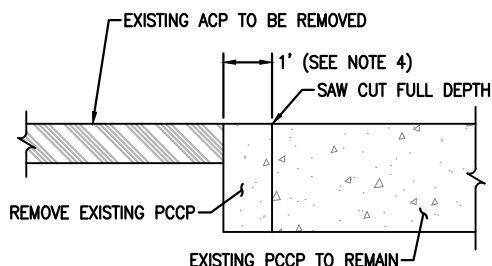
NOTES:

1. THICKNESS FOR PAVEMENT SECTION LAYERS, WHERE SHOWN, ARE MINIMUMS AND SHALL BE DETERMINED BY EACH PROJECT'S PAVEMENT DESIGN. PAVEMENT THICKNESS FOR FAA AIRPORT IMPROVEMENT PROGRAM (AIP)-ELIGIBLE PROJECTS, AND ANY PAVEMENTS THAT WILL SUPPORT AIRCRAFT TRAFFIC, SHALL BE DESIGNED PER FAA AC 150/5320-6 (CURRENT VERSION). FOR NON-AIP, NON-AIRCRAFT PAVEMENTS, DESIGN PAVEMENT THICKNESSES TO MEET WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT) "PAVEMENT POLICY" (CURRENT VERSION), OR OTHER STANDARD METHODOLOGY WHEN APPROVED BY THE PORT OF SEATTLE PROJECT MANAGER.
2. TYPE OF STABILIZED BASE COURSE MATERIAL AND NEED FOR BOND BREAKER TO BE DETERMINED BY PROJECT PAVEMENT DESIGN. STABILIZED BASE MAY INCLUDE CRUSHED AGGREGATE BASE COURSE (P-209), ASPHALT MIX PAVEMENT BASE COURSE (P-403 OR P-401), CEMENT TREATED BASE COURSE (P-304), LEAN CONCRETE BASE COURSE (P-306), CEMENT TREATED PERMEABLE BASE COURSE (P-307), OR ASPHALT TREATED PERMEABLE BASE COURSE (P-407).
3. USE OF HIGH EARLY STRENGTH CEMENT CONCRETE IS GENERALLY DISCOURAGED, AND SHALL ONLY BE USED WITH APPROVAL IN CASES WHERE THERE IS A SIGNIFICANT NEED FOR REDUCED CURE TIME. REFER TO FAA AC 150/5370-16 FOR ADDITIONAL INFORMATION.
4. CONCRETE PAVEMENTS FOR RUNWAY, TAXIWAY, AND APRON PAVEMENT SHALL BE DESIGNED FOR A 40-YEAR SERVICE LIFE.

FAA TECHNICAL SPECIFICATIONS REFERENCED FOR AIRFIELD PAVING PROJECTS

FAA TECHNICAL SPECIFICATION NUMBER*	DESCRIPTION
P-152	EXCAVATION, SUBGRADE, AND EMBANKMENT
P-153	CONTROLLED LOW-STRENGTH MATERIAL (CLSM)
P-154	SUBBASE COURSE
P-155	LIME-TREATED SUBGRADE
P-209	CRUSHED AGGREGATE BASE COURSE
P-304	CEMENT TREATED AGGREGATE BASE COURSE
P-306	LEAN CONCRETE BASE COURSE
P-307	CEMENT TREATED PERMEABLE BASE COURSE
P-401	ASPHALT MIX PAVEMENT
P-403	ASPHALT MIX PAVEMENT SURFACE COURSE
P-407	ASPHALT TREATED PERMEABLE BASE COURSE
P-501	CEMENT CONCRETE PAVEMENT
P-603	EMULSIFIED ASPHALT TACK COAT
P-604	COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS
P-605	JOINT SEALANTS FOR PAVEMENTS
P-608R	RAPID CURE SEAL COAT
P-609	SEAL COATS AND BITUMINOUS SURFACE TREATMENTS
P-610	CONCRETE FOR MISCELLANEOUS STRUCTURES

*REFER TO LATEST EDITION OF FAA ADVISORY CIRCULAR 150/5370-10, "STANDARD SPECIFICATIONS FOR CONSTRUCTION OF AIRPORTS" AVAILABLE VIA FAA WEBSITE AT:
https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5370-10



NOTE: THIS DETAIL TO BE USED ONLY WHERE REQUIRED DUE TO DAMAGED EDGE OF EXISTING CONCRETE PAVEMENT.

PAVEMENT DEMOLITION NOTES:

1. FOR SLAB REPLACEMENT, ALL REMOVALS SHALL BE ALONG EXISTING JOINTS, AND PARTIAL PANEL REPLACEMENTS ARE NOT ALLOWED. IF EXISTING JOINTS ARE NOT STRAIGHT OR ARE DAMAGED, SAW CUT FULL DEPTH INTO CLEAN, STRAIGHT LINES AS DIRECTED BY THE ENGINEER. KERF CUTS FOR WIRE OR PIPE INSTALLATION ARE NOT ALLOWED.
2. DEMOLITION OF EXISTING CONCRETE PAVEMENTS LOCATED WITHIN 25' OF EXISTING FUEL LINES OR TUNNEL STRUCTURES SHALL BE BY SAW CUT AND LIFT-OUT ONLY. BREAKING IN PLACE WILL NOT BE ALLOWED.
3. DEMOLITION OF EXISTING CONCRETE PAVEMENT ADJACENT TO PAVEMENT TO REMAIN SHALL BE BY SAW CUT AND LIFT-OUT ONLY. A RELIEF SAW CUT 2' FROM EDGE OF PAVEMENT TO REMAIN IS STRONGLY RECOMMENDED. REMOVE INTERIOR PIECES BEFORE REMOVING PIECES IMMEDIATELY ADJACENT TO PAVEMENT TO REMAIN.
4. AS DIRECTED BY THE ENGINEER, REMOVE PCCP TO OBTAIN A STRAIGHT HORIZONTAL AND VERTICAL EDGE.

SECTION

PCCP DEMOLITION DETAIL
SCALE: NTS

1

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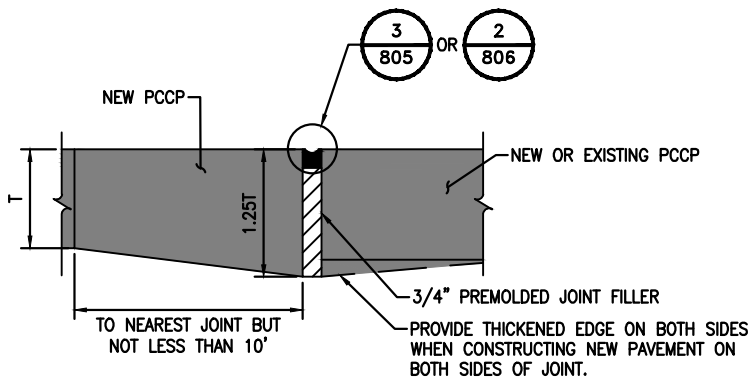
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2022

AIRFIELD PAVEMENT TYPICAL SECTIONS

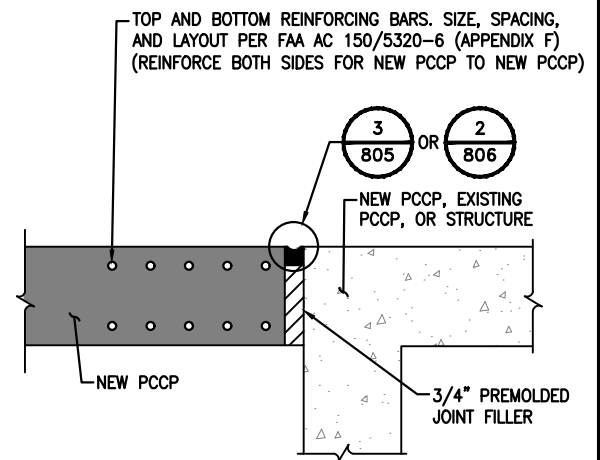
STANDARD DETAIL NO. **802**



SECTION

JOINT TYPE A
NEW PCCP TO NEW/EXISTING PCCP
THICKENED EDGE ISOLATION JOINT
SCALE: NTS

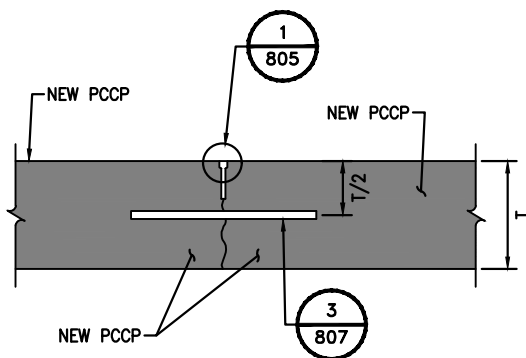
1
-



SECTION

JOINT TYPE A-1
NEW PCCP TO NEW/EXISTING PCCP OR STRUCTURE
REINFORCED ISOLATION JOINT
SCALE: NTS

2
-



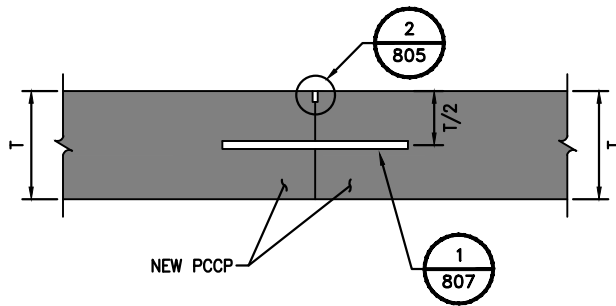
SECTION

JOINT TYPE C
NEW PCCP
DOWELED CONTRACTION JOINT
SCALE: NTS

3
-

GENERAL NOTES:

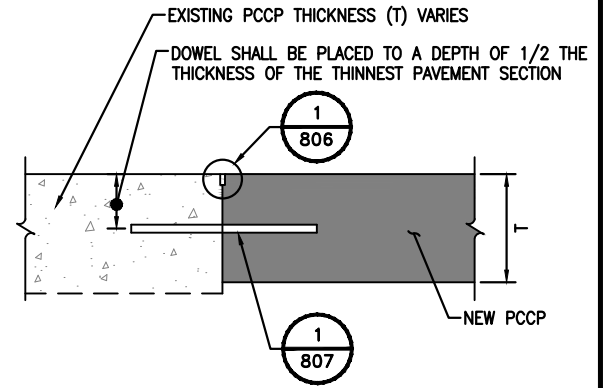
1. PCCP = PORTLAND CEMENT CONCRETE PAVEMENT (P-501).
2. T = THICKNESS OF PCCP.



SECTION

JOINT TYPE E
NEW PCCP TO NEW PCCP
DOWELED CONSTRUCTION JOINT
SCALE: NTS

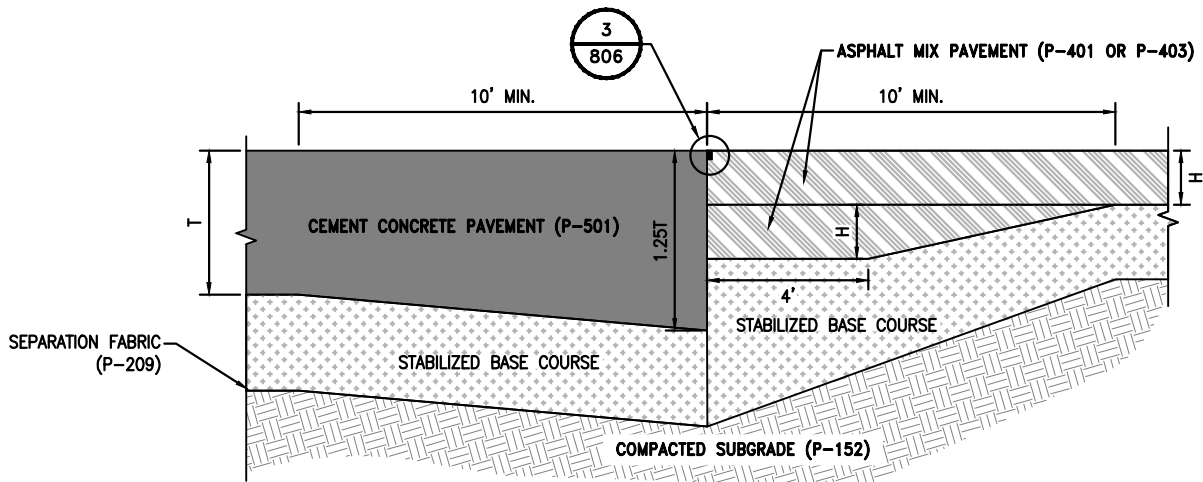
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SECTION

JOINT TYPE E-1
NEW PCCP TO EXISTING PCCP
DOWELED CONSTRUCTION JOINT
SCALE: NTS

2
-

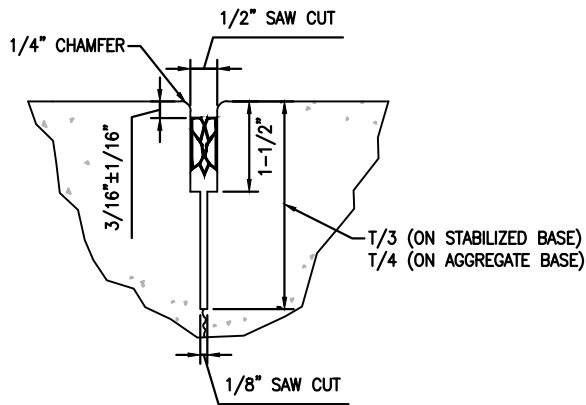


NOTE: THIS DETAIL IS INTENDED FOR TRANSITIONS BETWEEN RIGID AND FLEXIBLE PAVEMENTS SUBJECTED TO REGULAR AIRCRAFT OR VEHICLE TRAFFIC. THIS DETAIL DOES NOT TYPICALLY APPLY TO RUNWAY OR TAXIWAY SHOULDERS, EXCEPT IN SPECIFIC AREAS WHERE THERE IS FREQUENT OR REGULAR TRAFFIC ANTICIPATED.

SECTION

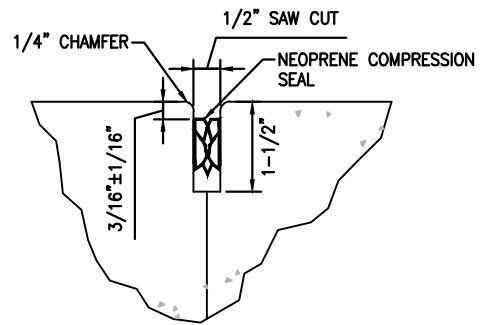
JOINT TYPE G
NEW PCCP TO NEW ASPHALT PAVEMENT
SCALE: NTS

3
-



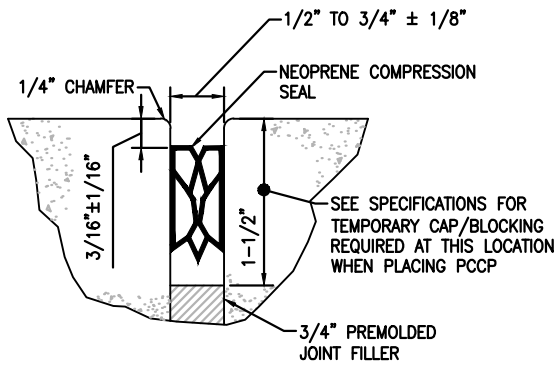
DETAIL

CONTRACTION JOINT
NEW PCC TO NEW PCC
SCALE: NTS



DETAIL

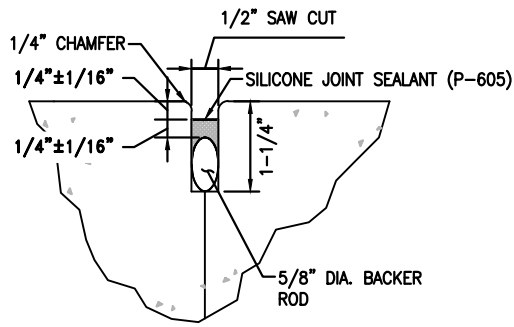
CONSTRUCTION JOINT DETAIL
NEW PCC TO NEW PCC
SCALE: NTS



DETAIL

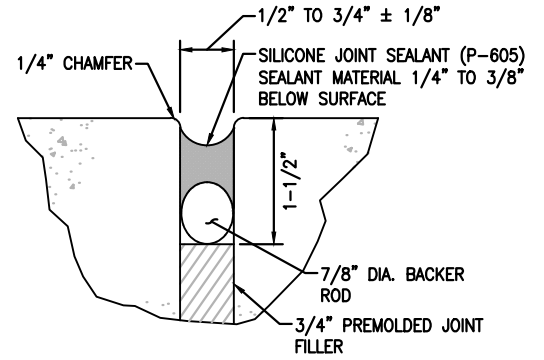
ISOLATION JOINT DETAIL
NEW PCC TO NEW PCC
SCALE: NTS





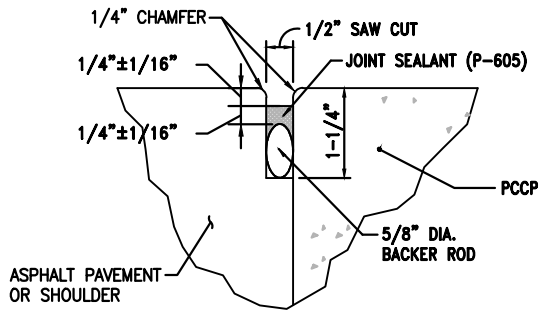
DETAIL

CONSTRUCTION JOINT DETAIL
NEW PCC TO EXISTING PCC
SCALE: NTS



DETAIL

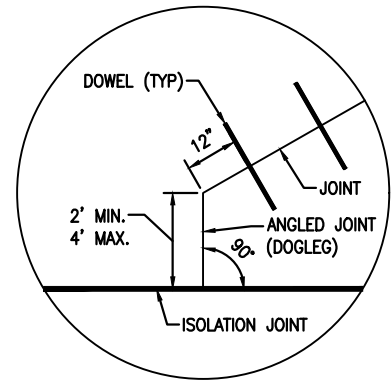
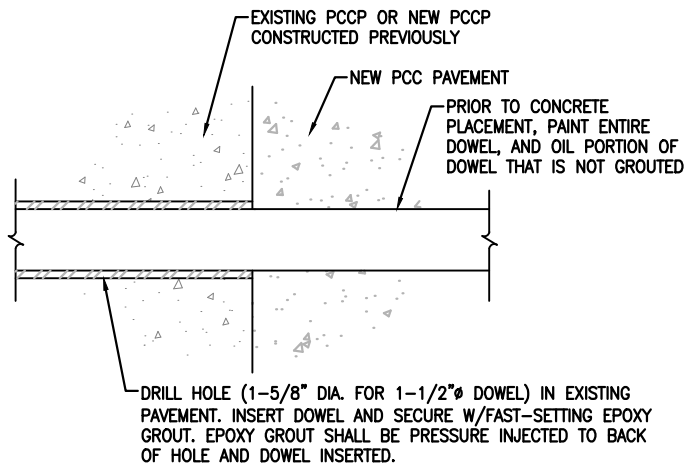
ISOLATION JOINT DETAIL
NEW PCC TO EXISTING PCC
SCALE: NTS



DETAIL

CONSTRUCTION JOINT DETAIL
ASPHALT TO PCC
SCALE: NTS





DETAIL

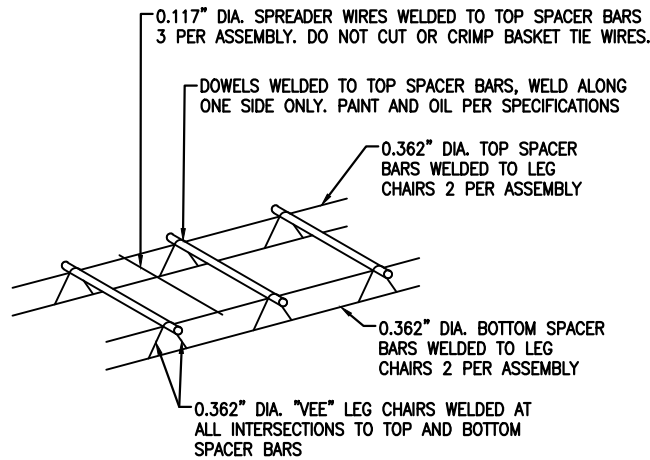
DRILLED DOWELS
SCALE: NTS

1

DETAIL

DOGLEGG JOINTS
SCALE: NTS

2



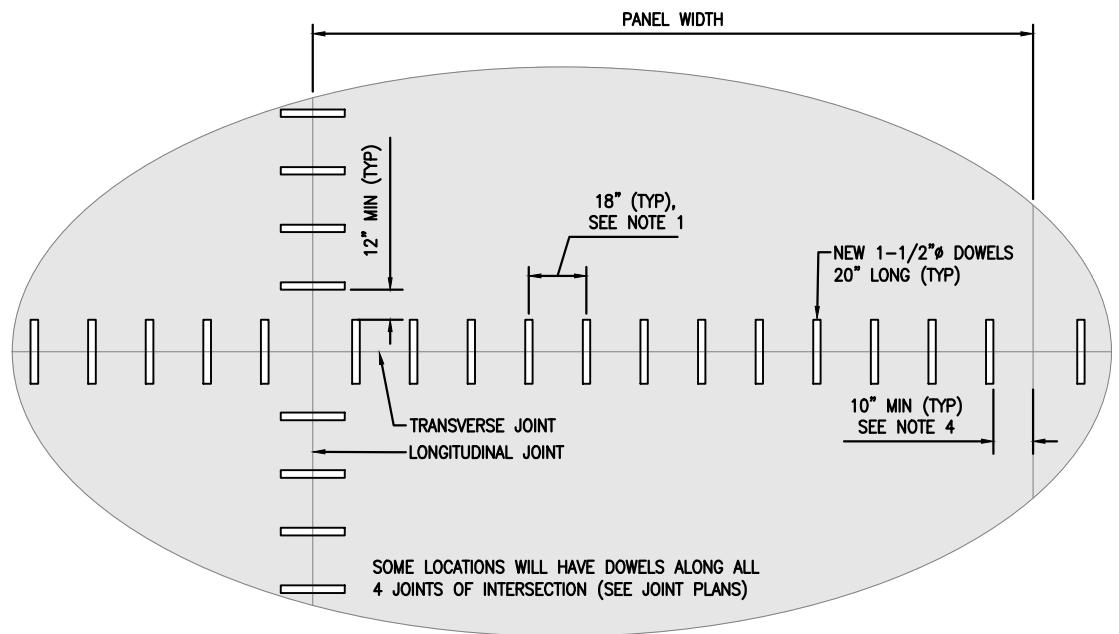
DETAIL

DOWEL BASKET ASSEMBLY
SCALE: NTS

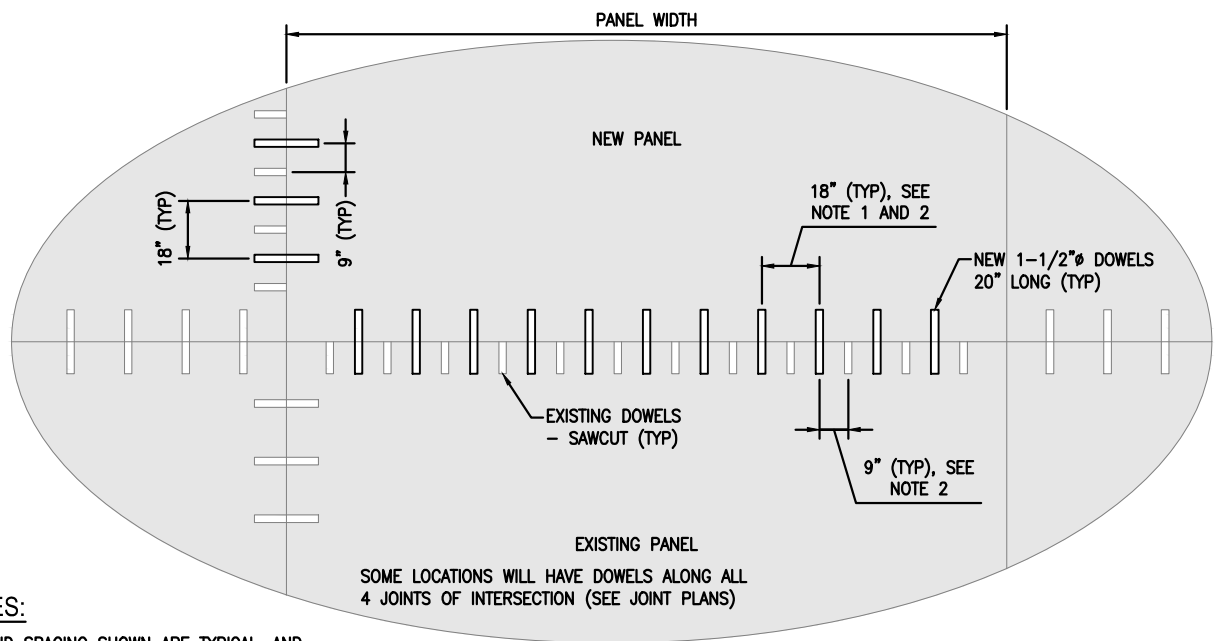
3

DOWEL BAR NOTES:

1. DOWEL BAR SIZES AND SPACING SHOWN ARE TYPICAL, AND SHALL BE VERIFIED OR UPDATED FOR EACH PROJECT ACCORDING TO THE REQUIREMENTS GIVEN IN FAA AC 150/5320-6.
2. BASKET MUST BE FIRMLY ATTACHED TO EXISTING OR NEW BASE.
3. ALL WIRE SIZES SHOWN ARE MIN.
4. DOWELS & TIE BARS SHALL BE HELD FIRMLY IN THE WELDED BASKET ASSEMBLY.
5. OIL FULL LENGTH OF DOWEL BARS AND ENTIRE BASKET AT ALL CONTRACTION JOINTS PER SPECIFICATIONS.



DETAIL
TYPICAL DOWEL BAR LAYOUT
NEW PCCP
SCALE: NTS

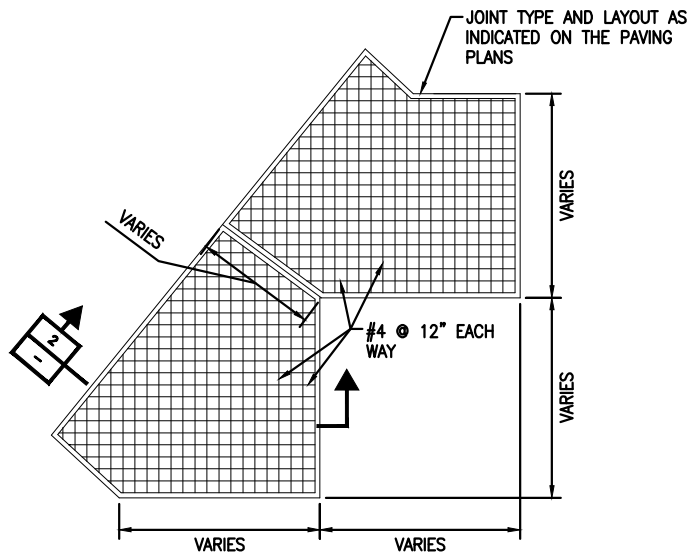


DETAIL
TYPICAL DOWEL BAR LAYOUT
NEW PCCP TO EXISTING PCCP
SCALE: NTS



DOWEL BAR NOTES:

1. DOWEL BAR SIZES AND SPACING SHOWN ARE TYPICAL, AND SHALL BE VERIFIED OR UPDATED FOR EACH PROJECT ACCORDING TO THE REQUIREMENTS GIVEN IN FAA AC 150/5320-6.
2. ACTUAL LOCATION OF EXISTING DOWELS IN THE FIELD MAY VARY. WHEN LAYOUT DIFFERS FROM EXISTING LAYOUT SHOWN IN DETAIL 2, INSTALL NEW DOWELS HALF WAY BETWEEN EXISTING DOWELS AND AT A MINIMUM DISTANCE FROM NEAREST JOINT AS SPECIFIED IN SPECIFICATION P-501.
3. DOWELS SHALL BE NO CLOSER THAN 10" TO THE JOINT.
4. DOWEL LAYOUT SHALL INCLUDE THE MAXIMUM NUMBER OF DOWELS THAT CAN FIT WHILE MAINTAINING THE SPECIFIED CENTER-TO-CENTER AND EDGE CLEARANCES.



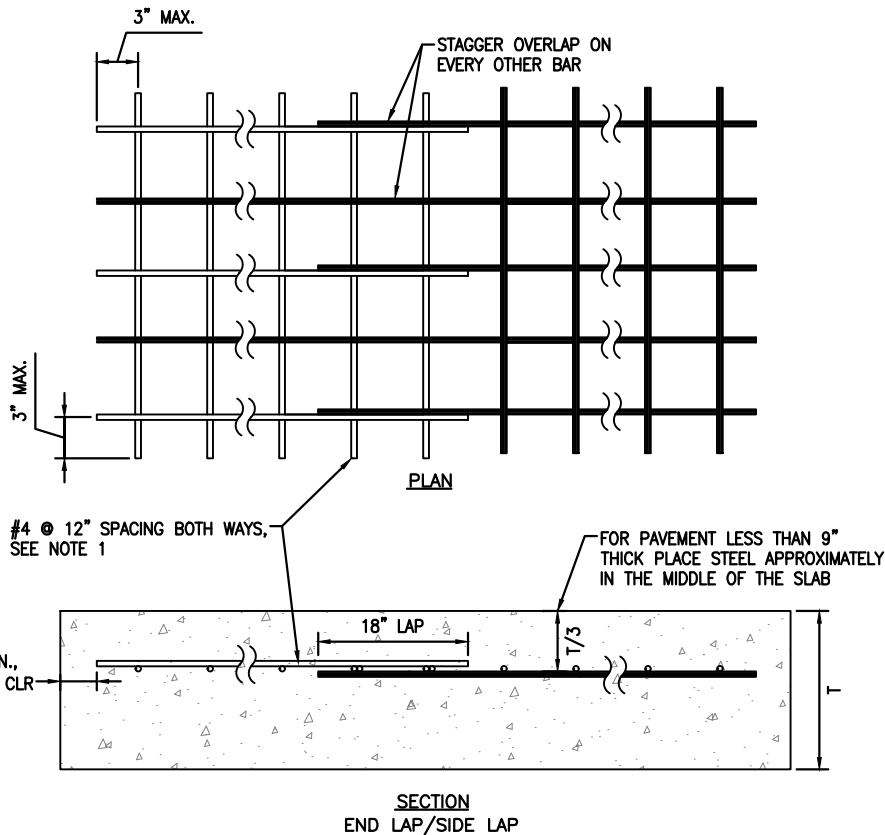
DETAIL

STEEL REINFORCEMENT MAT
TYPICAL LAYOUT
SCALE: NTS



REINFORCING STEEL NOTES:

1. BAR SIZES, SPACING, AND OVERLAP SHOWN ARE TYPICAL, AND SHALL BE VERIFIED OR UPDATED FOR EACH PROJECT ACCORDING TO THE REQUIREMENTS GIVEN IN FAA AC 150/5320-6.
2. PLACE ALL STEEL REINFORCEMENT ACCURATELY AND HOLD FIRMLY IN THE POSITION INDICATED ON THE DRAWING PRIOR TO AND DURING CONCRETE PLACEMENT.
3. TIE BARS AT ALL INTERSECTIONS, EXCEPT WHERE SPACING IS LESS THAN 1 FOOT IN EACH DIRECTION IN WHICH CASE TIE EVERY OTHER INTERSECTION.
4. AT PERIMETER, TIE BARS AT ALL INTERSECTIONS.



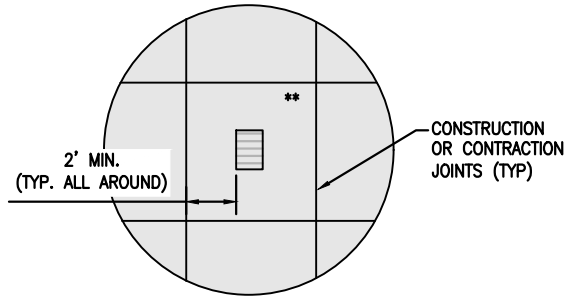
DETAIL

STEEL REINFORCEMENT MAT - TYPE I
SCALE: NTS



JOINT LAYOUT NOTES:

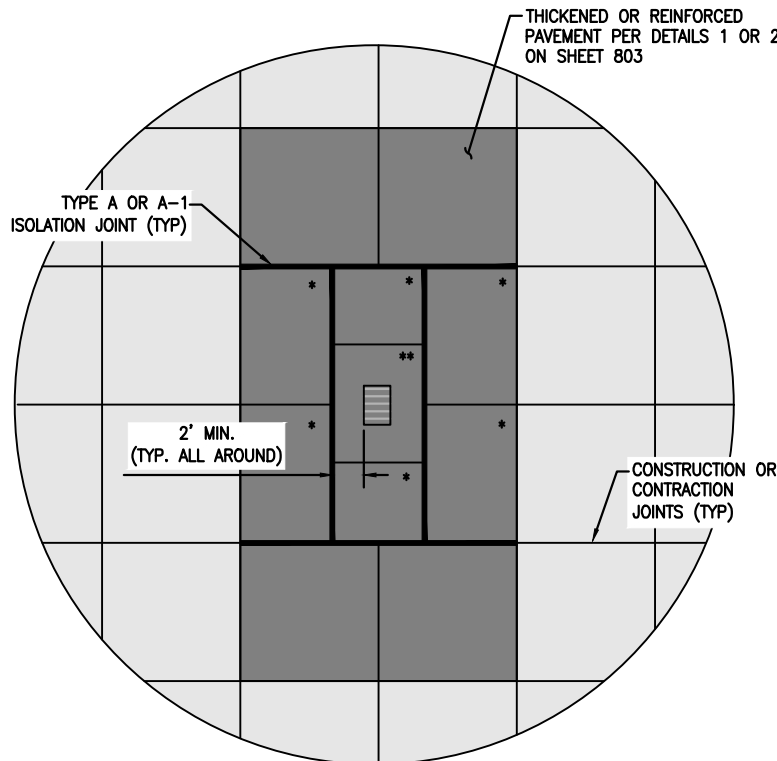
1. JOINT LAYOUT FOR CONCRETE PAVEMENTS SHALL BE IN ACCORDANCE WITH FAA GUIDANCE AND REQUIREMENTS IN AC 150/5320-6 (CURRENT VERSION).
2. TYPICAL JOINT LAYOUT GUIDANCE FROM THE FAA IS ALSO AVAILABLE ONLINE – REFER TO SAMPLE PCC JOINT PLANS AT https://cms.faa.gov/airports/engineering/pavement_design



** TYPE II PAVEMENT REINFORCING PER STANDARD DETAIL NO. 111

DETAIL

IDEAL STRUCTURE PLACEMENT
IN CONCRETE PAVEMENT
SCALE: NTS



** TYPE I PAVEMENT REINFORCING PER STANDARD DETAIL NO. 809
** TYPE II PAVEMENT REINFORCING PER STANDARD DETAIL NO. 111

NOTE: USE OF THIS DETAIL IS ONLY ALLOWED WHEN IDEAL PLACEMENT OF STRUCTURE SHOWN IN DETAIL 1 IS NOT POSSIBLE.

DETAIL

ALTERNATE JOINT LAYOUT AROUND STRUCTURE
IN CONCRETE PAVEMENT
SCALE: NTS

