



**City of Tillamook
Public Works
Design Standards**

2014

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CHAPTER 1 – General Requirements

1.1 Definitions

The following terms shall have the following meaning in this Ordinance. In some cases, further information is given.

AASHTO	American Association of State Highway and Transportation Officials
ADA	American with Disabilities Act
ADT	Average Daily Trips
Alley	A street primarily intended to provide secondary access to a public road, or to the side or rear of lots or buildings. Alleys are not intended for through traffic.
ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
AWWA	American Water Works Association
BMP	Best Management Practice
Building Sewer	That portion of the private sanitary or storm sewer extending from a point five feet outside the established line of the building or structure (including any structural projection except eaves) to main sewer
Capital Improvement Plan	The Capital Improvement Plan adopted by the City of Tillamook and any updates of the plan.
City	The City of Tillamook, Oregon
Construction Permit Agreement	An agreement signed by the owner containing all assurances deemed necessary by the City that all public improvements will be constructed in accordance with these standards and the approved project plans.
Contractor	The person designated by the City, or Owner to do the work in question.

Conveyance System The surface water conveyance system includes all portions of the surface water system, either natural or manmade, that transport storm and surface water runoff. The purpose of the conveyance system is to drain surface water from property.

DBH (Diameter at Breast Height):

Diameter of a tree measured at 4.5 feet above ground level.

Department The Department of Public Works

Culvert A surface water drainage pipe crossing a road, driveway, or pathway which has no attached structures.

Curbed Center Median An area in the roadway between opposing travel lanes that is defined by a curb.

Development **a.** All human-induced changes to improved or unimproved real property, including:

- 1.** Construction of structures requiring a building permit if such structures increase the impervious surface footprint on the real property;
- 2.** Land division, including subdivisions, lot line adjustments, expedited land partitions and minor land partitions. "Land Division" does not include plats for the sole purpose of converting existing buildings to condominiums;
- 3.** Drilling;
- 4.** Site alterations resulting from surface mining or dredging;
- 5.** Grading that would require an erosion control permit;
- 6.** Construction of earthen berms;
- 7.** Paving and roadway construction;
- 8.** Excavating that would require an erosion control permit;
- 9.** Clearing when it results in the removal of trees or native vegetation that would require a permit from the City or notification to the Oregon Department of Forestry;
- 10.** Redevelopment; and
- 11.** Construction of utility infrastructure.

b. The following activities are not included in the definition of development:

- 1.** Construction on lots in subdivisions meeting the criteria of ORS 92.040(2).
- 2.** Measures to repair, maintain, or remove existing structures, facilities, roadways, driveways, accessory uses, or other

development, provided such measures are consistent with City regulations, and do not encroach further into the Vegetated Corridor or Sensitive Area.

3. Interior modifications and vertical additions (additional stories) that do not modify the existing structure footprint or increase the building footprint impervious area of the site, provided such modifications or additions are consistent with City regulations and do not encroach further into the Vegetated Corridor or Sensitive Area.
4. Measures to replace within the existing footprint a structure(s) lost due to a catastrophic event such as fire, provided that such measures are consistent with City regulations. Structures that are partly or wholly within a FEMA designated 100-year floodplain that are damaged beyond more than 50% of the value or proposed to be improved by more than 50% of their value, must be elevated or flood-proofed consistent with the National Flood Insurance Program participation requirements

Director

The Director of Public Works for the City.

Drainage Ditch

a. Drainage ditches include:

1. Roadside ditches that carry only stormwater runoff from the adjacent road which may be mixed with unconcentrated flow from adjacent lots;
2. Constructed channels designed as part of the stormwater infrastructure and drain directly from stormwater facilities or storm pipe systems; and
3. Agricultural or other manmade ditches that divert water away from the natural stream for the purpose of irrigation or livestock watering.

b. Drainage ditches do not include historically altered streams or channels that convey surface water flows.

Easement or Right-of-Way

A right of use on real property of another, entitling the City to construct, own and maintain a public sanitary sewer, pump station, storm system, water main and related facilities on, under and through the subject real property.

Edge of Road

Face of curb or boundary of paved roadway at the gravel shoulder or boundary of unpaved roadway at the top of ditch.

Edge of Sensitive Area

The Edge of Sensitive Area is defined based on the type of sensitive area as detailed below:

- a. The top of the channel bank;
- b. The delineated boundary of the wetland, per DSL / Corps procedures for wetland delineation;
- c. The outside edge of spring emergence (measured as the area of saturation, hydric soil conditions, or channel formation, whichever is greatest);
- d. The average high water mark for lakes, ponds, and in- stream impoundments;
- e. For streams draining 10 or more acres where no defined channel exists, and where there are no other sensitive areas such as wetlands, the edge of the sensitive area shall be the centerline of the natural drainage swale.

Engineer	The person, firm, corporation, partnership, or association duly registered by the State of Oregon providing engineering work on a project or construction within the City. If the person providing the engineering for the project is a City employee or the City's Engineer of Record, then "engineer" expressly includes such employee.
Enhancement	Modification of a Sensitive Area or Vegetated Corridor to improve its ecological functions and values, improve its ability to protect the water resources, and improve surface water quality.
Erosion	The movement of soil particles resulting from the flow or pressure from water, or wind, or from tracking by vehicles or foot traffic.
Floodplain	The land area identified and designated by the United States Army Corps of Engineers, the Oregon Division of State Lands, FEMA, or Tillamook County that has been or may be covered temporarily by water as a result of a storm event of identified frequency.
Floodway	The portion of a watercourse required for the passage or conveyance of a given storm event as identified and designated by the City. The floodway shall include the channel of the watercourse and the adjacent floodplain that must be reserved in an unobstructed condition in order to discharge the base flood without increasing flood levels by more than one foot.
Ground Cover	A densely growing plant that is used to cover bare soil by forming a continuous mass of low foliage.

Half Street	Improvements of one-half (1/2) of an existing road in accordance with the Community Development Code, Transportation Plan, and applicable City standards. One- half (1/2) of the road shall mean the area between the right-of-way centerline and the ultimate right-of-way line.
Hazardous Material(s)	"Hazardous material(s)" or "hazardous substance(s)" means any element or compound that, when it enters in or upon the water, presents an imminent and substantial danger to the public health or welfare or the environment, including but not limited to fish, animals, vegetation or any part of the natural habitat in which they are found. "Hazardous material or substance" includes but is not limited to a substance designated under 33 U.S.C. §1321 (b)(2)(A), any element, compound, mixture, solution or substance designated under 42 U.S.C. §9602, any hazardous waste having characteristics identified under or listed under 42 U.S.C. §6921, any toxic pollutant listed under 33 U.S.C. §1317 (a), any imminently hazardous chemical substance or mixture with respect to which the Administrator of the United States Environmental Protection Agency has taken action under 15 U.S.C. §2606, and any residue classified as a hazardous waste pursuant to ORS 466.020(3).
Impervious Area	Pavement, maintained gravel areas, structures, public and private roadways, roofs, and other hard surfaces which are not specifically designed to allow water to infiltrate. Except in the case of some low impact development approaches, effective impervious area is not directly connected to the drainage system via piping.
Interim Improvement	An improvement that is a portion of the Ultimate Improvement, as prescribed by the Transportation Plan. An interim improvement is consistent with the ultimate improvement such that it does not require removal to construct the ultimate improvement.
Inspector	The person designated by the City to inspect the work.
Intersection	Refers to two (2) or more roads meeting at a point. For design purposes, an intersection is not formed by naming two (2) approaches of a continuous road at a curve or some other point with different road names.

Land Development Permit Process

Refers to the City process in which an applicant receives approval for a land development, and which may require construction of a road, sanitary sewer, storm sewer, water line and other related conditions.

Lateral

That portion of the private sanitary or storm sewer extending from a point five feet outside the established line of the building or structure (including any structural projection except eaves) to the public sanitary sewer or storm system main, including the fittings or connection to the mainline. The lateral includes both the "building sewer" and the "side sewer."

LIDA

Low Impact Development Approaches

Linear Development Project

Linear development projects include but are not limited to roads, trails, paths, and utility lines where development is taking place within a right-of-way or an easement on a parcel that is not owned or controlled by the applicant. Linear development projects also include linear projects such as trails where the project is occurring on only a small part of a large parcel owned by the applicant.

NAD

North American Datum

NAVD; NGVD

North American Vertical Datum; National Geodetic Vertical Datum

NSF

NSF International (formerly National Sanitation Foundation)

ODOT

Oregon Department of Transportation

"Or Equal," "Or Approved Equal," "Or Equivalent"

These terms indicate that the "equal" product is the same or better than the product or standard named or prescribed in function, performance, reliability, quality, and general configuration.

Determination of the quality in reference to the project design

requirements will be made by the City.
Contractor shall not use such "equal" products without prior written approval of the City.

ORS

Oregon Revised Statutes

Outfall

A point where collected and concentrated surface and stormwater runoff is discharged.

Owner or Property Owner

The person who is the legal record owner of the real property, or where there is a recorded land sale contract, the purchaser thereunder.

Path

A developed route primarily for use by pedestrians and non-motorized vehicles.

Perimeter Area

The area between the back of sidewalk and the right-of-way or easement for public travel line (whichever is farther back).

Person

Any individual, firm, partnership, joint venture, association, social, fraternal, educational, religious or charitable organization, fraternity, sorority, joint stock company, corporation, estate, trust, business trust, receiver, trustee, syndicate, municipal corporation, district or political subdivision or any legal entity whatsoever.

Pipe separation

The City of Tillamook Pipe line separation is a necessity for public health and safety, property and the quality of the pipeline contents. Pipeline failure or damage can result in pipeline contamination. Even the process of excavating one pipeline for repair can create risk to the adjacent pipelines. The City of Tillamook utilities lines require space for installation, repair and replacement. No other lines or conduits are allowed within 18" in any direction or 5' if running parallel of a City owned utility line; sewer lines must be 10'. This space is required but may be adjusted for site specific problems, if approved by the City of Tillamook Public Works and other agencies with jurisdictions. If other agencies such as DHS and DEQ or other Federal or State entity separation rules apply, the greatest distance will apply. All crossings of City of Tillamook utilities require a permit from the City of Tillamook.

Plans

The drawings and designs that specify construction details as prepared by the Engineer.

Planter Strip Area

The area between the sidewalk and the back of curb.

Post Construction Erosion Control

Re-establishing groundcover or landscaping prior to the removal of temporary erosion control measures.

Project Engineer

The engineer in responsible charge of designing the infrastructure improvements who must be registered in the State of Oregon.

The Property or The Site

The subject real property on which development or permitted activity takes or is proposed to take place. For activity occurring on property other than that which the applicant owns or controls, the property or the site shall mean the land within limits of the permanent and temporary construction easements or right-of-way.

Public Sanitary Sewer(s) and Storm and Surface Water System

The sanitary sewer and storm and surface water collection systems, within easements or right-of-way dedicated to the public or City, which are operated and under the jurisdiction of and maintained by the City.

Redevelopment

Redevelopment includes only those activities that alter existing improved impervious areas on the subject property. Redevelopment does not include the addition of impervious areas to areas that were previously pervious. Sites which alter existing impervious areas and add new impervious areas shall be regulated as development sites. Redevelopment includes but is not limited to: the expansion of or change to an existing building footprint or structure, provided such expansion only impacts already impervious areas; reconfiguration of existing roadways, driveways, or parking lots; and land disturbing activities related to structural or impervious area modifications.

Replacement Area

The mitigation area required to compensate for an encroachment into the Vegetated Corridor or Sensitive Area.

Road or Roadways

The entire right of way of any public or private way that provides ingress to or egress from property by means of vehicles or other means or that provides travel between places by means of vehicles. "Road" includes, but is not limited to:

- (a) Ways described as streets, highways, throughways or alleys;
- (b) Road related structures that are in the right of way such as tunnels, culverts or similar structures;
- (c) Structures that provide for continuity of the right of way such

	as bridges;
	(d) Structural embankment of the road surface and associated drainage ditches;
	(e) Roadways may or may not correspond to the road right-of-way.
City Road	A road established as part of the City road system by action of the City Council. See ORS 368.001 (1).
Public Road	A road dedicated for use by the public but not established as a City road. Maintenance is the responsibility of the adjoining property owners. See ORS 368.001 (5).
Sensitive Area	<p>a. Includes:</p> <ol style="list-style-type: none"> 1. Existing and created wetlands; 2. Rivers, streams, and springs, whether flow is perennial or intermittent; or 3. Natural lakes, ponds, and in-stream impoundments. <p>b. Does not include:</p> <ol style="list-style-type: none"> 1. Storm water infrastructure; 2. A Vegetated Corridor (a buffer) adjacent to the Sensitive Area; 3. An off-stream recreational lake, wastewater treatment lagoon, fire pond or reservoir; or 4. Drainage Ditches.
Shrub	A low-growing woody perennial plant having several major stems from the same base.
Side Sewer	The private sanitary sewer or storm system extending from the public sanitary sewer or storm system main to Building it serves.
Spring	The point at which groundwater emerges and forms a channel or swale.
Stream	A surface concentration of flow in a channel or swale in which a

flow of water occurs either perennially or intermittently.

Street Tree	Approved trees planted in Planter Strip Areas, Perimeter Areas, and tree wells or within five (5) feet of the back of sidewalk.
Stormwater	Stormwater is water that runs off only from impervious surfaces during rain events.
Stormwater Infrastructure	Any structure, feature, or drainage ditch that is designed, constructed, and maintained to collect and filter, convey, retain, or detain stormwater run off during and after a storm event for the purpose of water quality improvement or quantity management. It includes, but is not limited to, features such as constructed wetlands, water quality swales, landscaped retention areas, and detention ponds that are maintained as storm water quality or quantity control facilities.
Surface Water	Water that drains from the landscape via overland flow or ground water resurgence. Surface water flows can and often do include storm water runoff.
Transportation Plan	The City of Tillamook Transportation Plan. UL Underwriter's Laboratory, Inc.
Ultimate	As used in these standards, refers to an improvement, location, grade, or other matter, that is necessary to construct the full improvement prescribed in the Transportation Plan.
Vegetated Corridor	A corridor adjacent to a Sensitive Area that is preserved and maintained to protect the water quality functions of the Sensitive Area.
Visible or Measurable Erosion	

Visible or measurable erosion includes but is not limited to:

a. Deposits of mud, dirt, sediment or similar material exceeding one-half cubic foot in volume on public or private streets, adjacent property, or into the storm and surface water system, either by direct deposit, dropping, discharge, or as a result of the action of erosion.

b. Evidence of concentrated flows of water over bare soils; turbid or sediment laden flows; or evidence of on-site erosion such as

rivulets on bare soil slopes, where the flow of water is not filtered or captured on the site using the techniques in Chapter 7.

c. Earth slides, mudflows, earth sloughing, or other earth movement, which leaves the property.

Water Quality Sensitive Area, or Sensitive Area

See "Sensitive Area" definition.

Watercourse

A watercourse is a:

a. channel

b. creek

c. stream

d. river

e. swale, or

f. storm drain pipe in which a flow of water occurs either perennially or intermittently.

Wetlands

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Categories of wetlands include:

a. Created Wetlands. Those wetlands developed in an area previously identified as a non wetland to replace, or mitigate wetland destruction or displacement. A created wetland shall be regulated and managed the same as an existing wetland.

b. Constructed Wetlands. Those wetlands developed as a storm water facility, subject to change and maintenance as such. These areas must be clearly defined or separated from existing or created wetlands. Constructed wetlands shall be regulated as created wetlands only if they serve as wetland mitigation.

c. Jurisdictional Wetlands. Jurisdictional wetlands as determined by the Division of State Lands (DSL) or the US Army Corps of Engineers (COE).

d. Isolated Wetlands. Wetlands not connected to streams or

other surface water bodies.

Work

All labor necessary to produce the construction required by the approved construction plans, and all materials and equipment incorporated to complete construction.

1.2 General Process for Public Improvements

1.3 Preparation and Submittal of Engineering Plans

1.3.1 General

Submittal requirements consist of design plans, grading plans (where required), erosion control plans (where required), landscape plans (where required), drainage calculations, and other information as required to determine compliance with these standards for a proposed improvement. Designs submitted shall be stamped by a Registered Professional Engineer licensed to practice in the State of Oregon.

Responsible Persons

The applicant for land development approval, access permit, or other applicable permit or approval, shall be responsible for fulfillment of all requirements of these standards. The applicant may act through its designated Engineer. It is the responsibility of the applicant to notify the City of its designated Engineer and if there is a change in its designated Engineer.

The applicant is responsible for verifying existing utility lines actual locations. The applicant is responsible for keeping all City, County and State separation requirements.

1.3.2 Review Procedure

Three (3) sets of complete plans shall be submitted to the Department for an initial basic review. The purpose of this review is to check that all the required information has been submitted. The required information includes drainage calculations, and a list of requested exceptions to these Public Works Standards. If the submittal is complete, a detailed review will begin. If the submittal is not complete, notification will be given by the City to the Engineer specifying what is needed. Applications will be handled based on a first-in, first-out priority, based on the date they are determined to be complete.

Upon completion of the detailed review by the Department, staff will return one (1) set of plans with "Red Line" comments and calculations to the Engineer. The Engineer shall revise its plans to respond to the City's red-line comments and calculations. After the Engineer has completed all revisions, submit six (6) revised plan sets consisting of four (4) full size plan sets and two (2) 11"x 17" half scale plan sets together with the original "Red Line" plans to the City for approval. When the final submittal has been reviewed and approved, one (1) set will be stamped "Approved by City of Tillamook" and will be returned to the applicant/Engineer with the facility permit application packet.

This plan review and approval is valid for two (2) years from the date of the approval stamp. Extensions may be granted by the City Engineer's staff as provided in the Tillamook County Community Development Code, has first been approved.

1.3.3 Design Plan Format

English units of measure shall be used.

The plans shall be submitted on sheets 22"x34" or 24"x36".

Vicinity Maps shall be located on the first sheet of all plans and shall show the location of the project with respect to the nearest major road intersection.

The following note shall be on the first sheet of the plan set: "This design complies with ORS 92.044 (7) in that no utility infrastructure is designed to be within one (1) foot of a survey monument location shown on a subdivision or partition plat. Neither design exceptions nor final field location changes shall be permitted if that change would cause any utility infrastructure to be placed within the prohibited area."

A north arrow shall be shown on each plan view sheet and adjacent to any other drawing which is not oriented the same as other drawings on the sheet.

The scale shall be 1"=2', 4', 5', or 10' vertically and 1"=10', 20', 40', 50' or 100' horizontally for all drawings except structural drawings. A bar scale shall be provided on all plan view sheets.

Letter size shall not be smaller than 0.10 of an inch high.

A title block shall appear on each sheet of the plan set and shall be placed in the lower right-hand corner of the sheet, across the bottom edge of the sheet or across the right-hand edge of the sheet. The title block shall include the names of the project, the engineering firm, the owner, the City file number and the sheet title.

The Engineer shall stamp each sheet except for landscape plans.

A registered Landscape Architect shall prepare and stamp landscape plans. A single family dwelling on a residential lot is exempt from this requirement.

The description and date of all revisions to the plans shall be shown on each sheet affected, and shall be approved and dated by an Engineer as evidenced by signature or initial.

The location, elevation, and datum of a Tillamook County bench mark shall be shown. Temporary bench marks shall also be shown on the plans. Tillamook County bench marks are those permanent marks that have been approved and

accepted by the County Surveyor's Office and made available on the county web site. Horizontal control is based on the NAD 83/91 model. Vertical control is on NGVD 29 datum. All GPS elevations are on the NAVD 88 datum. No other marks or datums may be used without permission of the County Surveyor.

1.3.3.1 Plan View

Plan Views shall show the following:

Right-of-way, property, tract, and easement lines;

Subdivision name, lot numbers, road names and other identifying labels. Road names are subject to the approval of the City;

Location and stationing of existing and proposed road centerlines and curb faces within at least 200 feet of the project boundaries;

Horizontal curve data of road centerlines and curb returns;

Utilities and vegetation in conflict with the construction or operation of the road and drainage facilities;

Location, stationing and size of drainage, sanitary sewer and water facilities. Drainage, sanitary sewer and water facility stationing shall be located in relationship to the road stationing at all manholes or other key locations. Show drainage, sanitary sewer and water facilities both above and below the project;

Match lines with sheet number references and centerline stationing; Top of curb elevations along curb returns at quarter-points;

Location of the low points of road grades and curb returns;

Proposed and existing locations of sidewalks, mailboxes, sidewalk ramps, driveway approaches, manholes, sanitary sewer, storm sewer, water quality facilities and other public/private improvements;

Crown lines along portions of roads transitioning from one typical section to another;

Centerline stationing of all intersecting roads;

Location and description of existing survey monuments, including but not limited to, section corners, quarter corners and donation land claim corners;

Legend; Any additional information that the City Engineer's staff deems necessary.

1.3.3.2 Profile View

Profile Views shall show the following:

Stationing, elevations, vertical curve data and slopes for center of roads. For off-set or superelevation cross-sections, both curbs shall be profiled. Where curbs are not to be constructed, centerline of road and edges of pavement shall be shown;

Superelevation diagrams shall be provided with the road centerline profile drawing;

Original ground profile along the centerline and if necessary at the edges of the right-of-way if grade differences are significant;

Centerline of existing roads for a distance of at least two hundred (200) feet each way at intersections with proposed roads. Show original ground profile(s) beyond existing roads if necessary;

For roads that may be extended, show the extended profile at least two hundred (200) feet for local and neighborhood route roads and as required for roads with higher classifications. Extensions shall be designed to be compatible with the restraints of the terrain;

Vertical alignment of roads;

The top of curb for all cul-de-sacs, eyebrows and intersection curb returns;

All proposed drainage, sanitary sewer and water facilities, their types, all invert and top elevations, slopes, materials, bedding and backfill;

Existing drainage, sanitary sewer and water facilities, including off-site facilities, upstream and downstream, that affect the design (e.g., downstream restrictions that back water on to project site);

Profiles for ditch and creek flow lines shall extend a minimum of two hundred (200) feet beyond the project, both upstream and downstream. Typical cross sections at fifty (50) foot intervals shall also be submitted;

All existing and proposed sanitary and storm lines crossing the profile.

1.3.3.3 Landscape

Landscape plans shall illustrate a comprehensive overview of the existing and proposed vegetation with respect to transportation features, utility structures and any other road related appurtenances.

Landscape plans shall specify hardy and drought-resistant plant materials as

approved by the City Engineer. See plant list in appendix G. Selection, quantity, and size shall be compatible with soil types, required spacing, proximity to roadways and sidewalks, size of plantable area, topography, utilities (overhead, underground and at-grade), structures, and compatibility with vegetation proposed to remain.

Landscape plans shall be designed without the need for permanent irrigation.

The landscape plan shall include and identify the type, size and location of all vegetation to be preserved, removed, or installed. Vegetation includes, but is not limited to shrubs and ground cover, as well as trees and tree groups with a DBH of six (6) inches or more.

The landscape plan shall illustrate the type, size and location of trees or tree groups with a DBH of six (6) inches or more within the project limits.

1.3.4 Other Plan Sheets

Site grading plans.

Roadway Illumination design plan. Composite signing and striping plan.

A separate composite plan view with street trees, signing and street lights. Sanitary sewer plan and profile.

Storm sewer plan and profile. Water plan and profile.

Erosion control/1200C

1.3.5 Other Requirements

Other information to be shown on the design drawings or included with the plan submittal:

- a. Road classification;
- b. Design speed;
- c. Superelevation;
- d. Average Daily Trips (ADT) or Design Hourly Volume (DHV).
- e. Structural design plans and calculations for proposed structures (i.e., walls, box culverts, bridges, etc.).
- f. The design assumptions for each road (i.e., traffic coefficient, R- value, etc.).
- g. Typical road structural sections for both summer and winter construction.
- h. Type of pipe required
- i. Type of pipe bedding
- j. Other information as required

1.3.6 Drainage Calculations

Drainage calculations shall be presented in a clear, concise and complete manner. These calculations shall address all runoff into the drainage system; areas contributing flow to each inlet must be computed separately and each inlet with contributing area shall be designated and shown on an accompanying contour map work sheet. Adequacy of downstream storm sewers shall be investigated.

1.4 Approval of Engineering Plans

1.4.1 General

The Developer shall comply with the following procedures when submitting construction plans and specifications for a public improvement project to be constructed in a public right-of-way:

- a. The Developer and the Developer's Project Engineer shall schedule and participate in a pre-submittal conference with the City of Tillamook staff, including the Public Works Director and the City Manager. Such pre-submittal conference will normally be scheduled after any Planning Commission approvals have been granted for the project. The topics to be discussed at the pre-submittal meeting will include schematic methods for meeting the conditions of approval for the project, off-site public improvements and project impact thereto, on-site public improvements, the development agreement, project construction and inspection requirements.
- b. The construction plans shall demonstrate compliance with all approvals by other approval agencies, such as the City of Tillamook Planning Commission.
- c. The Project Engineer or Developer shall submit three (3) sets of construction plans and specifications to the City of Tillamook together with the required plan review fee. Simultaneously, the Project Engineer or Developer shall submit the plans and specifications to all other required approval agencies. Those agencies may include, but shall not be limited to:
 1. Sanitary Sewer: Oregon Department of Environmental Quality (DEQ)
 2. Water Mains: Tillamook Water Department and Oregon State Health Department
 3. Erosion Control: Oregon Department of Environmental Quality (DEQ)
 4. Wetlands: Oregon Division of State Lands (DSL) and US Army Corps of Engineers

Upon receipt of three (3) sets of plans, specifications and the plan review fee, the Public Works Director and/or City Engineer shall review the plans for conformance with the City's Design Standards and for overall project conformance with the conditions of approval. The Public Works Director shall either approve the plans as

submitted or return the plans with requested plan revisions and comments. It is the responsibility of the Developer to submit to the City copies of all plan approval letters from all required agencies.

Once the plans and specifications are approved by all the required agencies, The City and the Developer shall enter into a Development Agreement prepared by the City that shall meet state requirements and conditions that the Developer shall follow in the construction of the planned improvements. No construction shall commence on the project until plans have been submitted to the City of Tillamook and approval is granted in writing by the City of Tillamook.

1.5 Construction Inspection

1.5.1 General

Road, bridge, drainage or utility construction shall commence only after approval of the construction plans and issuance of a Facility Permit, Access Permit, or any other required permit, and posting of any required financial assurance. All public construction falling under the jurisdiction of the Department shall be inspected by an Oregon registered Engineer or a qualified individual under the supervision of an Oregon registered Engineer. The Department will not authorize work to begin on public improvements without designation of an inspecting Engineer by the owner or developer or the City.

If the owner or developer does not designate an inspecting Engineer, the City may perform inspection services at owner's or developer's request or may select from the Engineers who have indicated a desire to perform such services. All inspection costs including required testing shall be paid by the owner or developer directly through service contracts or agreements. The City will require inspection costs be included in the performance assurance and administration deposit as determined by the complexity of the construction and in accordance with prevailing fee schedules.

An Engineer whose firm, or any member of the firm, has a corporate, partnership or any form of real property interest in the development for which the improvements are required cannot be the designated inspecting Engineer.

The inspecting Engineer's relationship to the project must be solely that of a professional service nature.

The inspecting requirements of this chapter are not applicable to individual sidewalk, driveway or utility permits. The City may perform those inspections at its discretion.

1.5.2 City Responsibilities

Inspecting services provided by the City shall include:

- a. Liaison between the inspecting Engineer and the City;
- b. Monitoring of work progress and performance testing as deemed desirable;
- c. The performance of administrative and coordination activities as required to support the processing and completion of the project;
- d. The issuance of stop work orders upon notifying the inspecting Engineer of the City's intention to do so.
- e. Items 2 through 10 of Section 1.05.3 when the applicant has chosen the City as the inspection option.

1.5.3 Inspecting Engineer's Responsibilities

The inspecting Engineer of record must be registered to practice engineering in the State of Oregon. The Engineer must personally perform all responsibilities marked by an (*) in this section and must supervise all individuals performing delegated activities. Material testing not performed by the inspecting Engineer must be accomplished by a recognized testing firm using certified material testers or another registered Engineer.

The following minimum responsibilities are required of the designated inspecting Engineer:

- 1.*Execute a form accepting responsibility for inspection;
2. Maintain a project diary which contains at least the following information:
 - a. Job number and name of Engineer and designees;
 - b. Date and time of site visits;
 - c. Weather conditions, including temperature;
 - d. A description of construction activities;
 - e. Statements of directions to change plans, specifications, stop work, reject materials or other work quality actions;
 - f. Public agency contacts which result in plan changes or other significant actions;
 - g. Perceived problems and action taken;
 - h. General remarks;
 - i. Final and staged inspections;
 - j. Record all material, soil compaction, and pipeline tests.
3. The inspecting Engineer shall obtain and use a copy of City approved construction plans and specifications;
4. Review and approve all pipe, aggregate, concrete, AC and other materials to ensure their compliance with City standards;

- 5.* Submit all plan or specification changes in writing and obtain City approval prior to implementation;
6. Monitor and concur in construction activities to ensure end products meet City specifications;
- 7.* Perform or have performed material, composition and other tests required to ensure City specifications are met; sanitary and water main work.
8. Periodically check that curb, storm sewer work and pavement and detention pond grades are in accordance with approved plans;
9. For pavement construction, perform the following stage inspections and record date of each:
 - a. Curbs are built to line and grade;
 - b. Subgrade meets grade and compaction specifications;
 - c. Base rock meets grade and compaction specifications;
 - d. Leveling course meets grade and compaction specifications;
 - e. Wearing course meets grade and compaction specifications.

The City shall be given forty-eight (48) hour notice of impending stage inspections.

10.*Periodically certify to the City the amount of work completed to enable release of monies or a reduction of deposit amount;

11.* File with the City a completion report which contains:

- a. The original of the project completion certification;
 - b. A complete copy of the project diary initialed by the inspecting Engineer;
 - c. 2 (two) complete sets of as-built plans;
 - d. The results of material tests, compaction tests and soil analysis as detailed in the project diary.
- 12.** Call to the City's attention within two (2) working days all plan changes, changes in construction, change in materials, stop work orders or errors or omissions in the approved plans or specifications.

1.6 As-Built Drawings

Following acceptance of construction by the City, The Owner or Engineer shall submit four (4) full sets of reproducible as-built drawings of the project, marked "As-Built" on each page stamped and signed by the Engineer of Record for preliminary review. An electronic copy of the as-built drawing set shall also be submitted in PDF format as well as in AutoCad DWG or DXF format. The drawings shall describe any and all revisions to the previously approved construction plans and be of a quality and contrast suitable for reproducing and microfilming. If the

as-built submittal is not acceptable, the City will return the drawings and provide the Engineer notice of what is requested for re-submittal. Only complete sets will be accepted, the City will not accept individually corrected sheets. Electronic files shall be submitted to the City staff via email as an attached file. Alternatively, electronic files may be submitted on CD media or other approved means using the above indicated file format.

1.7 Requirements for Acceptance of Public Improvements

1.7.1 General

Upon Completion of the project and prior to acceptance of the streets and the public utilities by the City of Tillamook, the Project Engineer shall prepare and submit the following to the City of Tillamook:

- a. Two reproducible sets along with electronic sets per section 1.06 shall be submitted to the Public Works Department.
- b. The Project Engineer shall prepare and submit a letter of certification that the project was constructed in accordance with the approved plans and specifications. The Project Engineer shall include copies of all test results for the project.
- c. If the public improvements are part of a subdivision or partition of land, The Developer shall submit to the Public Works Director a draft of the final subdivision or partition plat showing all required utility easements on the face of the final subdivision or partition plat.
- d. The Project Engineer or Developer shall request in writing the City of Tillamook accept the streets and public utilities as a part of the public improvements, subject to a one year (minimum) written warranty provided by the Developer (or Developers) of the project improvements (warranty period may be longer if so determined by the City). The project improvements will only be accepted by the City of Tillamook based upon a City Council resolution to accept jurisdiction of the right-of-way and the public improvements therein.

All plans for streets and public utility systems shall be prepared by a Professional Engineer registered in the State of Oregon and shall meet the requirements of Section 1.03.

1.8 Warranty

The Owner shall furnish high quality equipment, supplies, and materials, and perform the work in accordance with these specifications. Any failure or omission of any City inspector to reject any defective equipment, supplies, materials, or work shall not be construed as an acceptance thereof nor release the Owner from his obligations hereunder. Upon notification of any deficiency by City, the Owner shall properly reconstruct or replace any defective equipment, supplies, materials, or work at its own expense at any time upon discovery of the defect during the period of construction and for the full guarantee period following

acceptance of the work and indemnify City from any claims resulting therefrom. The Owner shall guarantee all materials and equipment furnished and work performed for a minimum period of one year from the date of formal written acceptance by the City or longer warranty period if required by the written warranty agreement. The Owner further warrants and guarantees for a minimum period of one year from the date of final acceptance of the system that the completed system is free from all defects due to faulty materials or workmanship and the Owner shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects.

1.9 Design Exceptions

1.9.1 General

Any application for an approved exception to the standards and specifications in these Standards must be submitted as a Design Exception under this section.

The City Engineer may approve a design exception request so long as it does not conflict with the Community Development Code, the City Land Development Permit Decision, or any other relevant approvals, except as expressly provided herein. If the requested exception involves public safety, the City will rule in the direction of safety.

1.9.2 1.Exception Process

1.9.3 Criteria for Exception

The City Engineer may grant an exception to the adopted specifications or standards when any one of the following conditions is met:

- a. The specification or standard does not apply in the particular application;
- b. Topography, right-of-way or other geographic conditions impose an economic hardship on the applicant and an equivalent alternative is available which can accomplish the same design objective;
- c. A minor change to a specification or standard is required to address a specific design or construction problem which if not allowed will result in an undue economic hardship.

1.9.4 Submittal

Requests for a design exception shall be submitted in writing to the City Engineer.

Requests for an exception to access spacing requirements shall be submitted in writing to the City Engineer. Access standards are set by the Community

Development Code, with the City Engineer delegated the authority to grant exceptions under the same criteria stated above in Section 1.09.1.

All requests shall state the applicable standard, the desired exception, the reason for the request and a comparison between the applicable specification or standard and the exception as to function, performance and safety. If an exception is requested due to economic hardship, the request shall contain a statement on the impact to project cost with and without the exception. The request for exception shall be prepared by an Engineer and shall be stamped and signed by the Engineer.

Any approved exception to these Standards shall be documented and should reference nationally accepted guidelines, specifications, or standards. The approval of an exception shall not compromise public safety or the intent of these standards. An exception shall be approved only if the City Engineer finds that the alternative proposed by the Engineer meets the criteria in 1.09.1 and will provide equivalent or better function, performance, and safety.

1.9.5 Review

The request for design exception will be reviewed by the City Engineer who will make one of the following decisions within fourteen days:

Approve as requested; Approve with changes;

or

Deny with an explanation

Approval of a request in one project shall not constitute a precedent for other projects.

1.9.6 Appeal

The Applicant may appeal the City Engineer's decision to deny an exception to the City Manager. The appeal shall be submitted in writing within fourteen (14) days of the City Engineer's decision. The appeal shall be in writing, state the relevant facts, applicable provisions of these Standards, specific grounds for appeal, the relief sought, and shall include all information on which the applicant relies. The applicant shall have the burden of proving that an error was committed or that the requested exception meets the criteria of 1.09.1 and equals or exceeds the applicable standard as to function, performance, and safety.

The City Manager shall review all the information submitted with an appeal. The City Manager may request additional information from the Engineer, and may

meet with the parties. The City Manager shall render a decision in writing in the same format as provided in 1.09.3. The City Manager's decision shall be final.

1.9.7 Responsibility for Exceptions

The Engineer shall be responsible for informing the City Engineer, in writing, at the time of submittal of plans, of any desired exceptions to these standards. Only those exceptions so noted and expressly approved by the City Engineer, in writing, shall be lawful and permitted, notwithstanding approval of the overall "red-line" or "as-built" drawings.

1.10 Alternate Methods

Alternate methods or materials not explicitly approved in these Standards will be considered for approval on the basis of the intent, objectives, and applications set forth in these standards. Any alternative shall meet or exceed the minimum requirements set forth in these Standards. Those seeking such approvals shall make application in writing. Approval of any major or significant deviation or waiver from these Standards, as determined by the City Engineer, will be in written form.

The written application is to include the manufacturer's specifications, testing results, design drawings, calculations, maintenance and operation requirements, and other pertinent information. Request for approval of alternatives or waiver of a standard may be submitted with initial or subsequent plan submittals and shall include a written report with all pertinent information necessary to review, evaluate and approve the request. All requests will be reviewed and evaluated on a case-by-case basis.

CHAPTER 2 - Roads

2.1 Functional Classification

The functional classification of existing and proposed roads is established by the Transportation System Plan.

The Transportation System Plan classifies roads as:

- a. State Arterial;
- b. Arterial road;
- c. Collector road;
- d. State Collector
- e. Local road;
- f. Truck Route;

Exhibits 1-11 are to be used for the design of roads under the jurisdiction of the City of Tillamook.

2.2 Accesses

A Right-Of-Way permit is required to establish the location or to construct an access within the road right-of-way.

A separate Right-Of-Way permit is not required when the access is constructed in conjunction with the roadway improvements of an approved and permitted subdivision or development, and the Facilities Permit includes the subject access.

2.3 Half-Street Improvements

Half-street improvements may include any or all of the following elements:

- a. Dedication of right-of-way and easements;
- b. Grading and subgrade preparation;
- c. Construction or reconstruction of roadway paving, which may include:
 - 1. Turn lanes and bike lanes where required by the applicable standards and
 - 2. A minimum ten (10) feet of additional roadway paving width beyond the centerline of the right-of-way, if determined necessary by the City Engineer;
- d. Construction or reconstruction of concrete curb and gutter;
- e. Pavement markings where required;
- f. Construction or reconstruction of concrete sidewalk paving;
- g. Construction, reconstruction or extension of underground storm

- drainage, fire, water or sanitary sewer facilities;
- h. Relocation of existing utilities where required;
- i. Illumination at access points and along roadways where required; and
- j. Street trees where required.
- k. Other improvements as required through a development review process.

2.4 Width

Exhibits 1-5 summarize road width standards by functional classification. Public utility and sidewalk easements beyond the right-of-way are required in some instances

2.5 Number of Lanes

The number of travel lanes, between intersections, is defined by the Transportation System Plan. Additional width may be required at intersections in accordance with the Transportation Plan. Additional right-of-way may be needed with the additional width requirements.

2.6 Easements

Easements, adjacent to the right-of-way, may be needed.

Sidewalk and utility easement requirements are shown in Exhibits 1-6 for the various functional classes.

Easements for special features such as, but not limited to, walls, slopes, or other unique items may also be required.

Sidewalk easement width shall be determined during plan review and shall be measured to the back of the sidewalk. This applies to all road classifications.

2.7 Vision Clearance

The vision clearance shall conform to the requirements as shown in the CCT, Section § 153.021.

2.8 Lane Restrictions During Construction

Arterial roads shall not have lane restrictions between 6:30 AM to 9 AM, and 3:30 PM to 6:30 PM.

Collectors, and local roads with an ADT greater than 1000, shall not have lane restrictions between 7:00 AM to 8:30 AM, and 4:00 PM to 6:00 PM.

Lane restrictions during construction will all require a traffic control plan which must be reviewed and approved by the City Engineer before any closures can

occur.

2.9 Road Restoration

All road construction projects shall include road restoration. Road restoration shall return all existing infrastructure affected by the construction activities, including haul routes, to original or better condition. Infrastructure may include, but is not limited to, the road surface, base and subgrade, drainage facilities, signs, safety appurtenances, bicycle and pedestrian facilities, vegetation or landscaping and any other feature.

Restoration of road surfaces may require extensive rehabilitation, including, but not limited to slurry seal, overlay, grind and inlay, and full depth reclamation.

Projects which are outside of the City limits but will require use of City streets for equipment and material deliveries are subject to the requirements of this section.

2.10 Technical Specifications

2.11.1 General

This document, the 2008 Oregon Standard Specifications for Construction and ORS 209.140-155, define the requirements for protection of existing survey monuments during any construction and for setting new survey monuments following construction of new streets and roads.

2.11.2 Existing Survey Monuments

Any monuments that may be subject to destruction or disturbance shall be protected in accordance with ORS 209.140, 150, and 155.

Whenever an existing section corner, quarter corner or donation land claim corner monument or accessory, appears to be in danger of damage or destruction by any construction, the Engineer shall notify the County Surveyor in writing, not less than ten (10) working days prior to construction. The County Surveyor shall reference the monument prior to construction and replace it following construction. The County Surveyor may require a deposit for the anticipated cost and shall be reimbursed for all expenses from said replacement by the party responsible for the construction.

As per ORS 209.150 and 155, no person shall willfully or negligently remove, destroy or deface any existing survey monument. If damage cannot be avoided, the monument shall be referenced and replaced, under the direction of a Professional Land Surveyor, according to state law. A copy of the field notes referencing such monuments shall be provided to the County Surveyor if

requested by the County Surveyor. Failure to comply with this provision is subject to penalty according to ORS 209.990.

2.11.3 New Survey Monuments

Centerline monuments, as shown in the Standard Drawings, shall be installed at all centerline intersections of roads (including intersections with existing roads), point of curvature and point of tangency of each curve, and at all centers of cul-de-sacs, turn-arounds, or as required by the County Surveyor to sufficiently monument the right-of-way. Monuments shall be set by a registered Professional Land Surveyor or by the County, at the option of the County. If monuments are set by a Professional Land Surveyor, they shall file a record of survey complying with ORS 209.250 and any additional requirements set forth by the County Surveyor. If a monument box is used, or required to be used by the County, it shall be not less than twelve (12) inches inside diameter and shall be approved by the County Surveyor before its installation. The County Surveyor may approve an eight (8) inch inside diameter box.

2.12 Road Design

2.12.1 Subgrade Evaluation

Soil testing to obtain the strength characteristics of the soil is required for all roads for analysis and design of the road structural section. Soil tests shall be taken from undisturbed samples of the subgrade materials that are expected to be within three (3) feet of the planned subgrade elevation. One sample is needed for each five hundred (500) feet of roadway and for each visually observed soil type. Soil tests are required for a minimum of two (2) locations. Test results shall be correlated to the resilient modulus for asphalt pavement design.

Recommendations for both summer and winter construction shall be included. Both sections shall be included in the construction plans.

For Portland Cement Concrete:

The selected design structural strength of the soil shall be consistent with the subgrade compaction requirements. That is, the strength and compaction moisture content at optimum to slightly over optimum needs to be specified. The soils report shall address subgrade drainage and ground water considerations for year round conditions.

2.12.2 Structural Design

2.12.2.1 General

This section applies to the design of the road structural section and nonstructural concrete applications.

Structures not included in the Standard Drawings of this document shall be designed and constructed in accordance with the requirements of the AASHTO Load and Resistance Factored Design (LRFD) Bridge Design Specifications as modified by ODOT's 2013 Bridge Design and Drafting Manual (BDDM).

Modular curbs can be used upon City's approval

2.12.2.2 Structural Section

Roads may be constructed of:

Full depth asphaltic concrete (AC), or
Asphaltic concrete on a base of crushed rock or treated subgrade, or Portland cement concrete (PCC) on a base of crushed rock, treated subgrade, or hot mix asphalt concrete (HMAC).

Structural Section will be designed using the ODOT Pavement Design Guide with the following modifications:

Added Layer Coefficients (Table 3; Section 5.4):

Material	Layer Coefficient (per 1 inch of thickness)
Cement treated subgrade (treated in place)	0.10

Use of cement treated aggregate base (CTB) is not allowed.

Use a twenty (20) year design life.

2.12.2.3 Asphalt Pavement Design

The wearing surface of hot mix asphalt concrete (HMAC) roads shall be Level 2, 1/2 inch dense graded HMAC, for local roads and Level 3, 1/2 inch dense graded HMAC, for arterials, collectors, and commercial roads.

Minimum total thickness of asphalt concrete pavement section shall be three (3) inches. A minimum of two lifts is required with a minimum lift thickness of 1-1/2 inches and a maximum lift thickness of three (3) inches.

Asphalt Concrete shall be designed using the ODOT Contractor Mix Design Guidelines for Asphalt Concrete.

All pavements will be tested for compaction and the compaction requirement for any level of mix and any lift shall be 92% of Moving Average Maximum Density (MAMD).

The compaction level requirement for Level 2, Level 3, and Level 4 job mix formulae designs is as follows:

Level 2 mix, 75 gyrations

Level 3 mix, 100 gyrations

Level 4 mix, 125 gyrations

Warm Mix Asphalt (WMA) additive or process may be used. Additives or processes shall be approved by the City prior to use. When using WMA the minimum temperature behind the paver shall be 185 degrees Fahrenheit.

2.12.2.4 Portland Cement Concrete Pavement Design

Minimum thickness of Portland Cement Concrete shall be six (6) inches. Minimum mix design shall be Class 4,000 – 1-1/2" paving concrete.

2.12.2.5 Nonstructural Concrete

Nonstructural concrete used within the right-of-way shall be commercial grade concrete. For pavements, a mix design will be required.

2.12.3 Vertical Alignment

Alignments shall meet the following requirements:

Minimum tangent road gradients shall be one-half (0.5) percent along the crown and curb.

Maximum road gradients shall be fifteen (15) percent for neighborhood routes, and local roads, and ten (10) percent for all other roads. Grades in excess of these maximums must be approved through the design exception process by the City Engineer.

Within a minimum twenty (20) feet of the ultimate design edge curb line of the intersecting road, the slope of the chord of the vertical curve shall measure five (5) percent or less, for one or more of the following conditions:

- a. Local roads intersecting with a neighborhood route or higher functional classification road or
- b. Stop controlled intersection approaches

Grade changes with an algebraic difference greater than one (1) shall be accomplished with vertical curves.

Road grades, intersections and superelevation transitions shall be designed to not allow concentrations of storm water to flow over the pavement.

Off-set crowns are allowable per Standard Drawing No. 3030-ST.

Roads intersected by interim roads (not constructed to ultimate standards) shall be designed to match both present and ultimate vertical alignments of the intersecting roads. The requirements of this standard shall be met for both present and ultimate conditions.

Vertical curves shall conform to the values found in Exhibit 7 and 8.

Grade breaks up to an algebraic difference of one (1) may be applied at the point of vertical curvature and the point of vertical tangency.

Slope easements shall be dedicated or obtained for the purposes of grading outside of the rights-of-way.

Design of sag vertical curves may use shorter curves with the installation of additional road lighting.

Design of a 15 mph sag vertical curve is allowed at the intersection of a local road with a local road or a local road with a neighborhood route. The 15 mph design speed is only allowed on the intersecting stop-controlled local road approach. This is based on the reasonable speed of a vehicle turning from the through road to the intersecting road.

Exhibit 6

DESIGN CONTROLS FOR **CREST** VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

DESIGN SPEED	K
15	3
20	7
25	12
30	19
35	29
40	44
45	61
50	84
55	114

Exhibit 7

DESIGN CONTROLS FOR **SAG** VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

DESIGN SPEED	K*
15	10
20	17
25	26
30	37
35	49
40	64
45	79
50	96
55	115

WHERE:

$$K = L/A$$

A = Algebraic Difference in grades, percent. L = Length of vertical curve, feet.

The minimum sag vertical curve length is defined by: $L=AV^2/46.05$

Where V = road design speed

* Values may be reduced if road lighting is present for sag vertical curves. AASHTO Roadway Lighting Design Guide shall serve as a guide.

2.12.3.1 Superelevations

See Exhibit 9 for superelevation guidance.

Superelevation transitions will be designed with two-thirds of the transition in the tangent section and one-third of the transition in the curve section.

2.12.3.2 Vertical Clearance to Overhead Structures

The vertical, plumb distance between the ultimate design roadway surface and

the bottom of any structure or device spanning any portion of the roadway shall be no less than 17 feet. If a structure is proposed to be constructed over a section of roadway which is a sag vertical curve, the minimum clearance will be based on a WB-67 vehicle (assume a minimum vehicle height of 14 feet). The minimum vertical clearance will be the greater of 17 feet or the distance measured from the top of the vehicle to the ultimate design roadway surface as the vehicle traverses under the structure, plus 1 foot.

2.12.4 Horizontal Alignment

Alignments shall meet the following requirements:

Centerline alignment of improvements shall be parallel to the centerline of the right-of-way.

Centerline of proposed road extension shall be aligned with the existing road centerline.

Horizontal curves in alignments shall meet the minimum radius requirements as shown in Exhibit 9.

Exhibit 8

DESIGN SPEED/CENTERLINE RADIUS-MINIMUMS

ARTERIALS AND ALL COLLECTORS

Design Speed(MPH)	Slope/R min.					
	(e)-4%	(e)-2.5%	(e) 0%	(e)2.5%	(e) 4%	(e) 6%
25	335'	300'	255'	220'	205'	185'
30	500'	445'	375'	325'	300'	275'
35	710'	630'	530'	455'	420'	380'
40	970'	855'	710'	610'	560'	510'
45	1285'	1125'	930'	795'	730'	660'
50	1665'	1450'	1190'	1010'	925'	835'
55	2240'	1920'	1550'	1300'	1190'	1060'
60	3000'	2525'	2000'	1655'	1500'	1335'

ALL LOCAL ROADS, AND ALL TRUCK ROUTES

Design Speed(MPH)	Slope/R min.					
	(e)-4%	(e)-2.5%	(e) 0%	(e)2.5%	(e) 4%	(e) 6%
25	195'	185'	165'	150'	145'	135'
30	330'	305'	270'	245'	230'	215'
35	530'	475'	415'	370'	345'	320'

NOTES:

The radii in Exhibit 8 may not provide adequate intersection sight distance per Section 2.12.6. The Engineer may need to consider larger radii or sight distance easements to meet the City's intersection sight distance standards.

For Exhibit 8, off right-of-way runoff shall be controlled to prevent concentrated cross flow in superelevated sections.

If superelevation is used, road curves shall be designed up to a superelevation rate of 0.04 ft/ft. A superelevation of 0.06 ft/ft may be allowed if the curve is long enough to provide an adequate superelevation transition.

On local roads, requests for design speeds less than 25 mph may be considered through the design exception process based on topography, right-of-way, alternative design features previously approved through the land development permit process or geographic conditions which impose an economic hardship on the applicant. Requests must show that a reduction in centerline radius will not compromise safety. Additional sign posting may be required for designs below 25 mph. In no case shall the design speed for alternative designs be less than 20 mph for local roads and 15 mph for alleys.

2.12.5 Transitions

When required, transitions into dedicated turn lanes and islands shall use 10 (ten) degree reverse curves, $R=5729/D$ where R is the radius in feet and D is degree of curvature.

Pavement width transitions from a narrower width to a wider width shall be designed with a three (3) longitudinal to one (1) lateral taper. Delineation, as approved by the County, shall be installed to define the configuration.

For pavement width transitions from a wider width to a narrower width, the length of transition taper shall be determined as follows:

45 MPH or greater: $L = S \times W$

Less than 45 MPH: $L = (W \times S^2) / 60$

Where L = minimum length of taper (ft.) S = Design speed (MPH)

W = Edge of pavement to Edge of pavement offset width (ft)

Delineators, as approved by the City, may be installed to define the configuration. Maximum delineator spacing is the numerical value of the design speed, in feet (i.e. thirty-five (35) foot spacing for thirty-five (35) MPH).

In situations where a tapered transition from wider to narrower pavement cannot be provided, a barricade shall be installed at the end of the wider section of the road and a painted taper shall delineate the edge of the driving lane, as approved by the City. The barricade shall conform to the Standard Drawing 6020-ST. If the wider section does not provide an additional travel lane, a barricade is required with the painted transition optional.

Prior to incorporating a barricade into the design, evaluate intersection sight distance for driveway and road intersections. Intersection sight distance shall be certified for the affected accesses.

2.12.6 Intersections

The minimum requirements for intersections are:

The interior angle at intersecting roads shall be kept as near to ninety (90) degrees as possible and in no case shall it be less than seventy-five (75) degrees.

A tangent section shall be carried a minimum of thirty-five (35) feet each side of intersecting curb lines.

The area of influence of an intersection includes the curb returns and, where these facilities are required, the road segment from the intersection to the entry transitions of the dedicated turn lanes.

Curb radii at intersections shall be as shown in Exhibit 10 for the various functional classifications. The right-of-way radii at intersections shall be sufficient to maintain at least the same right-of-way to curb spacing as the lower classified road.

Sidewalk curb ramps shall be provided at all corners of all intersections, regardless of curb type, and shall conform to the Standard Drawings.

Grades and cross-slopes of sidewalks and crosswalks must meet ADA requirements.

2.12.7 Clear Zones

The engineer is responsible for meeting AASHTO guidelines.

For uncurbed roadways, apply the guidance in the AASHTO Roadside Design Guide.

For curbed roadways, in no case shall the horizontal clearance from face of curb to the face of non-breakaway obstacles be less than 2.0ft.

Exhibit 9

TURNING RADII (FEET)

Edge of Pavement/Curb - Minimums*

Road Classification	Arterial Road	Collector Road	Neighborhood Route Road	Transit Road	Commercial Industrial Road	Local Road
Arterial Road***	55	40	30	40	40	25
Collector Road***	40	40	30	40	40	25
Neighborhood Route *** Road	30	30	30	30	30	25
Transit Road***	40	40	30	40	40	25
Commercial Industrial Road***	40	40	30	40	40	25
Local Road**	25	25	25	25	25	<u>15</u>

* If bike lane or on-road parking exists, above radii maybe reduced by five (5) feet.

** On 28' Local Roads, parking shall be prohibited within 50' of a public road intersection.

*** Note: Curb return radii shall anticipate truck turning requirements and larger radii may be required.

2.13 Drainage Design

2.13.1 General

The following establishes the requirements for the design of drainage facilities.

These requirements shall apply to all storm drainage facilities in existing and proposed City Road rights-of-way, public rights-of-way, and public drainage easements. Storm drainage facilities include, but are not limited to ditches, culverts, inlets, drainage structures, swales, Low Impact Development Approaches (LIDA) and detention facilities, creeks and rivers.

2.13.2 System Components

Inlets, manholes, pipes and culverts (see Standard Drawings 1080-ST, 1081-ST and 1082-ST for culverts) shall be designed and constructed in conformance with the requirements of this document.

On Local roads and Neighborhood Routes, tee connections from the mainline storm sewer to catch basins and inlets may be used. On Arterial and Collector Roads, tee connections from the mainline storm sewer to catch basins and inlets may only be used when the mainline storm sewer is 36 inches diameter or larger, or the connecting lateral is no longer than 3 feet. In all cases, manholes shall be required at the low point of the road and in intersections. Tee connections for private area drains, subgrade drains and wall drains may be allowed but connection to a public drainage structure is preferred.

CG-30 and CG-48 type inlet catch basins, are required on all curbed City roads. Where sidewalk is curbtight, inlet manhole lids shall have no more than 2 holes. Where utility conflicts prevent designs with these inlets, the Engineer may propose another inlet design through the design exception process. Catch basins (CG-2) are allowed at the low point of the roadway.

Water quality facilities for private development are not allowed within the ultimate right-of-way for the road classification.

2.13.3 Ditches and Culverts

Proposed roadside ditches shall be properly sized to pass all required flows, have a maximum depth of no more than two (2) feet as measured from the shoulder of the road and side slopes no steeper than 2 horizontal to a 1 vertical. Proposed roadside ditch improvements that do not meet these requirements shall be piped. Urban roadside ditch culverts shall have mitered ends meeting the slope requirements in Standard Drawing 1082-ST.

2.13.4 Standard Drawings

Drainage structures shall conform to the applicable detail drawings in these standards or, where appropriate, of the Oregon Standard Drawings.

2.14 Ancillary Facilities

2.14.1 Bikeways

Bikeways shall be required in accordance with the Transportation Plan and CCT, Section § 153.022.

Bicycle facilities shall meet the requirements of this document and the AASHTO's Guide for the Development of Bicycle Facilities, as amended and adopted by ODOT's Highway Design manual, Chapter 13, Pedestrian and Bicycle, 2012. The design of the horizontal alignment, grade, sight distance, intersections, signing, marking, structures, drainage and lighting shall conform to these standards.

Structural sections of bicycle facilities on roads shall conform to the road structural section. Off road bicycle facilities shall be constructed over a sterilized, compacted subgrade with one of the following structures:

Four (4) inches of asphalt concrete (full depth), or
Three (3) inches of asphalt concrete with four (4) inches of three-quarter inch (3/4) minus crushed rock base, or
Four (4) inches of Portland cement concrete with two inches (2) of three-quarter inch (3/4) minus crushed rock base.

When bikeways are adjacent to curbs all inlets shall be type CG-30 or type CG-48.

There are no requirements for separate bicycle facilities on local roads or Neighborhood Routes. It is assumed that all local roads adequately accommodate bicycle riders, without a special bike lane designation.

2.14.2 Cul-de-sacs, Eyebrows and Turnarounds

The following specifies the minimum requirements for cul-de-sacs, eyebrows, and turnaround areas. Other turnaround geometrics may be used when conditions warrant and City Engineer approves the design and application of its use. Tillamook County Fire Defense Board Fire Code Official must be consulted for the following.

Cul-de-sacs, eyebrows and turnaround areas shall be allowed only as described in CCT, Section § 153.022.

Cul-de-sacs shall not be more than six hundred (600) feet in length. The length of a cul-de-sac shall be measured along the centerline of the roadway from the

near side ultimate face of curb of the nearest through traffic intersecting road to the farthest point of the cul-de-sac ultimate face of curb.

The minimum curb radius for cul-de-sac bulbs shall be forty-five (45) feet and the right-of-way radius shall be sufficient to maintain at least the same right-of-way to curb spacing as in the adjacent portion of the road.

Cul-de-sacs, eyebrows and turnaround areas shall have a ten (10) foot continuous public utility easement and a sidewalk easement extending outside the right-of-way around these features.

The minimum curb radius for transitions into cul-de-sac bulbs shall be twenty-five (25) feet and the right-of-way shall be sufficient to maintain the same right-of-way to curb spacing as in the adjacent portion of the road. See Standard Drawing 2210-ST.

Alternative turnaround designs, including hammerheads, shall conform to the Oregon Fire Code as approved by the Tillamook Fire District.

An Eyebrow Corner may be used on a local road where expected ADT will not exceed five hundred (500) vehicles per day. See Standard Drawing 2220-ST.

2.14.3 Private Roads

Requirements for private roads are contained in the CCT, Section § 153.022.

2.14.4 Stub Roads

Stub roads allow for future extensions. Reserve strips are required for the protection of public welfare. Reserve strips and street plugs are required to preserve the objectives of street extensions as contained in CCT, Sections § 153.022 and § 153.029. A barricade and future development sign will be installed in accordance with the Standard Drawings.

2.14.5 Curbs and Grading

The requirements for curbs and cross-slope grading for roads are:

Urban arterial and collector roads shall include curbs on both sides except in the situations of interim width improvements. Emergency mountable curb shall be required on urban arterial and collector roads. See Standard Drawing 2010-ST. Interim width urban roads shall have six (6) foot wide shoulders with a minimum 2' paved width adjacent to the road at the road cross-slope. The paved shoulder section shall be the same structural section as the rest of the road.

Grading outside the improved areas shall be as shown in Exhibits 1-6.

Cross-slope of the road section shall be no less than two and one-half (2.5) percent and no greater than five (5) percent. Whenever possible, the crown of the road shall be the same elevation as the top of the curbs.

2.14.6 Sidewalks

Sidewalks shall be constructed according to Standard Drawing 2110-ST. The location and width of the sidewalks shall be as required by the City Zoning Ordinance Design Standards.. Curbside sidewalks may be allowed as determined and approved in the Development's Notice of Decision. ADA requirements shall be met.

Property corners located within the sidewalk shall be monumented, to the County Surveyor's specifications by a licensed surveyor following the installation of the sidewalk.

In the instances where it is required to install sidewalks and a permanent sidewalk cannot be constructed or standards met, a temporary walkway may be constructed and a deposit made to the City equal to the cost of the sidewalk at ultimate line and grade, including any supporting structures. The temporary sidewalk may consist of Asphaltic Concrete or Portland Cement Concrete to a width, location and structure approved by the City Engineer.

The standard five (5) foot wide sidewalk shall be constructed a minimum of four (4) feet from the back of curb to the front edge of the sidewalk except as specified in the special area road section.

Locations with mail boxes and other roadside furniture shall provide for a minimum 5 foot wide sidewalk clearance. Construct in accordance with Standard Drawing 2120-ST.

2.14.7 Driveways

Driveways shall conform to the Standard Drawings 1010-ST, 1020-ST, 1030-ST, 1040-ST, 1050-ST, 1060-ST, 1080-ST, 1081-ST, and 1082-ST.

Driveways shall not be permitted on roads with existing or proposed motor vehicle access restrictions as set forth in the Transportation System Plan.

The spacing requirements shall conform to the requirements of the CCT, Sections § 153.022 and § 153.026.

Surface runoff shall not be allowed to flow over commercial driveways or sidewalks.

On roads without curbs, the driveway shall be of the same material as the roadway from the edge of the roadway to the right of way line or 15' from the edge of the roadway, whichever is greater.

2.14.8 Railings

Fall hazard protection: Within the public right-of-way, any drop greater than 30 inches shall be protected with fencing or railing, meeting Section 1013, Guards, of the 2010 Oregon Structural Specialty Code (OSSC). This also applies to culvert headwalls, culvert ends, wing walls and retaining walls or other locations subject to City approval.

2.14.9 Guardrails

The following specifies the minimum requirements for the location and type of guardrails:

Guardrails shall be designed and constructed per Oregon Standard Drawings. The decision of whether to install a guardrail or not shall be based on information found in AASHTO publication, Roadside Design Guide.

2.14.10 Retaining Walls

Retaining walls shall be used if slopes flatter than 1 1/2H:1V cannot be achieved.

Retaining walls shall be constructed to a height where the retained slope is no more than 1 1/2H:1V

Retaining walls supporting the road (fill walls) shall be located within the right-of-way. Access easements shall be granted for inspection and maintenance of the retaining walls.

Fill walls within the right-of-way shall accommodate future utilities. No grids or tiebacks shall be in the top 5' of walls within the right-of-way unless the grids or tiebacks are protected by a concrete cover.

No rockery walls are allowed to support the roadway prism.

Vertical drops 30" and greater shall have fall protection fencing meeting the above requirements in section 2.14.9, Fences:

Retaining walls that support private property above and along the frontage of roadways (cut walls) shall be located outside the right-of-way.

2.14.11 Subgrade Drainage

Subgrade road drainage must be considered in the design of each road. Subgrade drains shall be designed and constructed per the results and recommendations of the soils report. In the event that no subsurface drainage is required based on the soils report, a transverse perforated drain pipe shall be installed below the lowest subbase rock section at the low point of each sag vertical curve. The subgrade drains are for the purpose of collecting and conveying subgrade water only, not surface runoff. They are not to be considered part of the storm drainage system for storm drain pipe sizing purposes or for storm drain maintenance.

Subgrade drains shall connect to and drain into the public storm drainage system at inlet structures, manholes or road side ditches. See Standard Drawing 5010-ST. Surge from the storm drainage system shall not be allowed to back up into the subsurface drains. Alternatives to subsurface drainage measures may be used if approved by the City Engineer.

2.14.12 Landscape

Landscaping for public transportation facility improvement projects shall meet requirements listed in the CCT, Section § 153.014 and § 153.026.

2.14.12.1 General

Landscape materials shall meet landscaping requirements listed in CCT § 153.026. At maturity, street trees shall not conflict with overhead utilities. Plant material shall not be invasive or noxious.

Landscape material shall be selected and installed in such a way so as not to create a hazard.

Landscape material and any ancillary devices (i.e. stakes, guy wires, cages, etc.) shall be selected and installed in such a way so as to never block, impede, interfere, damage or otherwise hinder any travel lane, sidewalk, curb, gutter, sight distance, drainage facility, traffic control device, street light, utility, structures or any other natural or man-made object.

Existing landscaping, that is approved for preservation, shall be protected during construction.

2.14.12.2 Locations

Perimeter Areas:

Perimeter areas shall be planted with street trees, ground cover or shrubs as discussed in the CCT, Section § 153.026.

Planter Strip Areas:

Planter strip areas, identified in CCT, Section § 153.022, may be planted with approved street trees.

Wide Sidewalks:

Wide sidewalks may have approved street trees installed within tree wells, at the discretion of the City. Other approved landscaping may be allowed.

Curbed Center Medians:

Curbed center medians may be textured Portland cement concrete, pavers, or planted with an approved shrub or ground cover.

2.14.12.3 Materials and Installation

Street Trees

Street trees shall be provided along each segment of roadside frontage that is improved to ultimate width and the frontage includes new or existing sidewalks.

Street trees shall be sized, spaced and planted in accordance with CCT, Section § 153.026 and Chapter #93. The actual number of trees installed and their physical locations can be a function of mature canopy spread and avoiding conflicts with other features and requirements including but not limited to utility locations, sign locations, access points, sight distance and other appurtenances.

Street trees may be installed in the public right-of-way or on private property according to the CCT, Section § 153.026 and Chapter 93.

Street trees shall have a minimum trunk caliper of two (2) inches DBH. Street trees shall have a minimum branch height of eight (8) feet.

Street trees shall be non-fruit bearing.

Ground Cover

Ground cover may be provided along each segment of roadside frontage that is improved to ultimate width and includes new or existing sidewalks as stated in CCT, Section § 153.026.

Shrubs

Shrubs shall be supplied in minimum one (1) gallon containers or 9"-10" burlap balls

with a minimum spread of 12" to 15" as described in CCT, Section § 153.026, or bare rootstock in accordance with sizes and conditions specified in the *American Standard for Nursery Stock (2004 ed)*.

Wildflower Mix

Wildflower mixes may be commercially available according to the Oregon Standard Specifications for Construction. Seeding shall promote maximum vegetative cover to minimize weed establishment. All plantings in City ROW must meet requirements of the CCT, Section § 153.026.

Pavers

Pavers shall be pre-cast interlocking concrete blocks or variously dimensioned travel grade non locking pavers installed per manufacturer's recommendations.

Mulch

Mulch shall meet Oregon Standard Specifications for Construction, for materials and installation and shall be free of noxious weed seeds or plants and which contain no substance detrimental to plant life.

2.14.14 Traffic Management Devices

Traffic Management devices are permitted on local roads and Neighborhood Routes under two circumstances:

- a. New Construction – If required as a condition of approval in the land development permit process, and reviewed by the local fire marshal. These devices should be considered and may be required by the City Engineer where excessive speed or cut through traffic is predictable.

The following traffic management devices may be approved for new construction:

1. Curb extensions, see Standard Drawing 2230-ST
2. Medians
3. Speed cushions; see Standard Drawings 6060-ST -6063-ST

Colored or textured pavements are allowed. Pavers and thin surface treatments will not be allowed.

The installation of curb extensions requires the Engineer to examine the impacts of curb extensions to emergency vehicles. Of special concern is the turning radius at intersections.

If final engineering plans are submitted for approval where curb extensions or medians are proposed but are inconsistent with a project's land use approval, those plans shall not be approved.

- B. Existing roads modified by development - Additional traffic management devices are available such as: speed cushions, intersection diverters, traffic circles, and raised crosswalks. Use of these measures (and other traffic management devices) shall be reviewed by the local fire marshal and approved by the City Engineer through the design exception process. If such a request is submitted prior to development review, the exception will be subject to subsequent land development permit approval. If the exception request is submitted after development review, it will be forwarded to the City Engineer for review. If the City Engineer determines that it is consistent with the development approval and determined not to have significant land use impact, it will then be reviewed as a design exception request.

2.14.15 Traffic Calming

The City Engineer may require traffic management devices on local and neighborhood route roads, where issues of speeding or cut-through traffic are predictable.

2.14.16 Utilities

Dry Utilities

Utilities shall be located outside of the paved road if at all possible to avoid future cuts in paved roads. See Standard Drawing 3040-ST. On all phased (interim) road improvements, the necessary utilities shall be stubbed across the interim improvements to assure cuts are not necessary when the road is expanded to its full width.

Underground utilities intended to provide direct service to adjacent properties with future connections shall not be located in the full-width paved section of a road to be constructed. If all service connections are installed and extended beyond the full-width section prior to paving the road, underground utilities can be located in the paved section, if approved by the City Engineer.

Underground utilities being constructed along existing paved roads shall not be located under the existing pavement unless approved by the City Engineer. Underground utilities that must cross an existing paved road shall not be installed

by any method which cuts the pavement unless approved by the City Engineer.. The City Engineer may require an overlay or inlay of part or full road width when any pavement cut is made.

Underground utilities shall be buried a minimum depth of thirty (30) inches as measured from finished grade to top of utility.

Utility poles shall be installed behind the sidewalk when possible.

Utility poles to be relocated within the proposed improvement areas must be removed from the clear zone prior to placing sidewalk, curb, base rock and paving.

Whenever possible, manholes, valves, vaults and other structures shall be located out of wheel paths and ADA ramps. If they are located in sidewalks, solid lids with no holes shall be used.

All above ground structures and facilities shall meet the requirements for clear zones in section 2.12.7.

Wet Utilities

Sanitary and storm sewer systems, waterlines and gas lines shall be installed per these standards or the gas company standards as approved by the City Engineer. The City Engineer may require an overlay or inlay of part or full road width when any pavement cut is made.

All above ground structures and facilities shall meet the requirements for clear zones in section 2.12.7.

Whenever possible, manholes, valves, vaults and other structures shall be located out of wheel paths, bicycle lanes, ADA ramps and driveways. If they are located in sidewalks, lids with a maximum of 2 holes shall be used.

Pipes to be abandoned shall be removed or filled, as approved by the City Engineer.

2.15 Roadway Illumination

2.15.1 General

Roadway lighting plans will be prepared to meet the land development permit conditions of the specific project and the roadway classifications within the project. Design responsibility lies with the Project Design Engineer.

2.15.2 Plan Submittal

Plans shall be prepared in accordance with the requirements of Section 1.03 above, with the following additional requirements:

Numerically identify each luminaire and standard and locate by centerline station and offset from centerline. Provide the information in table form.

Specify light source (fixture and type), wattage, luminaire arm length and mounting height.

Provide illumination levels in tabular format, including average foot-candles, average to minimum ratio, maximum to minimum levels and lamp lumen depreciation factor. Provide an electronic file of the photometric calculations.

Conduit sizes, wire sizes, locations of electrical service and connection details.

Junction box type and location.

General lighting installation notes, including the type, manufacturer and specification of proposed equipment. All equipment must be included in the most current PUD approved street lighting equipment list.

The Engineer shall stamp and sign the illumination plans as part of the complete project plan set.

2.15.3 Design Standards

The light distribution pattern selected shall be that which gives the most cost-effective luminaire spacing for the design light level. Light dispersion above the 90° (horizontal) plane shall meet the dark sky requirements.

2.15.3.1 Luminaires, Luminaire Poles and Mast Arms:

Luminaires shall be as approved by PUD cobra-head fixtures with flat lenses and full cutoff optics unless prior approval is granted.

The following types of luminaire poles and arms (if included in the current PUD approved street lighting equipment list) will be acceptable for street lighting:

Round shaft poles and mast-arms Metal davit style poles and mast-arms

Other types of poles and mast-arms must have prior approval of the PUD and City Engineer through the design exception process before acceptance on the proposed plans.

The designated lighting pole and fixture of a new lighting installation shall consider adjoining systems and shall be consistent with adjoining systems when practical and economically feasible.

Alternative energy sources shall be considered where applicable and practical. Such sources shall specifically include solar energy applications as they become practical for road lighting levels of power and output.

2.15.3.2 Pedestrian Conflict Area Classifications

The classifications in this section are used solely for the purpose of determining appropriate roadway illumination.

Three classifications of pedestrian night activity levels and the types of land use with which they are typically associated are given below:

High—Areas with significant numbers of pedestrians expected to be on the sidewalks or crossing the streets during darkness. Examples are downtown retail areas, near theaters, concert halls, stadiums and transit terminals.

Medium—Areas where lesser numbers of pedestrians utilize the streets at night. Typical are downtown office areas, blocks with libraries, apartments, neighborhood shopping, industrial, older city areas and streets with transit lines.

Low—Areas with very low volumes of night pedestrian usage. These can occur in any of the cited roadway classifications but may be typified by suburban single family streets, very low density residential developments, and rural or semi-rural areas.

2.15.3.3 Pedestrian Lighting

The pedestrian scale lighting should be adequate to illuminate pedestrian facilities that are a part of town centers and plazas, off-street pathways and multi-use paths, or other areas identified in the Transportation Plan or Community Plan. Typically, this lighting is positioned over the sidewalk, rather than the street, at equal to or less than 16 feet above the sidewalk. Design information can be found in the RP-8 publication of the Illuminating Engineering Society of North America, "American National Standard Practice for Roadway Lighting." Illumination at midblock crossings will be evaluated on a case by case basis.

2.16 Alternate Local Roads

2.16.1 Alternate Local Roads

Alternate local roads are intended to provide a flexible design standard to respond to mixed use developments. It is the intent of this standard to provide general guidelines to the minimum widths and other design criteria. Use of alternate local road designs shall occur when required or approved as part of a result of a land development permit action that includes a provision specifically requiring design to one of the alternate local road standards. The road and sidewalk width, landscape features, and neighborhood traffic management devices set forth in the land development permit action shall be followed in road design.

Minimum standards shall be adequate to meet the requirements of the ADA and to allow emergency vehicular access. All alternate local road designs shall be approved by the fire marshal. Alleys will require special consideration as to the intended use; special consideration shall be given to utilities, garbage trucks and emergency vehicle access.

2.16.2 Neighborhood Traffic Management

Traffic Management devices are permitted on local roads and Neighborhood Routes under two circumstances:

- a. New Construction – If required as a condition of approval in the land development permit process, and reviewed by the fire marshal. These devices should be considered and may be required by the City Engineer where excessive speed or cut through traffic is predictable.

The following traffic management devices may be approved for new construction:

- 1 - Curb extensions, see Standard Drawing 2230-ST
- 2 - Medians
- 3 - Speed cushions, see Standard Drawings 6060-ST -6063-ST

Colored or textured pavements are allowed. Pavers and thin surface treatments will not be allowed.

The installation of curb extensions requires the Engineer to examine the impacts of curb extensions to emergency vehicles. Of special concern is the turning radius at intersections. A detail is included; see the Curb Extension Standard Drawing.

If final engineering plans are submitted for engineering approval where curb extensions or medians are proposed but are inconsistent with a project's land use approval, those plans shall not be approved.

- b. Existing roads modified by development - Additional traffic management devices are available as such as: speed cushions, intersection diverters, traffic circles, and raised crosswalks. Use of these measures (and other traffic management devices) shall be reviewed by the fire marshal and approved by the City Engineer through the design exception process. If such a request is submitted prior to development review, the exception will be subject to subsequent land use approval. If the exception request is submitted after development review, it will be forwarded to the City Engineer for review.

2.16.3 Traffic Calming

The City Engineer may require traffic calming devices on local and neighborhood route roads, where issues of speeding or cut-through traffic are predictable.

Exhibit 1 2-Lane Arterial Road Section Exhibit 2 4-Lane Arterial Road Section
Exhibit 3 Collector Road Section Exhibit 4 Local Road Section
Exhibit 5 Alternate Local Road Section

Exhibit 6 Design Controls for Crest Vertical Curves Based on Stopping Sight
Distance

Exhibit 7 Design Controls for Sag Vertical Curves Based on Stopping Sight
Distance

Exhibit 8 Design Speed/Centerline Radius-Minimums Exhibit 9 Turning Radii

Exhibit 10 Roadway Design Lighting Levels Table-Average Maintained Illuminance

Exhibit 11 Illuminance for Intersections

CHAPTER 3 – Storm Conveyance Systems

3.1 General Provisions

- a. The provisions of this chapter shall apply to all public conveyance systems within City jurisdiction. Interpretations of such provisions and their application in specific circumstances shall be made by the City.
- b. Except as otherwise provided, the extension of the public conveyance systems to serve any parcel or tract of land shall be done by and at the expense of the Property Owner or applicant. The City reserves the statutory right to perform the work or cause it to be performed and bill the Owner for the cost or to pursue special assessment proceedings as otherwise provided by City Ordinance or permit conditions.
- c. Except as otherwise provided, the Standard Drawings shall be followed for all aspects of conveyance design. Variances from the Standard Drawings shall require approval of the City.

3.2 Extension of Public Storm Conveyance Systems

A development requiring connection to the public sewer system shall extend the public storm conveyance systems to allow all adjacent uphill parcels to be served by the public systems. The City may waive this requirement for sanitary sewer or storm conveyance when one of the following conditions is met:

- a. The proposed connection to the public conveyance system is for an existing building.
- b. Topography prevents uphill parcels from being effectively served by the required conveyance extension.
- c. The uphill parcels are outside the Urban Growth Boundary and, in the City's view, the boundary is not likely to be expanded in the future to include uphill parcels.
- d. An analysis is provided demonstrating that the uphill parcels are likely to be served via another routing of the conveyance system and the City agrees with this analysis.

When physical extension of the conveyance system is not required for reasons other than topography, the City may require an easement for future sanitary sewer or storm conveyance.

3.3 Conveyance Easements

3.3.1 General

- a. Public storm conveyance facilities, not located within public right-of-way, shall be located within an easement granted to the City.
- b. The City may require that an area 5 feet in all directions from the edge of a manhole, catch basin, cleanout, or field inlet be encompassed in a public right of way or easement granted to the City.
- c. Access easements shall be provided to manholes or outlet pipe locations, where required by the City.

3.3.2 Standard Conveyance Easement Widths

- a. Easements for single lines shall be a minimum of 15-feet wide. Easements for multiple lines shall be a minimum of 20-feet wide. The City may require wider easements in the following situations:
 - 1. Large trunk sewers
 - 2. Sewers greater than 10 feet deep
 - 3. Areas with topographic constraints such as steep slopes or sites where bore pits may be required in the future.
- b. When a pipe will be stubbed, the easement shall extend a minimum of five feet past the end of the stub.

3.3.3 Reduced Conveyance Easement Widths

- a. Conveyance easement widths may be reduced to 10-feet for single lines and 15-feet for two lines if all the following conditions are met to the satisfaction of the City:
 - 1. A reduced easement width is needed due to the location of existing buildings that prevent a standard easement width.
 - 2. Another conveyance route within the development site and public right-of-way is not possible due to topography.
- b. When reduced conveyance easements are allowed, all the following additional requirements shall apply to the conveyance system within the reduced easement:
 - 1. The sewer shall be constructed of ductile iron pipe or, where approved by the City, enclosed within a steel-casing pipe.
 - 2. Manholes shall be located at the points where the conveyance system enters and exits the reduced easement section.
 - 3. The sewer lines shall not be more than 8-feet deep.
 - 4. If feasible, sewer lines shall not be located directly on the property line.

3.3.4 Encroachments

- a. Privately owned structures constructed within conveyance easements shall require an encroachment agreement with the City. Approval of the encroachment is at the discretion of the City.
- b. The encroachment agreement shall allow the City to remove the structure, as needed, to access the conveyance system. Replacement of the structure shall be at the property owner's expense.
- c. The City may require special protection for the conveyance system in the vicinity of the encroachment.

3.4 Flow Determination

3.4.2 Flow Determination – Storm Conveyance

- a. Land Use Assumptions for Flow Determination
25 and 100-year flows for design of conveyance systems shall be based on full build-out of the upstream basin based upon the most recent approved City Comprehensive Plan and realistic estimates of development densities in areas included in recent additions to the Urban Growth Boundary.
- b. Computational Methods for Runoff Calculations
Unless an alternative method is approved by the City in writing, calculation of storm runoff used for conveyance design shall be based on one of the following methods with the limitations on use of each listed.
 - 1. Rational Method**
The rational method is allowed with the following limitations:
 - A)** Drainage sub basin area cannot exceed 1 acre for a single calculation without approval from City.
 - B)** The time of concentration shall be five minutes when computed to be less than five minutes.
 - C)** Rainfall intensities shall be from the IDF table included in the Appendix as Standard Drawing 1275-ST.
 - 2. Santa Barbara Urban Hydrograph (SBUH)**
SBUH methods shall be based on the following information:
 - A)** The rainfall distribution to be used within the City is the

design storm of 24-hour duration based on the standard NRCS Type 1A rainfall distribution using the chart in Standard Drawings CA-1285.

B) Curve numbers shall be derived from the National Resources Conservation Service's (NRCS) runoff curve numbers contained in Technical Release 55 (TR-55)- Urban Hydrology for Small Watersheds.

C) Soil types shall be derived from the NRCS Soil Survey for Tillamook County.

3. TR-55

The TR-55 method developed by NRCS when used for runoff calculations shall be based on the following information:

A) A standard NRCS Type 1A storm shall be assumed.

B) Curve numbers shall be derived from the National Resources Conservation Service's (NRCS) runoff curve numbers contained in Technical Release 55 (TR-55)- Urban Hydrology for Small Watersheds.

C) Soil types shall be derived from the NRCS Soil Survey for Tillamook County.

3.5 Storm Conveyance Design Considerations

3.5.1 Design for Full Build Out

Storm drainage facilities shall be designed and constructed to accommodate all future full build-out flows generated from upstream property.

3.5.2 Storm Conveyance Design Criteria

- a. Design of the storm conveyance system shall provide a minimum 1 foot freeboard between the hydraulic grade line and the top of the structure or finish grade above pipe for 25-year post development peak rate of runoff.
- b. Design surcharge (hydraulic grade line) in pipe systems for the 25-year design storm event shall not cause flooding in portions of a habitable structure, including below floor crawl spaces, or otherwise create a hazard or danger to the health and safety of the public.
- c. Flows in streets during the 25-year event shall not run deeper than 4 inches against the curb or extend more than two feet into the motor vehicle travel lane.
- d. The overland flow component to accommodate the 100-year event shall not be allowed to flow through or inundate an existing building.

- e. Open channel systems shall be designed for minimum 1 foot freeboard from bank full provided no structures are impacted by the design water surface elevation.
- f. A maximum overland distance for sheet flow used in calculations shall be 50 feet.

3.5.3 Upstream Impacts

Modifications to the existing on-site storm drainage facilities shall not restrict flows thereby creating backwater onto off-site property to levels greater than the existing situation, unless approved by the impacted off-site Property Owners and the City. When approved, the off-site Property Owner(s) shall agree to and sign a permanent easement legally describing the location of the backwater storage and authorizing the use of their property for stormwater drainage and detention purposes. The easement shall be in a form approved by the City.

3.5.4 Downstream Impacts

- a. Downstream restrictions that create backwater during the 25- year design storm in the current or post-development condition may be required to be removed by the developer, at the discretion of the City.
- b. Removal of downstream obstructions shall not be allowed if the removal will cause, contribute, or exacerbate damage from flooding to existing buildings or dwellings in the 100-year design storm.
- c. When downstream restrictions are not removed, an on-site detention facility shall be required.

3.5.5 Cross-Lot Drainage

- a. Developments shall not materially increase or concentrate runoff onto adjacent properties, except when the runoff is contained in an existing drainage way.
- b. Developments shall accommodate existing off-site drainage entering a development site so as to not impact upstream property owners.

3.5.6 Dissipation of Runoff Discharge

Runoff exiting a development site shall be discharged with adequate energy

dissipaters to prevent downstream damage.

3.6 Pipe Design

3.6.1 Pipe Size

a. General

- 1.** Storm conveyance systems shall be designed to accommodate flows identified under Section 3.04, with storm design also recognizing the design considerations of Section 3.05.
- 2.** The Manning's coefficient value ("n") to be used in design shall be 0.013 for pipes.
- 3.** Sewers of sizes which are obviously larger than necessary for flows, but what are designed oversized to meet grade requirements, are not allowed.
- 4.** Sewers shall not decrease in size as they move downstream.

b. Storm Sewer Minimums

- 1.** Pipes from catch basins to the main line in the public right-of way shall be minimum nominal 8-inch diameter.
- 2.** Main line pipe shall be a minimum nominal 12-inch diameter.
- 3.** Storm pipes serving roof drains and area drains and located out of a public street right-of-way with no requirement to be extended shall be a minimum 6-inch diameter.

3.6.2 Location

- 1.** Storm pipes within a public right of way for a local street with curbs, shall be located in the street and 5 feet from the curbs, unless otherwise approved by the City.
- 2.** Storm pipes within a public right of way for a collector or arterial may be located behind and parallel to the curb with the approval of the City.
- 3.** Storm pipes in easements shall be located no closer than 5 feet from the easement line, unless otherwise approved by the City.

3.6.3 Separation

General

The City of Tillamook Pipe line separation is a necessity for public health and safety, property and the quality of the pipeline contents. Pipeline failure or damage can result in pipeline contamination. Even the process of excavating one pipeline for repair can create risk to the adjacent pipelines. The City of Tillamook utilities lines require space for installation, repair and replacement.

No other lines or conduits are allowed within 18" in any direction or 5' if running parallel of a City owned utility line; sewer lines must be 10'. This space is required but may be adjusted for site specific problems, if approved by the City of Tillamook Public Works and other agencies with jurisdictions. If other agencies such as DHS and DEQ or other Federal or State entity separation rules apply, the greatest distance will apply. All crossings of City of Tillamook utilities require a permit from the City of Tillamook.

3.6.4 Alignment

Public storm sewers shall be laid on a straight alignment and at uniform grade.

3.6.5 Grade

Storm sewers shall have sufficient slope to maintain a minimum flow velocity of 2.5 feet per second when flowing full, except that storm sewers in flow-through systems, as defined in subsection 3.07.2(a)(3), shall have a minimum flow velocity of 3.0 feet per second.

3.6.6 Steep Slopes

Sewers on slopes in excess of 20 percent shall be secured with anchor walls or metal pipe slope anchors as shown in Standard Drawings.

3.6.7 Pipe Cover

- a. In paved areas or areas anticipated to receive vehicular traffic, pipe cover shall be measured from the top of the paved surface (finish grade) to the upper exterior surface of the pipe barrel. The pipe bell shall not intrude into the subbase. In areas without pavement or vehicular traffic, pipe cover shall be measured from finish grade to the upper exterior surface of the pipe barrel.
- b. Except as specified in subsection c, minimum cover shall comply with Table 3-2, unless an exception is approved by the City.

TABLE 3-2 MINIMUM PIPE COVER

Type of Pipe	Paved Areas (inches)	Unpaved Areas (inches)
Other Approved Pipe	*	*
RCP Class III	30	18
RCP Class IV	24	12
RCP Class V	18	6
AWWA C900	24	12
AWWA C905	24	12
Ductile Iron	18	6

*As determined by the City Engineer

- c. Pipe cover for catch basin leads in paved areas can be reduced to 18 inches if AWWA C900 or C905 pipe is used.

3.7 Storm Conveyance Structure Design

3.7.1 Manholes

1. Manholes shall be provided at least every 350 feet, at every grade change, and at every change in alignment.
2. Manhole lids shall not be in a wheel path of the motor vehicle travel way.
3. All manholes shall be a minimum of 48 inches in diameter.
4. A detail shall be submitted with the plans where pipes enter or leave a manhole where the diameter of the pipe is larger than 24 inches or where more than four mainline connections are made.
5. A minimum of 8 inches of un-perforated wall separating the cut-outs or break-outs for the individual pipe connections shall be provided in manholes.
6. Where a connection is proposed to an existing manhole, elevation of the existing ledge, location of steps, and elevations of existing inlets and outlets shall be submitted with the plans.
7. Manholes constructed on lines with 12 inch or smaller pipes shall have a minimum 0.2 foot fall through the manhole unless otherwise approved by the City.
8. Where different size public conveyance pipes enter a manhole, the crowns of the upstream pipes shall be no lower than the crown on the downstream pipe without City approval.
9. A lateral entering a manhole at the end of the public conveyance system shall be designed so that the invert of the lateral is 6 inches above the invert of the outlet pipe.
10. All manhole bases shall be properly channelized.
11. No more than three side laterals or side sewers are allowed to be

connected to a manhole unless an exception is approved by the City.

- 12.** Manhole lids shall be in conformance with the Standard Drawings.

Additional Requirements:

- 1.** Manhole lids shall have a minimum of 12 inches of clearance from the edge of a curb and gutter.
- 2.** All piped inside drop manholes with 12-inch or larger pipe shall be a minimum of 60 inches in diameter.
- 3.** Permanent Clean Outs shall not be allowed in storm sewers. Temporary Clean Outs will be evaluated by the City on a case-by-case basis.
- 4.** Pipes entering manholes may have a maximum free fall of 2 feet as measured to the invert of the manhole base.
- 5.** A Curb Inlet Manhole or Modified Curb Inlet Manhole per Standard Drawings may be used in lieu of a manhole, when approved as part of a flow-through system. Standard inlets shall not be allowed in lieu of manholes in any system.

3.7.2 Catch Basins and Inlets

a. Types of Systems

1. Standard Catch Basin System

All catch basins shall be sumped. The main storm line shall not pass through any catch basins or sumped manholes unless approved by the City. No more than three catch basins may be connected in series before connecting to the main storm line. A ditch inlet or field inlet may be connected directly to the end of the main storm line.

2. Series Catch Basin System

Unsumped catch basins located on non-arterial and collector roadways are allowed provided a sumped manhole is constructed below the unsumped catch basins before the flow enters the main storm line. No more than three unsumped catch basins may be constructed above a sumped manhole. The main storm line may not pass through the catch basins or sumped manholes. No ditch inlet or field inlet may be part of a series of unsumped catch basins. All catch basins located on arterial or collector roadways that may receive wintertime sanding shall be sumped.

3. Flow-through Catch Basin System

This system is allowed within an arterial or major collector road, provided the main line storm pipe has a design velocity of at least 3.0 feet per second. All catch basins shall be sumped. An adequately sized water quality manhole is required at the

downstream end of the flow-through system.

4. Alternative systems including but not limited to: Bio Swales, Water Gardens, Pervious Pavement and other systems approved by the City

b. Design Considerations

1. All inlets and catch basins shall be designed to accept a 25 - year storm event. Grates shall, as far as practical, be designed to avoid failure due to accumulation of debris.

1.2 Storm water conveyance systems must be designed and installed so as to prevent oil and contaminants from entering the system.

2. Precast and poured in place catch basins, and gutter inlets are allowed.

3. All sumped catch basins shall be constructed with an 18-inch minimum sump.

4. The spacing of catch basins along a street shall be determined by the capacity of each catch basin to pass a 25 - year storm event. Where finish street grade is greater than or equal to 5 percent, catch basin spacing shall not exceed 250 feet. Where finish street grade is less than 5 percent, catch basin spacing shall not exceed 350 feet. In addition, catch basins shall be provided just prior to curb returns on streets with a centerline gradient of three percent or more and a street gutter drainage run of 100 feet or more.

5. Catch basins, except for CG-48 manholes shall be a maximum depth of 5 feet from the top of grate to the lowest pipe invert elevation, unless approved by the City.

6. The maximum distance for storm sewer connections between catch basins, inlets, and other structures shall be 250 feet.

7. In the case of inlets in streets, the maximum length of sewer between the inlet and a mainline structure shall be 40 feet for 10-inch pipe and 60 feet for 12-inch pipe unless additional length is required to cross the street right-of-way.

8. Tee connections from the main line sewer to catch basins and inlets may only be used in street rights of way if the lateral connecting the main line and the catch basin or inlet is no longer than 10 feet.

9. Inlet grates or tops shall be marked with "Dump No Waste" in accordance with the Standard Drawings.

10. Where design criteria and methodology are not specified in this Chapter, the following publications shall be used: ODOT Hydraulics Manual

A) Hydraulic Engineering Circular No. 12 (FHWA-TS-84-202) Drainage of Highway Pavements

3.7.3 Area Drains and Ditch Inlets

- a. Area drains in rear or side yards shall not be sumped and shall be properly channelized. Ditch inlets shall be equipped with an 18-inch sump.
- b. A main storm line shall not pass through an area drain or ditch inlet.
- c. Area drains or ditch inlets may be located at the upper terminus of a main storm line, may connect to the main storm line at a manhole, or may connect to the main storm line through a tee with a lateral no longer than 10 feet.
- d. The maximum acceptable intake flow rates for Type II area drains and ditch inlets with a grate angle of 30 degrees are shown in Table 3-3 where H is the Hydraulic Head measured in feet from the bottom of the grate to headwater and Q is the flowrate in cubic feet per second.

**TABLE 3-3
MAXIMUM INTAKE FLOW RATES FOR TYPE II AREA DRAINS AND DITCH INLETS WITH
GRATE ANGLE OF 30°**

H	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	7.0	10.0
Q	2.0	5.6	10.3	11.9	13.3	14.6	16.8	18.8	22.3	26.06

3.7.4 Constructed Channels

- a. Application

This section shall apply to open channels constructed to convey runoff to the existing public storm and surface water conveyance system. This section does not apply to design or construction of new roadside ditches or work within existing stream channels.

Development which re-grades existing roadside ditches or constructs new roadside ditches shall meet City of Tillamook Design Standards.

- b. Channel Design

1. Open channels shall be designed to prevent scouring of the channel.
2. Vegetation-lined channels shall be used whenever practicable as determined by the City. Rock-lined channels shall be used only where a vegetative lining will not provide adequate protection from erosion.
3. Where riprap protection is specified, riprap shall be placed over a woven geo-textile fabric.
4. Constructed open channels shall be sized to pass the required flows without causing erosion and shall have side slopes no steeper than 2H:1V.
5. No protruding pipes, culverts or other structures, which reduce or hinder the flow characteristics of the channel, will be allowed. Channels connections shall be designed to prevent scouring. All pipe connections shall match side slopes and incorporate a headwall.
6. Open channel designs shall be based on the minimum level of protection shown in Table 3-4.
7. The use of ditches, swales and side slopes for runoff control and runoff water treatment is encouraged but usually site specific. The City of Tillamook Public Works will consider plans on an individual basis.

TABLE 3-4
PROTECTION FOR NEW CHANNEL CONSTRUCTION

Velocity at Design Flow (fps)		Required Protection	Thickness (ft)	Min. Ht. above Design Water Surface (ft)
Greater than	Less than or Equal			
0	5	Vegetation Lining	Not Applicable	0.5
5	8	Bioengineered lining	Not Applicable	1
		ODOT Class 50 Riprap*	1.5	
8	12	ODOT Class 200 Riprap	2.5	2
12	20	Slope Mattress, etc.	Varies	2
20		Engineer designed		

* - The City may require ODOT Class 100 Riprap in areas with a likelihood of vandalism.

3.7.5 Culverts

a. Application

1. This section shall apply to culverts placed across streams and drainage ways. Culverts pass water under or through obstructions.
2. Culverts within FEMA floodplains shall be reviewed and approved by the local FEMA designated authority.
3. For culverts which convey flows from or through water quality sensitive areas; a local representative of Oregon Department of Fish and Wildlife (ODFW) or other applicable state or federal agency shall be contacted to determine if fish passage is required and to

identify site specific design criteria. All culverts shall be designed for fish passage in accordance with ODFW guidance for fish passage unless otherwise exempted by ODFW and the City.

b. Hydraulic Design

1. Culverts will be designed to safely pass the 25-year flow.

2. Headwater

A) For new culverts 18 inches in diameter or less, the maximum allowable design storm event headwater elevation (measured from the inlet invert) shall not exceed two times the pipe diameter or three times the pipe diameter with a seepage collar unless an exception is approved by the City. Minimum culvert size is 10".

B) For new culverts larger than 18 inches in diameter the maximum allowable design storm event headwater elevation (measured from the inlet invert) shall not exceed 1.5 times the pipe diameter unless an exception is approved by the City.

C) The maximum headwater elevation of a design storm event for new culverts shall be at least one-foot lower than the road or parking lot sub-grade and shall not cause flooding of adjacent property.

3. Inlet

For culverts 18 inches in diameter and larger, the embankment around the culvert inlet shall be protected from erosion by lining around inlet with rock or other protection. The lining shall extend upstream from the culvert a minimum of five feet and shall be as high as the designed headwater elevation.

4. Outlets

For culverts 12 inches in diameter and larger, the receiving channel of the outlet shall be protected from erosion by rock lining, bio-engineering, or other City approved energy dissipater.

5. Inlet Control Analysis

The headwater depth for pipes under inlet control shall be determined using the nomographs contained the Standard Drawings, ODOT

Hydraulics Manual, or a modeling methodology consistent with FHWA's HY8.

6. Outlet Control Analysis

The headwater depth for pipes under outlet control shall be determined using the nomographs contained in the Standard Drawings, the ODOT Hydraulics Manual, or a modeling methodology consistent with FHWA's HY8.

3.7.6 Outfalls

- a. Outfalls will be designed to prevent scouring at the outfall discharge and provide velocity reduction prior to discharge to the receiving channel.
- b. Where riprap protection is specified, riprap protection shall be placed over a woven geo-textile fabric.
- c. Outfalls shall be above the mean low water or tide level unless an exception is approved by the City.
- d. Engineered energy dissipaters, including but not limited to, stilling basins, drop pools, hydraulic jump basins, baffled aprons, and bucket aprons, shall be designed using published references such as Hydraulic Design of Energy Dissipaters for Culverts and Channels published by the Federal Highway Administration of the United States Department of Transportation, the ODOT Hydraulics Manual and others. The design reference shall be cited on the construction plan submittal.
- e. All outfalls shall be provided with a rock splash pad or other approved erosion control measure. Rock protection at outfalls shall be designed in accordance with Table 3-5.

**TABLE 3-5
ROCK PROTECTION AT OUTFALLS**

Discharge Velocity		Minimum Required Protection Dimensions				
Greater than	Less than or Equal	Type	Thickness (ft)	Width	Length (use greater of)	Height Over Crown
0	5	ODOT Class 50 Riprap*	1.5	Diam. + 6 ft	8 ft. or 4 x diam.	1 ft
5	10	ODOT Class 200 Riprap	2.5	Greater of: Diam. + 6 ft	12 ft. or 4 x diam.	1 ft
10		Engineered Energy Dissipater Required				

* The City may require ODOT Class 100 Riprap in areas with a likelihood of vandalism.

3.7.7 Headwalls

Pipe headwalls or other approved end protection shall be required where pipe material other than concrete or ductile iron is exposed in the design of an outlet or inlet pipe or where required to stabilize slope. Details of all headwalls and end protection shall be included in the construction drawings.

3.7.8 Trash Racks and Debris Barriers

If trash racks or debris barriers are required by the City for pipe or culvert systems, the Engineer shall submit the trash-rock-debris barrier system design to the City for approval.

3.8 Pipe and Fittings

3.8.1 General

The materials used shall be adequate to carry anticipated dead and live loads within the deflection limits specified by the manufacturer. All pipe and culverts shall have a minimum design service life of 75 years per Oregon Department of Transportation standards. Joints shall be gasketed unless otherwise approved by the City.

3.8.2 Materials

Materials shall be the following types or equal when approved in writing by the City.

a. Concrete Pipe-NRCP/RCP

1. Non-reinforced concrete pipe shall conform to requirements of ASTM C14. Unless otherwise specified, pipe shall conform to Class 3 design requirements.

2. Reinforced concrete, non-pressure pipe shall conform to the requirements of ASTM C76 or C655 and shall be of the class specified. Unless otherwise specified, pipe shall meet the design requirements of Wall B. Reinforced concrete low head pressure pipe shall conform to the requirements of ASTM C361.

3. Gaskets shall conform to the requirements of ASTM C443.

4. All concrete pipe shall be at least seven days old before it can be installed if it has been steam cured. If the pipe has not been steam cured, it must cure for a minimum of 21 days prior to use.

b. Ductile Iron Pipe-DIP

Ductile iron pipe shall conform to the requirements of ANSI A21.50-1 or AWWA C150-1, cement lined push-on joint. The minimum thickness class shall be Class 50 (up through 12-inch diameter pipe) and Class 51 (for 14-inch diameter and larger pipe). Ductile iron pipe and fittings shall also conform to the specifications for line and grade in subsection 3.08.3(a).

c. Polyvinyl Chloride Pipe-PVC

1. Type:

A) ASTM 3034 SDR 35 or SDR 26 dia. 4-15"

B) ASTM F-679 SDR 35 dia. 18-24"

C) ASTM C-900; D-1784 DR 18 dia. 4-12"

D) ASTM C-905; D-1784, DR 18 dia. 16-24"

2. Gaskets shall conform to the requirements of ASTM 477 and ASTM 3212.

d. A2000-PVC

All A2000 PVC pipe and fittings shall conform to ASTM F949 specifications.

- e. **PVC Rib**
PVC Rib pipe and fittings shall be made of PVC, as defined in ASTM D1784. The pipe stiffness shall correspond with the series as determined in accordance with ASTM D2412. Series 46 and 28 are allowed. Gaskets shall conform with ASTM 477.
- f. **Corrugated Polyethylene-CPP**
 - 1. Corrugated polyethylene pipe shall be double wall with watertight joints and fittings.
 - 2. CPP shall meet the following specifications:
 - A) AASHTO M 252, diameter 10 inches and less
 - B) AASHTO M 294 or ASTM F 2306, diameter 12 through 60 inches
 - 3. Spiral pipe is not acceptable.
 - 4. The connecting bands shall conform to the requirements of AASHTO M196, except the minimum width of bands for 12 inch and larger pipe shall be 12-inches. Minimum width for pipes less than 12-inches shall be 7-inches. The base metal of the connecting bands shall be the same base metal as that of the pipe. The gauge of the connecting bands may be two standard use thicknesses lighter than that used for the pipe, but not less than 0.060 of an inch thick. The band couplers shall be connected with stainless steel bolts of not less than ½ inch diameter.
 - 5. Corrugated aluminum pipe shall not be placed in a ditch in direct contact with hydrating Portland Cement or lime.
- h. **Fittings**
 - 1. **General**
Wye fittings shall be provided in the sewer main, when allowed, for side sewers. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered. All fittings shall be of the same materials as the pipe unless otherwise approved. Fittings shall be free from cracks and shall adhere tightly to each joining surface. All fittings shall be capped or plugged, and gasketed with the same gasket material as the pipe joint, fitted with an approved mechanical stopper, or have an integrally cast knockout plug. The plug shall be able to withstand all test pressures without leaking, and when later removed, shall permit continuation of piping with joints similar to those in the installed line.
 - 2. **Concrete Pipe**
Fittings shall be manufactured integrally and be of a class at least

equal to that of the adjacent pipe.

3. Ductile Iron

Fittings shall be mechanical or push-on of the class as specified.

Mechanical joint cast iron fittings shall conform to AWWA C110 and shall be of a class at least equal to that of the adjacent pipe. Push-on joint fittings shall be gray iron with body thickness and radii of curvature conforming to ANSI A21.10.

The inside diameter of the fittings shall match the inside diameter of the pipe.

4. PVC Pipe

Fittings shall conform to the applicable portions of the following specifications: ASTM D1785, ASTM D2729, ASTM D2466, ASTM 2467, ASTM D3033, and ASTM D3034. Fitting joints shall be the same as the pipe joints.

5. Line Tap Fittings.

A) Indexed PVC (polyvinyl chloride) Tee Saddle - manufactured in accordance with ASTM D-3034 with minimum cell classification of 12454B-C or 12364-C as defined in ASTM D-1784. Elastomeric seals meeting ASTM F-477 specifications, and are located at both the lead and skirt ends of the saddle. Stainless steel bands meeting series 300 and are a full 9/16-inch wide. This saddle is allowed on PVC, clay, IPS, concrete, asbestos cement, and PE pipe. See Standard Drawing 540.

B) Insert a Tee shall meet the same standards as the Indexed PVC Tee Saddle. This saddle is allowed only on thick wall pipe material, e.g., concrete, ductile iron, rib type plastic. See Standard Drawing 530.

i. Grout

Grout shall be Sika 212, Euco N-S, Five Star, or approved equal nonmetallic cementitious commercial grout exhibiting zero shrinkage per ASTM C-827 and CRD-C-621. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing.

3.8.3 Workmanship

a. Line and Grade

Survey control hubs for both line and grade shall be provided by the Engineer in a manner consistent with accepted practices. The Contractor shall establish line and grade for pipe by the use of lasers or by transferring the cut from the offset stakes to the trench at whatever intervals necessary to maintain the line and grade. The Contractor shall check line and grade as necessary. In the event that the limits prescribed in this Chapter are not met, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding further with the work. Variance from the established line and grade shall not be greater than 1/32-inch per inch of pipe diameter and shall not exceed 1/2-inch for line and 1/4-inch for grade, providing that such variation does not result in a level or reverse-sloping invert. Variation in the invert elevation between adjoining ends of pipe, including fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

b. Side Sewer Connections

All side sewer connections shall be made with wye fittings unless otherwise approved by the City. Tee stations will be staked by the Engineer.

c. Pipe Handling

The Contractor shall unload pipe only by approved means. Pipe shall not be dropped to the ground and shall not be dropped or dumped into trenches. The Contractor shall inspect all pipes and fittings prior to lowering into trench to ensure no cracked, broken, or defective materials are used. The Contractor shall clean ends of pipe thoroughly, remove foreign matter and dirt from inside of pipe, and keep it clean during laying and joining. The Contractor shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. The Contractor shall remove all damaged pipe from the job site.

d. Foreign Material

The Contractor shall take all precautions necessary to prevent excavated or other foreign material from entering into the pipe during the laying operation. At all times, when laying operations are not in progress, the Contractor shall use a mechanical plug at the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints. All foreign material shall be removed from the pipe prior to its acceptance by the City.

e. Pipe Laying

Pipe laying shall proceed upgrade with spigot ends pointing in the direction of the flow. After a section of pipe has been lowered into the prepared trench, the Contractor shall clean the end of the pipe to be joined, the inside of the joint, and the rubber ring (if required) immediately before joining the pipe, and make assembly of the joint in accordance with the recommendations of the manufacturer for the type of joint used. The Contractor shall provide all special tools and appliances required for the joint assembly. After the joint has been made, the pipe shall be checked for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints.

f. Movable Shield

When pipe is laid within a movable trench shield, the Contractor shall take all necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead. The bottom of the shield shall not extend below the springline of the pipe without recompacting the pipe zone.

g. Cutting Pipe

When cutting or machining the pipe is necessary, the Contractor shall use only tools and methods recommended by the pipe manufacturer and approved by the City. The Contractor shall cut cast iron or ductile iron pipe with saw or with rolling pipe cutter and shall not flame cut.

h. Transition Fittings

1. When joining different types of pipes, the Contractor shall use approved rigid fittings. No flexible fittings will be approved.

2. PVC couplers or adapters shall meet the ASTM 3034 SDR 35/C900 DR 18 D1784 specifications.

3. Ductile iron transition couplings shall meet the ASTM A536 80 for center and end rings, ASTM D2000 3 BA75 for gaskets and AWWA C 111 80 for bolts and nuts.

i. Pipe Bedding

The Contractor shall install pipe zone material uniformly on both sides of the pipe up to the spring line of the pipe. Material shall be compacted to ensure proper support within the haunching area.

j. Line Taps

1. Line taps shall be core drilled unless approved otherwise by the City. Core drilled holes shall be done using a cylinder style hole saw for plastic pipe material or a diamond core bit for concrete and ductile iron pipes.

2. Prior to installation of the tee, the area around the cored hole shall be clean and free of all rough edges.

3. While installing the tee, no rock, dirt, or debris shall be allowed to enter the main sewer line.

4. The Contractor shall install 3/4-inch minus gravel in the pipe zone around the line tap, from 4-inches below the pipe or to undisturbed ground and to 6-inches above the pipe.

5. Solid copper #12 tracer wire or tracer wear shall be installed on top of pipe.

6. The sewer main shall be a minimum of two sizes (nominal inside diameter) larger than the line tap.

7. A minimum main sewer pipe wall thickness of 0.35 inches shall be required in order to use an Inserta-tee.

3.9 Testing and Acceptance

3.9.1 General

a. Sequence of Testing

Testing shall occur in the following order. At the City's discretion, failure of any of the tests may require all testing to be completed again.

1. Compaction
2. Placement of base rock
3. Mandrel
4. Smoke Testing
5. Video

b. Type of tests

1. Storm sewers:

All gravity storm systems shall be video inspected, pass the required compaction test in accordance with Section 7.02.3(b)(6), and a deflection test for flexible pipes. All details of testing procedures shall be subject to approval of the City.

c. Test Equipment

The Contractor shall furnish all necessary testing equipment and perform the tests in a manner satisfactory to the City.

3.9.2 Line Cleaning

Prior to the inspection of storm systems by the City, the Contractor shall ball and flush and clean all parts of the system. The Contractor shall remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the system at or near the closest downstream manhole. If necessary, the Contractor shall use mechanical rodding or bucketing equipment. Upon the City inspection of the system, any foreign matter still present shall be flushed and cleaned from the system as required.

3.9.4 Deflection Test for Flexible Pipe

- a. Sewers constructed of flexible pipe materials shall be deflection tested. The test shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the nominal pipe diameter unless otherwise specified by the City. The mandrel shall be a rigid, nonadjustable, odd-numbering-leg (9 legs minimum) mandrel having an effective length of not less than its nominal diameter. Testing shall be conducted after placement of base rock for streets and after the line has been completely balled and flushed out with water, compaction tests have been completed and accepted.
- b. The Contractor will be required to locate and repair any sections failing to pass the deflection test and to retest the section.

3.9.5 Video Inspection of Gravity Systems

All sewers shall be video inspected and recorded in accordance with the order prescribed in Section 3.09.1 prior to City acceptance of the systems. All pipes shall be thoroughly flushed immediately prior to the video inspection. A 1-inch target ball shall be placed in front of the camera. If the system is video inspected by a private firm or entity other than the City, a copy of the video recording and a written TV Inspection Report on a form approved by City, shall be supplied to the City. The video recording shall be recorded in color and on an electronic format as approved by the City. All problems discovered during video inspection shall be noted on the video recording and the written report.

3.9.6 Video Inspection for Warranty Acceptance

The storm lines shall be video inspected during the one year warranty period to determine any defects in the system that are to be corrected by the developer or

Contractor.

3.10 Bores

3.10.1 General

The carrier pipe in all bores shall be installed within a steel case, unless otherwise approved by the City.

3.10.2 Installation

- a. Casing
The casing shall be smooth steel of a size to permit proper construction to the required line and grade. The steel casing shall be fabricated in sections for field welded joints. The casing wall thickness shall be a minimum size of 1/4-inch.
- b. Pipe Supports
The sewer pipe shall be supported on three sides by pipe supports. Pipe supports shall be approved by the City.
- c. Placing Fill in Casing
The annular space shall be filled between the casing and pipe completely with lean grout or sand to prevent pipe flotation.
- d. Concrete Seals
After the sewer pipe has been tested and approved, concrete plugs shall be poured at each end of the casing.

3.11 Other Requirements for Public Storm Conveyance Systems

3.11.1 Surveying

The Owner's Engineer or Surveyor shall be responsible for establishing the location of the sanitary and storm sewer system by means of construction stakes offset along the center lines prior to commencement of construction. Moving upstream, there shall be a construction stake placed within 25 feet of each manhole, and at no more than 100-foot intervals along the mainline. Each lateral location shall be staked.

3.11.2 Railroad Crossings

Crossing of railroad rights-of-way shall be done in a manner which conforms to the requirements of the railroad having jurisdiction. If bonds or certificates of insurance protection are required, they shall be furnished by the Contractor or Owner to the railroad company concerned. The City shall be named as an additional insured.

Actual permits or easements for such crossings shall be obtained by the Owner and all terms for such permits or easements shall be met by the Owner and Contractor.

3.11 Laterals

3.11.1 General Provisions

- a. The specifications contained herein, together with the State of Oregon Uniform Plumbing Code and all other applicable requirements of federal, state, and local law shall govern the installation of laterals.
- b. The provisions of City Ordinances requiring permits, fees, and other requirements shall be complied with prior to the start of work on any portion of the storm pipeline systems.

3.11.2 Planning Considerations

- a. Where a parcel requiring connection to a public storm conveyance system cannot connect through a lateral meeting the requirements of this section, then extension of the public conveyance system shall be required. This extension of the public system is in addition to the requirements of Section 3.02.
- b. Each parcel shall be served by individual laterals, except in the following situations:
 - 1. Duplexes, townhouses, and other buildings that cross property lines may be served by a single storm lateral.
 - 2. Two adjacent single-family dwellings or two duplexes may be served by a single storm lateral where, in the judgment of the City, all the following conditions are met:
 - A) An existing public street must be trenched to install the lateral(s).
 - B) The elevation of the lowest floor with plumbing in the buildings to be served does not differ by more than 1 foot.
 - C) The laterals are at least 6 inches in diameter and meet all requirements for public sewer construction as specified in Chapter 3 of these standards.
 - D) A cleanout meeting the requirements of Standard Drawing 500 is installed at the boundary of the right of way line or at a location approved by the City.

3.11.3 Design Considerations

a. Gravity Service

1. Laterals shall provide gravity service to a parcel.
2. Storm laterals shall provide gravity service to the roof drains of buildings on a parcel.
3. The City may require the minimum first floor finished floor elevations to be shown on the plans to demonstrate that gravity service can be provided.

a. When allowed by the Building Official, laterals may cross a single adjoining property if the following criteria are met:

1. The portion of the lateral on the adjoining property has a minimum 3 feet of cover over the pipe and the pipe is ductile iron.
2. The portion of the lateral on the adjoining property contains no bends.
3. The lateral crosses the adjoining property in a private easement that is a minimum of 10 feet wide.
4. A copy of the private easement is provided to the City, demonstrating the legal right of the parcel being served to install and maintain a private lateral on the adjoining property.
5. The portion of the lateral crossing the adjoining parcel is less than 100 feet long.
6. The lateral can be used for only one property.
7. The lateral crossing is not one of a number of lateral crossings in a new development designed to avoid constructing a storm sewer extension.
8. The Engineer provides justification, to the satisfaction of the City, that the crossing is needed.

- c. Side sewers shall be less than 50 feet in length. The City may approve side sewers in excess of 50 feet in extraordinary circumstances.
- d. Side sewers shall connect to the mainline sewer with a 45 degree wye or connect to a manhole at an angle of 60 to 90 degrees from the mainline sewer.
- e. Side sewers shall contain no bends.

- f. A minimum grade of 2 percent is required for side sewers, unless a lesser grade is approved by the City.
- g. The use of weepholes in place of storm laterals shall be allowed where all the following conditions are met:
 - 1. Adequate fall exists so that foundation drains discharge by gravity through the weepholes or other approved discharge point.
 - 2. Calculations are provided with submitted plans showing pipe slope and cover meet the minimums required by the City.
 - 3. All portions of the lot can be adequately drained so runoff does not cross onto other property.

3.11.4 Installation

- a. Material
Side sewer pipes shall meet the requirements of Section 3.08.
- b. Excavation and Backfill
All excavation and backfill for laterals shall comply with Section 8.02.
- c. Markings
 - 1. Laterals shall be marked with a detectable underground magnetic tape or single strand #12 copper wire.. The magnetic tape or wire shall be placed from the main pipeline to the end of the lateral with 18-inches vertical separation between the tape/wire and pipe. The magnetic tape shall be green in color and have the following marking:

A) CAUTION STORM DRAIN BURIED BELOW

A green 2 x 4 plastic stake and 3M locator ball shall be installed at the end of the storm lateral extending from the invert of the pipe to at least 3 feet above the ground surface. The stake shall be marked indicating that it is a storm lateral as well as with the length of the marker itself. A #12 solid core green wire shall be placed alongside the 2 x 4. Trinangulated measurements and reference shot photographs will be required

2. The location of laterals shall be indicated by a permanent marker, acceptable to the City.

A) Where the sewer is in a street with curbs, the marker shall be on the curb.

B) Where the sewer is in a street without curbs, the marker shall be on the sidewalk.

C) Where the sewer is in a street without curbs or sidewalks, the Engineer shall present to the City for approval an alternative permanent marking method.

D) A cleanout located on the private side of the right-of-way boundary is an acceptable permanent marker.

3.12 Flood Management Design Standards

3.12.1 Purpose

The purpose of these standards is to reduce the risk of flooding, prevent or reduce the risk to human life and property, and maintain the functions and values of floodplains, such as allowing for the storage and conveyance of stream flows through existing and natural flood conveyance systems.

3.12.2 Flood Management Areas Defined

a. Flood management areas shall include, but are not limited to, the following:

1. Land identified within the 100-year floodplain and floodway as shown on the Federal Emergency Management Agency Flood Insurance Riskmaps (FIRM).

b. Applicants shall use the most recent and technically accurate watershed model information available as approved by the City, to determine flood areas.

3.12.3 Design Criteria

The standards that apply to the flood management areas apply in addition to local, state, and federal restrictions governing floodplains and flood hazard areas.

- a.** All fill placed in a floodplain shall be balanced with an equal amount of soil material removal and shall not decrease floodplain storage capacity at any stage of a flood (2, 25, or 100-yr event). No net fill in any floodplain is allowed except when all of the following conditions are met:

 - 1.** When an area has received special protection from floodplain improvement projects which either lower the floodplain, or otherwise protect affected properties;
 - 2.** Where the exceptions comply with adopted master plans, watershed management plans, or subbasin plans, if any; and
 - 3.** When all required permits and approvals have been obtained in compliance with FEMA rules and other local, state, and federal laws regarding fill in floodplains.
- b.** Large areas may not be excavated in order to gain a small amount of fill in a floodplain. Excavation areas shall not exceed the fill areas by more than 50 percent of the square footage, unless approved by the City.
- c.** Any excavation dug below the winter "low water" elevation shall not count toward compensating for fill since these areas would be full of water in the winter and not available to hold stormwater following a rain. Winter "low water" elevation is defined as the water surface elevation during the winter when it has not rained for at least three days, and the flows resulting from storms have receded. This elevation may be determined from records, studies, or field observation. Any fill placed above the 100-year floodplain will not count towards the fill volume.
- d.** The excavated area shall be designed to drain if it is an area identified to be dry in the summer, e.g., if it is used for a park or mowed in the summer. Excavated areas identified to remain wet in the summer, such as a constructed wetland, shall be designed not to drain. For areas that are to drain, the lowest elevation shall be at least 6 inches above the winter "low water" elevation, and sloped to drain. One percent slopes will be allowed in areas less than 1,000 square feet.

- e. Excavation to balance a fill shall be located on the same parcel as the fill unless it is not reasonable or practicable to do so. In such cases, the excavation shall be in the same drainage basin, within points of constriction on the conveyance system, if any, as near as practical to the fill site, and shall be constructed as a part of the same development project.
- f.
- g. Short term parking (motor vehicles remain parked for less than 18 hours per day) in the floodplain may be located at an elevation of no more than one foot below the ten year floodplain so long as the parking facilities do not occur in a Water Quality Sensitive Area or vegetated corridor. Long term parking (motor vehicles remain parked for greater than 18 hours without being moved) in the floodplain may be located at an elevation of no more than one foot below the 100-year floodplain so long as the parking facilities do not occur in a Water Quality Sensitive Area or Vegetated Corridor.
- h.
- i. Temporary fills permitted during construction shall be removed upon completion of construction prior to the close of the in- stream work window as defined by Oregon Department of Fish and Wildlife or other local, state or federal authority.
- j.
- k. Excavation and fill required for the construction of detention facilities or other facilities, such as levees, shall be specifically designed to reduce or mitigate flood impacts. Levees shall not be used to create vacant buildable land.
- l. Excavation and fill required to restore or enhance floodplains, riparian areas, wetlands, uplands, and streams, including but not limited to the planting of vegetation and daylighting existing storm pipes, shall be permitted as long as the design complies with these requirements and applicable federal and state standards.
- m.
- n. The floodplain may not be modified to increase water velocities such that stream bank erosion will be increased, unless the stream banks are protected to prevent the increased erosion.
- o.
- p. Uncontained areas of hazardous materials are prohibited within flood management areas.
- q.
- r. Existing nonconforming uses are allowed to continue in the flood management area. Existing nonconforming uses may be modified with approval from the City.
- s.

- t. Any proposed work within or modification to a floodway shall be certified by an Oregon Registered Professional Engineer as to how it conforms to these standards and all other state, and FEMA regulations.
- u.
- v. For streams, creeks, rivers and other watercourses where the floodway has not been identified, the entire floodplain shall be treated as a floodway unless a study has been prepared by an Oregon Registered Professional Engineer and approved by the City to define the floodway limits for a stream section.
- w.
- x. A "no rise" determination will be prepared by an Oregon Registered Professional Engineer for all development within the flood plain.

CHAPTER 4 – Sanitary Sewer Conveyance Systems

4.1 General Provisions

- a. The provisions of this chapter shall apply to all public conveyance systems within City jurisdiction. Interpretations of such provisions and their application in specific circumstances shall be made by the City.
- b. In addition to these rules, all sanitary sewers shall be designed and constructed to the rules of the Oregon Department of Environmental Quality. Where these rules conflict with the state rules, the state rules shall apply.
- c. Except as otherwise provided, the extension of the public conveyance systems to serve any parcel or tract of land shall be done by and at the expense of the Property Owner or applicant. The City reserves the statutory right to perform the work or cause it to be performed and bill the Owner for the cost or to pursue special assessment proceedings as otherwise provided by City Ordinance or permit conditions.
- d. Except as otherwise provided, the Standard Drawings shall be followed for all aspects of conveyance design. Variances from the Standard Drawings shall require approval of the City.
- e. Upstream manhole rim must be 2' lower than the lowest service connection on the property.

4.2 Extension of Public Sanitary Sewer Conveyance Systems

A development requiring connection to the public sewer system shall extend the public sanitary sewer conveyance systems to allow all adjacent uphill parcels to be served by the public systems. The City may waive this requirement for sanitary sewer conveyance when one of the following conditions is met:

- a. The proposed connection to the public conveyance system is for an existing building.
- b. Topography prevents uphill parcels from being effectively served by the required conveyance extension.
- c. The uphill parcels are outside the Urban Growth Boundary and, in the City's view, the boundary is not likely to be

expanded in the future to include uphill parcels.

- d. An analysis is provided demonstrating that the uphill parcels are likely to be served via another routing of the conveyance system and the City agrees with this analysis.

When physical extension of the conveyance system is not required for reasons other than topography, the City may require an easement for future sanitary sewer conveyance.

4.3 Conveyance Easements

4.3.1 General

- a. Public sanitary sewer conveyance facilities, not located within public right-of-way, shall be located within an easement granted to the City.
- b. The City may require that an area 5 feet in all directions from the edge of a manhole, catch basin, cleanout, or field inlet be encompassed in a public right of way or easement granted to the City.
- c. Access easements shall be provided to manholes, where required by the City.

4.3.2 Standard Conveyance Easement Widths

- a. Easements for single lines shall be a minimum of 15-feet wide. Easements for multiple lines shall be a minimum of 20-feet wide. The City may require wider easements in the following situations:
 - 1. Large trunk sewers
 - 2. Sewers greater than 10 feet deep
 - 3. Areas with topographic constraints such as steep slopes or sites where bore pits may be required in the future.
- b. When a pipe will be stubbed, the easement shall extend a minimum of five feet past the end of the stub.

4.3.3 Reduced Conveyance Easement Widths

- a. Conveyance easement widths may be reduced to 10-feet for single lines and 15-feet for two lines if all the following conditions are met to the satisfaction of the City:

1. A reduced easement width is needed due to the location of existing buildings that prevent a standard easement width.
 2. Another conveyance route within the development site and public right-of-way is not possible due to topography.
- b. When reduced conveyance easements are allowed, all the following additional requirements shall apply to the conveyance system within the reduced easement:
1. The sewer shall be constructed of ductile iron pipe or, where approved by the City, enclosed within a steel-casing pipe.
 2. Manholes shall be located at the points where the conveyance system enters and exits the reduced easement section.
 3. The sewer lines shall not be more than 8-feet deep.
 4. If feasible, sewer lines shall not be located directly on the property line.

4.3.4 Encroachments

- a. Structures constructed within conveyance easements shall require an encroachment agreement with the City. Approval of the encroachment is at the discretion of the City.
- b. The encroachment agreement shall allow the City to remove the structure, as needed, to access the conveyance system. Replacement of the structure shall be at the property owner's expense.
- c. The City may require special protection for the conveyance system in the vicinity of the encroachment.

4.4 Flow Determination

- a. Public sanitary sewers shall be sized to carry the ultimate flow for a basin in accordance with the current City adopted master plan and any applicable amendments and updates. At ultimate design flow, pipe shall flow no more than at 2/3 pipe diameter for sewers 15 inch diameter

or less, nor $\frac{3}{4}$ pipe diameter for sewers 18 inch diameter and larger.

- b. When required by the City, a report shall be submitted showing design calculations for sizing the proposed sanitary sewer system. The report shall include the information below. The City may waive parts of the informational requirements that they deem as unnecessary.

1. Drainage Basin

A reference map showing the drainage basin in which the project is located may be required. The map shall show the major basin that is consistent with the current City adopted master plan and any applicable amendments and updates.

2. Population Density

The population density figures shall be from the most recent information obtained for use by the zoning or City planning department. If these figures vary from those of the applicable master plan estimates, this difference shall be noted in the design calculations.

3. Flow Variations and Peaking Factor

Accepted flow design practice shall be employed. The current adopted Master Plan, and any applicable amendments and updates, shall be used for approved flow parameters and peaking factor unless more current information particular to the basin in which the project is located is available and this information is approved by the City.

4. Infiltration and Inflow

Infiltration and inflow shall be represented in flow calculations in the design of the sanitary system. The infiltration and inflow figures shall be from the current adopted Master Plan or any applicable amendments or updates.

5. Sewage Flows

Sewage flows shall be calculated based on the design criteria in this chapter.

4.5 Pipe Design

4.5.1 General

- a. Sanitary conveyance systems shall be designed to accommodate flows identified under Section 4.04.
- b. The Manning's coefficient value ("n") to be used in design shall be 0.013 for pipes.
- c. Sewers of sizes which are obviously larger than necessary for flows, but that are designed oversized to meet grade requirements, are not allowed unless otherwise allowed by the City.
- d. Sewers shall not decrease in size as they move downstream.
- e. Sanitary Sewer Minimums
 - 1. Public sanitary sewers shall be a minimum of 8 inches in diameter unless otherwise approved by the City.
 - 2. Sewer laterals shall have a minimum 4-inch inside diameter.

4.5.2 Location

- a. Sanitary sewers within a public right of way shall be located within 5 feet of the right of way center line and no closer than 10 feet from the edge of the right of way, unless otherwise approved by the City.
- b. Sanitary sewers in easements shall be located no closer than five feet from the easement line, unless otherwise approved by the City.
- c. The City may require maintenance access easements.

4.5.3 Separation

- a. General

Unless approved by the City, the minimum separation distance between parallel sanitary and storm sewers and utilities shall be 5 feet clear. If vertical separation between utilities is greater than 3 feet, additional horizontal spacing may be required to allow for maintenance access.
- b. Sanitary Sewer in Vicinity of Water Supplies
 - 1. No sanitary sewer shall be less than 10 feet from any well, spring, or other source of domestic water supply.
 - 2. All sanitary sewers which are located within 50 feet from

any such source of domestic water supply shall be constructed of ductile iron water pipe with watertight joints, C 900/905 PVC (Polyvinyl Chloride), or other City approved pipe.

3. Sanitary sewers and domestic water lines shall not be laid in the same trench.

4. Parallel water and sanitary sewer lines, wherever possible, shall be at least 10 feet apart horizontally when there is less than 18 inches of vertical clearance between water and sanitary sewer. When physical conditions render this spacing impossible or impractical, ductile iron pipe with watertight joints, concrete encasement, C-900/905 PVC, or pipe approved by the City shall be required.

5. Wherever it is necessary for sanitary sewer and water lines to cross each other, the crossing should be at an angle of approximately 90 degrees. The sanitary sewer shall be located 18 inches or more below the water line or be constructed of City approved pipe for a distance of 9 feet on both sides of the water line.

4.5.4 Alignment

Public sanitary sewers shall be laid on a straight alignment and at uniform grade.

4.5.5 Grade

Sanitary sewer grades shall meet both the following requirements:

1. Sanitary sewers shall have sufficient slope to maintain a minimum flow velocity of 2.0 feet per second when flowing full or half full.
2. The minimum grades for sanitary sewers shall be those specified in Table 4-1.

TABLE 4-1
SANITARY SEWER MINIMUM GRADES

Inside Pipe Diameter (Inches)	Grade (ft per 100 ft)
6	0.60
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

4.5.6 Steep Slopes

Sewers on slopes in excess of 20 percent shall be secured with anchor walls or metal pipe slope anchors as shown in Standard Drawings.

4.5.7 Pipe Cover

- a. In paved areas or areas anticipated to receive vehicular traffic, pipe cover shall be measured from the top of the paved surface (finish grade) to the upper exterior surface of the pipe barrel. The pipe bell shall not intrude into the sub base. In areas without pavement or vehicular traffic, pipe cover shall be measured from finish grade to the upper exterior surface of the pipe barrel.
- b. Minimum cover shall comply with Table 4-2, unless an exception is approved by the City.

TABLE 4-2 MINIMUM PIPE COVER

Type of Pipe	Paved Areas (inches)	Unpaved Areas (inches)
Other Approved Pipe	*	*
RCP Class III	30	18
RCP Class IV	24	12
RCP Class V	18	6
AWWA C900	24	12
AWWA C905	24	12
Ductile Iron	18	6

*As determined by City Engineer

4.6 Manholes and Structures

4.6.1 Manholes

- a. Manholes shall be provided at least every 350 feet, at every grade change, and at every change in alignment.
- b. Manhole lids shall not be in a wheel path of the motor vehicle travel way.
- c. All manholes shall be a minimum of 48 inches in diameter and have a minimum 12 inch ledge in the base.
- d. A minimum of 8 inches of un-perforated wall separating the cut- outs or break-outs for the individual pipe connections shall be provided in manholes.
- e. Where a connection is proposed to an existing manhole, elevation of the existing ledge, location of steps, and elevations of existing inlets and outlets shall be submitted with the plans.
- f. Manholes shall have a minimum 0.2 foot fall through the manhole unless otherwise approved by the City.

- g. Where different size public conveyance pipes enter a manhole, the crowns of the upstream pipes shall be no lower than the crown on the downstream pipe without City approval.
- h. A lateral entering a manhole at the end of the public conveyance system shall be designed so that the invert of the lateral is 6 inches above the invert of the outlet pipe.
- i. All manhole bases shall be properly channelized.
- j. No more than three side laterals or side sewers are allowed to be connected to a manhole unless an exception is approved by the City.
- k. Manhole lids shall be in conformance with the Standard Drawings.
- l. Additional Requirements:
 - 1. A manhole shall be located at the upstream end of the pipe except as allowed in Section 4.06.2.
 - 2. Unless approved by the City, manholes shall not be closer than five feet to a curb line.
 - 3. If the vertical distance from the side sewer invert to the lowest pipe invert exceeds 2 feet, an inside drop may be required.

4.6.2 Cleanouts

- a. Cleanouts shall be allowed only on pipelines where the sewer line has no possibility for future extension and the distance between the cleanout and a manhole is a maximum of 150 feet. The standpipe shall be the same size as the pipeline up to a maximum of 8-inches.
- b. Locations of permanent cleanouts shall be approved by the City. Permanent cleanouts shall not be installed within a driveway.
- c. Temporary cleanouts may be installed within the right-of-way at the end of a stub street where the street is expected to be extended in the future and the design of the sewer system does not warrant that a manhole be constructed at this location. The maximum distance of a main line

extension without a temporary cleanout is 15 feet. The City will make the determination when and where temporary cleanouts are allowed. When the sewer is extended, the temporary cleanout shall be removed.

4.7 Pipe and Fittings

4.7.1 General

Sanitary sewer pipe shall have flexible gasket joints. Joints on all fittings shall be the same as the joints used on the pipe. Caps or plugs shall be furnished with each fitting, outlet, or stub as required with the same type gasket and/or joint in the pipe.

4.7.2 Materials

Materials shall be the following types or equal when approved in writing by the City.

- a. Ductile Iron Pipe-DIP
Ductile iron pipe shall conform to the requirements of ANSI A21.50-1 or AWWA C150-1, cement lined push-on joint. The minimum thickness class shall be Class 50 (up through 12-inch diameter pipe) and Class 51 (for 14-inch diameter and larger pipe). Ductile iron pipe and fittings shall also conform to the specifications for line and grade in subsection 4.07.3(a).

- b. Polyvinyl Chloride Pipe-PVC
Type:
 - A) ASTM 3034 SDR 35 or SDR 26 dia. 4-15"
 - B) ASTM F-679 SDR 35 dia. 18-24"
 - C) ASTM C-900; D-1784 DR 18 dia. 4-12"
 - D) ASTM C-905; D-1784, DR 18 dia. 16-24"

2. Gaskets shall conform to the requirements of ASTM 477 and ASTM 3212.

- c. Fittings

- 1. General

- Wye fittings shall be provided in the sewer main for side sewers. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered. All fittings shall be of the same materials as the pipe unless otherwise approved.

- Fittings shall be free from cracks and shall adhere tightly to each joining surface. All fittings shall be capped or plugged, and gasketed with the

same gasket material as the pipe joint, fitted with an approved mechanical stopper, or have an integrally cast knockout plug. The plug shall be able to withstand all test pressures without leaking, and when later removed, shall permit continuation of piping with joints similar to those in the installed line.

2. Ductile Iron

Fittings shall be mechanical or push-on of the class as specified. Mechanical joint cast iron fittings shall conform to AWWA C110 and shall be of a class at least equal to that of the adjacent pipe. Push-on joint fittings shall be gray iron with body thickness and radii of curvature conforming to ANSI A21.10.

The inside diameter of the fittings shall match the inside diameter of the pipe.

3. PVC Pipe

Fittings shall conform to the applicable portions of the following specifications: ASTM D1785, ASTM D2729, ASTM D2466, ASTM 2467, ASTM D3033, and ASTM D3034. Fitting joints shall be the same as the pipe joints.

4. Line Tap Fittings.

A) Indexed PVC (polyvinyl chloride) Tee Saddle - manufactured in accordance with ASTM D-3034 with minimum cell classification of 12454B-C or 12364-C as defined in ASTM D-1784. Elastomeric seals meeting ASTM F-477 specifications, and are located at both the lead and skirt ends of the saddle. Stainless steel bands meeting series 300 and are a full 9/16-inch wide. This saddle is allowed on PVC, clay, IPS, concrete, asbestos cement, and PE pipe. See Standard Drawing 540.

B) Inserta Tee shall meet the same standards as the Indexed PVC Tee Saddle. This saddle is allowed only on thick wall pipe material, e.g., concrete, ductile iron, rib type plastic. See Standard Drawing 530.

d. Grout

Grout shall be Sika 212, Euco N-S, Five Star, or approved equal nonmetallic cementitious commercial grout exhibiting zero shrinkage per ASTM C-827 and CRD-C-621. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing.

e. Proof Tests

The City may require that a joint system be pre-qualified as to the watertightness capability of the joint system. Material and test equipment for proof testing shall be provided by the manufacturer. When approved,

internal hydrostatic pressure may be applied by a suitable joint tester. Pipe material and joint assembly may be subject to the following three proof tests at the discretion of the City.

1. Pipe in Straight Alignment

No less than three or more than five pipes selected from stock by the City shall be assembled according to the manufacturer's installation instructions with the ends suitably plugged and restrained against internal pressure. The pipe shall be subjected to 10 psi hydrostatic pressure for 10 minutes. Free movement of water through the pipe joint wall shall be grounds for rejection of the pipe.

2. Pipe in Maximum Deflected Position

A test section description follows for each pipe material. The pipe shall be subjected to 10 psi hydrostatic pressure for 10 minutes. Free movement of water through the pipe joint or pipe wall shall be grounds for rejection of the pipe.

3. Joints under Differential Load

The test section shall be supported on blocks or otherwise as described for each pipe material. There shall be no visible leakage when the stressed joint is subjected to 10 psi internal hydrostatic pressure for 10 minutes.

A) Ductile Iron Pipe

For deflected position, a position 1/2-inch wider than the fully compressed section shall be created on one side of the outside perimeter. For differential loads, one of the pipes shall be supported so that it is suspended freely between adjacent pipe bearing only on the joints. A force shall be applied per Table 4-3 along a longitudinal distance of 12 inches immediately adjacent to one of the joints:

TABLE 4-3
TEST LOADS FOR PIPES UNDER DIFFERENTIAL LOAD
(Ductile Iron Pipe)

Pipe Size (Inches)	Force (Pounds)
4	600
6	900
8	1,200
10	1,500
12	1,800
15	3,700
18	4,400
21	5,000
24 and over	5,500

B) PVC Pipe

For deflected position, two 12-1/2 foot lengths shall be joined, then deflected along an arc of 720-foot radius (0.11 feet offset at the end of each length from a tangent at the joint). For differential load, two lengths shall be joined and uniformly supported for at least two feet on both sides of the joint and adjacent pipe deflected to 95 percent of its vertical diameter.

4.7.3 Workmanship

a. Line and Grade

Survey control hubs for both line and grade shall be provided by the Engineer in a manner consistent with accepted practices. The Contractor shall establish line and grade for pipe by the use of lasers or by transferring the cut from the offset stakes to the trench at whatever intervals necessary to maintain the line and grade. The Contractor shall check line and grade as necessary. In the event that the limits prescribed in this Chapter are not met, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding further with the work. Variance from the established line and grade shall not be greater than 1/32-inch per inch of pipe diameter and shall not exceed 1/2-inch for line and 1/4-inch for grade, providing that such variation does not result in a level or reverse-sloping invert. Variation in the invert elevation between adjoining ends of pipe, including fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

- b. Side Sewer Connections
All side sewer connections shall be made with wye fittings unless otherwise approved by the City. Tee stations will be staked by the Engineer.
- c. Pipe Handling
The Contractor shall unload pipe only by approved means. Pipe shall not be dropped to the ground and shall not be dropped or dumped into trenches. The Contractor shall inspect all pipes and fittings prior to lowering into trench to ensure no cracked, broken, or defective materials are used. The Contractor shall clean ends of pipe thoroughly, remove foreign matter and dirt from inside of pipe, and keep it clean during laying and joining. The Contractor shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. The Contractor shall remove all damaged pipe from the job site.
- d. Unless approved by the City, the Contractor shall not break into an existing sewer line until the system has been tested in accordance with the requirements of Section 4.08 and is ready for acceptance by the City, as outlined in Chapter 1. When a Contractor ties into a "live" line, the Contractor shall keep the new sanitary line plugged at the downstream end of the construction to prevent entry of groundwater and debris into the public sanitary sewer system.
- e. Foreign Material
The Contractor shall take all precautions necessary to prevent excavated or other foreign material from entering into the pipe during the laying operation. At all times, when laying operations are not in progress, the Contractor shall use a mechanical plug at the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints.
- f. Pipe Laying
Pipe laying shall proceed upgrade with spigot ends pointing in the direction of the flow. After a section of pipe has been lowered into the prepared trench, the Contractor shall clean the end of the pipe to be joined, the inside of the joint, and the rubber ring (if required) immediately before joining the pipe, and make assembly of the joint in accordance with the recommendations of the manufacturer for the type of joint used. The Contractor shall provide all special tools and appliances required for the joint assembly. After the joint has been made, the pipe shall be checked for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints.

- g. Movable Shield**
When pipe is laid within a movable trench shield, the Contractor shall take all necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead. The bottom of the shield shall not extend below the springline of the pipe without recompacting the pipe zone.
- h. Cutting Pipe**
When cutting or machining the pipe is necessary, the Contractor shall use only tools and methods recommended by the pipe manufacturer and approved by the City. The Contractor shall cut cast iron or ductile iron pipe with milling type cutter or with rolling pipe cutter and shall not flame cut.
- i. Transition Fittings**

 - 1.** When joining different types of pipes, the Contractor shall use City approved fittings.
 - 2.** PVC couplers or adapters shall meet the ASTM 3034 SDR 35/C900 DR 18 D1784 specifications.
 - 3.** Ductile iron transition couplings shall meet the ASTM A536 80 for center and end rings, ASTM D2000 3 BA75 for gaskets and AWWA C 111 80 for bolts and nuts.
- j. Concrete Closure Collars**
The Contractor shall pour closure collars against undisturbed earth, remove all water from the excavation, construct suitable forms to obtain shapes that will provide full bearing surfaces against undisturbed earth as indicated, and use closure collars only when approved by the City, and then only to make connections between dissimilar pipe or where standard rubber- gasketed joints are impractical. Before the closure collars are installed, the Contractor shall wash pipe to remove all loose material and soil from the surface on which they will be placed.
- k. Pipe Bedding**
The Contractor shall install pipe zone material uniformly on both sides of the pipe up to the springline of the pipe. Material shall be compacted to ensure proper support within the haunching area.
- l. Line Taps**

 - 1.** Line taps shall be core drilled unless approved otherwise by the City. Core drilled holes shall be done using a cylinder style hole saw for plastic pipe material or a diamond core bit for concrete and ductile iron pipes.

2. Prior to installation of the tee, the area around the cored hole shall be clean and free of all rough edges.
3. While installing the tee, no rock, dirt, or debris shall be allowed to enter the main sewer line.
4. The Contractor shall install 3/4-inch minus gravel in the pipe zone around the line tap, from 4-inches below the pipe or to undisturbed ground and to 6-inches above the pipe.
5. #12 solid copper wire shall be installed within 18 inches of the top of pipe on all side sewers.
6. The sewer main shall be a minimum of two sizes (nominal inside diameter) larger than the line tap.
7. A minimum wall thickness of 0.35 inches shall be required when installing an Inserta-tee.

4.8 Testing and Acceptance

4.8.1 General

- a. Sequence of Testing
Testing shall occur in the following order. At the City's discretion, failure of any of the tests may require all testing to be completed again.

1. Compaction
2. Placement of base rock
3. Mandrel
4. Air test/Smoke test
5. Video

- b. Type of tests

All gravity sanitary pipelines shall pass the required air tests/smoke tests, pass the required compaction test in accordance with Section 7.02.3(b)(6), be video inspected, and be free of visible leaks. All flexible pipes shall pass a deflection test. All projects shall pass the required manhole tests. All details of testing procedures shall be subject to approval of the City.

c. Test Equipment

The Contractor shall furnish all necessary testing equipment and perform the tests in a manner satisfactory to the City.

1. Additional requirements:

Any arrangement of testing equipment, which will provide observable and accurate measurements of air leakage under the specified conditions, will be permitted. Gauges for air testing shall be calibrated with a standardized test gauge.

4.8.2 Line Cleaning

Prior to the internal pressure testing and inspection of sanitary systems by the City, the Contractor shall ball and flush and clean all parts of the system. The Contractor shall remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the system at or near the closest downstream manhole. If necessary, the Contractor shall use mechanical rodding or bucketing equipment. Upon the City inspection of the system, any foreign matter still present shall be flushed and cleaned from the system as required.

4.8.3 Manholes

- a. Unless otherwise approved by the City, acceptance tests shall be conducted on all manholes. Hydrostatic testing or vacuum testing will be required.
- b. Sanitary sewer manholes shall be tested for acceptance after the trench has been backfilled, compaction requirements have been met, road base rock has been installed and the street paved, and chimney seals or concrete manhole closure collars have been installed. If the manholes have passed the tests and the castings have been disturbed by construction activities or need to be reinstalled, the manholes shall be re-tested.
- c. Hydrostatic Testing. The test will consist of plugging all inlets and outlets and filling the manhole with water to the rim. Leakage in each manhole shall not exceed 0.2 gallons per hour per foot of head above the invert. Leakage will be determined by refilling to the rim using a calibrated or known volume container. Testing results shall be recorded on a form approved by the City.
- d. Vacuum Testing. The test will consist of plugging all inlets and outlets. The test head shall be placed at the inside of the top of the cone, include grade rings and castings, and the seal inflated in accordance with the manufacturer's recommendations. A vacuum of 10-inches of

mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if the time for the vacuum reading to drop to 9-inches meets or exceeds the values indicated in Table 4-4.

TABLE 4-4 ACUUM TESTING TABLE

Depth of Manhole	Allowable Time (seconds)		
(feet)	48-inch	60-inch	72-inch
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	65
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

4.8.4 Air Testing, Pipe Line

a. General

After construction of the system, including service connections, required backfilling, compaction testing, placement of base rock for streets, and other required testing, the Contractor shall conduct a low-pressure air test. The Contractor shall provide all equipment and personnel for the test. The method, equipment, and personnel shall be subject to the approval of the City. The City may, at any time, require a calibration check of the instrument used. The pressure gauge used shall have minimum divisions of 0.10 psi and have an accuracy of 0.0625-psi (one-ounce per square inch). All air used shall pass through

a single control panel.

b. Safety Precautions

All plugs used to close the sewer for the air test must be capable of resisting the internal pressures and must be securely braced, if necessary. All air testing equipment must be placed above ground and no one shall be permitted to enter a manhole or trench where a plugged line is under pressure. All pressure must be released before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the test line at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. The Contractor shall use care to avoid the flooding of the air inlet by infiltrated ground water. The Contractor shall inject the air at the upper plug if possible. Only qualified personnel shall be permitted to conduct the test.

c. Method

All air testing shall be by the Time Pressure Drop Method. The test procedures are described as follows:

1. Clean the lines to be tested and remove all debris.
2. The Contractor has the option of wetting the lines prior to testing.
3. Plug all open ends with suitable test plugs; brace each plug securely.
4. Check the average height of ground water over the line. The test pressures required below (Section 4.08.4(c)(8)) shall be increased 0.433 psi for each foot of average water depth over the line.
5. Add air slowly to the section of system being tested until the internal air pressure is raised to the test pressure specified below (Section 4.08.4(c)(8)).
6. After the internal test pressure is reached, at least two minutes shall be allowed for the air temperature to stabilize, adding only the amount of air required to maintain pressure.
7. After the temperature stabilization period, disconnect the air supply.
8. Acceptance shall be based upon meeting or exceeding the requirements specified below. Note the test method is dependent upon the type of pipe material.
 - A) PVC, HDPE, and Ductile Iron Pipe:
The minimum time duration permitted for the prescribed low-pressure exfiltration pressure drop from a starting pressure of 4.0

psi between two consecutive manholes should not be less than that shown in Table 4-3. The table lists test duration values for a pressure drop of 0.5 psi in excess of ground water pressure above the top of the sewer pipe, respectively. Values given accommodate both an allowable average loss per unit of surface area and an allowable maximum total leakage rate.

9. Record the diameter (in), length (ft), end manhole number, time, pressure drop, and groundwater level of the test on an inspection form. The recording form shall become a permanent record of the project.

- d. Smoke testing will be required along with a successful air test.

4.8.5 Deflection Test for Flexible Pipe

- a. Sewers constructed of flexible pipe materials shall be deflection-tested. The test shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the nominal pipe diameter unless otherwise specified by the City. The mandrel shall be a rigid, nonadjustable, odd-numbering-leg (9 legs minimum) mandrel having an effective length of not less than its nominal diameter. Testing shall be conducted after placement of base rock for streets and after the line has been completely balled and flushed out with water, compaction tests have been completed and accepted.
- b. The Contractor will be required to locate and repair any sections failing to pass the deflection test and to retest the section.

4.8.6 Video Inspection of Gravity Systems

All sewers shall be video inspected and recorded in accordance with the order prescribed in Section 4.08.1 prior to the City acceptance of the systems. All pipes shall be thoroughly flushed immediately prior to the video inspection. A 1-inch target ball shall be placed in front of the camera. If the system is video inspected by a private firm or entity other than the City, a copy of the video recording and a written TV Inspection Report on a form approved by the City, shall be supplied to the City. The video recording shall be recorded in color and on an electronic format as approved by the City. All problems discovered during video inspection shall be noted on the video recording and the written report.

4.8.7 Video Inspection for Warranty Acceptance

The sewer lines shall be video inspected during the one year warranty period to determine any defects in the system that are to be corrected by the developer or Contractor.

TABLE 4-5
SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE
INDICATED FOR Q = 0.0015*

1 Pipe Diam .	2 Min. Time	3 Length for Min. Time	4 Time for Longer Length	Specified Minimum for Length (L) Shown (min:sec)							
Inches	(min:sec)	Feet	Seconds	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:3	115:2
42	19:74	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:3	157:0
48	22:67	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:2	205:0

*Q is the allowable rate in cu.ft/min/sf of inside surface area of pipe.

4.9 Bores

4.9.1 General

The carrier pipe in all bores shall be installed within a steel case, unless otherwise approved by the City.

4.9.2 Installation

- a. Casing
The casing shall be smooth steel of a size to permit proper construction to the required line and grade. The steel casing shall be fabricated in sections for field welded joints. The casing wall thickness shall be a minimum size of 1/4-inch or in accordance with the requirements of the jurisdiction of the right of way.
- b. Pipe Supports
The sewer pipe shall be supported on three sides by pipe supports. Pipe supports shall be No. 2 Western Red Cedar or approved equal. Pipe supports shall protect the pipe from damage during installation and limit pipe floatation.
- c. Placing Fill in Casing
The annular space shall be filled between the casing and pipe completely with lean grout or sand to prevent pipe flotation.
- d. Concrete Seals
After the sewer pipe has been tested and approved, concrete plugs shall be poured at each end of the casing.
- e. Pipe separation
- f. The City of Tillamook Pipe line separation is a necessity for public health and safety, property and the quality of the pipeline contents. Pipeline failure or damage can result in pipeline contamination. Even the process of excavating one pipeline for repair can create risk to the adjacent pipelines. The City of Tillamook utilities lines require space for installation, repair and replacement. No other lines or conduits are allowed within 18" in any direction or 5' if running parallel of a City owned utility line; sewer lines must be 10'. This space is required but may be adjusted for site specific problems, if approved by the City of Tillamook Public Works and other agencies with jurisdictions. If other agencies such as DHS and DEQ or other Federal or State entity separation rules apply, the greatest distance will apply. All crossings of City of Tillamook utilities require a permit from the City of Tillamook.

4.10 Other Requirements for Public Sanitary Sewer Conveyance Systems

4.10.1 Surveying

The Owner's Engineer or Surveyor shall be responsible for establishing the location of the sanitary sewer system by means of construction stakes offset along the center lines prior to commencement of construction. Moving upstream, there shall be a construction stake placed within 25 feet of each manhole, and at no more than 100-foot intervals along the mainline. Each lateral location shall be staked.

4.10.2 Railroad Crossings

Crossing of railroad rights-of-way shall be done in a manner which conforms to the requirements of the railroad having jurisdiction. If bonds or certificates of insurance protection are required, they shall be furnished by the Contractor or Owner to the railroad company concerned. The City shall be named as an additional insured.

Actual permits or easements for such crossings shall be obtained by the Owner and all terms for such permits or easements shall be met by the Owner and Contractor.

4.11 Laterals

4.11.1 General Provisions

- a. The specifications contained herein, together with the State of Oregon Uniform Plumbing Code and all other applicable requirements of federal, state, and local law shall govern the installation of laterals.
- b. The provisions of City Ordinances requiring permits, fees, and other requirements shall be complied with prior to the start of work on any portion of the sanitary pipeline systems.

4.11.2 Planning Considerations

- a. Where a parcel requiring connection to a public sanitary sewer conveyance system cannot connect through a lateral meeting the requirements of this section, then extension of the public conveyance system shall be required. This extension of the public system is in addition to the requirements of Section 4.02.
- b. Each parcel shall be served by individual laterals for sanitary, except in the following situations:

1. Duplexes, townhouses, and other buildings that cross property lines may be served by a single sanitary lateral.

4.11.3 Design Considerations

a. Gravity Service

1. Laterals shall provide gravity service to a parcel.
2. Sanitary laterals shall provide gravity service to the main living area of a dwelling or primary use area of a non-dwelling such that a majority of the fixtures units, including those in kitchens, can achieve gravity sanitary sewer service.
3. Grinder pumps shall only be used to serve portions of buildings that cannot be served by gravity, such as daylight basements.
4. The City may require the minimum first floor finished floor elevations to be shown on the plans to demonstrate that gravity service can be provided.

b. When allowed by the Building Official, laterals may cross a single adjoining property if the following criteria are met:

1. The portion of the lateral on the adjoining property has a minimum 3 feet of cover over the pipe and the pipe is ductile iron.
2. The portion of the lateral on the adjoining property contains no bends.
3. The lateral crosses the adjoining property in a private easement that is a minimum of 10 feet wide.
4. A copy of the private easement is provided to the City, demonstrating the legal right of the parcel being served to install and maintain a private lateral on the adjoining property.
5. The portion of the lateral crossing the adjoining parcel is less than 100 feet long.
6. The lateral can be used for only one property.
7. The lateral crossing is not one of a number of lateral crossings in a new development designed to avoid constructing a sanitary sewer extension.
8. The Engineer provides justification, to the satisfaction of the City, that

the crossing is needed.

- c. Side sewers shall be less than 50 feet in length. The City may approve side sewers in excess of 50 feet in extraordinary circumstances.
- d. Side sewers shall connect to the mainline sewer with a wye or connect to a manhole at an angle of 60 to 90 degrees from the mainline sewer. Side sewers shall contain no bends in the right-of-way unless specifically approved by the City Engineer.
- e. If the connection of the lateral to the property is less than 12" above the rim elevation of the upstream manhole then a combination backwater valve and knife valve must be installed.
- f. A minimum grade of 2 percent is required for side sewers, unless a lesser grade is approved by the City.

4.11.4 Installation

a. Material

Side sewer pipes shall meet the requirements of Section 4.07.2.

b. Excavation and Backfill

All excavation and backfill for laterals shall comply with Section 8.02.

c. Markings

1. Laterals shall be marked with a detectable underground # 12 solid core copper tracer wire. The wire tape shall be placed from the main pipeline to the end of the lateral with 18-inches vertical separation between the wire and pipe. The wire shall be green in color.

The City requires a permanent marker for finding the end of sewer laterals-3M locator ball along with a plastic green post and trigangulated accurate measurements with reference shot photographs.

2. The location of laterals shall be indicated by a permanent marker, acceptable to the City.

A) Where the sewer is in a street with curbs, the marker shall be on the curb.

B) Where the sewer is in a street without curbs, the marker shall

be on the sidewalk.

C) Where the sewer is in a street without curbs or sidewalks, the Engineer shall present to the City for approval an alternative permanent marking method.

D) A sanitary sewer cleanout located on the private side of the right-of-way boundary is an acceptable permanent marker.

CHAPTER 5 - General Construction Specifications for Conveyance Systems

5.1 General Provisions

The specifications contained in this Chapter, together with Oregon Department of Environmental Quality and U.S. Environmental Protection Agency standards and any other applicable requirements of the City, shall govern the character and quality of material, equipment, installation and construction procedures for gravity flow portions of public sanitary sewer and storm systems.

5.1.1 Scheduling

a. Sequence of Operations

The Contractor shall plan and execute construction work to cause a minimum of interference to the operation of existing City facilities. It may be necessary to do certain parts of the construction work outside normal working hours in order to avoid undesirable conditions, and it shall be the obligation of the Contractor to make this change to the work schedule. This scheduling, however, is subject to the City approval, and does not relieve the Contractor from making its work available for inspection.

Connections between existing work and new work shall not be made until necessary inspections and tests have been completed on the new work and it is found to conform in all respects to the requirements of the plans and specifications, unless otherwise approved by the City.

b. Progress of Construction

Construction shall proceed in a systematic manner that will result in minimum inconvenience to the public. Construction staking for the work being performed shall be completed prior to the start of excavation. The Contractor shall limit its operations to a small length of work area per crew. At no time shall the trenching equipment be farther than 300 feet ahead of the pipe laying crews, unless advance written permission is given by the City. The trench shall be backfilled so that no section of trench is left open longer than 24 hours. Trenches located in a right-of-way shall be completely backfilled before the Contractor leaves the site for the day unless the trench is adequately secured with steel plates.

Cleanup of all construction debris, excess excavation, excess materials, and complete restoration of all fences, mail boxes, ditches, culverts, signposts, and similar items shall be completed immediately following the final backfilling of the trench.

Any area disturbed by the Contractor's operations inside dedicated easements shall be restored to its original condition. Any area that is disturbed by the Contractor's operations outside the dedicated easement shall be restored to the Property Owner's satisfaction.

5.1.2 Preservation, Restoration, and Cleanup

- a. Site Restoration and Cleanup**
The Contractor shall keep the premises clean and orderly at all times during the work and leave the project free of rubbish or excess materials of any kind upon completion of the work.
During construction, the Contractor shall stockpile the excavated trench materials so as to do the least damage to adjacent lawns, grassed areas, gardens, shrubbery, trees, or fences, regardless of the ownership of these areas. All excavated materials shall be removed from these areas, and these surfaces shall be left in a condition equivalent to their original condition and free from rock, gravel, boulders, or other foreign material. The Contractor shall replace topsoil areas over all trenches with a minimum finished depth of 12 inches of topsoil. All existing drainage ditches and culverts shall be reopened and graded, and original drainage restored. All damaged irrigation and house drainage pipe, drain tiles, sanitary sewer or storm laterals, and culverts shall be repaired expeditiously. The finished surface shall conform to the original surface and shall be free-draining, free from holes, rough spots, or other surface features detrimental to a seeded area.
- b. Preservation of Drainage Ditches**
Following the backfill of the trenches, the Contractor shall restore all public storm drain ditches that have been destroyed, damaged, or otherwise modified during construction to the condition equal to or better than the condition of the ditch before construction, and as approved by the City. Ditches shall be built in their original locations unless otherwise redesigned as part of the project.
- c. Stream and Creek Crossings**
The Contractor shall comply with all provisions of the permits required by the Oregon Division of State Lands, the U.S. Army Corps of Engineers, Tillamook County, the City and any other agencies having jurisdiction.

5.1.3 Interferences and Obstructions

a. General

Various obstructions may be encountered during the course of the work. Maps and information regarding underground utilities shall be obtained from the utility owning and operating such utilities, but the location of such utilities is not guaranteed. A minimum of 48 hours notice shall be given to all utility offices that may be affected by the construction operation. The contractor shall comply with the Oregon "locate law" ORS 757.557. If services of any utility are interrupted due to the construction operation, the proper authority shall be notified immediately.

b. Protection

The Contractor shall exercise all due care in protecting property along the route of the improvement. This protection shall include, but not be limited to, trees, yard, fences, drainage lines, mail boxes, driveways, shrubs and lawns. If any of the above has been disturbed, they shall be restored to as near their original condition as possible.

5.1.4 Permanent Survey Monuments

The Contractor shall not disturb permanent survey monuments, property corners, stakes or benchmarks without prior written consent of the appropriate county surveyor. It shall be the responsibility of the Contractor to protect such survey markers. Survey markers which are disturbed or lost shall be replaced by a registered land surveyor. When a change is made in the finished elevation of the pavement, or any roadway in which a permanent survey monument is located, the monument cover shall be adjusted to the new grade.

CHAPTER 6 – Water System Design and Construction Standards

6.1 General Requirements

6.1.1 Scope and Definitions

- a. The City of Tillamook Water Division System Standards includes provisions, technical specifications, and requirements for construction within the City of Tillamook.
- b. In addition to following these Standards, water system design and construction shall abide by all relevant codes, ordinances, and regulations. In cases of conflicting requirements, the more stringent standard shall apply.
- c. Standard Drawings are included in these Standards to supplement the written specifications, but the written specifications shall have precedence over the Standard Drawings in the event of conflicts.
- d. The City Engineer has the authority to recommend or allow deviations from these Standards in necessary circumstances, according to his or her best judgment.
- e. Public health and safety shall be adequately protected in the Project Engineer's designs and at all times during construction of water system improvements.
- f. All construction and other water system-related work shall be performed by experienced workers using tools in good repair to a high quality of workmanship.
- g. The City of Tillamook Pipe line separation is a necessity for public health and safety, property and the quality of the pipeline contents. Pipeline failure or damage can result in pipeline contamination. Even the process of excavating one pipeline for repair can create risk to the adjacent pipelines. The City of Tillamook utilities lines require space for installation, repair and replacement. No other lines or conduits are allowed within 18" in any direction or 5' if running parallel of a City owned utility line; sewer lines must be 10'. This space is required but may be adjusted for site specific problems, if approved by the City of Tillamook Public Works and other agencies with jurisdictions. If other agencies such as DHS and DEQ or other Federal or State entity separation rules apply, the greatest distance will apply. All crossings of City of Tillamook utilities require a permit from the City of Tillamook.

The City of Tillamook Water Division may revise the Standards at any time without prior notification. Any amendment shall take effect upon the date indicated in the amendment upon posting to the City's website.

6.1.2 General Process for Water System Improvements

- a. In general, the process for designing and installing water system improvements shall be as follows:
- b.
 - 1. The Developer shall submit engineering plans prepared by the Project Engineer and sealed with professional engineer's stamp in accordance with ORS 672, along with the plan review fee.

2. The City shall review the engineering plans. If changes and revisions are required, the Project Engineer shall revise and resubmit the plans.

3. Following approval of plans by the City, the Developer's Contractor shall install the improvements in accordance with the approved plans.

4. The City's Inspector's shall monitor and inspect the work throughout construction to ensure compliance with the approved plans and City Standards.

5. Upon completion of the work, the Developer shall submit As- Built Drawings prepared by the Project Engineer.

6. After final acceptance by the City, the Developer shall provide a one year warranty on the improvements.

Prior to initiating the project design, the Project Engineer shall contact the City Engineer, who may suggest or require a pre- design meeting to discuss the specific requirements for the project.

6.1.3 Preparation and Submittal of Engineering Plans

a. All plans for water system improvements must be prepared and sealed by a Project Engineer who is licensed by the state of Oregon.

b. Generally, engineering plans shall include the following information:

1. Existing and proposed utilities (sewer, storm, power, gas, telecom, cable, poles, etc.)

2. Existing and proposed curbs, sidewalks, driveways, mailboxes, and other street features.

3. Existing and proposed rights-of-way and easements.

4. Horizontal and vertical alignments of new public mains.

5. Size, material, and location of new and existing water mains and services.

6. Size, type, and location of new and existing water appurtenances, including:

A) Valves

B) Hydrants

C) Fittings (Bends, Tees, Crosses, Reducers)

D) Pressure Regulators

E) Vaults

F) Meters

7. Joint restraint requirements.

8. Cathodic protection requirements.

9. City Standard Drawings that are applicable to the project.

10. Existing and required easements for water improvements.

11. Proper call-outs and notation.

c. If applicable, include drawings showing:

1. Landscaping plans showing the layout of irrigation systems, backflow device(s), and any decorative water features.

2. Mechanical plans of boilers, chillers, and other water- consuming mechanical devices.

3. Plumbing plans with location of on-site backflow devices; fire line drawings showing plans of antifreeze (either potable or non- potable) loops, etc.

d. All drawings submitted for review and approval shall be on sheets with a size of either 22 inches by 34 inches or 24 inches by 36 inches.

e. Minimum text height shall be 0.10 inch.

f. Plans shall include a cover sheet with the following information:

1. Project name.

2. Owner's name, address, phone number, fax number, and email address.

3. Project Engineer's name, address, phone number, fax number, and email address.

4. Contractor's name, address, phone number, fax number, and email address.

5. Project location (Vicinity Map)

g. Submit plan review fee and three sets of subdivision drawings to the City Engineer for review and approval: one full set and two partial sets of drawing sheets showing only the water system improvements.

6.1.4 Approval of Engineering Plans

a. The City Engineer's approval of the sealed plans is required prior to the start of any construction. Plan approvals are only valid for six months from the date of approval.

b. Any changes to approved plans initiated by the Project Engineer or as a result of field conditions must be resubmitted and approved by the City Engineer.

c. The Developer or their agent shall obtain all required permits.

- d. Any property to be developed that is not currently within the City boundary shall be annexed into the City prior to extending water service to the site, unless an extra-territorial water line extension has been approved.

6.1.5 Construction Inspection

- a. The Developer's Contractor shall contact the Inspector at least 48 hours prior to any water system construction to request a pre-construction conference.
- b. The City Engineer and Inspector shall have access to the project at all times in order to make routine visual inspections of the work.
- c. No work shall be buried before it is inspected and accepted by the Inspector. Potholing of buried water lines may be required at the Developer's expense to allow verification that the installation meets the requirements of the Standards.
- d. Should any inspection reveal that construction is not proceeding according to the approved plans and/or Water Division Standards, the City Engineer or Inspector may order all work stopped and all defective work removed and replaced. If a revision is necessary, the Project Engineer shall provide the City Engineer with revised plans for review and approval before work resumes.
- e. Work by Developer's Contractor outside City's normal business hours shall require a minimum of 48 hours notice to Inspector. Overtime costs for City inspection will be paid by the Contractor.

6.1.6 Electronic "As-Built" Drawings

- a. Upon completion of new residential or commercial subdivisions, the Project Engineer shall submit an electronic file of the final plat and as-built drawings.
- b. Electronic files shall be submitted to the City Engineer via email as an attached file in AutoCAD.DWG or .DXF format. Verify the appropriate format version with the City's Inspector.
- c. Alternatively, electronic files may be submitted on CD media or other approved means using the above-indicated file format.

6.1.7 Requirements for Acceptance of Water System Improvements

The following items must be completed prior to final acceptance of water system improvements:

- a. Compliance with all relevant Standards, including but not limited to standards for design, construction, disinfection, and pressure testing.
- b. Completion of second lift of paving, ensuring that all valve boxes are

raised and flush with surface. The City may approve the installation of water meters prior to placement of the second paving lift if:

1. It is during the winter period, approximately November 15 through March 15.
 2. Weather and temperature conditions are unacceptable for final paving.
 3. A deposit or bond in the amount of 10% of the value of the water system improvements, or a minimum of \$5,000, is deposited with the City prior to release of the subdivision for water meter installation.
 4. The Developer agrees to complete final paving within 30 days after paving conditions return to acceptable temperatures.
- c. Request for final subdivision inspection and correction of any deficiencies identified by the City at the final inspection walk-through.
 - d. Submission of electronic files for the project, as described in Section 6.01.6.
 - e. Provide documentation that any required easements and/or right-of-way dedications have been completed and recorded.
 - f. The City reserves the right to withhold installation of water meters until the project has been granted final acceptance.

6.1.8 Warranty

- a. A one-year warranty period shall be provided for the water system improvements by the Developer. Any failure of materials and workmanship during the warranty shall be repaired or replaced to the City's satisfaction at the Developer's expense.
- b. The warranty period shall begin on the date of final written acceptance of the project by City of Tillamook Water Division.

6.1.9 Easements

- a. Where it is not practical or possible to install water system improvements within a dedicated public right-of-way, the City may allow the improvements to be installed within a dedicated easement on private property.
- b. Water line easements shall be centered on the pipe. Minimum easement widths shall be 15 feet for areas with vehicular access (roadways, parking lots, etc.) and 20 feet for areas without vehicular access. Additional width may be required for special circumstances such as slopes or other cases as determined by the City.
- c. Easements for vaults or other water system appurtenances shall extend a minimum of 5 feet on all sides of the structure. Additional width may be required for special circumstances such as slopes or other cases as determined by the City.

- d. Easements granted to the City shall allow for access, construction, operations, maintenance, replacement, reconstruction, and removal of the water system improvements.
- e. The easement shall be solely for water systems improvements and not shared by other utilities or structures without the prior written consent of the City.
- f. If access to the easement area and associated appurtenances is not directly available from a public right-of-way, an access easement along the most direct route of access shall be granted to the City.
- g. Easement exhibits shall be prepared by a Professional Land Surveyor. Easement dimensions and language shall be subject to final approval by the City. Easements shall be recorded prior to final project approval.

6.1.10 General Design Requirements

- a. Any permanent appurtenance that is above sidewalk and/or finish grade shall be at least 18 inches behind the sidewalk. No permanent signs, structures, or plant materials are allowed within three feet of City Water Division facilities.
- b. In locations outside of the established right-of-way, mark water line appurtenances, such as valves, blowoff assemblies, and cathodic protection test stations, with a Carsonite marking post. Post shall be blue in color, a minimum width of 3.5 inches, and be set with the top of post three feet above finished grade.

6.1.11 General Materials Requirements

- a. Only materials designed for potable water service and meeting NSF Standard 61, the American Water Works Association (AWWA) standards, and other applicable standards shall be used in those elements of the water system which may come in contact with potable water. All materials must be certified "lead-free".
- b. All materials used for water system construction shall be of new manufacture. No rebuilt, reconditioned, or previously used materials shall be used.

6.1.12 General Construction Requirements

- a. Safety and Worksite Conditions
 - 1. Project safety shall be the responsibility of the contractor.
 - 2. Contractors shall use every reasonable precaution to safeguard the persons and property of the traveling public. It shall be the sole responsibility of the Contractor to furnish, place, and maintain the barricades, barriers, lights, signage, and flaggers necessary to protect the traveling public and their property.

3. Contractors shall abide by the City's Safety Standards and all OSHA and other applicable safety regulations.

4. All barricades and obstructions shall be protected at night by signal lights, which shall be suitably distributed and operated from sunset to sunrise.

5. Contractors shall provide and maintain sanitary facilities for employees in accordance with applicable regulations.

6. The Contractor shall clean all spilled dirt, gravel, or other foreign material caused by construction operations from all streets at the end of each day's operation. Contractor shall adhere to all applicable erosion control requirements.

b. Permits and Road Closures

1. The Contractor or Developer shall obtain the appropriate utility permit(s) from the city, state, or county with jurisdiction for the streets or roads within the project work area prior to construction of system improvements.

2. Contractors shall comply with all rules and regulations of the applicable city, state, and county authorities regarding the closing of public streets or highways to use of public traffic. No road shall be closed to the public, except by express permission of the affected regulating authority.

c. Valve Operation Prohibited

1. Operation of valves in the City's water system by anyone other than City employees is strictly prohibited. Contractors shall not open or close valves, or take any other action that may affect the operation of the existing water system, except as specifically required by the plans and specifications, and only with prior approval by the City.

2. The Contractor shall notify the City at least 48 hours in advance of valve operation and/or interruption of the existing service.

d. Interruption of Utility Service

1. In the event of accidental interruption of domestic water, sewer, storm drain, or other utility services, the responsible party shall immediately notify the City Inspector or City Engineer.

2. The responsible party shall arrange for restoration of service as promptly as possible and bear all costs of repair. In no case shall interruption of any water or utility services be allowed outside of working hours, unless prior approval is granted by the City.

e. Damage to Water System during Construction

1. The City shall be notified immediately if any part of the water system is damaged in any way.

2. Repair of any damage to the City's facilities caused by a Contractor shall be made to the City's Standards at the Contractor's expense. The City, at its option, may make the repairs and bill the Contractor on a time and materials basis.

f. Relocation of Existing Mains

1. Any water line relocation work that is a requirement of the development shall be performed by City Water Division crews at the Owner's expense on a time and materials basis unless otherwise authorized by the City. A deposit for the estimated cost of the work is required prior to commencement of the work.

g. Water Service Installation

1. All installation, relocation, or abandonment of service lines 2 inches in diameter and smaller shall only be performed by City Water Division crews unless otherwise authorized by the City.

h. Connections to the Water System

1. Connections to existing mains for new mains or services larger than 2 inches in diameter shall be wet-tapped by a pre-approved tapping contractor using proper equipment. Contact the City Engineer or Inspector for a current list of pre-approved tapping contractors.

2. Contractor shall notify the Inspector at least 48 hours prior to beginning installation, relocation, or abandonment of service lines larger than 2 inches in diameter.

i. Preservation of Land Survey Monuments

The Contractor shall preserve all existing survey monuments in and around the work area. If any survey monument will be disturbed by construction, it is the responsibility of the Developer or Contractor to hire a Professional Land Surveyor licensed in the State of Oregon to conduct a pre-construction survey and replace the affected monuments in accordance with state laws.

j. Preservation/Replacement of Existing Structures

Contractor shall preserve, repair, or replace all existing structures damaged during construction, including but not limited to storm sewers, catch basins, and culverts.

k. Substitution of Materials

1. Whenever any material, device, or process is specified by proprietary name, name of manufacturer, or catalog number, such specifications shall establish a standard of quality.

2. The specifications shall not prohibit the use of suitable products by other manufacturers of equal or better quality, and shall be allowed by the words "or as approved" or "approved equal."

3. In such cases, the Contractor shall submit complete data to the City Engineer for consideration of another material, device, or process, which shall be substantially equal in every respect to that specified. The City Engineer will determine whether a substitute material is acceptable.

4. Substitute materials shall not be used unless approved by the City Engineer in writing.

6.2 Water Mains

6.2.1 Design

a. The pipe cover shall be 36 inches unless otherwise approved or required by the City Engineer.

b. Pipe Sizes

1. The minimum standard main size shall be six inches.

2. Four-inch mains may be permitted when ALL of the following conditions are met:

- A. The run is less than 300 feet.
- B. There are no more than eight services.
- C. There is no possibility of future main extension.
- D. There is no need for a fire hydrant.

3. Fire hydrants shall not be connected to mains less than six inches in diameter.

4. The City may require mains to be upsized to serve future development.

5. The City will make the final determination on the size of new mains.

6. Any hydraulic calculations that justify pipeline sizing shall be made using a Hazen-Williams "C" coefficient of 100.

c. Location of Mains

1. Water mains shall generally be located within the public right-of-way.

2. Water mains shall generally be located on the south and east sides of the street, six feet from the face of curb to the pipe centerline. Refer to Standard Drawing 100-WA.

3. Water mains along looped or curved streets shall not switch sides of the street.

4. Water mains in streets with development along only one side of the

street shall be placed six feet from the face of the curb adjacent to the lots served. This minimizes service line length and avoids "long-side" connections to fire hydrants.

5. When it is not possible to install the main within a public right-of-way, the City may allow the main to be installed within an easement. See Section 6.01.9 for easement requirements.

d. Dead End Mains

1. Dead end mains generally are not allowed.

2. When dead ends are permitted by the City, a fire hydrant for a blowoff, where applicable is required.

3. If future extension of the street is anticipated, a line-size valve and two-inch blowoff assembly shall be installed at the end of the dead end line. See Drawing 202-WA for phase break blow off detail.

4. If dead end main is in a cul-de-sac or future extension is not anticipated, a restrained mechanical joint cap and two-inch standard blow off assembly shall be installed. See Drawing 203-WA for two-inch standard blow off detail.

5. At the discretion of the City, a hydrant may be installed in lieu of a blowoff assembly on six-inch and larger mains where future extension is not anticipated.

6. If future extension of the street is anticipated, dead end mains shall be extended to within five feet of the edge of pavement.

e. Water mains with a 12-inch or larger diameter shall have a fire hydrant assembly installed at locations specified by the City Engineer. See Drawing 205-WA for six-inch standard blow off detail.

f. Pipe Alignment

1. Generally, the City encourages the use of deflected pipe joints in lieu of bend fittings.

2. Water main vertical alignment shall be designed to minimize high points where possible without resulting in excessively deep pipe installations.

3. Wherever it is necessary to deflect pipe from a straight line either in a vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection allowed shall not exceed the values in Table 6-1. The manufacturer's maximum allowable pipe joint deflection shall not be exceeded.

Table 6-1
Maximum Allowable Deflection of DI Pipe Restrained Joints (18-foot pipe length)

Pipe Diameter (in)	Mechanical Joint Maximum		Push-On Joint Maximum Deflection	
	Angle (degrees)	Offset per 18- foot pipe length	Angle (degrees)	Length Offset per 18-
4	8	31	5	18
6	7	27	5	18
8	5	20	5	18
10	5	20	5	18
12	5	20	5	18

1. The maximum deflection shall be determined from Table 6-1 or as recommended by the pipe manufacturer, whichever is less.
2. Safe deflection for 150 psi pressure. For higher pressure, reduce tabulated deflection 10 percent for each 10 psi added pressure and confirm allowable deflection with Inspector.

g. Restrained Joints

All joints on water mains shall be restrained. Both restrained joints (all joints) and thrust blocks at pipe bends will be required.

1. Thrust restraint shall be provided by restrained joints that are approved by the City and pipe manufacturer.
2. Thrust blocks shall be used as thrust restraint at all hot tap locations. In all other cases where restrained joints are not feasible, thrust blocks may only be used with prior authorization by the City. Size and bearing area of thrust blocks is dependent on site-specific soils and other factors. Developer's engineer shall provide stamped design calculations for thrust blocks on all pipes larger than 12 inches in diameter.
3. Straddle blocks shall be installed to provide thrust restraint at the direction of the City. Size and bearing area of straddle blocks is dependent on site-specific soils and other factors. Minimum dimensions and reinforcement are shown in Drawing 200-WA. Developer's engineer shall provide stamped design calculations for straddle blocks on all pipes larger than 12 inches in diameter.

h. Casing Pipe, Spacers, and Seals

1. Underground water mains crossing a railroad, an ODOT right-of-way, or a stream shall be installed in a casing pipe.
2. The size and extents of the casing shall be determined by the City on a case by case basis.

i. Cathodic Protection

1. Prior to pipeline design and construction, the City may require soil sampling and testing for corrosivity.

2. Testing requirements shall be determined on a case-by-case basis.
3. If soil conditions are found to be possibly corrosive to buried pipe and fittings, cathodic protection measures such as bonded pipe coatings, bonded pipe joints, sacrificial anodes, alternate pipe materials, or other measures may be required by the City.

6.2.2 Materials

- a. Generally, all pipe used within the City shall be ductile iron restrained joint and all fittings shall be mechanical joint. The City may require or allow alternate types of pipe depending on site conditions, pipe size, and application.
- b. All pipe and fitting shall be manufactured in the USA unless otherwise approved by the City.
- c. Push On Joint Ductile Iron Pipe
 1. All pipe shall be Class 52 ductile iron, unless specified otherwise by the City. Pipe shall conform to ANSI/AWWA C151/A21.51 and C104/A21.4.
 2. Pipe shall have restrained joints such as Tyton™, as licensed by U.S. Pipe and Foundry Company, Fastite™, as licensed by American Pipe, or equal, except where specifically shown or detailed otherwise.
 3. Pipe shall be manufactured by:
 - A. U.S. Pipe
 - B. Pacific States Cast Iron Pipe Company
 - C. American Cast Iron Pipe Company
 - D. Griffin Pipe
 - E. American Pipe
 - F. City-approved equal
 4. Ductile iron pipe must be cement-mortar lined.
 5. A non toxic vegetable soap lubricant shall be supplied from the pipe manufacturer in sufficient quantities for installing the pipe.
- d. Ductile Iron Fittings
 1. Ductile iron fittings shall conform to ANSI/AWWA C110/A21.10 and/or ANSI/AWWA C153/A21.53. Fittings shall have the following information cast upon them:
 - A. Manufacturer's identification
 - B. Country of manufacture
 - C. Pressure rating
 - D. Number of degrees or fractions of a circle (bends)
 - E. The City may require additional metallurgical documentation or other certifications.
 2. Fitting joints shall have mechanical joint (MJ) ends, except where

specifically shown or detailed otherwise.

3. The pressure rating for all fittings shall be equal to or greater than the pressure rating of adjacent pipe.

4. Lining

A. Fittings shall have a fusion-bonded epoxy lining of six to eight mil nominal minimum thickness. Lining shall conform to the requirements of ANSI/AWWA C550 and C116/A21.16.

B. Alternatively, the fittings may be cement mortar lined to the same thickness specified for the pipe.

e. Mechanical Joint Fittings and Restraints

1. Mechanical joint fittings shall be ductile iron short pattern.

2. Fittings shall conform to ANSI/AWWA C110/A21.10 and shall be of a class at least equal to that of the adjacent pipe.

3. Bolts shall be domestic Cor-Ten or ductile iron tee-head bolts.

4. Mechanical Joint Restraints.

A. Romac Grip Ring Kits shall be provided as joint restraint. If Grip Ring is not available the City may accept Mega Lug style restraint

B. The joint restraint ring and wedge components shall be constructed of grade 60-42-10 ductile iron conforming to ASTM A536. Wedges shall be heat-treated to a minimum hardness of 370 BHN. The dimensions of the retainer gland shall be compatible with joint bells conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.52/C153.

C. The restraint shall be MEGALUG Series 1100 restraint device as manufactured by EBAA Iron, Inc., or equal.

f. Flanged Fittings

1. Flanged fittings shall conform to ANSI/AWWA C110/A21.10 and shall be faced and drilled Class 125 flanges that match ANSI B16.1 fittings.

2. Flanged fittings allowed under ANSI/AWWA C110/A21.10 are ductile or gray iron. Ductile iron is higher strength and is required by the City.

3. Flange bolts and nuts shall be Grade 304 or 316 stainless steel with standard course threads. Threads on bolts and nuts shall be coated with a food grade anti-seize material to prevent thread galling.

g. Gaskets

1. Gasket material for flanged joints in ductile iron pipe shall consist of 1/8-inch thick, full-face one-piece, cloth inserted, rubber gaskets conforming to Section 4 of ANSI/AWWA C207 and ANSI B16.21.

A. The gasket shall be cut with holes to pass bolts.

B. Gasket material shall be free of corrosive alkaline or acidic ingredients.

C. Lining shall conform to Section 3.2.5.

h. Restrained Joints

1. Joints shall be restrained using either mechanical joint restraints or Field Lok™ (Tyton), Fastite™ (American) gaskets or equal (as approved by pipe manufacturer). Gaskets shall conform to ANSI/AWWA C111/A21.11, and shall be suitable for the specified pipe sizes and pressures. Gaskets should have stainless steel locking segments vulcanized into the gaskets to grip the pipe and prevent joint separation.
2. Thrust block and straddle block materials shall be 3,500 psi minimum compressive strength concrete and reinforcement (if required) shall be #4 minimum diameter steel rebar with a minimum tensile strength of 30 ksi.

i. Sleeves and Mechanical Couplings

1. Full-body sleeves for buried service shall be ductile iron with mechanical joint components. Sleeves shall conform to ANSI/AWWA C111/A21.11.
2. Mechanical couplings for non-buried service shall be ductile iron with rubber rings and ductile iron bolts and nuts. Couplings shall be Dresser, Smith Blair, or as approved.

j. Tapping Sleeves

1. Tapping sleeves shall be ductile iron, epoxy-coated steel, or stainless steel fittings as specified in Table 6-2.
2. Branch outlet from tapping sleeve shall be a minimum of Schedule 10 material thickness and shall have a test plug.

Table 6-2. Acceptable Tapping Sleeves

Size	Sleeve Types
Size-on-Size	JCM 432 Ford FTSS Mueller H-304 Smith Blair 665 Romac SST III (w/ stainless steel flanges) Or equal stainless steel, MJ.
Size by Reduced Size, 12" or Less	JCM 452 stainless steel with outlet seal Romac SST III Ford FTSS Mueller H-304 Smith Blair 665 Or equal
Size by Reduced Size, Greater 12"	Types JCM 532 stainless steel outlet Epoxy-coated steel with stainless steel bolts
Small taps, 1" and Smaller	Tap directly on the DI pipe. See Section 6.05.

See Section 6.02.3.c and Drawing 8-WA for tapping sleeve installation information.

k. Casing Pipe, Spacers, and Seals

1. Casing Pipe

A. Casing pipe shall be smooth steel conforming to ASTM A36 with minimum yield strength of 36,000 psi.

B. The minimum wall thickness shall be as required by the jurisdiction governing the highway, railroad, or stream bed under which the casing will be installed. In no case shall the casing wall thickness be less than 1/4 inch.

2. Spacers

A. Casing spacers shall be 12" wide, two piece construction, and all stainless steel.

B. The spacer shall have a minimum of four runners through 14" pipe size, to secure carrier pipe within the casing and to resist movement of the pipeline.

C. Casing spacers shall be as manufactured by Cascade Manufacturing, Calpico, Inc., or approved equal.

3. Casing seals shall be Model "C" custom pull-on casing ends, as manufactured by Calpico, Inc., or approved equal.

l. Polyethylene Wrap.

1. Provide 8 mil low density polyethylene film, in tubular form, without tears, breaks or other defects conforming to the requirements of AWWA C105:

A. Raw material requirements:

i. Group 2 (linear)

ii. Color: Black,

iii. Dielectric strength: Volume resistivity, 10^{15} ohm-cm, minimum,

iv. Density: 0.910 to 0.935 g/cm³

B. Physical properties:

i. Tensile strength: 3,600 psi, minimum

ii. Elongation: 700 percent, minimum

iii. Dielectric strength: 800 V/mil thickness, minimum

iv. Impact resistance: 600g, minimum,

v. Thickness: low-density polyethylene film shall have a minimum thickness of 0.008 inch,

vi. Propagation tear resistance: 2,550 gf (grams force), minimum.

C. Polyethylene Tape and Primer: Provide 3-inch wide, plastic-backed, 12 mil black adhesive tape Polyken No. 900-12 and Polyken 1027 Primer, or approved equal.

6.2.3 Construction

a. Cutting the Pipe

1. Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damaging the pipe or lining and so as to

leave a smooth end at right angles to the axis of the pipe. Do not flame cut.

2. Cut ductile iron pipe according to manufacturer's recommendation.

3. Dress cut ends of push-on joint pipe by beveling, as recommended by the manufacturer.

b. Laying the Pipe

1. Pipe location, depth of cover, and other relevant requirements from Section 8.02 shall apply.

2. The pipe bedding, pipe zone, and backfill materials shall comply with Section 8.02. Check the grade with a straight edge before laying each section of pipe and correct if necessary. Pipelines intended to be straight shall not deviate from straight alignment at any joint in excess of one inch horizontally or vertically.

3. At each joint, dig bell (joint) holes of ample dimensions in the bottom and sides of the trench to allow the joint to be properly made and to permit easy visual inspection of the entire joint.

4. Provide ample means of removing all water entering the trench, according to Section 8.03.b.2. Do not lay pipe in water or when, in the opinion of the City, trench conditions are unsuitable.

5. Do not drop pipeline materials into the trench. Carefully lower all pipe and appurtenances into the trench by means of a crane or other suitable equipment to prevent damage materials and protective coatings.

6. Unless otherwise directed, lay pipe with bell end facing in the direction of the laying. For lines on steep slopes, face bells upgrade only.

7. Cleaning pipe and fittings

A. Clean the outside of the spigot and the inside of the bell with a wire brush. Remove all lumps, blisters, and excess coal tar coating from the bell and spigot ends of each pipe.

B. Wipe all dirt, grease, and foreign matter from fittings and the ends of MJ pipe and push-on joint pipe.

C. Do not allow any foreign material to enter the pipe during storage or placement in the trench. Pipe should be cleaned, sanitized and ends sealed before installation.

8. Restrained Joint Pipe

A. Lay and join pipe with restrained type joints in strict accordance with the manufacturer's recommendations.

B. After the first length of restrained joint pipe is installed in the trench, secure pipe in place with approved backfill material tamped under and along sides to prevent movement. Keep ends clear of backfill. After each subsequent section is joined, place backfill to the spring line to prevent movement.

C. Lubricant for the pipe gaskets shall be furnished by the pipe

manufacturer, and no substitutes will be permitted under any circumstances.

9. Mechanical Joint Fittings

- A.** Install the particular fittings furnished in accordance with the manufacturer's recommendations.
- B.** Clean the ends of the fittings to remove all dirt, mud, and foreign matter by washing with water and scrubbing with a wire brush.
- C...** Slip the gland and gasket on the plain end of the pipe. Lubricate the end of the pipe to facilitate sliding the gasket in place. Then guide the fitting onto the spigot of the pipe previously laid.

10. Flanged Fittings

- A.** Bolts for flange fittings shall be full-nut installation (i.e., three full threads showing past nut).
- B.** Coat threads on bolts and nuts with a food grade anti-seize material to prevent thread galling and torque to manufacturer's recommended torque.
- C.** Flanged fittings shall be fully wrapped with three layers of 8 mil polyethylene sheet secured with polyethylene tape.

c. Tapping Sleeves

- 1.** Coordinate with City Inspector at least 48 hours prior to tapping. Inspector shall be onsite to witness tapping.
- 2.** Tapping sleeves shall be installed per the manufacturer's instructions. Generally, the installation process for tapping ductile iron or cast iron pipe shall be as follows:
 - A.** Clean all dirt, corrosion, and other foreign material from the pipe surface.
 - B.** Verify pipe diameter and tapping sleeve size.
 - C.** Apply pipe joint lubricant to pipe and gasket.
 - D.** Place the saddle section of the sleeve on the pipe and mate the band section with the saddle section. Ensure that gasket is properly positioned and that no foreign material is trapped between the pipe and gasket.
 - E.** Install lug bolts, position the sleeve, and hand tighten the lug bolts to hold the unit in place.
 - F.** Tighten the bolts according to the manufacturer's recommended sequence to the recommended torque and verify final torque several times throughout the installation process.
 - G.** Install flange gasket, attach tapping valve per manufacturer's instructions, and support the assembly with blocking and shims.
 - H.** Pressure test the valve and sleeve assembly and check for leaks.
 - I.** Verify proper bolt torque, assembly alignment, and cutter size.
 - J.** Attach the drilling machine to the tapping valve and support entire assembly with blocking and shims.
 - K.** Tap pipe, close valve, and verify bolt torque on tapping sleeve.
 - L.** Open tapping valve slightly to flush any foreign material and provide pipe coupon to Inspector.
 - M.** Ensure that all pipes and valves are fully supported with compacted crushed rock bedding per Section 8.02.b prior to

backfilling.

d. Thrust Blocks

1. Thrust blocks shall be poured monolithically between the pipe and undisturbed native soil.
2. Fittings shall be wrapped in three layers of 8-mil polyethylene sheet secured with polyethylene tape prior to concrete placement.
3. All joints and fittings shall be accessible for repair after thrust blocking is in place.

e. Straddle Blocks

1. Straddle blocks shall be poured monolithically against the pipe and undisturbed native soil.
2. Straddle blocks shall be poured around a minimum of two "Megalug style followers" in accordance with Section 6.02.2.e.4 and installed per manufacturer's recommendations.
3. Ensure that no unrestrained joints exist between the straddle block and pipe sections or fittings that are to be removed.
4. Ensure concrete straddle blocks have cured sufficiently before removing pipe sections or fittings or otherwise inducing a load on the straddle block.
5. See Drawing 200-WA.

6.2.4 Hydrostatic Testing, Flushing, and Disinfection

Follow Oregon Health Division rules under City's supervision

6.3 Valves and Valve Boxes

6.3.1 General Requirements

a. Isolation Valve Size, Spacing, and Location

1. Valve size shall match water main size.
2. Valves 12 inch and smaller, as well as all tapping valves, shall be gate valves. Valves larger than 12 inch shall can be butterfly valves. All valves shall open with a counterclockwise rotation of a 2-inch square nut.
3. In general, spacing between isolation valves shall not exceed 800 feet.
4. Valve installation shall be done according to City Standards and will vary depending on the field conditions.

b. Pressure Reducing Valves

1. The location, size(s), configuration, and settings of pressure reducing valves (PRVs, regulators) will be determined by the City Engineer to work

in conjunction with the City's existing network of pressure zones.

2. PRVs shall be installed in a vault which shall conform to Section 6.06 of these Standards.

3. PRVs shall be equipped with an adequately sized pressure relief valve located less than 500 feet downstream (low pressure side) of the valve. Pressure relief valves shall be located in an area where discharge is easily visible from the street, but where discharge will not cause flooding or property damage. Pressure relief valves shall be installed in a vault which shall conform to Section 6.06 of these Standards.

c. Strainers

1. An approved "H" strainer shall be installed within a distance of ten pipe diameters upstream of the pressure reducing valves.

d. Air and Vacuum Release Valves

1. An air release valve is required when the pipe has a high point that is at least one pipe diameter higher than the remainder of the pipe segment.

2. On 16-inch and larger diameter pipelines, air and vacuum release valves may be required at additional locations.

3. The air and vacuum release valves shall permit the release of large volumes of air when the line is being filled with water, the release of smaller amounts of accumulated air under normal operating conditions, and the re-entrance of air into the line to break any vacuum caused by the water leaving the line rapidly.

4. Generally, 12-inch and smaller mains shall have 1-inch air and vacuum release valves and mains larger than 12 inches in diameter shall have a 2-inch or larger air and vacuum release valves as determined by the City Engineer.

e. The valves shall be designed to operate under working pressures of 150 psi or greater, (if needed), and shall have been tested at a pressure not less than 300 psi.

6.3.2 Materials

a. Gate Valves

1. Gate valves shall be ductile iron body, bronze mounted, resilient seat, NRS valves with O ring seals, and shall conform to ANSI/AWWA C509 and C515 for ductile iron body valves.

2. All exposed fasteners shall be Grade 304 or 316 stainless steel.

3. Valves shall open when the stem is rotated counterclockwise. Unless otherwise shown, valves shall have 2 inch square wrench nut.

4. Joint materials shall conform to ANSI/AWWA C111/A21.11.

b. Butterfly Valves

1. Butterfly valves shall be the rubber seated type, suitable for direct burial service. Valve shall be equipped with ductile iron body and 304 stainless steel shaft with 304 stainless steel journals. The butterfly valves shall conform to ANSI/AWWA C504 for Class 150B.

2. All exposed fasteners shall be 304 or 316 stainless steel.

3. Valves shall withstand 150 psi or greater (if needed) working pressure and 150 psi pressure differential across the valve.

4. Valve disc shall be ductile iron alloy conforming to ASTM A536 Type 1, chrome edged ductile iron with Buna N rubber seat bonded to the valve body, or ductile iron with rubber disc seat and 304 stainless steel mating surface attached to the valve body conforming to ANSI/AWWA C504, Section 4.3.5.3. Shaft and disc seals shall be designed for a drip tight seal.

5. Joint materials shall conform to Section 6.02.2 and ANSI/AWWA C111/21.11.

c. Acceptable Manufacturers

1. Only valves from the following manufacturers shall be provided for installation in the City's facilities:

- A.** Kennedy Valve
- B.** M & H Valve Company
- C.** Clow Valve Company
- D.** American Flow Control
- E.** Mueller Co.
- F.** AVK Group d.

d. Butterfly Valve Operators

1. Butterfly valves shall be furnished with totally enclosed, integral valve operator designed to withstand a minimum of 300 ft lb input torque without damage to the valve or operator.

2. Operators shall be fully gasketed, grease packed, and designed to withstand submersion in water to a pressure of 10 psi.

3. Operators shall have a 2 inch square wrench nut.

4. Butterfly valves shall open with a counterclockwise rotation of a 2-inch square nut. A minimum of 30 turns of the operating nut shall be required to move the disc from a fully opened position to a fully closed position.

5. Operator Extensions

- A.** If the operating nut is deeper than 48 inches below finished grade, provide steel operating extensions to bring the operating nut to 24 inches below the ground or pavement surface.
- B.** The operator extension shall have a steel disc to allow centering

of the stem in the valve box. Disc shall be located directly below the top operator nut and no less than six feet apart if the extension is eight feet or more in length.

C. See Standard Drawing 5-WA for typical valve operator extension.

e. Valve Boxes for Buried Gate and Butterfly Valves

1. Valve boxes shall be one piece, cast iron type as manufactured by Olympic Foundry, or approved equal. The valve box and cover shall be No. VB910 with a "W" cast into the top.

2. A 6-inch diameter type ASTM D3034 SDR 35 PVC pipe shall be used as a spacer for the lower portion of the valve box. Length of spacer shall be as required depending on depth to operating nut.

f. Pressure Reducing Valves

1. Valves shall be Clayton Model 90-01 or 690-01 as manufactured by Cla-Val Co., or approved equal.

2. The PRV shall be a hydraulically operated, diaphragm- actuated, globe pattern valve, equipped with a resilient, synthetic rubber disc forming a tight seal against a single removable seat insert.

3. Diaphragm

A. Shall not be used as a seating surface. No packing glands, or stuffing boxes, or valves with pistons are permitted.

B. Repairs shall be possible without removing the valve from the pipeline.

C. The diaphragm assembly shall be fully guided at both ends by bearings in the valve cover and seat. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

4. The pilot control shall be a direct-acting, adjustable, spring- loaded, normally-open diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. A fixed orifice shall be included in the control system. All pilot control materials shall be 304 or 316 stainless steel.

5. The main valve and body shall be of ductile iron construction. The main valve trim shall be brass (QQ-B-626), bronze (ASTM B61), and 303 stainless steel. The pilot control system shall be of cast bronze (ASTM B62) with stainless steel trim and tubing.

6. Pilot systems shall have an adjustment range of 30-300 PSI.

7. The PRV shall be furnished with an internal and external 12 mil protective coating with an FDA approved fusion-applied epoxy resin.

8. Valves shall accommodate at least 100 psi greater than the normal

upstream working pressure in case of surge.

g. Pressure Relief Valves

1. Valves used for pressure relief shall meet all of the requirements of Section 6.3.2.f (pressure reducing valves).

h. 'H'Strainers

1. Strainers 1" through 2" shall be 250 lb Apollo International TCG Series, or equal, WSP-rated strainers constructed from high-tensile ASTM A-126 Class B cast iron with blow-off connections and easily removable cylindrical screens. A tapered seat allowing screens to be self-cleaning and tight fit shall be provided.

2. Strainers 3" and larger shall be Class 125 or 250 as applicable for the system pressure, Apollo International FC1 or FC2 Series, or equal. Strainers shall have flanged connections.

3. Self-cleaning shall be accomplished by opening the blow-off connection.

i. Air and Vacuum Release Valves

1. The valve inlets shall have iron pipe threads. The air and vacuum release valves shall be ARI Model D-040-C

2. The pipe used for the air release valve assemblies shall be brass or copper tubing at the inlet and shall conform to Standard Drawings 601 and 602.

3. Connection to main shall be per the requirements of Section 6.05 (service lines).

4. Enclose in Carson meter boxes or approved equal: for 1-inch size, Model No. 1730D P15L, and for 2-inch size, Model No. 1730D-P15L.

6.3.3 Construction

a. Gate and Butterfly Valve Installation

1. Before installation, the valves shall be thoroughly cleaned of all foreign material, and shall be inspected for proper operation to verify that the valves seat properly.

2. Valves shall be installed so that the stems are vertical, unless otherwise directed.

3. Wrap valve body in three layers of 8-mil polyethylene sheet secured with polyethylene tape prior to backfilling.

4. Joints

A. Joints shall conform to ANSI/AWWA C600. Valves shall be installed in accordance with Standard Drawing 3-WA.

- B.** Faces of flanges shall be cleaned thoroughly before flanged joint is assembled. After cleaning, the gasket shall be inserted and the nuts tightened uniformly around the flange.
- C.** After tightening nuts, three full threads shall be showing on the end of the bolt where it is exposed beyond the nut.
- D.** Joints shall be tested with the adjacent pipeline for leakage. If joints leak under test, valves shall be disconnected and reconnected, and the valve and/or pipeline retested.

b. Gate and Butterfly Valve Boxes

- 1.** Center the valve boxes and set plumb over the wrench nuts of the valves. Valve boxes shall not rest on the valve body. Set the valve box covers flush with the surface of the finished pavement.
- 2.** Cut extensions to the proper length so that the valve box does not ride on the extension when set at finished grade.
- 3.** Backfill shall be the same as specified for the adjacent pipe. Place backfill around the valve boxes and thoroughly compact to a density equal to that of the adjacent trench, avoiding damage to or displacement of the valve box. Misaligned valve boxes shall be excavated, centered, plumbed, and backfilled at the Contractor's expense.
- 4.** Where the valve is located in an unpaved area, the Contractor shall pour a concrete pad around the valve box. The concrete shall be 24 inches square by 4 inches thick, and shall be placed on a base of four inches of compacted crushed rock. Crushed rock shall meet the requirements of Section 8.02.b. Refer to Standard Drawing 3-WA for concrete pad.
- 5.** Valve boxes shall be installed in conformance with Standard Drawing 3-WA.

c. Air and Vacuum Release Valve Boxes

- 1.** Thoroughly compact the gravel beneath the concrete box and set the box so that it conforms to the elevation of the ground.
- 2.** Place at least 12 inches of crushed rock beneath the air release valve. Crushed rock shall meet the requirements of Section 8.02.b.
- 3.** Allow at least six inches of clearance between the street ell and the box top.
- 4.** Test and disinfect air valve assemblies in conjunction with the pipeline.

6.4 Fire Hydrants

6.4.1 Fire Hydrant Locations

- a.** Fire hydrants generally shall be placed at the radius point of curb

returns at street intersections. Midblock installations may be approved by the City but are not preferred. If installed at a midblock location, hydrant shall be placed at a property line between adjacent lots.

- b. Fire hydrants shall be placed 18" behind top face of curb in a planter strip or 18" behind curbtight sidewalks. Refer to Standard Drawings 100-WA and 101-WA.
- c. Section 508.5 of the Oregon Fire Code states that no part of any single family residential building shall be greater than 400 feet from a hydrant, as measured along the most practical accessible route.
- d. No part of any commercial, industrial, or multiple family residential building shall be greater than 250 feet from a hydrant, as measured along the most practical accessible route.
- e. No concrete, fencing, vegetation, or other obstructions interfering with the hydrant operation shall be installed in the hydrant clear zone. The clear zone is a triangular area that extends three feet behind a hydrant, five feet on each side, and is 20 feet wide at the curb. Refer to Standard Drawing 102-WA.
- f. Place hydrants so as to provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians.

6.4.2 Materials

- a. Fire hydrants shall be of the break flange or safety top type. Hydrants shall conform to ANSI/AWWA C502 and shall be orange above the ground line with the bonnets painted with white reflectorized paint.
- b. The normal depth of bury shall be four feet.
- c. Hydrants shall be connected to the main with 6-inch ductile iron pipe per the requirements of Section 6.04.3.
- d. Fire hydrants shall have nominal 5¼-inch main valve openings, have 6-inch bottom connections, and be equipped with two 2½-inch hose nozzles and one 4½-inch pumped nozzle. Nozzle threads shall be American National Standard, and inlet connections shall be mechanical joint.
- e. Operating nut shall be 1½-inch national standard pentagon nuts.
- f. The main valve shall be equipped with O ring seals and shall open when turned counterclockwise.
- g. Only the following hydrants shall be provided for installation:
 - 1. Mueller
 - 2. Kennedy
- h. Drain rock for hydrant installation shall be 1-1/2"-3/4" and meet the requirements of ODOT Section 00430.11.

6.4.3 Construction

a. Hydrant Installation

1. Hydrant installation shall conform to Standard Drawings 100- WA, 101-WA, and 102-WA as well as Section 3.7 of ANSI/AWWA C600, except where otherwise specified.
2. Connect to existing mains with tapping sleeve and gate valve installed per Section 6.02.3. c and Standard Drawing 8-WA. Tapping valve shall be flange by MJ gate valve and shall match hydrant line size.
3. For hydrant installations in conjunction with new main construction, connect to main with standard MJ by MJ by flange tee fitting and flange by MJ gate valve.
4. Do not excavate below sub base grade. Backfill overexcavated areas with crushed rock per the requirements of Section 8.02.b to provide a firm foundation.
5. Provide a square, level, concrete pier block underneath the hydrant. Block shall be eight inches thick and 12 inches on each side.
6. Place hydrant carefully to avoid damage to the pier block. Jointing procedures shall conform to Section 4.3 of ANSI/AWWA C600.
7. All joints shall be restrained using MJ restrained joint follower glands per Section 6.2.
8. After hydrant is in place and connected to the pipeline, place temporary blocks to maintain the hydrant in a plumb position during subsequent work.
9. Place geotextile fabric on base rock before placement of drain rock around base block and hydrant bottom after hydrant has been placed. The drain rock pocket shall be not less than four cubic feet, and the top of gravel shall be not less than six inches above the hydrant drain opening. Once drain rock is in place bring remaining geotextile fabric over the top of the drain rock. Do not connect drainage system to sewer. Pour concrete stabilizing donuts and backfill according to City's recommendations.
10. Set all hydrants plumb and nozzles parallel with, or at right angles to, the curb. When placed behind the curb or sidewalk, set hydrant barrel so that no portion of the pumper hose nozzle cap is less than 18 inches from the top face of the curb or backside of the sidewalk (if curbtight).
11. With the pumper nozzle facing the curb, set hydrants so that the safety flange is a minimum of three inches and a maximum of six inches above finished grade or sidewalk level.

12. Improperly positioned hydrants shall be disconnected and relocated at the Contractor's expense.

Section 6.05 Water Service Connections

6.5.1 General Requirements

- a. The customer shall pay for service installations in advance, based on meter size. Contact the City for fees.
- b. For new services in partitions and subdivisions, the Developer shall submit a copy of the preliminary plat showing lot numbers at least ten days prior to prepayment of service fees.
- c. Service installation fees are based on excavation of clean native materials. Extra costs, including but not limited to excavation of hard rock material or boulders, removal of excess material, and re-compaction for trenches, shall be borne by the Developer.
- d. Curbs
 - 1. Curbs shall be installed prior to the installation of service lines and meter boxes. The area behind the curb shall be leveled within ten feet of the back of curb to allow room to facilitate the installation of service boxes at proper elevation.
 - 2. If no curbs are planned, meter location and grade hubs shall be staked for each meter. See Standard Drawings 7-WA, 7D- WA, 7PD-WA, and 7P-WA for water service typical installations.
 - 3. The lot lines shall be clearly marked with lot numbers on the face of curb before service layout will be completed by the Inspector. The City's installation crew will be notified once the service layout has been completed.
- e. Service Installation
 - 1. Water meters, meter boxes, meter vaults, and service lines and taps may be installed by City crews if City so desires to exercise this option, otherwise contractor is responsible if authorized by the City. Service installation will be scheduled only after work activities outlined in Section 6.2.4.c have been completed.
 - 2. Water service installation shall be after road subgrade is cut and road baserock is installed, and before installation of "dry" utilities is complete. Otherwise, additional costs may be incurred. The City will not be responsible for restoring finished subgrade.
 - 3. All taps shall use a tapping saddle. Any taps on PVC pipe shall use saddles. Saddles also are allowed for any tap on ductile iron pipe.
- f. Water Services and Meters

1. Pressure in Mains

A. City policy is to provide water service at a minimum pressure of 50 psi. Available pressure at specific locations may fall below this value depending on geographic features within a particular pressure zone.

B. Where the pressure exceeds 80 psi, the City may require Developers to install a pressure reducing facility such as a vault housing pressure reducing valves (PRVs) on the main, or individual pressure regulating devices on each service line on the customer's side of the meter as required by plumbing code.

2. Provision of Water Meters

A. Each individual tax lot (residential) shall have a separate water meter.

B. If the structure on a single tax lot is a duplex or triplex, individual meters for each unit will be installed upon request at the time that the dwelling is constructed.

C. Tax lots with more than four dwelling units are considered "multi-family use," which is in the City's commercial class and shall require a master meter.

3. Meter Sizes

A. The size of water meters shall be based on the total demand as reflected by the number of fixture units in the plumbing system. The meter size shall be determined according to methods and procedures outlined in Section 610.4 and 610.8 or Section 610.5 of the Uniform Plumbing Code (UPC).

B. 1-inch and larger meters will be served from a single service line connected to the water main.

Contact the City Engineer for requirements for meters larger than two inches.

4. Location of Meters

A. The City generally places meters at the edge of the public right-of-way near the intersection of a property line. The City has the authority to move or change placement of water meters within the PUE.

B. Meters 1-inch and smaller shall be located in the PUE adjacent to the right-of-way at the property line.

C. Meters 1½-inch and larger shall be located in a vault on the Developer's property in a dedicated easement adjacent to the street right-of-way. The easement dimensions shall extend ten feet beyond each outside wall of the meter vault.

D. No other utilities shall be located within three feet of a meter or service line.

E. Private Streets. Individual meters serving homes on private streets shall be installed in clusters or banks adjacent to the entrance of the private street. Refer to Standard Drawings 7-WA, 7D-WA, 7P-WA, 7PD-WA, and 9-WA.

5. Backflow prevention assemblies are required on all meters 1½ inches and larger and for any size meter serving a high hazard facility. See Section 6.07 for further information on backflow assemblies.

6.5.2 Materials

- a. This section is applicable to 2-inch and smaller water service connections. **All fittings must be threaded brass and brass Packjoint with restraint-City will specify what is accepted**. For installation of water service connections larger than two inches, contact the City Engineer for installation specifications.
 - b. Corporation Stops
 1. Corporation stops for 1-inch copper service lines shall have CC thread inlet and Pack joint connection outlet and shall be Ford F600, or approved equal.
 2. Corporation stops for 1½-inch and 2-inch copper services shall be Mueller H 15023, or as approved.
 - c. Tapping Saddles
 1. Service saddles for 1½-inch and larger services shall be Romac Style 202S service saddle tapped for FIPT and with neoprene gaskets.
 2. Service saddles shall have an epoxy-coated ductile iron boss with stainless steel double or triple straps.
 3. Service saddles shall be adequate for use with the size, type, and class of the water pipe.
 - d. The City does not allow single service branch installations, every service must have separate line and tap, unless approved by the City.
- a. Meter Boxes and Covers

1. Meter boxes shall be as shown in Table 6-4.

Table 6-4. Required Meter Boxes Meter Box Type

Meter Size (inches)	Meter Box Type
5/8" x 3/4"	Brooks No. 36 or equal
1"	Brooks No. 37 or equal
1 ½" and 2"	Carson No. 1730-18-5BML

2. Use angle valves as specified by Table 6-5.

Table 6-5. Required Angle Valves

Valve size (inches)	Angle Valve Type
3/4	KV43-332WQ (compression), or equal
3/4 U-branch	Ford KV13-342W , or equal
1	KV43-444WQ (compression), or equal
1 ½ and 2	Mueller H-14277, or equal

3. Copper tube used for service connections shall be Type K, soft or rigid, and shall conform to ASTM B88. Copper tubing must be

manufactured in the U.S.A.

6.5.3 Construction

a. Installation of Service Connections

1. Trench excavation and backfill shall conform to Chapter 8. Cover over pipe shall be as indicated on Standard Drawing 10- WA.

2. Service Saddles

A. Thoroughly clean the pipe surface and apply a suitable gasket lubricant per the manufacturer's instructions.

B. Position the saddle body over the pipe, install the straps, install the nuts to finger tight, and check to ensure that the gasket is seated flat onto the pipe face.

C. Tighten the nuts evenly in 20 pound increments to the manufacturer's recommended torque specifications.

3. Copper Tubing Installation

A. Copper tubing shall be cut with square ends, reamed, cleaned, and made up tightly.

B. Install copper tubing in full length segment without joints where possible. Where joints are required, use approved restrained pack joint fittings.

C. Care shall be taken to prevent the tube from kinking or buckling on short radius bends. Kinked or buckled sections of copper tube shall be cut and the tube spliced with the proper brass fittings at the Contractor's expense.

4. Meter Box Installation

A. Meters and meter boxes shall be installed as shown in Standard Drawings 7-WA, 7D-WA, 7P-WA, 7PD-WA, and 9-WA or as directed.

B. Finish grade of completed meter enclosure shall allow a minimum of one inch and a maximum of four inches clearance from the top of the meter to the meter box.

C. Meter boxes shall be set or constructed plumb, with the top set horizontally. Grade adjustments of the meter boxes shall be by using standard extension sections for the box specified.

D. Lightly compacted earth backfill shall be placed inside of the meter boxes to depth indicated. Backfill around meter boxes as specified for adjoining pipe. Provide adequate space to allow for sidewalk installation.

5. Meter Installation

A. Installation of meters will be withheld until the City has accepted the project.

B. Prior to connection of the meter, the angle valve shall be opened and the service line flushed of all foreign materials.

C. Depending on the elevation difference between the meter and the proposed building to be served, the City may require a gate valve or backflow prevention device on the customer side of the meter at the meter box.

D. The City only accepts Sensus AMR meters according to the City's

specifications, they must be installed according to their standard and have the appropriate Sensus radio attached.

6. Disinfection and hydrostatic tests shall be performed on the service connections and pipes according to Section 6.2.4.

6.6 Precast Concrete Vaults

6.6.1 Vault Design

- a. Vaults shall be provided for the following items:
 - 1. Meters and backflow devices larger than two inches in size.
 - 2. Pressure reducing valves.
 - 3. Other appurtenances as required by the City.

6.6.2 Vault Materials

- a. Base rock and concrete shall conform to Section 8.02.d.2.
- b. Precast Concrete Vaults
 - 1. Concrete shall have a minimum compressive strength of 4,000 PSI and be in accordance with ASTM C858.
 - 2. The precast concrete vault shall have clearance of at least 12 inches between the enclosed device and the vault walls, unless otherwise specified within the Standards or by the City Engineer.
 - 3. The ladder shall have clearance of at least 30 inches horizontally (in front of ladder) to any obstruction in the vault and 15 inches laterally (beside the ladder), along the entire length of the ladder.
 - 4. Vaults shall be of size sufficient to house the valve or device, ladder, other required equipment, and maintain the required clearances for safety and access. The City Engineer reserves the right to make the final determination on minimum acceptable vault size.
 - 5. The vault shall have precast concrete top, center, extension, and base sections.
 - 6. Vault components shall be as manufactured by:
 - A. Oldcastle Precast (formerly Utility Vault Co.) of Wilsonville, OR
 - B. Hanson Pipe & Precast of Portland, OR
 - C. Approved equal
- c. Ladders
 - 1. Vaults shall be equipped with a ladder meeting the requirements of OSHA, as applicable, and as shown in Standard Drawing 300-WA.
 - 2. Vaults six feet and greater in depth shall be equipped with a Utility Vault Company Model 1672, or equal, aluminum ladder extension.

3. Ladder extension shall extend 40 inches above the top rung of ladder.
4. Ladders and accessories shall be fabricated steel with deformed rungs and shall be hot-dipped galvanized after fabrication.
5. Ladder shall be properly secured with stainless steel hardware of sufficient size.

d. Drainage

1. Provide a minimum 3-inch diameter bore-sighted drain to daylight with rodent screen, Refer to Standard Drawing 310-WA.
2. If drain to daylight is not feasible, provide a sump pump per Section 6.06.2.e.

e. Sumps

1. Provide a sump and sump pump for vaults where drain to daylight is not feasible.
2. The sump for the vault shall conform to dimensions shown on Standard Drawing 310-WA. Sump pump shall be Grundfos Model KP250 1/3 HP stainless steel, and shall have a normally open free-floating liquid level switch that closes when liquid level rises.
3. Pump shall be equipped with 1-1/4 inch discharge and miscellaneous piping for discharge including an inline check valve and isolation gate valve (size equal to the discharge line size) downstream of the check valve.
4. Provide power source at a voltage compatible with the sump pump motor. Conduit for power shall be a minimum of two feet from any other pipe penetration.

f. Sidewalk Door

1. The top section of the vault shall be furnished with an aluminum sidewalk door. The model shall be:
 - A. Bilco Type J or JD
 - B. Syracuse Castings Type CH or CHD
 - C. L.W. Products Type S or D
 - D. Approved equal.
2. The door shall be furnished with the following:
 - A. Channel frame with an anchor flange around the perimeter
 - B. 1½-inch drain coupling
 - C. Aluminum diamond plate cover designed to withstand a live load of 300 psf
 - D. Compression springs to assist operation
 - E. Automatic hold-open arm with release handle
 - F. Locking hasp

- G.** Snap lock with removable handle.
- H.** Stainless steel hardware and forged brass hinges with stainless steel pins.

3. Aluminum in contact with concrete shall be coated with bituminous coating.

4. The drain from the sidewalk door shall be stubbed-out to the exterior of the vault.

5. H-20 rated lids and doors shall be required for vaults under roadways, parking lots, and other locations with vehicular traffic, unless fully protected by bollards.

g. Vault Joints

1. Preformed plastic gaskets for horizontal vault joints shall meet requirements of Federal Specification SS-S-00210.

2. Gaskets shall be:

- A.** Kent Seal No. 2 manufactured by Hamilton Kent Manufacturing Company of Kent, OH
- B.** Ram-Nek by K.T. Snyder Company, Inc. of Houston, TX
- C.** Approved equal

h. Grout and Damp-proof Coatings

1. Damp-proof the exterior below-grade walls and base with a water-based blend that reacts with the free lime and calcium hydroxides in the concrete to seal the vault. An asphalt compound of brush or spray consistency conforming to Federal Specification ASTM D449 may be used with the City Engineer's approval.

2. Vaults damp-proofed using clear compounds shall be marked in black paint as having received such a coating. The markings shall indicate the type of material used.

6.6.3 Vault Installation

- a.** Excavation, base rock, and backfill shall conform to Sections 8.02.d and 8.03.b.6. If material in bottom of excavation is unsuitable for supporting unit, excavate and backfill to required grade with foundation stabilization as specified in Section 6.02.1.6
- b.** Place precast vaults in conformance with Standard Drawings 300-WA, 310-WA, and 811-WA.
- c.** Install preformed plastic gaskets for vault sections in accordance with manufacturer's instructions and the following:
 - 1.** Carefully inspect precast vault sections to be joined. Do not use sections with chips or cracks in the tongue.

2. Install gasket material in accordance with manufacturer's instructions. Use only primer furnished by gasket manufacturer.

3. Completed vaults shall be rigid and watertight.

4. Top of vault lid shall be six inches above adjacent finished landscape grade.

d. Pipe Penetrations

1. Openings in vault walls shall be no larger than two inches greater than flange diameter of pipe being installed.

2. Openings in knockout shall be made using a core drill or a series of smaller diameter drill holes along the circumference of the opening with centers no more than two inches in diameter.

3. Prior to backfilling around vaults, use non-shrink grout to seal all joints and wall penetrations, and patch wall areas with rock pockets.

6.7 Backflow Prevention General Requirements

6.7.1 Purpose and General Requirements

- a. Preservation of the quality of the public water supply is vital. No person may purposefully create a cross-connection that may cause any wastewater, foreign liquids or substances, or water from an alternate water source to enter the public water system. When a cross-connection is identified, the owner must immediately remove the cross-connection or install an approved backflow preventer.
- b. Cross-connections and backflow assemblies shall comply at all times with Oregon Administrative Rule (OAR) 333-61-0070, OAR 333- 61-0071 and the Uniform Plumbing Code (UPC). Contact the City of Tillamook Water Division for further information.
- c. Backflow assemblies shall be customer owned and maintained. Assemblies shall be tested annually as well as after installation, repair, and relocation. The owner shall bear the testing costs. Tests shall be conducted by a certified tester or journeyman plumber, as specified by OAR 333-061-0072.
- d. Backflow assemblies shall be installed on the service line at the property line, on private property outside of public easements. Per the City resolution, assemblies shall be available to inspection at all reasonable times.
- e. When a backflow assembly is installed behind the meter, thermal expansion may occur due to the building's hot water heater. The Uniform Plumbing Code requires additional equipment to be installed to control the thermal expansion.
- f. The City reserves the right to discontinue water service if a required

backflow assembly is not installed, tested, and maintained, if it is removed or bypassed, or if an unprotected cross-connection exists. Service may not be restored until such conditions or defects are corrected and verified by the City.

CHAPTER 7 – Erosion Prevention and Sediment Control

7.1 General Provisions

- a. The requirements of this Chapter shall apply to all activities requiring an Erosion Control Permit. The Applicant for the Erosion Control Permit shall be responsible for meeting these requirements. Approval and/or inspection of Erosion Control work by the City will not relieve the Applicant of this responsibility.
- b. Nothing in this section shall relieve any person of the obligation to comply with the regulations or permits of any federal, state, or local authority.
- c. The use of erosion prevention techniques, including proper site planning and construction phasing, shall be emphasized, rather than sediment control measures.
- d. These erosion control rules apply to all properties within the City of Tillamook, regardless of whether that property is involved in a construction or development activity.

7.2 Erosion Prevention and Sediment Control (EPSC) Standards

7.2.1 Erosion Prohibited

- a. Visible or measurable erosion as defined in Chapter 1, which enters, or is likely to enter, the public or private storm and surface water system or other properties, is hereby prohibited, and is a violation of these rules. The owner of the property, permittee under a Site Development Permit, together with any person or persons, including but not limited to the Contractor or the Engineer causing such erosion, shall be held responsible for violation of these rules.
- b. No person shall create physical erosion by dragging, dropping, tracking, or otherwise placing or depositing, or permitting to be deposited, mud, dirt, rock or other such debris upon a public street or into any part of the public storm and surface water system, or any part of a private storm and surface water system which drains or connects to the public storm and surface water system. Any such deposit of material shall be immediately removed using hand labor or mechanical means. No material shall be washed or flushed into any part of the storm and surface water system until all mechanical means to remove the debris have been exhausted and preventative sediment filtration is in place. The owner of the property, permittee, under a Site Development Permit, together with any person or persons, including but not limited to the Contractor or the Engineer who causes such erosion, shall be held responsible for violation of these rules.

7.2.2 EPSC Plans

With the exception of individual single-family home sites less than 1 acre, an EPSC plan shall be prepared in accordance with the requirements of Section

1.03 for all sites where an Erosion Control Permit is required.

7.2.3 Approved BMPs

The best management practices (BMPs) prescribed in subsection 7.03 are the approved BMPs that shall be used to meet subsection 7.02.1. Use of other BMPs shall require approval from the City.

7.2.4 Minimum BMPs

The minimum BMPs required shall include all the Base Measures described in subsection 7.03.2. In addition, for sites requiring an EPSC plan, the additional BMPs described in the EPSC plan shall be required.

7.2.5 Additional BMPs Required

Depending on site-specific conditions, the required base measures may be inadequate to prevent erosion and control sediment discharges. In these cases, additional BMPs shall be applied to the site to meet the requirements of section 7.02.1.

7.2.6 Wet Weather Measures

On sites where vegetation and ground cover are removed, vegetative ground cover shall be planted and established by October 1 and continue to function through May 31 of the following year, or as approved by the City. If ground cover is not established by October 1, the open areas shall be protected through May 31 of the following year with straw mulch, erosion blankets, or other methods approved by the City.

7.2.7 NPDES 1200-C Permit

An NPDES 1200-C permit is required for projects disturbing greater than one acre requiring an Erosion Control Permit.

7.2.8 Maintenance and Removal of BMPs

- a. The permittee shall maintain the facilities and techniques contained in the approved EPSC plan so as to continue to be effective during the construction phase, post construction phase, establishment of permanent vegetation, or any other permitted activity. If the facilities and techniques approved in an EPSC plan are not effective or sufficient as determined by the City site inspection, the permittee shall submit a revised plan within three working days of written notification by the City. Upon approval of the revised plan by the City, the permittee shall immediately implement the additional facilities and techniques included in the revised plan. In cases where erosion is likely to occur, the City may require the applicant to install interim control measures prior to submittal of the revised EPSC plan.
- b. Temporary BMPs, such as sediment fences, shall be removed after permanent vegetation is established.

7.2.9 Removal of Sediment

When erosion occurs and sediment is deposited in locations where it can enter the storm and surface water system, the sediment shall be immediately removed using hand labor or mechanical means. No material shall be washed or flushed into any part of the storm and surface water system until all mechanical means to remove the debris have been exhausted and preventative sediment filtration, e.g., inlet protection, is in place.

7.2.10 Contaminated Soils

In the event the construction process reveals soils contaminated with hazardous materials or chemicals, the Contractor shall stop work immediately, ensure no contaminated material is hauled from the site, remove the Contractor's work force from the immediate area of the contaminated area, leaving all machinery and equipment, and secure the area from access by the public until such time as a response team has relieved them of that responsibility. The Contractor shall immediately notify an emergency response team, the City, and Department of Environmental Quality of the situation.

7.2.11 Other Requirements

- a. To the degree practicable, existing vegetation shall be protected and left in place, in accordance with the clearing limits on the approved EPSC plan.
- b. Trees shall not be used as anchors for stabilizing working equipment.

7.3 Best Management Practices

7.3.1 General

This section provides a list of approved BMPs. Each BMP shall be implemented consistent with additional information in the Standard Drawings.

7.3.2 Base Measures

The following BMPs, as described in Table 7-3, shall be implemented on all sites requiring an Erosion Control Permit:

- a. Gravel Construction Entrance/Exit
- b. Linear Barrier or Perimeter Control (Sediment Fence)
- c. Storm Drain Inlet Protection

7.3.3 Erosion Prevention BMPs

Erosion prevention is the highest priority in the overall EPSC plan and shall be integrated into a project throughout the planning, design, scheduling, and construction phases. Erosion prevention BMPs shall be included in the approved EPSC plan. Table 7-1 is a list of approved erosion prevention BMPs.

TABLE 7-1 EROSION PREVENTION BMPs

BMP	Std. Drawin	Description
Preserve Natural Vegetation		Maintain existing vegetation or place vegetative buffer strips. This BMP is especially effective for sites with sensitive resources like wetlands, stream corridors, lakes, and steep slopes.
Buffer Zone		An undisturbed area or strip of natural vegetation or an established suitable planting adjacent to a disturbed area that reduces erosion and runoff. A Vegetated Corridor shall not be used or considered a buffer zone under this chapter.
Temporary and Permanent Seeding		Vegetative cover established on disturbed areas to reduce erosion by seeding with appropriate and rapidly growing grasses. Permanent seeding can be used in conjunction with erosion control blankets and mats to provide both temporary and permanent erosion prevention control.
Ground Cover		A protective layer of straw or other suitable material applied to the soil surface. Various ground cover methods include straw mulch, hydro-mulch, and compost blankets.
Hydraulic Application		A mechanical method of applying erosion control materials, other than simply hydro-seeding, to bare soil.
Sod		Permanent or temporary turf for immediate erosion protection and stabilization.
Matting	800 805	A class of products that includes manufactured mulch materials that are produced in a roll configuration that is placed on the ground and held in place by stakes, metal staples, geotextile pins, or other fastening system.
Soil Binders		Materials that are applied to the soil surface for dust control and temporary erosion control. These are also known as hydraulic soil stabilizers.
Stockpile Management	810	Methods to reduce or eliminate loss of sediment from temporary stockpiles of soil.
Dust Control		Water applied over susceptible areas, typically due to dry soil conditions, during high wind periods. (Also see section 6.03.6).

7.3.4 Runoff Control BMPs

The purpose of runoff control BMPs is to control stormwater runoff and drainage patterns at construction sites. Runoff control BMPs shall be included in the EPSC plan. Table 7-2 is a list of approved runoff control BMPs.

TABLE 7-2
RUNOFF CONTROL BMPs FOR ALL SITES

BMP	Std. Detail	Description
Pipe Slope Drain	815	The pipe slope drain carries concentrated runoff down steep slope without causing gullies, erosion, or saturation of slide-prone soils. It should be designed to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device, or stabilized area.
Outlet Protection	820 825	Outlet protections are physical structures that velocity and energy of concentrated flow to at conveyance outlets. Outlet protection includes lined basins, concrete aprons, and stilling basins.
Surface Roughening	830 835	Soil surface is roughened by mechanical methods. slopes prepared by surface roughening shall meet engineering compaction requirements. This BMP is intended to only affect the surface of soils and is intended to compromise slope stability or overall compaction.
Check Dams	840 845	Small, temporary dams placed across a natural or made channel or drainage ditch designed to drainage ditch erosion caused by stormwater restricting the velocity of flow in the ditch. Check are often used as a temporary measure while a being permanently lined with vegetation or other to prevent erosion.
Diversion Swale or Dike	850	A ridge of compacted soil or a vegetated lined swale located at the top, base or somewhere along a sloping disturbed area.

7.3.5 Sediment Control BMPs

- a. Sediment control BMPs include any practice that traps soil particles after they are dislodged and moved by wind, water, or mechanical means. These BMPs are usually passive systems that rely on filtering or settling particles out of the water or wind once they have become suspended. Sediment control BMPs treat the soil as a waste product that must be removed from where it has been transported and accumulated requiring disposal at an approved location.
- b. Sediment control BMPs are considered the last line of defense before stormwater runoff leaves a site and are not to be used as the primary methods for erosion prevention and sediment control.
- c. These BMPs are to be applied prior to and during earthwork.
- d. Sediment control BMPs shall be included in the approved EPSC plan.
- e. The perimeter sediment barrier identified in Table 7-3 is not required

where:

1. Flows are collected through the use of temporary or permanent grading or other means such that the flows are routed to an approved settling pond, filtering system, or sediment barrier.
 2. There are no concentrated flows, slopes are less than 10 percent, and runoff passes through a grassed area which is either owned by the applicant or such use is allowed, through written agreement, by the Owner of the grassed area. The grass area shall be at least equal in dimensions to the project area. The grass area shall not be located in a Vegetated Corridor or Sensitive Area.
 3. The surface is protected by re-established permanent vegetation.
- f. Table 7-3 is a list of approved sediment control BMPs.

TABLE 7-3 SEDIMENT CONTROL BMPs

BMP	Std. Detail	Description
Gravel Construction Entrance *	855	Gravel construction entrances shall be required at each entrance to the site. If a property contains or is adjacent to a stream, watercourse, or stormwater facility, or wetlands, BMPs in addition to a gravel construction entrance shall be required to prevent physical erosion into the water or wetland.
Tire Wash Facility	865 870	The wheel wash, which shall be incorporated with a construction entrance, shall be designed and anticipated traffic loads.
Linear Barrier or Perimeter Control *	875	Linear barrier (sediment fence) shall be installed around down-gradient perimeter of the site to control sheet flow the site. Sediment fence shall not be used as a measure that intercepts sediment-laden runoff and filters traps sediment or non-stormwater flows behind the shall not be placed across stream channel.
Wattles	880 885	Wattles are small, cylindrical barriers composed of biodegradable fibers encased in photodegradable netting. Wattles are placed in shallow trenches and along the contour of newly constructed or disturbed slopes.
Storm Drain Inlet Protection *	900- 925	Temporary inlet protection shall be provided for all for the duration of construction to keep sediment, trash, other construction-related pollutants out of the storm system.
Rock or Brush Filter Berm	890	Rock or brush filter berms are temporary barriers composed of brush, wrapped in filter cloth, and secured or rock anchored in place. These are designed for sheet flow, not concentrated flow, and shall not be placed across a stream or channel.
Sidewalk Subgrade Gravel Barrier	895	Undercut lots or sidewalk subgrades with rock base are linear drainage barriers that provide an effective sediment filtration and retention area behind the curb.
Dewatering		Separation of sediment and water can be achieved through filtration, either by gravity or with pressure.
Sediment Trap	930	A sediment trap consists of a small, temporary ponding area with a rock weir or perforated riser pipe at the outlet. This BMP shall not be used for a drainage basin greater than 5 acres.
Sediment Basin	935	A temporary sediment basin has one or more inflow points and baffles to spread the flow for wet and dry storage. The sediment basin is effective for about one year with a drainage area less than 10 acres.

* - There measures are minimum requirements for all projects per Section 7.03.2.

7.3.6 Dust Control BMPs

Dust shall be minimized to the extent practicable, utilizing all measures necessary, including, but not limited to the following BMPs.

- a. Sprinkling haul and access roads and other exposed dust producing areas with water.
- b. Application of dust palliatives on access and haul roads as approved by the City.
- c. Establishing temporary vegetative cover.
- d. Placing wood chips or other effective mulches on vehicle and pedestrian use areas.
- e. Maintaining the proper moisture condition on all fill surfaces.
- f. Pre-wetting cut and borrow area surfaces.
- g. Use of covered haul equipment.

7.3.7 Non-Stormwater Pollution Control BMPs

- a. For the purposes of this section, non-stormwater pollution includes, but is not limited to, concrete truck wastewater, paint, fuel, hydraulic fluid, solvents, glues, and other waste materials characteristic of construction sites.
- b. Non-stormwater pollution controls consist of general site and materials management measures that directly or indirectly aid in minimizing the discharge of sediment and other construction related pollutants from the construction site.
- c. Approved non-stormwater pollution control BMPs include:
 - 1. Concrete truck washout areas
 - 2. Written spill prevention and response procedures
 - 3. Employee training on spill prevention and proper disposal procedures
 - 4. Protected areas for equipment storage and maintenance where the risk of pollution is minimal

7.4 Inspection

7.4.1 Pre-Construction Conference

- a. Prior to the initial EPSC inspection, the City may require, or the permittee, Owner, or Contractor may request, a pre-construction conference to review and discuss the EPSC plan for the site.
- b. A pre-construction conference shall be required when the risk of erosion is high due to one or more of the following factors:
 - 1. Wet weather construction

2. Steep slopes with severe erosion potential
3. Construction adjacent to a sensitive area or vegetated corridor
4. Mass grading on a large site

7.4.2 City Initial EPSC Inspection

- a. On all projects, except single family home construction sites, erosion prevention and sediment control base measures shall be installed by the permittee and then inspected and approved by the City inspector prior to the start of any permitted activity.
- b. For single-family home construction sites, erosion prevention and sediment control measures for each property shall be installed by the permittee and then inspected and approved by the City inspector prior to the building foundation installation. Foundation approvals shall not be given until erosion prevention and sediment control measures are approved.

7.4.3 Permittee Inspections

The permittee shall provide ongoing inspection of EPSC measures. Table 7- 4 identifies the required minimum inspection frequency.

TABLE 7-4
Minimum EPSC Inspection Frequency

Site Condition	Minimum Inspection Frequency
Active period	Daily when stormwater runoff, including runoff from snow melt, is occurring.
Prior to site becoming inactive or in anticipation of site inaccessibility	Once to ensure that EPSC measures are in working order. Any necessary maintenance and repair shall be made prior to leaving the site.
Inactive periods greater than 7 consecutive calendar days	Once every 2 weeks.
Periods during which the site is inaccessible due to inclement weather	If practical, inspections shall occur daily at a relevant and accessible discharge point or downstream location.

7.4.4 Final Inspection

- a. A final erosion control inspection shall be required on all sites prior to the sale or conveyance to a new Property Owner(s) or prior to the removal of EPSC measures.
- b. For single family sites seeking final erosion control inspection between September 1 and May 31, groundcover using approved techniques shall be completed before the single- family site can be deemed complete.

CHAPTER 8 – Trench Excavation and Backfill

8.1 Definitions

- a. Trench Excavation
Trench excavation is the removal of all material encountered in the trench to the depths shown on the plans or as directed by the City.
- b. Trench Foundation
The bottom of the trench on which the pipe bedding is to lie. The trench foundation provides the support for the pipe.
- c. Pipe Bedding
The furnishing and placing of specified materials on the trench foundation to uniformly support the barrel of the pipe from the trench foundation to the springline of the pipe.
- d. Pipe Zone
The full width of the trench from six inches above the top outside surface of the barrel of the pipe to the springline of the pipe.
- e. Spring Line
Halfway up the sides of the pipe when it has been laid on the pipe bedding.
- f. Trench Backfill
The furnishing, placing, and compacting of material in the trench between the top of the pipe zone material and the bottom of the pavement base rock, ground surface, or surface materials as directed.
- g. Native Material
Earth, gravel, rock, or other common material free from humus, organic matter, vegetative matter, frozen material, clods, sticks, and debris, isolated points or areas, or larger stones which would cause fracture or denting of the structure or subject it to undue stress.

8.2 Materials

- a. Trench Foundation
Trench foundation shall be native material in all areas except where ground water or other conditions exist and, in the opinion of the Engineer, the native material is such that it cannot support the bedding and pipe. In those conditions, geotextile fabrics approved by the City shall be installed or the unsuitable material shall be removed as required and the trench backfilled with approved crushed aggregate.
- b. Pipe Bedding
Pipe bedding material shall be clean crushed rock with a maximum size of 3/4 inch, uniformly graded from coarse to fine or as approved by the City.
- c. Pipe Zone
The pipe zone material shall consist of approved bedding material except when using reinforced concrete pipe, ductile iron pipe or C 900 pipe, where native material, i.e. earth, gravel, rock, or combination thereof

may be used. All pipe zone materials shall be subject to the City approval.

d. Trench Backfill

Above the pipe zone will be divided into the following classifications:

1. Class A Backfill. Class A backfill shall be native or common material, which in the opinion of the Engineer meets the desired characteristics required for the specific surface loading.

A. The City may require a geotechnical engineering investigation of the suitability of native materials for use in trench backfill.

B. Class A backfill material shall be free of organic material, wood, rocks larger than 6 inches in any dimension, and other debris.

C. The moisture content of Class A backfill material shall be no more than 5% above optimum during backfill placement and compaction.

2. Class B Backfill. Class B backfill shall be 3/4"-0" granular Grade A crushed rock material, unless otherwise approved.

A.. Class B backfill material shall be crushed rock meeting the requirements of ODOT Standard Specifications Section 00641 and Section 02630.

B. Designated size shall be 3/4"-0" with no more than 5% passing the No. 200 sieve (wet analysis).

e. Geotextile Fabric

The geotextile fabric used in trench stabilization shall be lightweight, nonwoven filter fabric, such as Mirafi 140N or equal, for unstable soil conditions or high strength woven filter fabric (Mirafi 600x or equal) for highly unstable soil conditions. The Engineer shall select the appropriate fabric based on the soil conditions.

8.3 Construction

a. Excavation

1. Clearing the Right-of-Way

Clearing shall be completed prior to the start of trenching. Brush shall be cut as near to the surface of the ground as practicable and removed to a disposal site approved by the City. The Contractor shall observe all federal, state, and local laws relating to fire permits, burning materials and other requirements. Under no condition shall brush be covered by excavated materials prior to being cleared and removed.

Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, nor interfere with the function of existing drainage facilities.

2. Open Trench Limit

The length of the open trench shall always be kept to a minimum. The City shall determine the amount of open trench allowed based upon work conditions of the area. In normal cases, the open trench length shall not exceed 300 feet.

Related trench construction such as pavement, road gravel, concrete restoration, etc., shall be completed within 800 feet of the open trench limit unless otherwise authorized.

3. Trench Width

The trench width at the surface of the ground shall be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches shall be of sufficient width to allow for shoring, proper joining of the pipe, and backfilling of material along the sides of the pipe. The width of trenches in which pipe is to be laid shall be 12 inches greater than the nominal diameter of the pipe or 24 inches minimum, unless otherwise approved by the City Engineer.

No maximum width of trench at the top of the pipe is specified in this Chapter. When required by design, the maximum trench width shall be shown on the plans. If the maximum width shown is exceeded by the Contractor without written authorization, the Contractor will be required to provide pipe of a higher strength designation, a higher class of bedding, or both, as approved by the City. Excavation for manholes and other structures shall be wide enough to provide a minimum of 12-inches between the structure's surface and the sides of the excavation.

b. Installation

1. Shoring

The Contractor shall provide all materials, labor, and equipment necessary to adequately shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in compliance with all OSHA requirements. That portion of cribbing or sheeting extending below the springline of rigid pipe or below the crown elevation of flexible pipe shall be left in place unless satisfactory means of consolidating bedding or side support, disturbed by cribbing or sheeting removal, can be demonstrated. If a movable box is used in lieu of cribbing or sheeting and the bottom cannot be kept above the springline of the crown elevation of flexible pipe, the bedding or side support shall be carefully reconsolidated behind the movable box prior to placing backfill. The use of horizontal strutting below the barrel of pipe or the use of pipe as support for trench bracing will not be permitted.

2. Dewatering

The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the excavation during the time the trench is being prepared for the pipe, during the laying of the pipe, and until the backfill at the pipe zone has been completed. Groundwater shall be controlled such that softening of the bottom of excavations or formation of "quick" conditions or "boils" during excavation shall be prevented. Dewatering systems shall be designed to prevent removal of the natural soils, and maintained in such a manner that the groundwater level outside the excavation is not reduced to the extent that adjacent structures or property would be damaged or endangered.

3. Trench Foundation

When, in the judgment of the Engineer, the existing material in the bottom of the trench is unsuitable for supporting the pipe, the Contractor shall install geotextile fabrics or excavate below the pipe, as directed. The Contractor shall place trench foundation material to the bottom of the pipe bedding. The trench foundation material shall be placed over the full width of the trench and compacted in layers not exceeding six inches deep to the required grade.

4. Pipe Bedding

Pipe bedding consists of leveling the bottom of the trench on the top of the foundation material and placing bedding material to the horizontal centerline of the pipe, unless otherwise specified. The Contractor shall spread the bedding smoothly to the proper grade so that the pipe is uniformly supported along the barrel, and excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under the pipe shall provide a firm, unyielding support along the entire pipe length. Particular attention shall be given to the area from the flow line to the horizontal centerline of the pipe or top of bedding to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone. Pipe bedding shall be placed the full width of the trench.

5. Grade

The Contractor shall follow Standard Drawing 590. The subgrade upon which the bedding is to be placed shall be firm, undisturbed, and true to grade. If the trench is over-excavated, the Contractor shall restore to grade with material of the type specified for pipe bedding and place the material over the full width of the trench.

6. Backfill

Backfill shall not be placed in the trench in such a way as to permit free-fall of the material until a minimum of two feet of cover is provided over the top of the pipe. Under no circumstances shall the Contractor allow sharp, heavy materials to drop directly onto the pipe or pipe zone material around the pipe. If the required compaction density has not been obtained, the Contractor shall remove the backfill from the trench and recompact. This process shall be repeated until the Contractor has established a procedure that will provide the required field density. The Contractor will then be permitted to proceed with backfilling and compact the remainder of the pipeline under the approved procedure.

With approval of the City, the Contractor may substitute water settling as an alternate compaction method. Water settling shall be done only with approved jetting equipment and methods. Water settlement shall not relieve the Contractor of the responsibility for compaction of trench backfill as specified in this Chapter for standard compaction methods. The location and extent of trench water settling will be determined by the Engineer. The Contractor shall backfill the trench as specified to a point level with or slightly above the required grade to allow for settlement. After all structures are completed and all subsurface utilities have been restored to their original condition, the Contractor shall place water in the trench section in such quantities and in such a manner that all portions of the backfill for the entire trench depth become saturated. The

Contractor shall determine the procedures and provide the quantity of water required in every case to effect complete water settlement of the backfilled materials. Under no circumstances will the jetting pipe be inserted closer than two feet above the top of the pipeline. Any subsequent settlement of the trench during the warranty period shall be considered to be the result of improper water settlement or compaction and shall be promptly corrected.

The granular backfill within four feet of finished grade shall be compacted to not less than 95 percent relative compaction as determined by Method A of AASHTO T99. Backfill more than four feet from finished grade shall be compacted to not less than 90 percent relative compaction. Tests to determine compliance with the compaction requirements shall be provided as required by the City.

7. Impervious Zone

When installing sanitary sewers within a stream corridor or wetland area, an impervious zone of clay or other approved material shall be installed to prevent draining the wetland. The impervious zone shall be 2 feet thick parallel to the pipe, extending from the bottom of the pipe bedding to the top of the pipe zone, and extending one foot beyond each side of the trench wall. This zone shall be compacted to 90 percent relative compaction as determined by Method A of AASHTO T99.

8.4 Pavement Restoration

8.4.1 Materials

a. Crushed Rock

The following rock specifications shall be required.

1. Base Course Rock

Rock for the base course of the street shall be 1-1/2-inches and shall conform to the applicable portions of the standard specifications for highway construction of the Oregon State Highway Division for course aggregate base material.

2. Leveling Course Rock

Rock for leveling course shall be 3/4-inch minus, conforming to the applicable portions of the Standard Specifications for Highway Construction of the Oregon State Highway Division for leveling course.

b. Asphalt Concrete

1. Prime Coat

Materials for prime coat shall be emulsified asphalt type CMS 2 or approved equal.

2. Tack Coat

Materials for tack coat shall be emulsified asphalt-type RS 1, CRS 1, or approved equal.

3. Base Course

When more than two inches of asphalt concrete is required, the asphalt concrete shall be placed in two or more courses. The base course shall be Class B asphaltic concrete mix conforming to the Standard Specifications for Highway Construction of the Oregon State Highway Division.

4. Surface Course

Asphaltic concrete for the surface course shall be Class C mix conforming to the Standard Specification of the Oregon State Highway Division. All surface course mix design is subject to final approval by the City.

8.4.2 Workmanship

a. Subgrade

The Contractor shall:

- 1.** Bring the trench to a smooth, even grade at the correct distance below the top of the existing pavement surface, allowing for base rock, leveling rock and asphalt concrete.
- 2.** Trim existing pavement so that the trench width plus 12- inches of asphalt is removed creating a "T" cut section as shown in Standard Drawing 600.
- 3.** Remove any pavement which has been damaged or which is broken and unsound and provide a smooth, sound edge for joining the new pavement by sawcutting.
- 4.** Compact the top four feet of pavement subgrade to 95 percent relative density, ASTM D2049.
- 5.** And accomplish supplementary compaction where required with approved mechanical vibrating or power tampers.

b. Base Aggregate Course and Leveling Course

The Contractor shall obtain approval of the subgrade by the City prior to placing any base course material on the subgrade. Workmanship in manufacturing, placing, compacting, and maintaining base, or leveling course, shall be in conformance with the requirements of the Standard Specifications for Highway Construction of the Oregon State Highway Division, except as modified in this Chapter.

c. Tack Coat

After the leveling course has been compacted, the Contractor shall apply the tack coat to the edges of the existing pavement and manhole frames at 0.06 to 0.12 gallons per square yard. The surface upon which the tack coat is applied shall be dry and clean of dirt, dust, and other matter inhibiting asphalt adherence.

d. Asphaltic Concrete

1. Weather Conditions

Asphaltic concrete shall not be placed when the atmospheric temperature is lower than 40 degrees F., during rainfall, or when the surface is frozen or wet. Exceptions will be permitted only in special cases and only with prior written approval of the City.

2. Base Course

If a base course of asphaltic concrete is required, the Contractor shall place the asphaltic concrete on the prepared subgrade over the trench to a depth of two inches. The Contractor shall spread and level the asphaltic concrete and compact it by rolling or by use of hand tampers where rolling is impossible. Power rollers shall be capable of providing compression of 250 pounds per inch of width.

3. Surface Course

The Contractor shall place the asphaltic concrete to the required depth; spread and level the asphaltic concrete with hand tools or by use of a mechanical spreader, depending upon the area to be paved; bring the asphaltic concrete to the proper grade and compact by rolling or the use of hand tampers where rolling is impossible; roll with power rollers capable of providing compression of 250 pounds per inch of width; and begin the rolling from the outside edge of the replacement progressing toward the existing surfacing, lapping the existing surface at least one half the width of the roller. If existing surfacing bounds both edges of the replacement, the Contractor shall begin rolling at the edges of the replacement, lapping the existing surface at least one half the width of the roller, and progressing toward the center of the replacement area. Each preceding track shall be overlapped by at least one half the width of the roller and make sufficient passes over the entire area to produce the desired result, as determined by the City. The finished surface of the new compacted paving shall be flush with the existing surface and shall conform to the grade and crown of the adjacent pavement. Immediately after the new paving is compacted, all joints between new and original asphaltic pavement shall be painted with hot asphaltic or asphaltic emulsion and be covered with dry paving sand before the asphaltic solidifies.

e. Protection of Structures

The Contractor shall provide whatever protective coverings may be necessary to protect the exposed portions of bridges, culverts, curbs, gutters, posts, guard fences, road signs, and any other structures from the paving operations. All oil, asphalt, dirt, or other undesirable matter that may come upon these structures by reason of the paving operations shall be removed.

Existing and new water valve boxes, manholes, catch basins, or other underground utility appurtenances shall be made level with the finish asphalt grade. The City or other appropriate authority shall be contacted prior to any facility adjustments for guidance as to the appropriate procedures, standards and materials to be used. All covers shall be protected during asphalt application.

f. Rock Surfacing

Where so directed by the City, the Contractor shall place a minimum of two inches of level course rock, as specified in this Chapter, for the full

width of all streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction.

- g.** Contractor's Responsibility
The Contractor shall repair all settlement of pavement over trenches within the warranty period at no charge to the City.
- h.** Driveways
Driveways shall be replaced to original conditions following the work. Such replacement shall be done in accordance with all applicable legal standards for road shoulders within the limits of the work.

8.5 Compaction Testing

- a.** Field compaction test results shall be evaluated based on a standard Proctor (ASTM D698) laboratory test completed on a representative sample of the material being used as trench backfill.
- b.** A certified testing agency shall perform compaction testing and the Contractor shall provide the test results to the City. If results indicate that compaction or moisture content is inadequate, backfill material shall be removed and replaced prior to continuation of work.
- c.** Testing of backfill compaction shall include a test at the surface and at two-foot increments below the surface. Testing shall be conducted every 25 feet along the trench length or as directed by the City Engineer.
- d.** Any trench backfill not passing the compaction test and/or showing visible failure shall be rejected and replaced.

CHAPTER 9 – Wastewater Pump Stations and Force Mains

9.01 General

Where a wastewater pump station and force main are required to serve an undeveloped area, as determined and indicated in the Master Plan, the requirements will be determined by the City Engineer

CHAPTER 10 – Septic Tank Effluent Pump (STEP) Systems

10.1 General Provisions

- a. With approval of the City STEP system which pump to a public sewer line may be installed when:
 - 1. A public gravity sewer or existing STEP public force main is adjacent to the lot and
 - 2. Gravity access to a public sewer line cannot reasonably be obtained, and
 - 3. The City determines that a public pump station serving multiple properties is not a more appropriate solution, and
 - 4. Only one house, commercial building or complex of buildings is connected to the STEP system and pressure line, and
 - 5. Unless approved by the City, the public sewer line at the point of connection is polyvinyl chloride (PVC) material, and flows in the public line are such that hydrogen sulfide generation will not be a problem.
- b. The STEP system operation, maintenance, electricity and replacement are the responsibility of the property owner. The property owner is also responsible for the repair or replacement of the tank and connections if infiltration occurs. It is in accordance with Ordinance No. 1291 and the CCT § 52.035, 52.036, 52.037, 52.038, 52.051, 52.054, 52.055, 52.056, 52.057, 52.058 and any other ordinances that might pertain.
- c. The City shall be permitted to enter upon private property for the purpose of inspection, observation, measurement, sampling, and testing of STEP system.

10.0 2 Technical Specifications.

On-Site Interceptor Tank

- a. Tanks shall be precast concrete and shall have been designed by a registered engineer as to size and site use specification and approved by the City. The manufacturer shall provide the structural design and certification to the City for review.
- b. The tank shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of delivery to the site as per DEQ requirements (24 hour test).

- c. The tank shall successfully pass a hydrostatic test as per DEQ requirements (24-hour test) at the time of manufacture and after installation at the site.
- d. The tank shall be installed in accordance with the manufacturer's instructions. The installation and testing shall be witnessed by City personnel.

10.2.1 Risers and Lids

- a. Inlet risers, if required, shall be ribbed PVC. Risers shall be at 24 inches.
- b. Outlet risers shall be ribbed PVC. Outlet risers shall be at least 12 inches high and minimum nominal diameter of 24 inches.
- c. Lids shall be Orenco Systems Model FL-24g or equal, and provided with neoprene gasket and stainless steel bolts.
- d. Risers and lids shall be free from infiltration.

10.2.2 Pumping Assemblies

The pumping system shall be an Orenco Pumping System, or equal, that is designed by a registered engineer to meet the application of it intended use.

10.3 Application

The applicant shall submit to the City two copies of the engineering plans prepared by a licensed professional engineer. The application shall also show that gravity sewer is not available to the lot, that there is no practical way to server the lot with gravity sewer, and that there will not be a hydrogen sulfide problem at the point of connection to the gravity system.

The City may set and charge additional fees for the plan review and inspection of STEP system installations.

Prior to final acceptance by the City, the Property Owners shall furnish an easement for access to property stating that the STEP system exists on the property, that it is a private system (not owned or maintained by the City), and that the City shall be permitted to enter upon the subject property for the purpose of inspection, observation, measurement, sampling, and testing of the STEP system.

10.4 Inspection

Inspection and testing of the individual STEP system shall be required prior to final acceptance by the City.

CHAPTER 11 – Runoff Treatment and Control

11.1 General Provisions

- a. The provisions of this chapter shall apply to all development projects within City jurisdiction. Interpretations of such provisions and their application in specific circumstances shall be made by the City.

11.2 General Requirements for Water Quantity and Quality Facilities

11.2.1 Erosion Protection

- a. Inlets to water quality and quantity facilities shall be protected from erosive flows through the use of an energy dissipater or rip rap stilling basin of appropriate size based on flow velocities. Flow shall be evenly distributed across the treatment area.
- b. All exposed areas of water quality and quantity facilities shall be protected using coconut or jute matting. Coconut matting or high density jute matting (Geojute Plus or approved equal) shall be used in the treatment area of swales and below the water quality volume levels of ponds. Low density jute matting (Econo-jute or approved equal) may be used on all other zones.

11.2.2 Vegetation

- a. Except as specified in section 11.07, vegetation shall be in accordance with Appendix A: Planting Requirements.
- b. No invasive species shall be planted or permitted to remain within a facility which may affect its function, including, but not limited to the following:
 - 1. Himalayan blackberry (*Rubus discolor*)
 - 2. Reed canarygrass (*Phalaris arundinacea*)
 - 3. Teasel (*Dipsacus fullonum*)
 - 4. English Ivy (*Hedra helix*)
 - 5. Nightshade (*Solanum* sp.)
 - 6. Clematis (*Clematis ligusticifolia* and *C. vitifolia*)
 - 7. Cattail (*Typhus latifolia*)
 - 8. Thistle (*Cirsium arvense* and *C. vulgare*)
 - 9. Scotch Broom (*Cytisus scoparius*)
 - 10. Knotweed

11.2.3 Fencing

- a. Unless otherwise approved by the City, delineation fencing shall be required around facilities and/or tracts containing facilities. The fence shall be 4-foot high, vinyl-clad chain link fence conforming to Drawing No. 740.
- b. When a facility is fenced, the fence shall include a 12-foot wide lockable gate for maintenance access conforming to Standard Drawing No. 740.

- c. If a facility is located adjacent to a Vegetated Corridor, wildlife friendly fencing shall be utilized.

11.2.4 Access

- a. General Access Requirement

Access roads shall be provided for maintenance of all water quality and quantity facilities. The following criteria are considered to be the minimum required for facilities maintained by the City. If the design Engineer anticipates that any of the requirements will not be met due to the configuration of the proposed development, the design Engineer is advised to meet with the City Engineer to gain approval for the deviation prior to submittal.

- b. Standard Road Design

1. The road section shall be three (3) inches of class "C" asphaltic concrete; over two (2) inches of ¾"-0" compacted crushed rock; over six (6) inches of 1½"-0" compacted crushed rock; over subgrade compacted to 95-percent AASHTO T-99; or, the design Engineer may submit an alternate design certified as capable of supporting a 30-ton maintenance vehicle in all weather conditions.

2. Strengthened sidewalk sections shall be used where maintenance vehicles will cross.

3. Maximum grade shall be 10-percent with a maximum 3- percent cross-slope.

4. Minimum width shall be 12 feet on straight runs and 15 feet on curves.

5. Curves shall have a minimum 40-foot interior radius.

6. Access shall extend to within 10-feet of the center of all structures unless otherwise approved by the City.

7. The City may require a curb or other delineator at the edge of the road for drainage, a curb stop, or to demarcate the road where the road edge is not apparent.

8. The side slope for road embankments shall be 2H:1V or flatter.

9. A vehicle turnaround shall be provided when the access road exceeds 40' in length.

- c. Alternate Access Road

An alternate access road design meeting the requirements of this section may be approved by the City for facilities in which access is required for general maintenance and long term care of the facility, but where there is no structure, as determined by the City, requiring regular maintenance.

1. The road section shall meet the requirements of 11.02.4(b)(1) or an alternate section certified as capable of supporting AASHTO HS-20 loading.
2. As an alternative to the requirements of 11.02.4(c)(1)), a concrete grid paver surface may be constructed by removing all unsuitable material, laying a geotextile fabric over the native soil, placing pavers, filling the honeycombs/grids with soil, and planting appropriate grasses.
3. Strengthened sidewalk sections shall be required where maintenance vehicles will cross.
4. Maximum grade shall be 20-percent with a maximum 3- percent cross-slope.
5. Minimum finished width shall be 12 feet.
6. The City may require a curb or other delineator at the edge of the road for drainage, a curb stop, or to demarcate the road where the road edge is not apparent.
7. The side slope for road embankments shall be 2H:1V or flatter.
8. A vehicle turnaround shall be provided when the access road exceed 40' in length.

11.2.5 Maintenance Responsibilities

- a. Unless otherwise approved by the City, newly constructed water quality or quantity facilities serving multiple parcels or public roads shall be publicly maintained or assured through an ongoing maintenance agreement.
- b. Publicly maintained water quality or quantity facilities shall be covered by a surface and stormwater management easement dedicated to the City. The City shall also be granted an access easement to maintain the facility. The City will typically not own the land the facility is on.
- c. Unless otherwise approved by the City, development creating multiple parcels intended for separate ownership shall enclose the publicly maintained water quality and quantity facilities in a tract.

11.3 Water Quantity Control Requirements

11.3.1 Mitigation Requirement for Quantity

Each new development shall incorporate techniques for mitigating its impacts on the public stormwater system in accordance with Section 3.05. The City shall determine which of the following techniques may be used to satisfy this mitigation requirement.

- a. Construction of permanent on-site stormwater quantity detention facilities designed in accordance with this chapter; or

- b. Enlargement or improvement of the downstream conveyance system in accordance with this chapter and Chapter 3;
or
- c. Payment of a fee as approved by the City.

11.3.2 Criteria for Requiring On-Site Detention

- a. On-site facilities shall be constructed when any of the following conditions exist:
 - 1. There is an identified downstream deficiency, and the City determines that detention rather than conveyance system enlargement is the more effective solution.
 - 2. Detention provides a timing benefit for the overall system.
 - 3. There is an identified regional detention site within the boundary of the development.

11.3.3 Hydraulic Design Criteria

- a. Detention design shall be assessed by dynamic flow routing through the basin. Documentation of the proposed design shall be included in the drainage report. Acceptable analysis programs include those listed below, as well as others using the SBUH or TR-55 methodology, provided the considerations outlined in Section 3.04.2 are followed.
 - 1. HYD
 - 3. HEC-1
 - 4. HEC-HMS
 - 5. SWMM
 - 6. HYDRA
 - 7. Others as approved by the City
- b. Peak runoff rates shall not exceed pre-development rates for the specific range of storms, per Subsection 11.03.4(b).
- c. A pond overflow system shall provide for discharge of the design storm event without overtopping the pond embankment or exceeding the capacity of the emergency spillway.
- d. Provide an emergency spillway sized to pass the 100-year storm event or an approved hydraulic equivalent. Emergency spillway shall be located in existing soils when feasible and armored with riprap or other approved erosion protection extending to the toe of the embankment.

11.3.4 Other Requirements

- a. All water quantity facilities shall be designed in accordance with City guidance documents and be consistent with this Chapter.

- b. When required, stormwater quantity on-site detention facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development runoff rates from the site, based on 24-hour storm events ranging from the 2-year return storm to the 25-year return storm. Specifically, the 2, 10, and 25-year post-development runoff rates will not exceed their respective 2, 10, and 25-year pre-development runoff rates; unless other criteria are identified in an adopted watershed management plan or subbasin master plan.
- c. When required because of an identified downstream deficiency, stormwater quantity on-site detention facilities shall be designed such that the peak runoff rates will not exceed pre-development rates for the specific range of storms where the downstream deficiency is evident.
- d. Construction of on-site detention shall not be allowed as an option if such a detention facility would have an adverse effect upon receiving waters in the basin or subbasin in the event of flooding, or would increase the likelihood or severity of flooding problems downstream of the site.
- e. Low impact development approaches, designed in accordance with this Chapter, can be utilized to meet all or part of any detention requirements on a site.

11.4 Water Quantity Facility Design Standards

11.4.1 Facility Design Criteria

- a. The facility can be a combined water quality and quantity facility provided it meets all relevant criteria.
- b. Interior side slopes up to the Maximum Water Surface: 3H:1V or flatter.
- c. If interior slopes need to be mowed side slope: 4H:1V or flatter.
- d. Exterior Side Slopes: 2H:1V or flatter, unless analyzed for stability by a geotechnical engineer.
- e. Minimum Freeboard: 1-foot from 25-year design water surface elevation.
- f. Provide an approved outlet structure for all flows.
- g. Certain situations require use of multiple orifice plates to achieve

11.4.2 Walls in Water Quantity Facilities

- a. Retaining walls may serve as pond walls if the design is prepared and stamped by a registered professional engineer and a fence is provided along the top of the wall. At least 25% of the pond perimeter shall be vegetated to a side slope of 3H:1V or flatter.

- b. Walls that are 4 feet or higher shall meet all of the following criteria:
 - 1. Be approved by a licensed structural or geotechnical engineer;
 - 2. The City shall not have maintenance responsibility for the wall. The party responsible for maintenance of the walls within the water quantity tract or easement shall be clearly documented on the plat or in alternate form as approved by the City.

11.5 Water Quality Treatment Requirements

11.5.1 General

Owners of new development and other activities which create new impervious surfaces or increase the amount of stormwater runoff or pollution leaving the site are required to construct or fund permanent water quality facilities to reduce contaminants entering the storm and surface water system.

11.5.2 Criteria for Requiring Construction of a Water Quality Facility

- a. A water quality facility shall be constructed on-site unless, in the judgment of the City, any of the following conditions exist:
 - 1. The site topography or soils makes it impractical, or ineffective to construct an on-site facility;
 - 2. The site is small, and the loss of area for the on-site facility would preclude the effective development.
 - 3. There is a more efficient and effective regional site within the subbasin that was designed to incorporate the development or is in the near vicinity with the capacity to treat the site.
 - 4. The development is for the construction of one or two family (duplex) dwellings on an existing lot of record.
- b. If construction of an onsite facility is not required as a result of meeting conditions outlined in Section 11.05.2 (a) (1)-(3), the Owner of the development shall pay a System Development Charge In-Lieu of Construction of On-Site Facilities in accordance with City Rules and Regulations. This charge shall be calculated on an equivalent basis of constructing the minimum Standard Water Quality Swale. This In-Lieu fee shall not apply to single-family residential partitions.

11.5.3 Required Treatment Design Efficiency

- a. Stormwater quality facilities shall be designed to remove 65 percent of the total phosphorous from the runoff from the impervious area that is tributary to the facility.
- b. The phosphorous removal efficiency specifies only the design requirements and is not intended as a basis for performance evaluation or compliance determination of the stormwater quality control facility installed or constructed pursuant to this Chapter.

- c. The following alternative approaches are available for meeting the treatment design efficiency standard in this section:
 - 1. Pretreatment as specified in section 11.05.7 in combination with one of the following facilities:
 - A) Vegetated Swale
 - B) Extended Dry Basin
 - C) Constructed Water Quality Wetland
 - 2. Proprietary treatment systems meeting the requirements of section 11.05.8
 - 3. Low impact development approaches that can be demonstrated, to the satisfaction of the City, to meet the removal efficiency standard in this section.

11.5.4 Design Considerations

- a. If an onsite water quality facility cannot be constructed to treat the runoff from the development's impervious surface, then with City approval, an on- or off-site water quality facility may be designed to treat runoff from an equivalent area of adjacent untreated impervious surfaces.
- b. Facilities shall be designed such that flow from the development is treated off-line from the storm conveyance system and reconnected to upstream flows following treatment. If an off-line facility is not feasible, additional capacity may be required for upstream flow.
- c. Discharges to sensitive areas shall maintain the hydro period and flows of pre-development site conditions to the extent necessary to protect the characteristic functions of the sensitive area. Conversely, discharge of flows that may be critical to downstream water quality sensitive areas into other catchments will not be permitted unless addressed in the applicant's Service Provider Letter.
- d. The stormwater quality facilities shall be designed for one-half of the 2-year, 24 hour storm.
- e. All water quality facilities shall be designed in accordance with this Chapter.

11.5.5 Impervious Area Used In Design

- a. For single family and duplex residential subdivisions, stormwater quality facilities shall be sized for all impervious area created by the subdivision and for all existing impervious area proposed to remain on site, including all existing and proposed residences on individual lots at the rate of 2640- square feet of impervious surface area per dwelling unit. For the purpose of design calculations, the actual impervious surface can be utilized as an alternative to 2640 square feet per dwelling unit when the average lot size on a single-family residential project is less than 2000 sq.ft.

- b. Except as noted in subsection (d) below, for all developments other than single family and duplex, including row houses and condominiums, the sizing of stormwater quality facilities shall be based on the impervious area created by the development and for all existing impervious area proposed to remain on site, including structures and all roads and impervious areas. Impervious areas shall be determined based upon building permits, construction plans, or other appropriate methods of measurement deemed reliable by the City.
- c. The impervious area used in design shall be modified in accordance with subsection 11.07 when approved low impact development approaches are utilized.
- d. For redevelopment sites, the impervious area used to design water quality facilities shall be based on Table 11-1.

TABLE 11-1
IMPERVIOUS AREA REQUIRING TREATMENT ON REDEVELOPMENT SITES

Existing Impervious Area on Site	Existing Impervious Area Disturbed by Redevelopment	Impervious Area Required to Treat
<5,280 sq.ft.	≤ 100%	No new treatment
≥5,280 sq.ft. and <0.5 acres	< 1,000 sq.ft.	No new treatment
	≥ 1,000 sq.ft.	100% of impervious area
≥0.5 acres and < 5 acres	< 1,000 sq.ft.	No new treatment
	≥ 1,000 sq.ft. and < 25%	Disturbed impervious area + 25% of undisturbed impervious area
	≥ 25% and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	≥ 50%	100% of impervious area
≥5 acres	< 1,000 sq.ft.	No new treatment
	≥ 1,000 sq.ft. and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	≥ 50%	100% of impervious area

11.5.6 Water Quality Volumes and Flows

- a. **Water Quality Storm**
The water quality storm is the storm required by regulations to be treated. The storm defines both the volume and rate of runoff. The water quality storm is defined in subsection 11.05.4 (d).
- b. **Water Quality Flow (WQF)**
The WQF is the peak design flow anticipated from the water quality storm.

11.5.7 Pretreatment

- a. **Pretreatment Required**

Unless approved by the City, sheet flow of impervious surfaces into water quality facilities shall not be allowed without pretreatment. Incoming flows to the water quality facility shall be pretreated using a water quality manhole in accordance with subsection 11.06.1 or other pre-treatment method as approved by the City. Other methods of pretreatment may include proprietary devices, filter strip, trapped catch basin, or other methods as approved by the City.
- b. **Proprietary Pre-Treatment Devices**
 - 1. The use of proprietary pre-treatment devices shall be permitted on a case by case basis with approval by the City.
 - 2. The devices will be sized in accordance with the manufacturer's recommendations; however, the minimum treatment flow must be the water quality flow.
 - 3. Technical submittals from the manufacturer are required, including hydraulic design criteria, particulate removal efficiency, and maintenance requirements and schedule.

11.5.8 Proprietary Treatment Systems

- a. **Proprietary treatment systems shall meet the removal efficiency requirement defined in section 11.05.3(a) and be approved by the City for use in the situations identified in subsection (c) below or in accordance with City approved ongoing maintenance plan.**
- b. **Maintenance**
 - 1. Proprietary treatment systems shall be maintained by the City except those systems used in the situations specified in section 11.05.8(c)(1) and (2) below or in accordance with City approved ongoing maintenance plan.
 - 2. Proprietary systems require a long-term maintenance plan identifying maintenance techniques, schedule, and responsible parties. This maintenance plan shall be submitted and approved

with the drainage report for a project.

- c. Proprietary treatment systems shall be allowed in situations meeting one of the following criteria:
 - 1. Treatment of runoff from a single parcel.
 - 2. Treatment of runoff from an adjoining commercial, industrial, or multi-family, or condominium parcels which share a common parking lot.
 - 3. Treatment of runoff from new and expanded collector and arterial roadways where no other opportunities exist for treatment without necessitating the removal of homes or businesses.
 - 4. Treatment of runoff from new developments in high-density zoning classifications where the development is primarily single-family residential and the average lot size is less than 2500 square feet.
 - 5. Treatment of runoff as part of a master planned regional facility approved by the City.

11.6 Water Quality Facility Design Standards

11.6.1 Water Quality Manholes

- a. Hydraulic Criteria:
 - 1. Minimum Design Flow: Water Quality Flow
 - 2. Upstream flow splitter may be used to bypass conveyance flows in excess of the Water Quality flow.
- b. Design Criteria:
 - 1. Shall conform to Standard Drawing No. 250 or an equivalent detail approved by the City.
 - 2. Minimum Manhole Diameter: 60-inch
 - 3. Maximum size of incoming pipe: 18-inch
 - 4. Sump Depth: No deeper than 5 feet from invert out to bottom of sump
 - 5. Volume of sump: 20 cubic feet/ 1.0 cfs of flow into the water quality manhole, up to the 25-year flow. Flow calculations shall include the effect of an upstream flow splitter.
 - 6. Maintain a 3-foot clear access zone between the inside structure.
 - 7. Orient access to structure in a clear zone.

11.6.2 Vegetated Swale

a. Hydraulic Design Criteria

- 1. Design Flow: Water Quality Flow**
- 2. Minimum Hydraulic Residence Time: 9 minutes**
- 3. Maximum Water Design Depth: 0.5 feet**
- 4. Minimum Freeboard: 1.0 foot (for facilities not protected from high flows)**
- 5. Manning "n" Value: 0.24**
- 6. Maximum Velocity: 2.0 fps based on 25-year flow**

b. Design Criteria

- 1. Provide an energy dissipater at the entrance to swale, with a minimum length of 4 feet. It will be designed to reduce velocities and spread the flow across the treatment cross section.**
- 2. The use of intermediate flow spreaders may be required.**
- 3. Minimum Length: 100 feet**
- 4. Minimum Slope: 0.5%**
- 5. Minimum Bottom Width: 2 feet**
- 6. Maximum Treatment Depth (measured from top of gravel): 0.5 feet**
- 7. Side Slope:**
 - A) In Treatment Area: 4H:1V or flatter**
 - B) Above Treatment Area: 2.5H:1V or flatter**
- 8. The treatment area shall have 2"-¾" river run rock placed 2.5 to 3 inches deep on high density jute or coconut matting over 12 inches of topsoil or base stabilization method as approved by the City. Extend river rock, topsoil, and high density jute or coconut matting to top of treatment area (or WQV level). Extend topsoil and low density jute matting to the edge of water quality tract or easement area.**
- 9. Provide an approved outlet structure for all flows.**
- 10. Where swales wrap 180-degrees forming parallel channels, freeboard shall be provided between each of the parallel channels. A 1-foot (above ground surface) wall may be used above the treatment area to provide freeboard while enabling a narrower system. As an alternative, a soil-based berm may be used. The berm shall have a minimum top width of 1 foot and 2.5H:1V or flatter side slopes.**
- 11. Where swales are designed with ditch inlets and outlet structures**

and design of maintenance access to such structures may be difficult due to swale location, swales may be designed as flow-through facilities with unsumped structures. Maintenance access to one end of the facility will still be required.

11.6.3 Extended Dry Basin

a. Hydraulic Design Criteria:

- 1.** Permanent Pool Depth: 0.4 feet
- 2.** Permanent pool is to cover the entire bottom of the basin.
- 3.** Minimum Water Quality Detention Volume:
1.0 x Water Quality Volume (WQV)
- 4.** Water Quality Drawdown Time: 48 hours
- 5.** Orifice Size:
USE: $D = 24 * [(Q / (C[2gH]^{0.5}) / \pi)^{0.5}$
Where:
D (in) = diameter of orifice $Q(\text{cfs}) = \text{WQV}(\text{cf}) / (48 * 60 * 60)$ $C = 0.62$
 $H(\text{ft}) = 2/3 \times \text{temporary detention height to centerline of orifice.}$
- 6.** Maximum Depth of Water Quality Pool (not including Permanent Pool): 4-feet or as limited by issuing jurisdiction.

b. Design Criteria:

- 1.** Minimum of 2 cells, with the first cell (forebay) at least 10% of surface area. The forebay shall also constitute 20-percent of the treatment volume. Where space limits multi-cell design, use one cell with a forebay at the inlet to settle sediments and distribute flow across the wet pond.
- 2.** Inlet and outlet structures shall be designed to avoid direct flow between structures without receiving treatment (i.e. short circuiting of flow).
- 3.** Minimum Bottom Width: 4 feet
- 4.** Side Slopes in Basin Treatment Area: 3H:1V
- 5.** Minimum Freeboard: 1-foot from 25-year design water surface elevation.
- 6.** The treatment area shall have high density jute or coconut matting over 12 inches of topsoil or base stabilization method as approved by the City. If required by the City, 2"-3/4" river run rock shall be placed 2.5 to 3 inches deep in areas where sustained flow is anticipated to occur. Extend river rock (if required), topsoil, and high density jute or coconut matting to top of treatment area (or WQV level). Extend topsoil and low density jute matting to the edge of water quality tract or easement area.

7. Provide an approved outlet structure for all flows.

8. The Engineer shall certify that the pond storm sewer design is in compliance with Chapter 5 of these standards and that at normal design water surface that the upstream storm sewer will not be in a surcharged condition for longer than 24 hours

11.6.4 Constructed Water Quality Wetland

a. Hydraulic Design Criteria:

1. Permanent Pool Volume: 0.55 x Water Quality Volume (WQV)

2. Water Quality Detention Volume: 1.0 x Water Quality Volume (WQV)

3. Water Quality Drawdown Time: 48 hours

4. Orifice Size:

$$\text{USE: } D = 24 * [(Q / (C[2gH]^{0.5}) / \pi]^{0.5}$$

Where:

D (in) = diameter of orifice Q(cfs) = WQV(cf) / (48*60*60) C = 0.62
H(ft) = 2/3 x temporary detention height to centerline of orifice.

5. Maximum Depth of Permanent Pool: 2.5-feet or as limited by issuing jurisdiction

6. Maximum velocity through the wetland should average less than 0.01-fps for the water quality flow. Design should distribute flows uniformly across the wetland.

7. Provide for a basin de-watering system with a 24-hour maximum drawdown time.

b. Design Criteria:

1. Minimum of 2 cells, with the first cell (forebay) at least 10% of surface area. The forebay shall also constitute 20-percent of the treatment volume. Where space limits multi-cell design, use one cell with a forebay at the inlet to settle sediments and distribute flow across the wet pond.

2. Permanent pool depth to be spatially varied throughout wetland.

3. Provide a perimeter zone 10 to 20-feet wide, which is inundated during storm events.

4. Side Slopes for Wetland Planting: 5H:1V or flatter.

5. Side Slopes for Non-Wetland Planting: 3H:1V or flatter.

6. Over-excavate by a minimum of 20-percent to allow for sediment deposition.

7. Minimum Freeboard: 1-foot from 25-year design water surface elevation.

8. Provide an approved outlet structure for all flows.

11.6.5 Walls in Water Quality Facilities

- a. Walls are not allowed in the treatment areas of any water quality facility.
- b. Walls that are 4 feet or higher or that are periodically inundated shall meet all of the following criteria:
 - 1. Be approved by a licensed structural or geotechnical engineer.
 - 2. The City shall not have maintenance responsibility for the wall. The party responsible for maintenance of the walls within the tract shall be clearly documented on the plat or in alternate form as approved by the City.

11.7 Low Impact Development Approaches (LIDA)

11.7.1 Purpose

The advantages of LIDA continue to be documented for providing pollutant reduction associated with urban development. Generally, the first priority for LIDA is to minimize stormwater runoff generated from urban development to reduce hydrologic impacts. Low impact development approaches can offer greater flexibility for the overall use of space on a site, potentially eliminating the need to construct a separate stormwater treatment facility.

Selection of appropriate LIDA, including surface infiltration, should ensure there are no adverse downstream drainage impacts and an appropriate maintenance program can be developed to sustain the functionality of the LIDA.

11.7.2 LIDA Design Considerations

- a. LIDA may be used in combination or with standard water quantity and quality facilities to meet the requirements of this Chapter.
- b. The applicant shall provide an analysis in the drainage report of the ability of any proposed LIDA to meet the water quantity and quality requirements for a project.
- c. LIDA shall be approved on a case by case basis by the City based on their ability to meet the requirements of these rules.
- d. Approval of use of an LIDA by the City does not eliminate the need for the applicant to secure approval from other appropriate agencies for use of LIDA on their project.

11.7.3 LIDA Approvable by the City

- a. Table 11-2 shows the LIDA the City may approve to meet the requirements of this chapter. The table shows where LIDA can be used in a publicly maintained system and whether LIDA can be designed to meet the quality or quantity requirements of the Chapter. The descriptions provided are general and designers should consult the City Engineer for more specific design considerations.
- b. Where the impervious area to be treated by an LIDA is less than 15,000 square feet, the Sizing Factor shall be used to calculate the required surface area of the selected LIDA. For impervious areas greater than 15,000 square feet, a specific design for the site shall be required. The Sizing Factor does not apply to quantity control. LIDA used for quantity control shall require a specific design for a site.
- c. LIDA not included in Table 11-2 may be approved by the City if the applicant can demonstrate that the LIDA can meet the requirements of this Chapter.
- d. LIDA require a long-term maintenance plan identifying maintenance techniques, schedule, and responsible parties. This requirement shall be noted in a maintenance plan and a maintenance agreement shall be submitted and approved with the drainage report for a project.

TABLE 11-2
APPROVABLE LOW IMPACT DEVELOPMENT APPROACHES

LID	Description	Public Systems	Quantity Control	Quality Control	Sizing Factor/ Restrictions
Porous Pavement	Porous pavement is a water permeable structural ground cover which infiltrate precipitation, attenuates stormwater runoff flows and volumes, and reduces temperature. Pervious concrete and asphalt resemble their solid pavement counterparts, but have more void spaces that allow water to pass through. Pervious pavers are typically made of pre- cast concrete, brick, stone, or cobbles and set to allow water to flow between them.	No	Yes	No	1:1 impervious area deduction
Green Roof	A green roof (or ecoroof) is a vegetated roof system with waterproofing material, drainage, growing medium, and specially selected plants. A green roof can be used to reduce site impervious area and manage stormwater runoff. Green roofs also help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in dry seasons. The design must be low maintenance and use irrigation only to sustain the health of vegetation. Building Official approval is required for installation of eco-roofs and roof gardens.	No	No	Yes	1:1 impervious area deduction
Infiltration Planters/ Rain Gardens	Infiltration planters or rain gardens are landscaped reservoirs used to collect, filter, and infiltrate stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil and infiltrates into the ground. Depending on the site, infiltration planters can be constructed with or without walls to contain the facility.	Yes	Yes	Yes	0.06 Min. Width: 30in Max. Slope 0.5%

LID	Description	Public Systems	Quantity Control	Quality Control	Sizing Factor/ Restrictions
Flow-through Planters	Flow-through planters are landscaped reservoirs that collect and filter stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil until flowing through to an approved conveyance. These are appropriate where soils do not drain well or there are site constraints. Depending on the site, flow-through planters can be constructed with or without walls to contain the facility.	Yes	No	Yes	0.06 Min. Width: 30in Max. Slope 0.5%
LIDA Swales	LIDA swales are narrow, gently sloping depressions planted with dense vegetation or grasses designed to receive, filter, and infiltrate the runoff, allowing pollutants to settle and filter out as the water percolates through the swale soil and infiltrate into the ground. Swales can include check dams to help slow and detain the flow.	Yes	No	Yes	0.06 Min. Bottom Width: 2ft Slope 0.5% to 6.0%
Vegetated Filter Strips	Vegetated filter strips, are gently sloping areas designed to receive sheet flow from adjacent impervious surfaces. Vegetated filter strips are vegetated with grasses and groundcovers that filter and reduce the velocity of stormwater.	Yes	No	Yes	0.06 Min. Width: 5ft Slope: 0.5% to 6.0%

11.7.4 Small Developments and LIDA

For development or redevelopment projects with overall site area less than 1 acre, no additional stormwater treatment is required when all the following conditions are met:

- a. At least 75% of the post-development impervious area shall be treated with LIDA providing water quality treatment; and
- b. An increased level of erosion control, as identified by the City, shall be used during construction; and
- c. The site is vacuumed prior to acceptance by the City, if appropriate for the LIDA utilized.

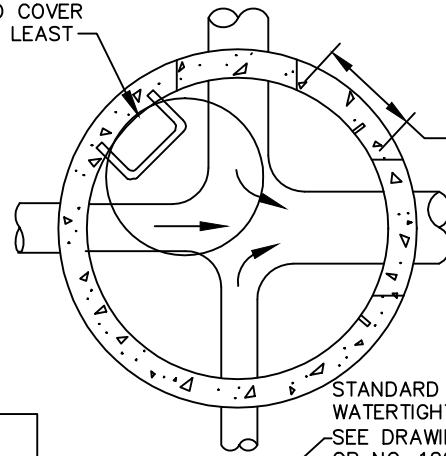
APPENDICIES

Appendix A – Standard Drawings for Conveyance System

Appendix B – Standard Street Detail Drawings

Appendix C – Standard Water System Details

LOCATE FRAME AND COVER
OVER LEDGE OF AT LEAST
12" IN WIDTH



MAXIMUM 27" FROM
TOP OF FIRST STEP
TO TOP OF CASTING

STANDARD FRAME AND COVER OR
WATERTIGHT FRAME AND COVER.
SEE DRAWING NO. 110-SA/ST
OR NO. 120
SET FRAME IN NON-SHRINK
GROUT

NOTES:

1. ALL PRE-CAST MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478.
2. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 P.S.I. AND SLUMP OF 2" TO 4".
3. ALL JOINTS SHALL BE SEALED WITH PRE FORMED GASKETS SUCH AS KENT-SEAL NO. 2, RAM-NECK, OR AN APPROVED EQUAL CONFORMING TO FEDERAL SPECIFICATION SS-S00210.
4. ALL PIPE CONNECTIONS TO MANHOLE SHALL BE WATERTIGHT.
5. PIPE CONNECTIONS OF 24" OR GREATER SHALL REQUIRE A MANHOLE AND CHANNEL DETAIL.
6. PIPE CONNECTIONS OF FOUR OR MORE MAINLINES SHALL REQUIRE A MANHOLE CONNECTION AND CHANNEL DETAIL.
7. PROVIDE A MINIMUM OF 8" OF INTACT (UNDISTURBED) MANHOLE WALL BETWEEN PIPE BREAKOUTS AS MEASURED ON THE INSIDE FACE OF THE MANHOLE.
8. BREAKOUT OF WALL FOR PIPE SHALL BE 2" MINIMUM AND 4" MAXIMUM CLEAR OF PIPE WALL.
9. THIS DETAIL LIMITED TO MAXIMUM INTERIOR DROP OF 24" FOR SANITARY CONNECTION AND 48" FOR STORM CONNECTION.
10. WATERTIGHT/TAMPER PROOF MANHOLE FRAME AND COVER SHALL BE USED IN ALL EASEMENT AND OFF STREET AREAS.

GRADE RINGS (2", 4", OR 6")
MAXIMUM 12" SET IN
NON-SHRINK GROUT

STANDARD ECCENTRIC
36" CONE

MANHOLE STEPS. SEE
DRAWING NO. 100

MANHOLE SECTION
(VARIABLE 1'-4')

60" MINIMUM

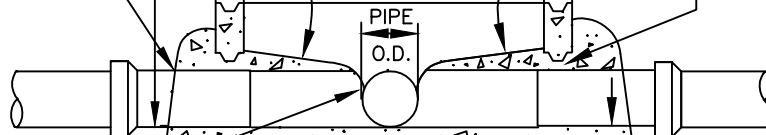
5" MINIMUM

48" MIN.

MINIMUM 12" LEDGE
(ONE REQUIRED)
1" / FT. SLOPE TYP.

2" MIN. FROM TOP OF
PIPE TO MANHOLE
SECTION

SEE DRAWING NO 020
FOR PIPE CONNECTIONS



SMOOTH FINISH CHANNEL TO
3/4 VERTICAL HEIGHT OF PIPE

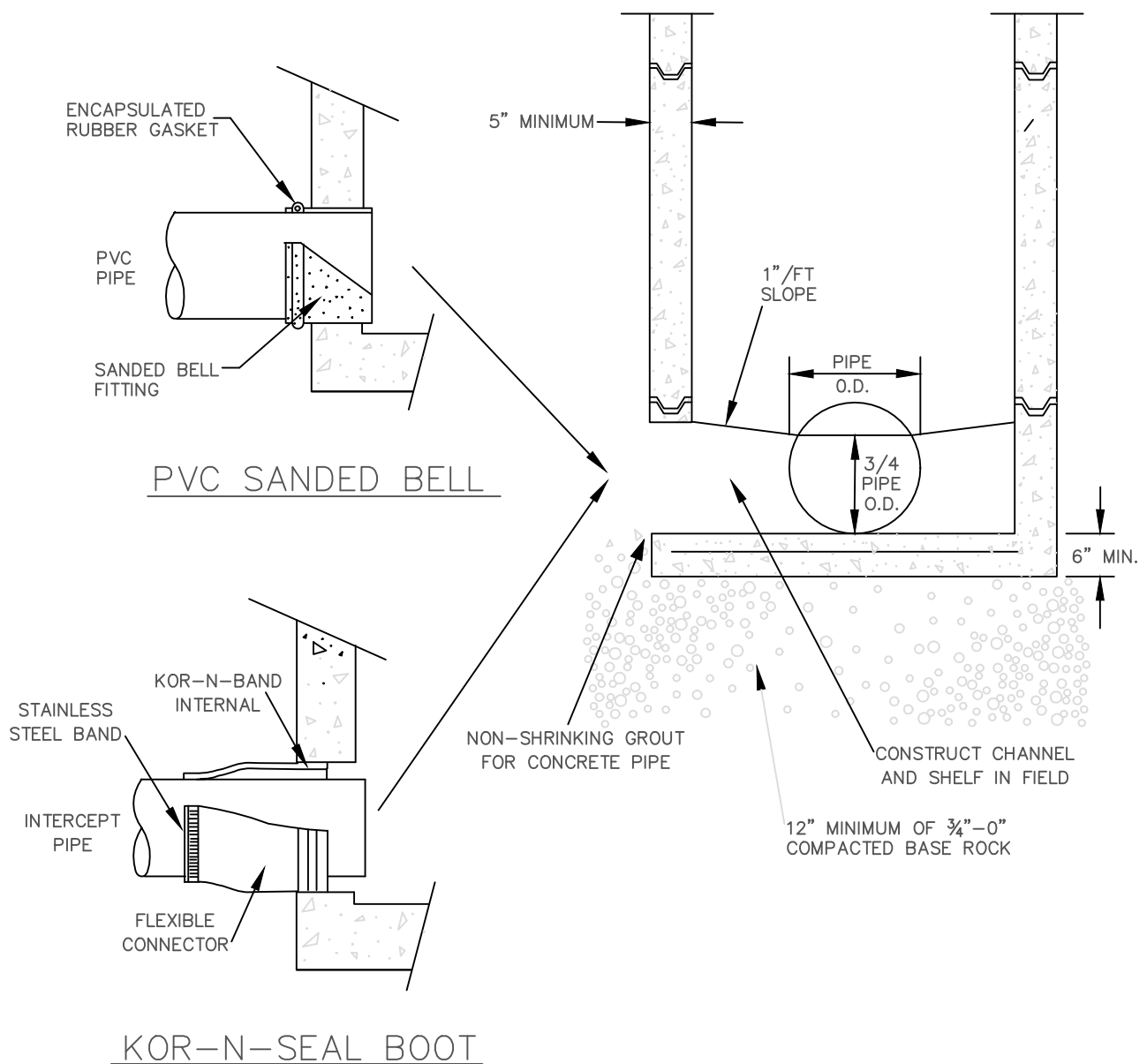
8" MINIMUM CONCRETE

12" MINIMUM OF 3/4"-0" COMPACTED
BASE MATERIAL

72" MINIMUM

NOTES:

1. ALL PRE-CAST MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478 AND APPLICABLE PROVISIONS OF STANDARD DRAWING NO. 010.
2. INSTALL PIPE WITH PIPE JOINT 2'± OUTSIDE OF MANHOLE WALL.

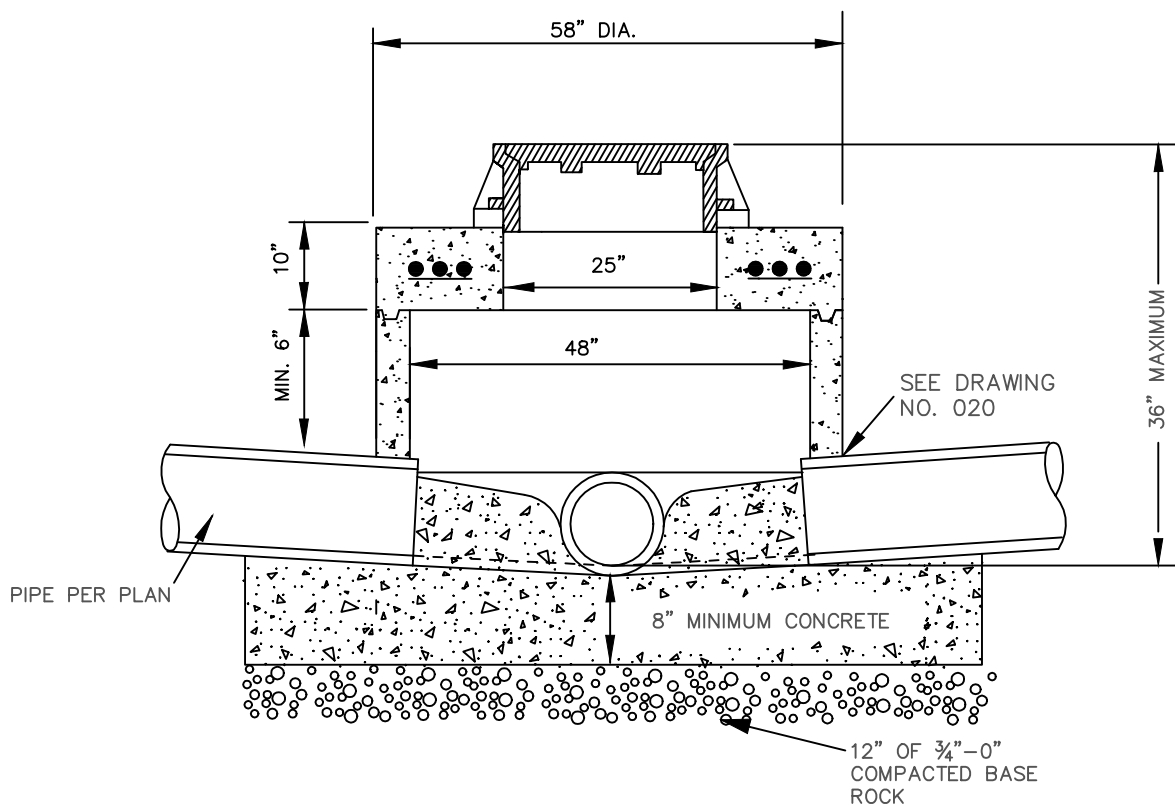


NOTES:

1. ALL JOINTS AND RUBBER GASKETS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-433.
2. ALL MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478 AND APPLICABLE PROVISIONS OF STANDARD MANHOLE, DRAWING NO. 010.
3. CENTER OPENING FLAT TOP REQUIRED.

STANDARD MANHOLE FLAT TOP
REINFORCEMENT

#6 BAR AROUND OUTSIDE OF OPENING
#6 DIAGONALS BOTH SIDES OF OPENING
#6 6" O.C. BOTH WAYS



NOTES:

1. ALL JOINTS AND RUBBER GASKETS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-433.
2. ALL MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478 AND APPLICABLE PROVISIONS OF STANDARD MANHOLE, DRAWING NO. 010.
3. STEPS REQUIRED ON FLAT TOP MANHOLES DEEPER THAN 48".

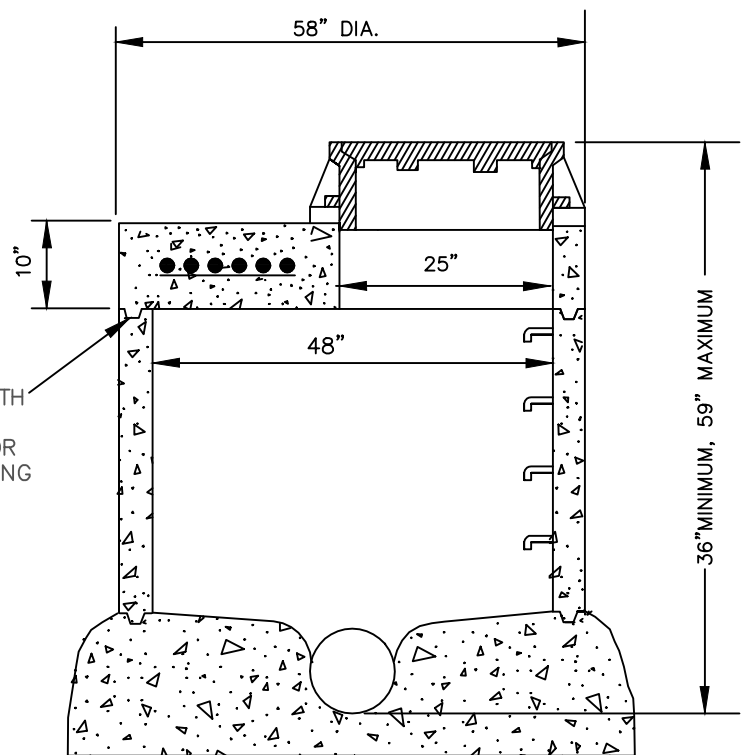
RUBBER GASKET FLAT TOP
REINFORCEMENT

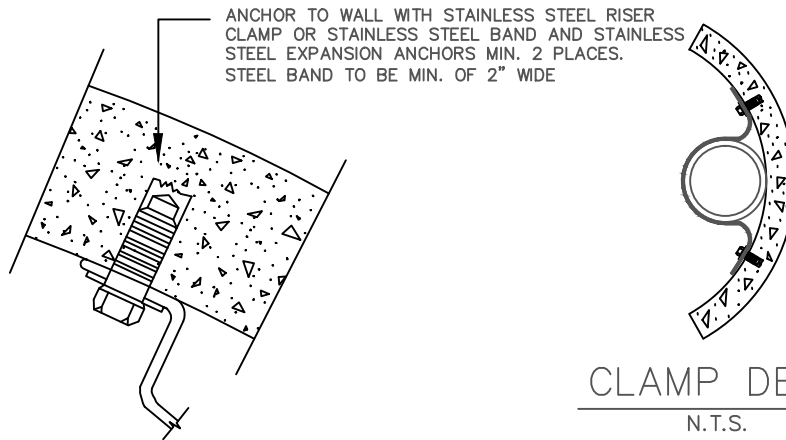
OR

STANDARD MANHOLE FLAT TOP
REINFORCEMENT

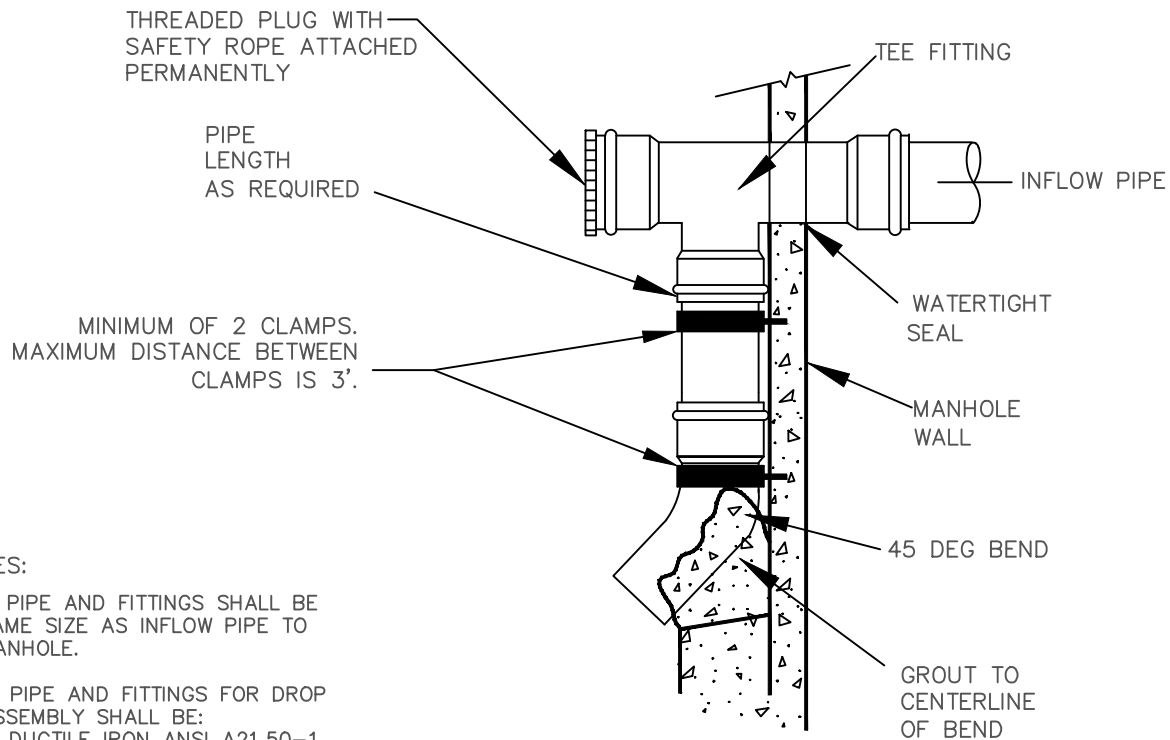
#6 BAR AROUND OUTSIDE OF OPENING
#6 DIAGONALS BOTH SIDES OF OPENING
#6 6" O.C. BOTH WAYS

ALL JOINTS SHALL BE SEALED WITH
PRE-FORMED GASKETS SUCH AS
KENT-SEAL NO. 2, RAM-NECK, OR
AN APPROVED EQUAL CONFORMING
TO FEDERAL SPECIFICATION
SS-S00210.



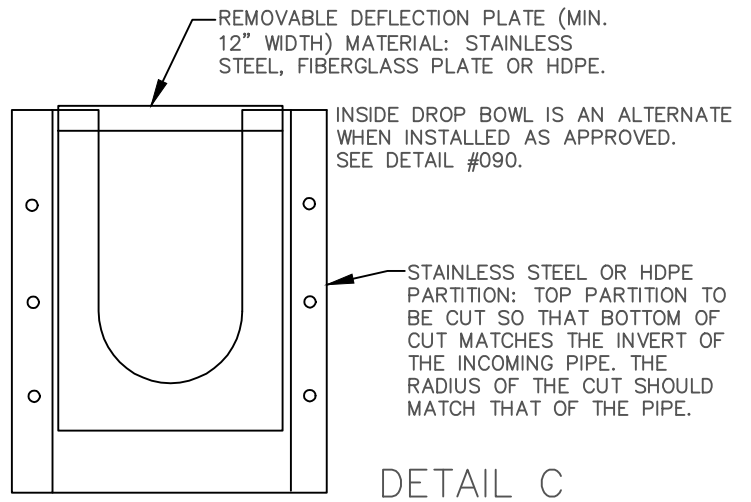
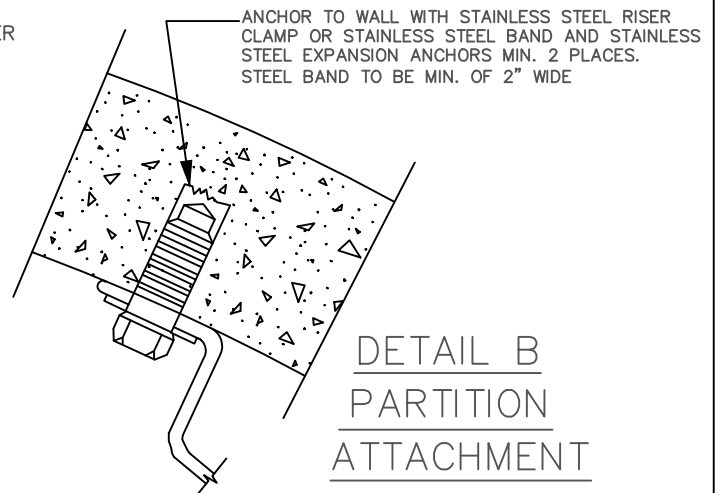
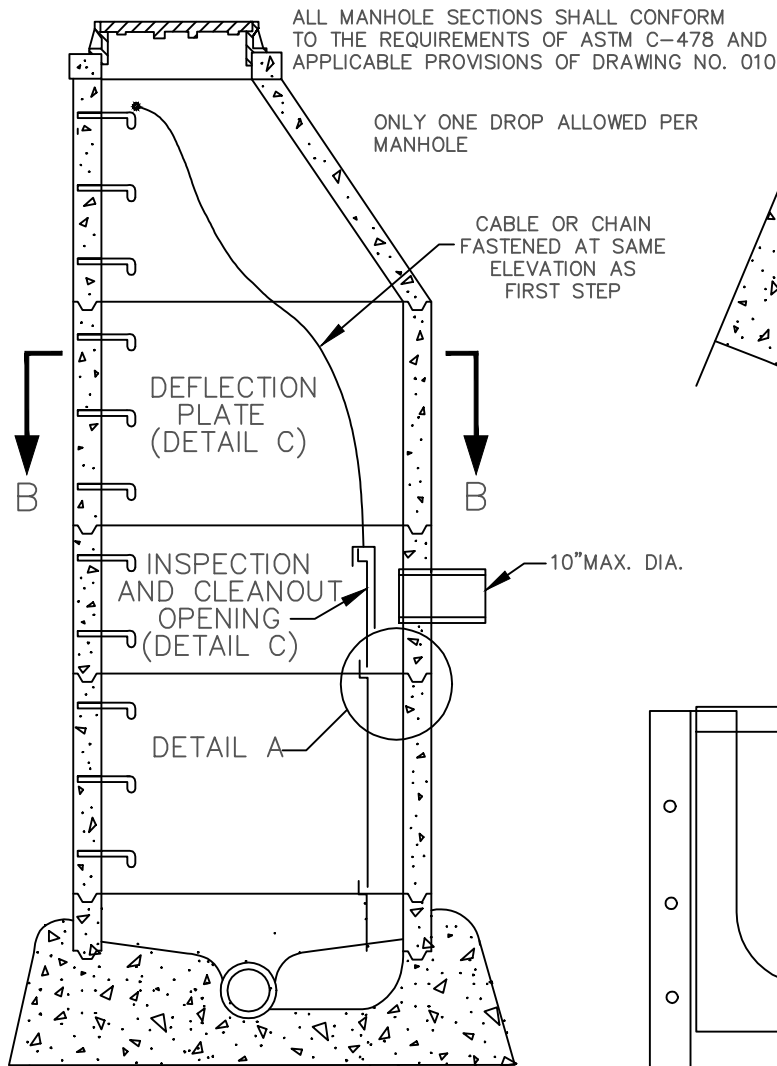
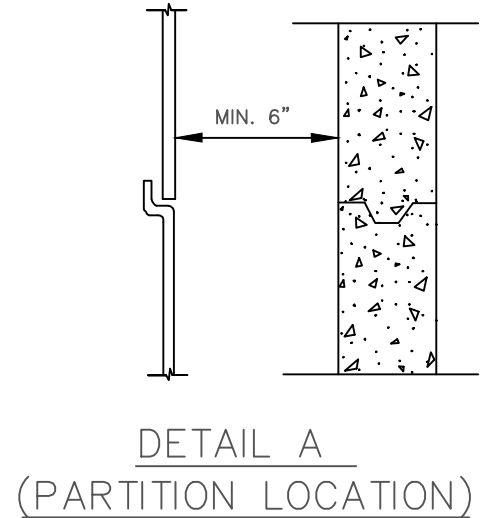
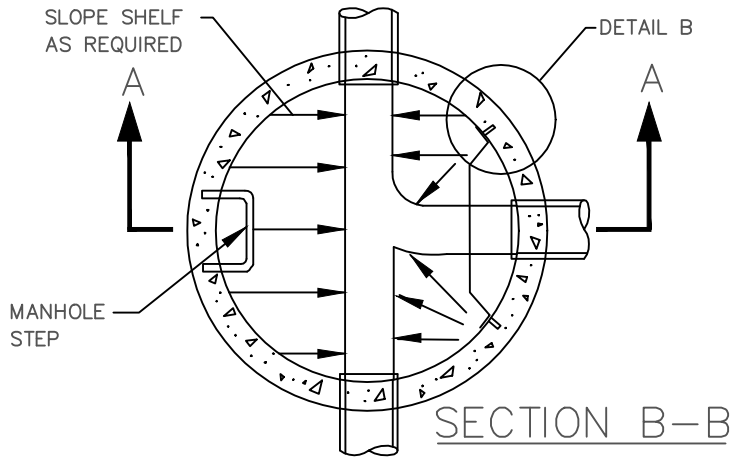


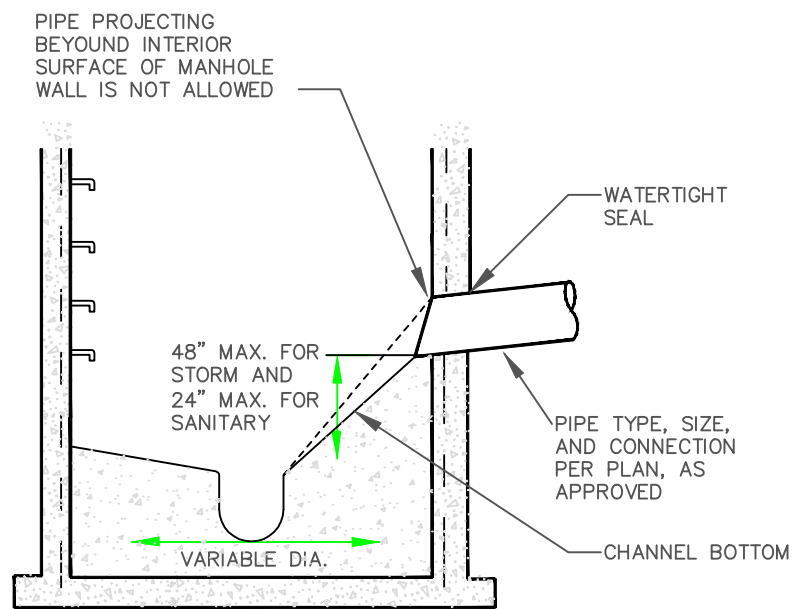
MECHANICAL INSIDE DROP (OPTIONAL)



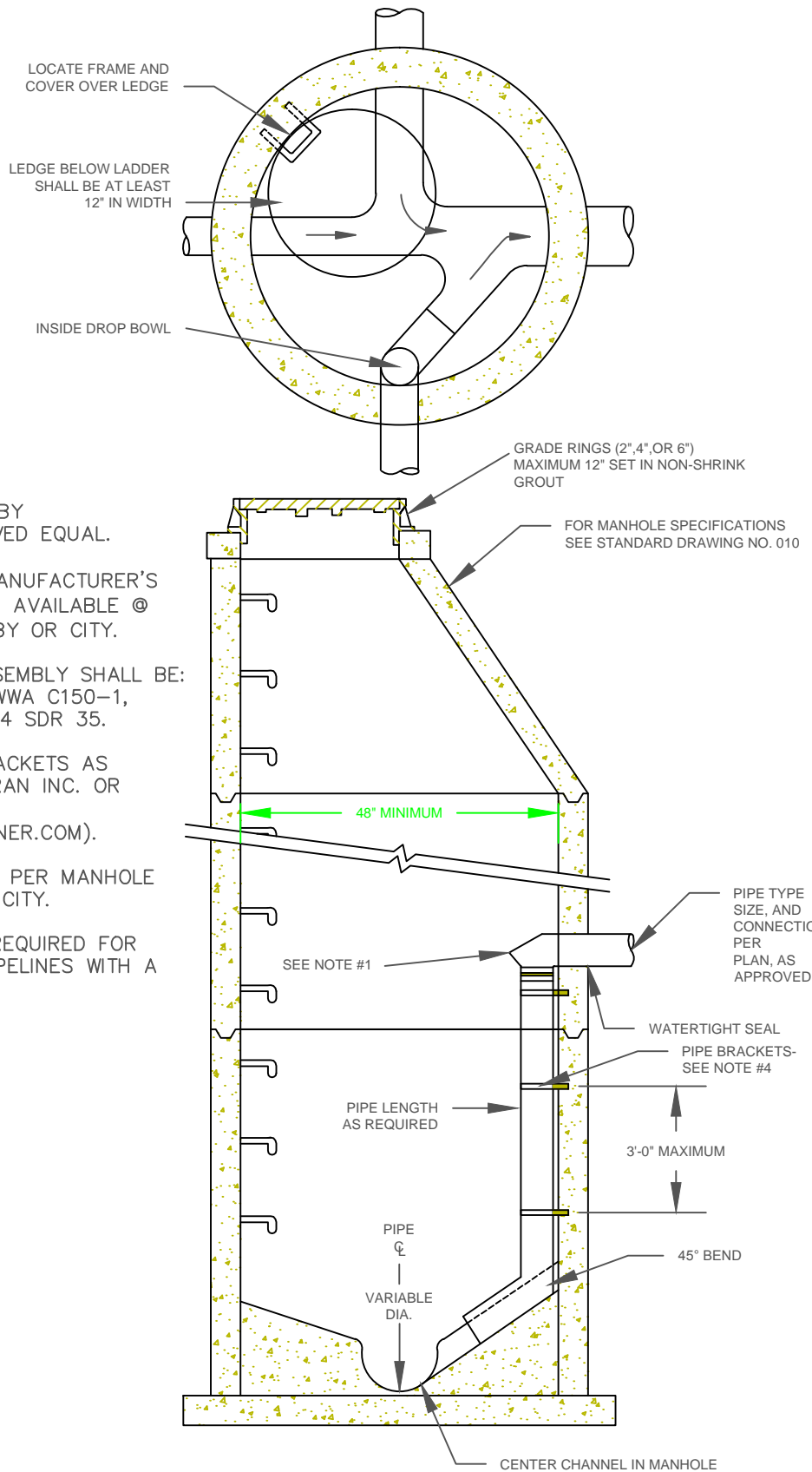
NOTES:

1. PIPE AND FITTINGS SHALL BE SAME SIZE AS INFLOW PIPE TO MANHOLE.
2. PIPE AND FITTINGS FOR DROP ASSEMBLY SHALL BE:
DUCTILE IRON ANSI A21.50-1,
AWWA C150-1, AWWA C-900 OR
PVC ASTM 3034 SDR 35.





OPEN INSIDE DROP
WITH BEAVER SLIDE

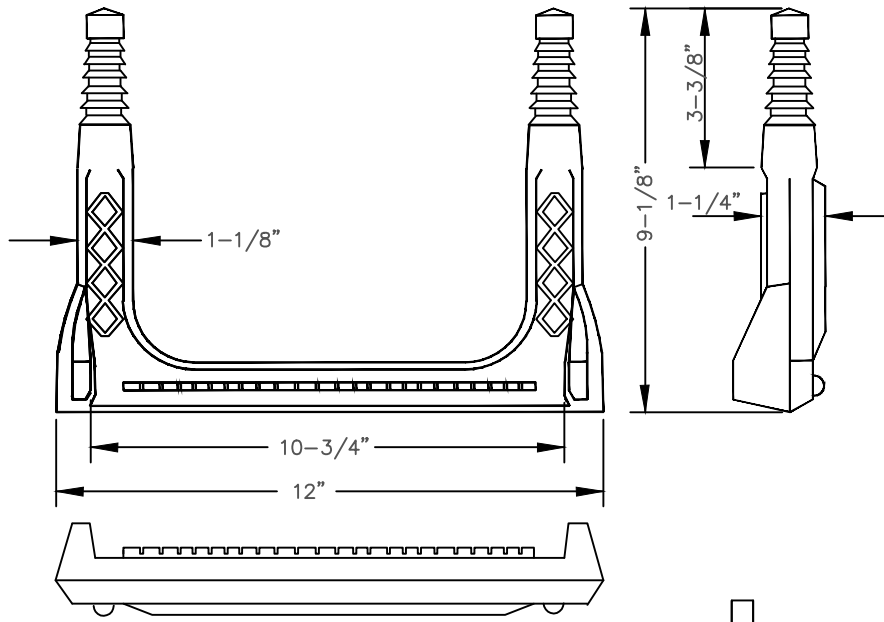


NOTES:

1. DROP BOWL AS MANUFACTURED BY RELINER-DURAN INC. OR APPROVED EQUAL.
2. DROP BOWL TO BE SIZED PER MANUFACTURER'S RECOMMENDATIONS (INFORMATION AVAILABLE @ RELINER.COM) OR AS REQUIRED BY OR CITY.
3. PIPE AND FITTING FOR DROP ASSEMBLY SHALL BE: DUCTILE IRON ANSI A21.50-1, AWWA C150-1, AWWA C-900 OR PVC ASTM 3034 SDR 35.
4. STAINLESS ADJUSTABLE PIPE BRACKETS AS MANUFACTURED BY RELINER-DURAN INC. OR APPROVED EQUAL. (INFORMATION AVAILABLE @ RELINER.COM).
5. NO MORE THAN ONE DROP BOWL PER MANHOLE WITHOUT WRITTEN APPROVAL BY CITY.
6. WRITTEN APPROVAL BY CITY IS REQUIRED FOR DROP BOWL INSTALLATION ON PIPELINES WITH A SLOPE OF 5% OR GREATER.

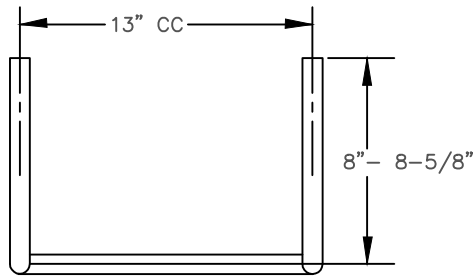
NOTES:

1. ALL STEPS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478.
2. MANHOLE STEPS MUST BE TIGHT AND FIRMLY EMBEDDED.
3. ALL STEPS WITHIN A MANHOLE SHALL BE OF THE SAME DESIGN, TYPE, AND SIZE.

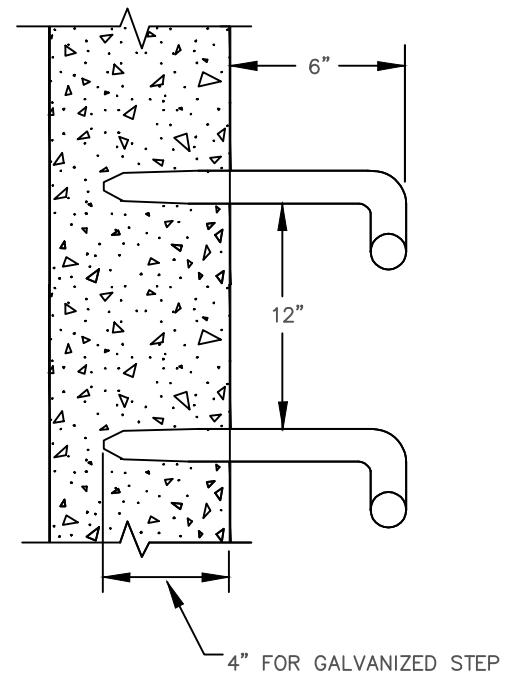
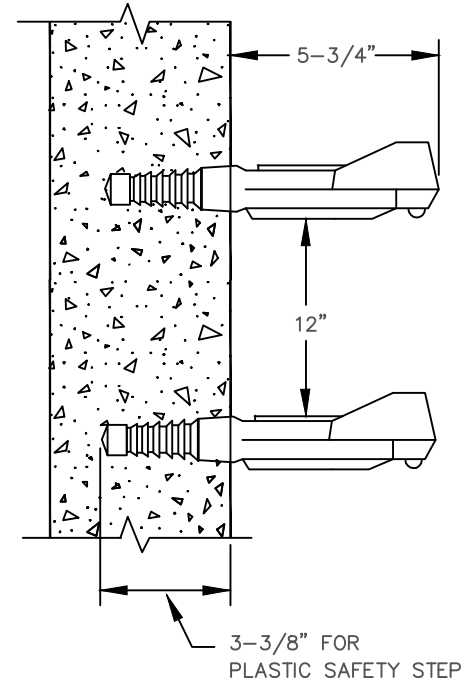
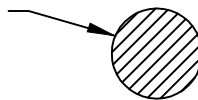


COPOLYMER POLYPROPYLENE PLASTIC

1/2" GRADE 60 REINFORCEMENT



#6 3/4" GALVANIZED BAR



MATERIALS:

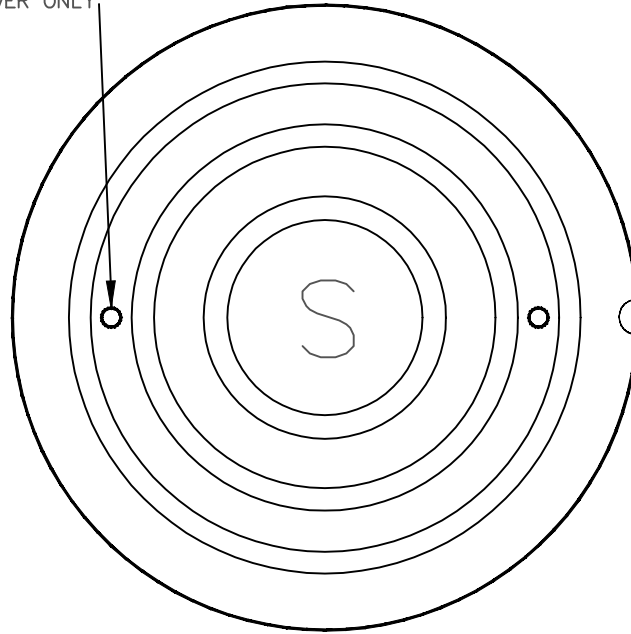
GALVANIZED:

#6 (3/4" DIA.) GALVANIZED DEFORMED REINFORCING BAR.
REINFORCING BAR CONFORMING WITH ASTM A-615 GRADE 40.
GALVANIZED CONFORMING WITH ASTM A-123.

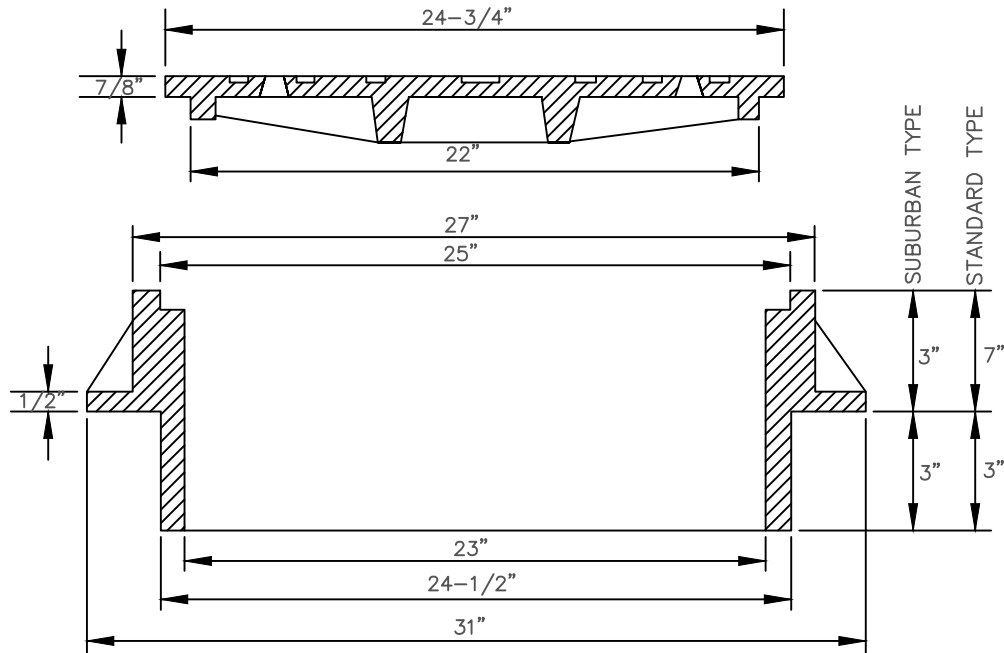
PLASTIC:

MUST CONFORM WITH ASTM C-478.
STEEL REINFORCING BAR MINIMUM 1/2" GRADE 60.
MEETING REQUIREMENTS OF ASTM A615 ENCAPSULATED
WITH INJECTION MOLDED COPOLYMER POLYPROPYLENE
WITH SERRATED SURFACES.

PRE CAST $\frac{3}{4}$ " CONICAL
HOLES (2) SANITARY
COVER ONLY



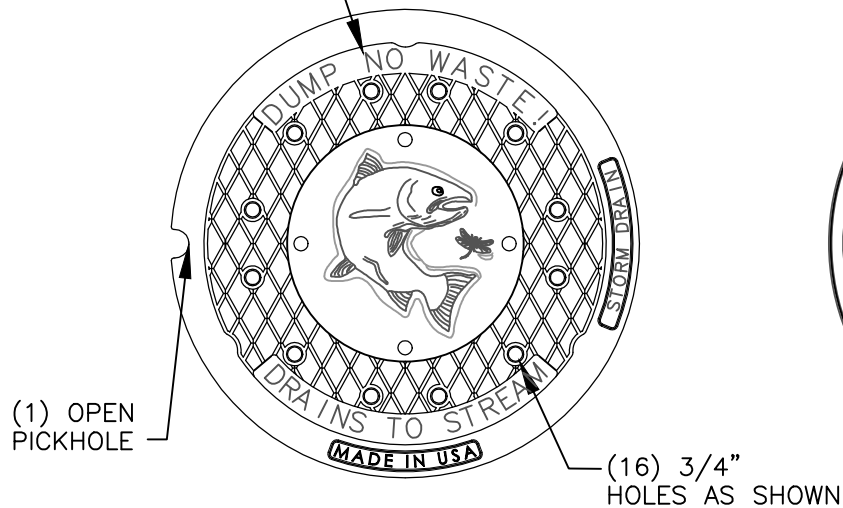
SANITARY



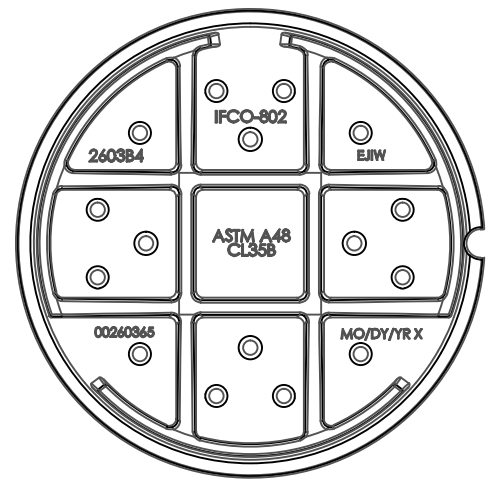
NOTES:

1. SUBURBAN TYPE NOT FOR USE IN TRAFFIC AREAS OF COLLECTOR AND ARTERIAL STREETS
2. COVER AND FRAME SHALL BE GRAY CAST IRON ASTM A-48 CLASS 30.
3. COVER AND FRAME TO BE MACHINED TO A TRUE BEARING ALL AROUND.
4. NOTCH LID FOR LIFTING HOOK.

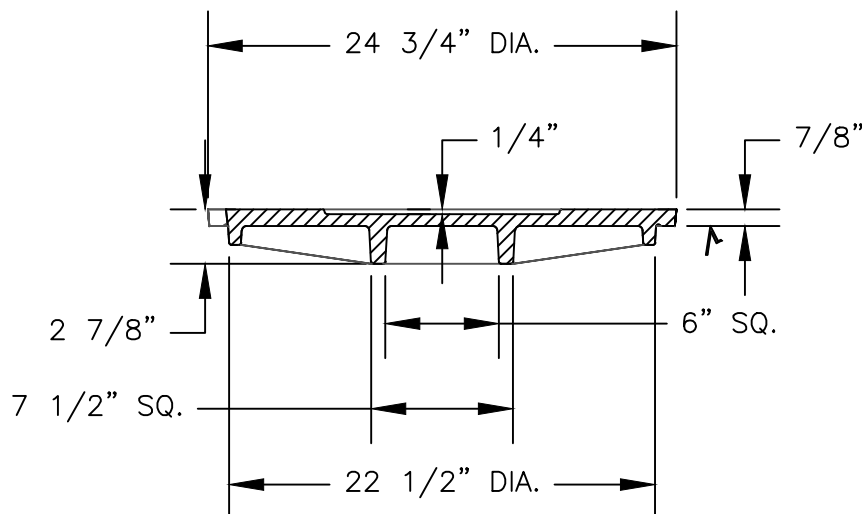
1" FLAT FACE LETTERING
(RECESSED FLUSH)



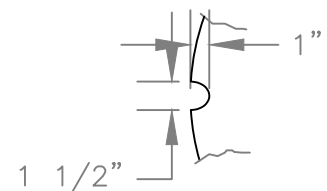
PLAN VIEW



COVER BACK



SECTION VIEW



PICKHOLE DETAIL

SEE DETAIL #110 FOR MANHOLE COVER AND FRAME SPECIFICATIONS.

A diagram of a circular structure, possibly a cross-section of a pipe or a mechanical component. The structure is composed of several concentric circles. A central horizontal axis passes through the center, with arrows at both ends labeled 'A'. Two vertical axes also pass through the center, with arrows at the top ends labeled 'A'. The structure is divided into four quadrants by these axes. There are small circular features, possibly rivets or bolts, located at the intersections of the axes with the inner boundary of the structure. The diagram is a technical drawing, likely for a patent application, showing the geometry and symmetry of the component.

SEE BOLT-DOWN
DETAIL

B

B

24 3/4"

SECTION A-A

7/8"

SECTION B-B

DOWN
TAIL

WATERTIGHT/TAMPER PROOF MANHOLE FRAME AND COVER SHALL BE USED IN ALL EASEMENT AND OFF STREET AREAS AND OTHER AREAS SHOWN ON THE DRAWINGS.

BOLT-DOWN DETAIL

1 7/16"

5/6"

7/8"

1 1/4" O.D.
S. STEEL WASHER
3/32" THICK

FLAT RUBBER
WASHER

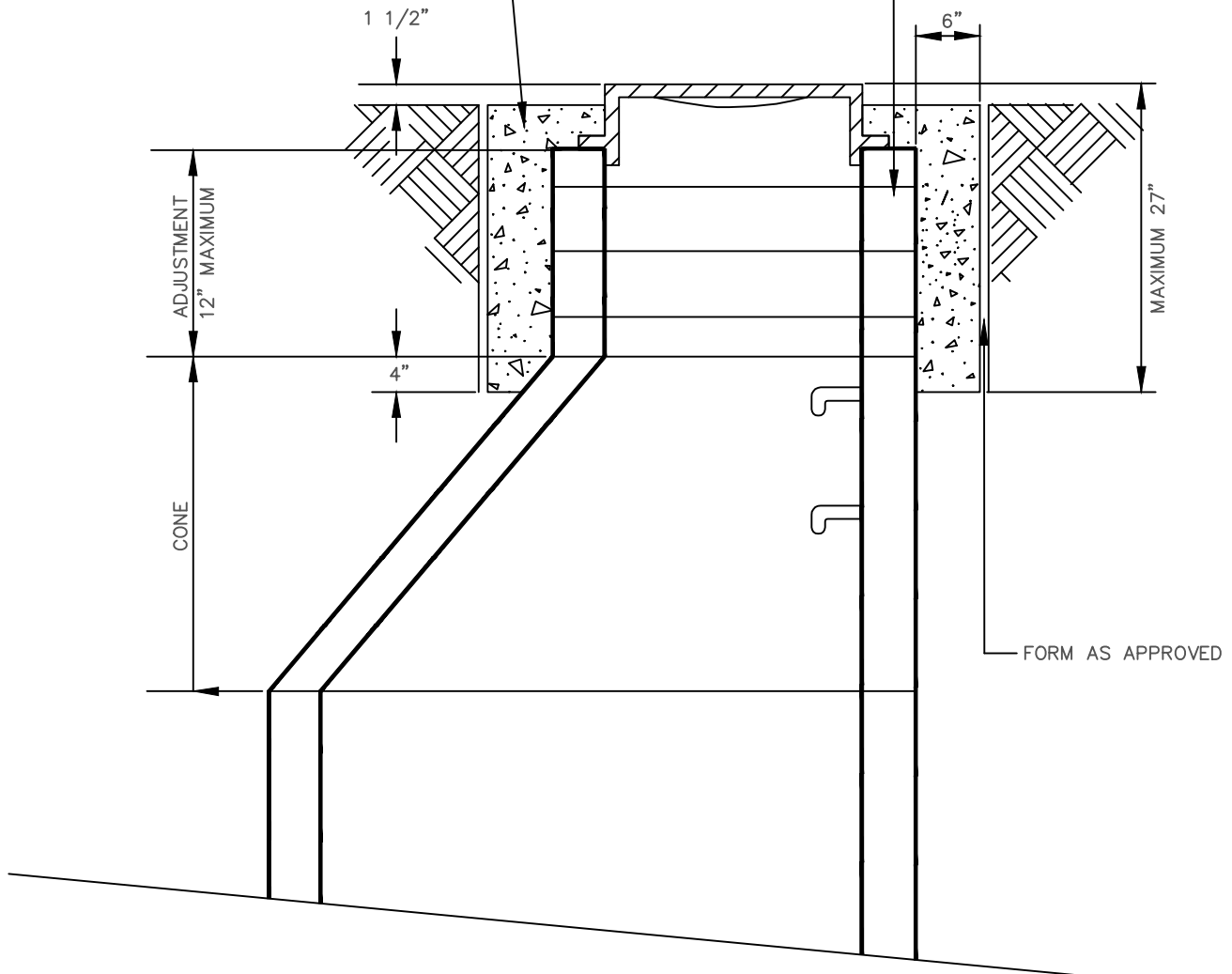
3/4"

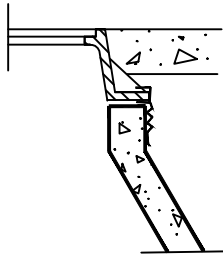
1/2"

1/4" NEOPRENE GASKET

CONCRETE FOR CLOSURE COLLAR SHALL BE READY-MIXED CONFORMING WITH ASTM C94, ALTERNATE 2 AND SHALL HAVE A COMPRESSIVE STRENGTH OF 3000 PSI @28 DAYS.

ADJUSTMENT GRADE RINGS AND CASTING FRAME SET IN 1" OF NON-SHRINKING GROUT





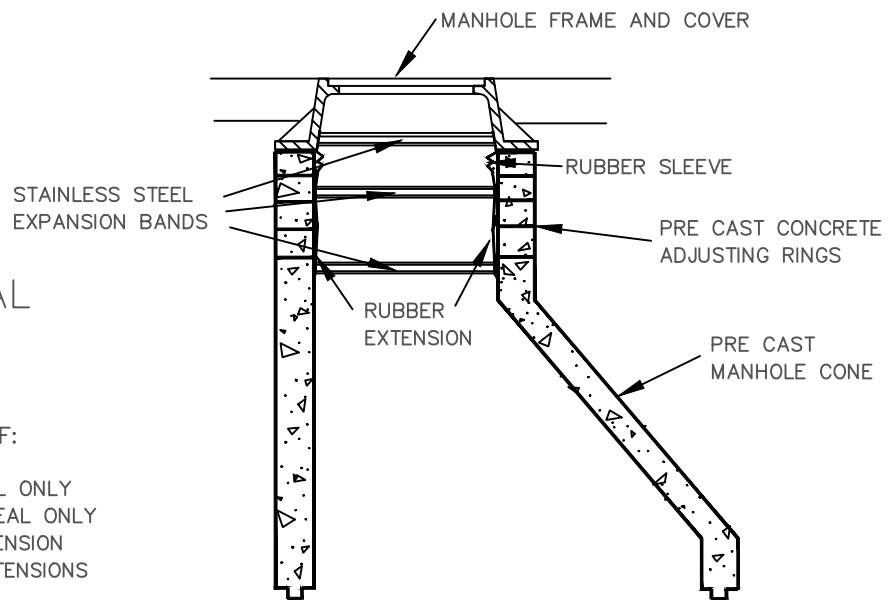
NARROW EXTERNAL RUBBER SEAL

TO SPAN CHIMNEY HEIGHTS OF:

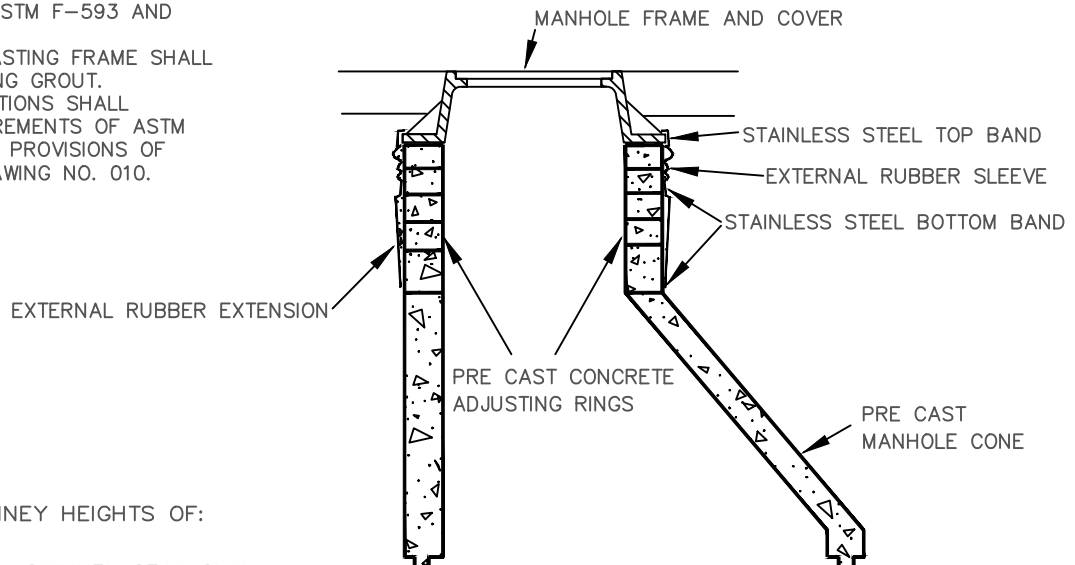
- | | | |
|-------------------|---|-------------------------|
| 0-3" | - | NARROW (6") SEAL ONLY |
| OVER 3" - 6 1/2" | - | STANDARD (9") SEAL ONLY |
| OVER 6 1/2" - 12" | - | STD. SEAL + EXTENSION |
| OVER 12" | - | SEAL + MULT. EXTENSIONS |

NOTES:

1. SLEEVES AND EXTENSIONS SHALL HAVE A MINIMUM OF $\frac{3}{16}$ " THICKNESS.
2. RUBBER SHALL BE EXTRUDED HIGH GRADE COMPOUND CONFORMING TO ASTM C-923.
3. BANDS SHALL BE FABRICATED FROM 16 GAUGE STAINLESS STEEL CONFORMING TO ASTM A-240, TYPE 304.
4. NUTS AND BOLTS SHALL BE STAINLESS STEEL CONFORMING TO ASTM F-593 AND 594, TYPE 304.
5. ALL GRADE RING AND CASTING FRAME SHALL BE SET IN NON-SHRINKING GROUT.
6. PRE CAST MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478, AND APPLICABLE PROVISIONS OF STANDARD MANHOLE DRAWING NO. 010.



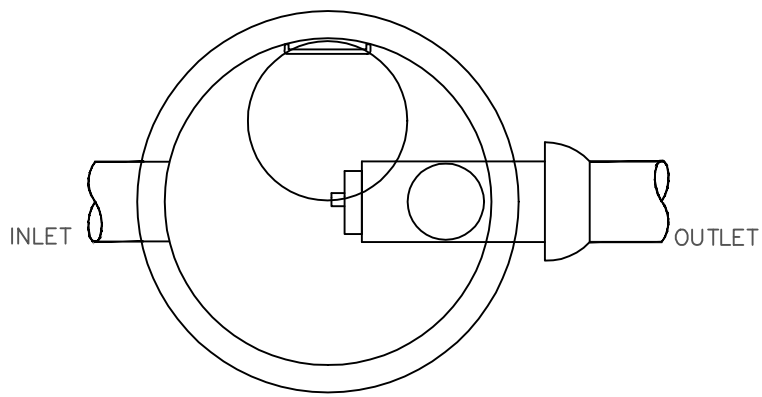
INTERNAL MANHOLE CHIMNEY SEAL



TO SPAN CHIMNEY HEIGHTS OF:

- | | | |
|------------------|---|-------------------------|
| 0-4 1/2" | - | CHIMNEY SEAL ONLY |
| OVER 4 1/2" - 9" | - | SEAL + 7" EXTENSION |
| OVER 9" - 12" | - | SEAL + 10" EXTENSION |
| OVER 12" | - | SEAL + MULT. EXTENSIONS |

EXTERNAL MANHOLE CHIMNEY SEAL



PLAN

NOTES:

1. ALL MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478 AND APPLICABLE PROVISIONS OF STD. MANHOLE DRAWING NO. 010
2. INLET AND OUTLET PIPE NOT TO EXCEED 18" DIA.
3. PROVIDE SPECIAL DETAIL FOR OUTLET FLOW CONTROL EXCEEDING 18" DIA.
4. ALL OUTLETS SHALL HAVE FLOW CONTROL DEVICE.

SUMP VOLUME AVAILABLE

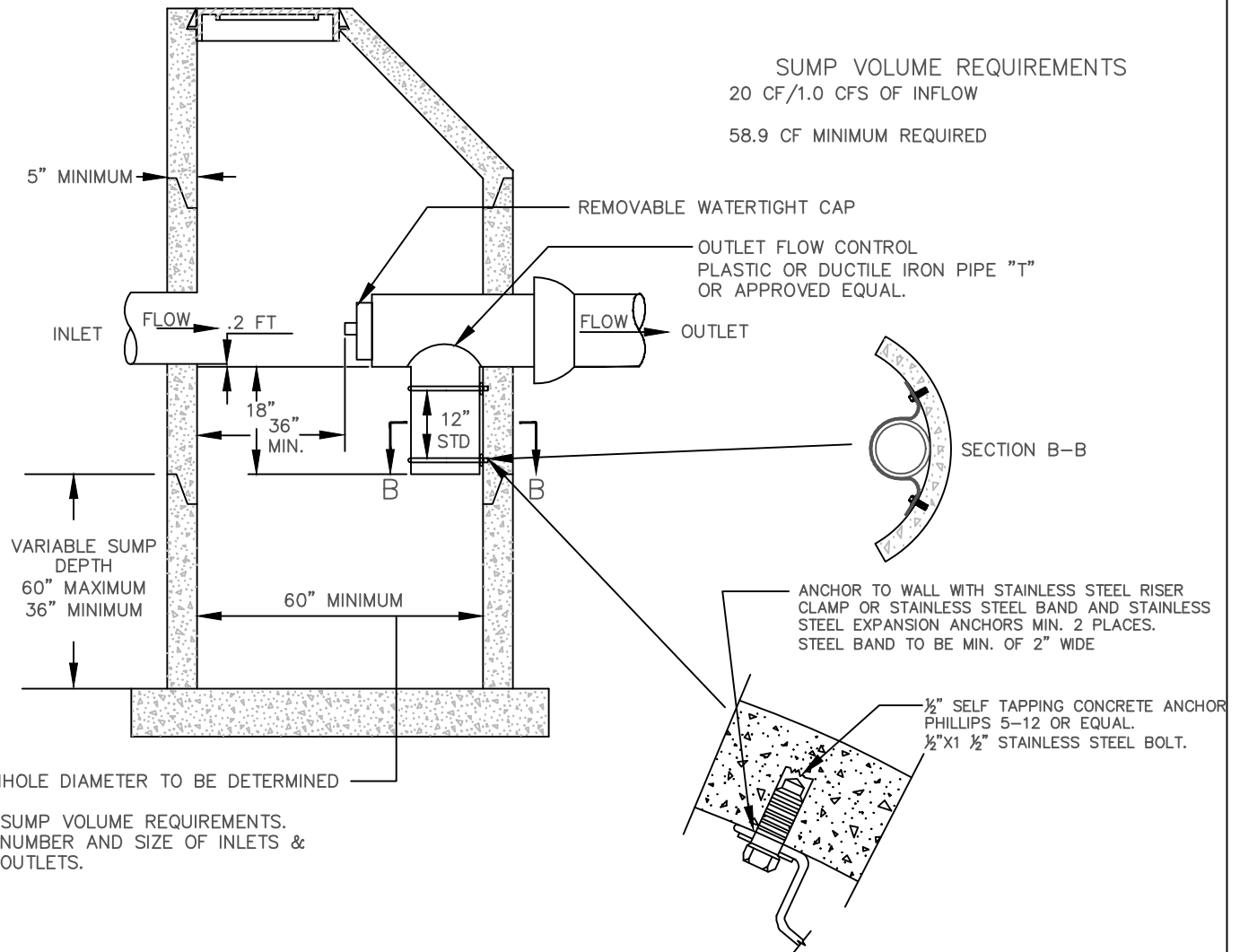
	MINIMUM	MAXIMUM
60" M.H.=	58.9 CF	98.1 CF
72" M.H.=	84.8 CF	141.3 CF
84" M.H.=	115.4 CF	192.3 CF

PROVIDE SPECIAL DETAIL FOR VOLUME REQUIREMENTS EXCEEDING 192.3 CF

SUMP VOLUME REQUIREMENTS

20 CF/1.0 CFS OF INFLOW

58.9 CF MINIMUM REQUIRED



MANHOLE DIAMETER TO BE DETERMINED

BY:

1. SUMP VOLUME REQUIREMENTS.
2. NUMBER AND SIZE OF INLETS & OUTLETS.

CLAMP DETAIL
(SECTION A-A)

N.T.S.

SEE NOTE AT TOP OF
STANDARD DETAIL #020.

NOTES:

1. ALL MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478 AND APPLICABLE PROVISIONS OF STD. MANHOLE DRAWING NO. 010
2. INLET AND OUTLET PIPE NOT TO EXCEED 18" DIA.
3. PROVIDE SPECIAL DETAIL FOR OUTLET FLOW CONTROL EXCEEDING 18" DIA.
4. ALL OUTLETS SHALL HAVE FLOW CONTROL DEVICE.

SUMP VOLUME AVAILABLE

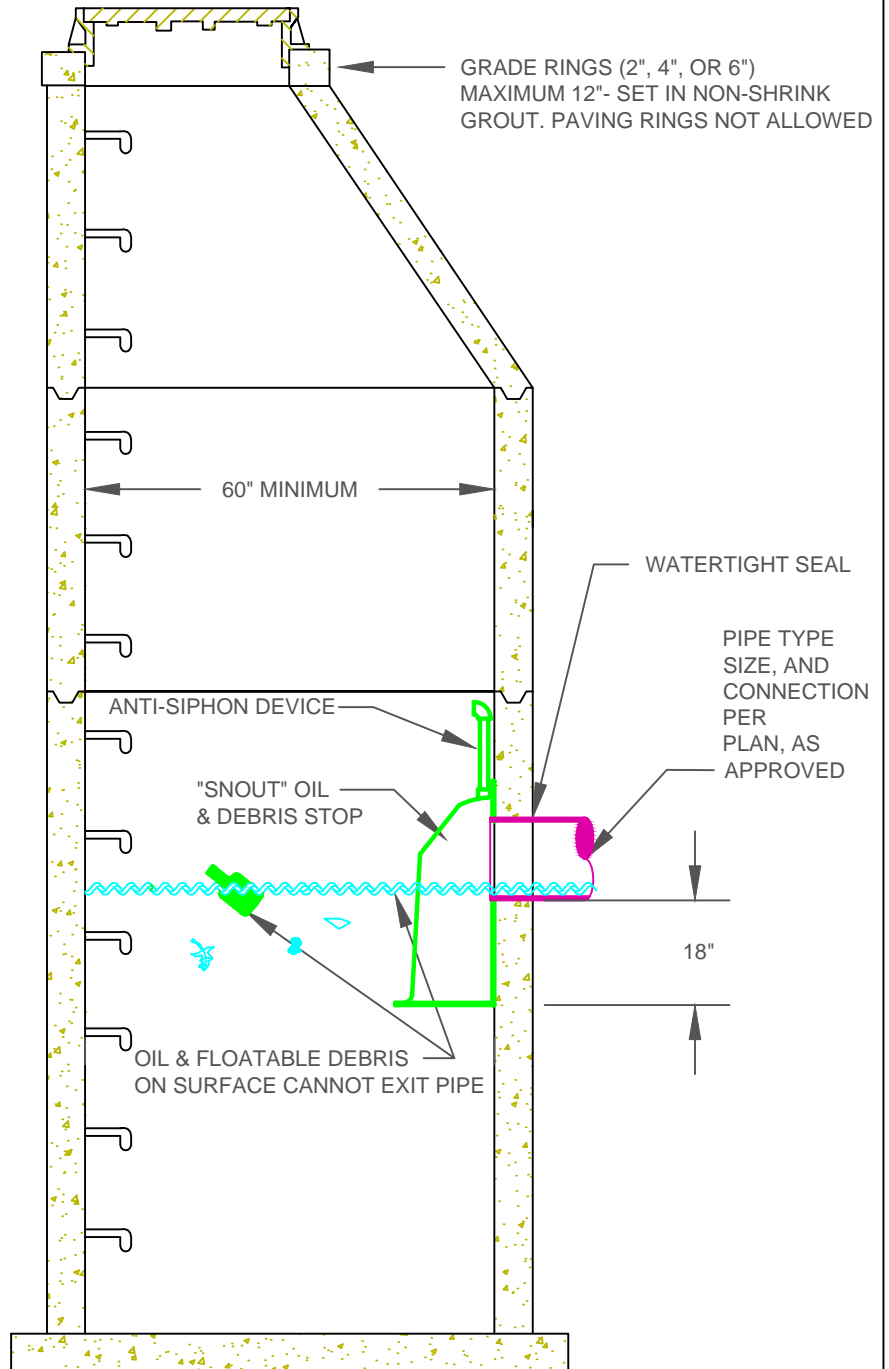
MINIMUM	MAXIMUM	
60" M.H.=	58.9 CF	98.1 CF
72" M.H.=	84.8 CF	141.3 CF
84" M.H.=	115.4 CF	192.3 CF

PROVIDE SPECIAL DETAIL FOR VOLUME REQUIREMENTS EXCEEDING 192.3 CF

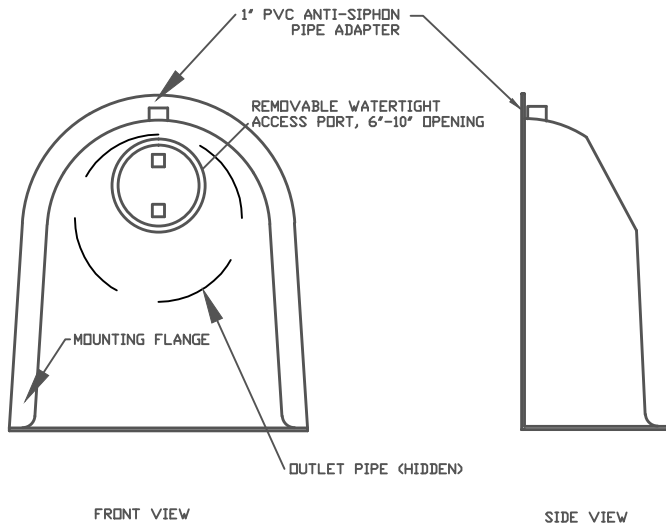
SUMP VOLUME REQUIREMENTS

20 CF/1.0 CFS OF INFLOW

58.9 CF MINIMUM REQUIRED

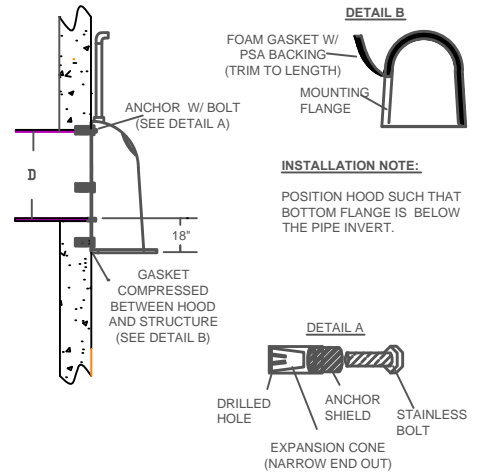


CONFIGURATION DETAIL



SNOUT OIL-WATER-DEBRIS SEPARATOR

INSTALLATION DETAIL



NOTES:

1. ALL HOODS SHALL BE CONSTRUCTED OF A GLASS REINFORCED RESIN COMPOSITE WITH ISO GEL COAT EXTERIOR FINISH WITH A MINIMUM 0.125" LAMINATE THICKNESS.
2. ALL HOODS SHALL BE EQUIPPED WITH A WATERTIGHT ACCESS PORT, A MOUNTING FLANGE, AND AN ANTI-SIPHON VENT AS DRAWN. (SEE CONFIGURATION DETAIL)
3. THE SIZE AND POSITION OF THE HOOD SHALL BE DETERMINED BY OUTLET PIPE SIZE AS PER MANUFACTURER'S RECOMMENDATION.
4. THE BOTTOM OF THE HOOD SHALL EXTEND DOWNWARD A DISTANCE OF 18" FROM I.E. OUT.
5. THE ANTI-SIPHON VENT SHALL EXTEND ABOVE HOOD BY MINIMUM OF 3" AND A MAXIMUM OF 24" ACCORDING TO STRUCTURE CONFIGURATION.
6. THE SURFACE OF THE STRUCTURE WHERE THE HOOD IS MOUNTED SHALL BE FINISHED SMOOTH AND FREE OF LOOSE MATERIAL.
7. THE HOOD SHALL BE SECURELY ATTACHED TO STRUCTURE WALL WITH 3/8" STAINLESS STEEL BOLTS AND OIL-RESISTANT GASKET AS SUPPLIED BY MANUFACTURER. (SEE INSTALLATION DETAIL)
8. INSTALLATION INSTRUCTIONS SHALL BE FURNISHED WITH MANUFACTURER SUPPLIED INSTALLATION KIT.
INSTALLATION KIT SHALL INCLUDE:
 - A. INSTALLATION INSTRUCTIONS
 - B. PVC ANTI-SIPHON VENT PIPE AND ADAPTER
 - C. OIL-RESISTANT CRUSHED CELL FOAM GASKET WITH PSA BACKING
 - D. 3/8" STAINLESS STEEL BOLTS
 - E. ANCHOR SHIELDS

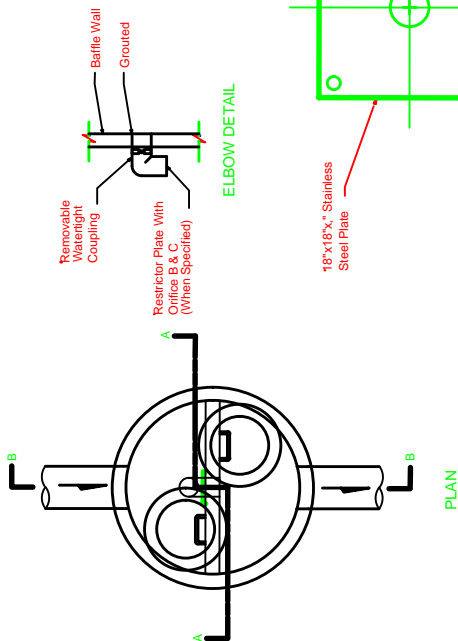
FLOW CONTROL STRUCTURE DETAIL

DRAWING NO. 270

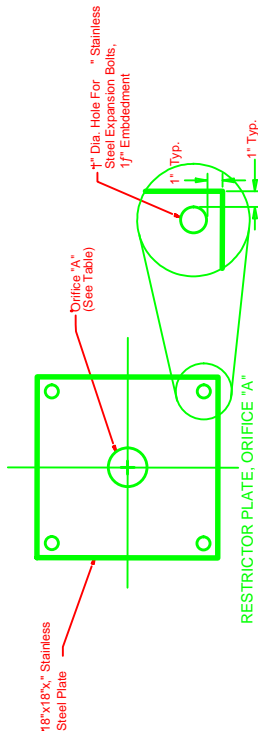
REVISED 10-2014

NOTES:

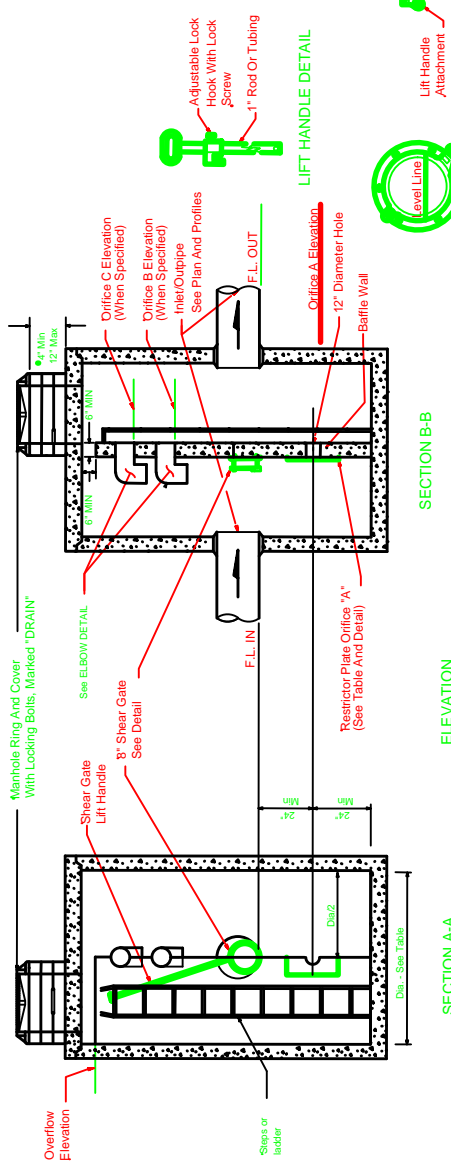
1. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.
2. PRECAST BAFFLE SHALL BE KEYPED AND GROUTED IN PLACE.
3. JOINT BETWEEN CONCRETE BAFFLE AND MANHOLE WALL SHALL BE WATERTIGHT.
4. UPPER FLOW ORIFICE SHALL BE ALUMINUM, ALUMINIZED STEEL OR GALVANIZED STEEL. GALVANIZED STEEL SHALL HAVE TREATMENT 1.
5. FRAME AND LADDER OR STEPS ARE TO BE OFFSET SO THAT: SHEAR GATE IS VISIBLE FROM THE TOP; CLIMB-DOWN SPACE IS CLEAR OF RISER AND GATE; FRAME IS CLEAR OF CURB.
6. MULTI-ORIFICE ELBOWS SHALL BE PREINSTALLED TO INSURE LADDER CLEARANCE.
7. RESTRICTOR PLATE WITH ORIFICE AS SPECIFIED IN THE CONTRACT. OPENING IS TO BE CUT ROUND AND SMOOTH. NEOPRENE GASKET SHALL BE INSTALLED BETWEEN THE ORIFICE PLATE AND CONCRETE BAFFLE TO PROVIDE A WATERTIGHT SEAL.
8. SHEAR GATE SHALL BE MADE OF ALUMINUM ALLOY IN ACCORDANCE WITH ASTM B 26M AND ASTM B 275, DESIGNATION Z932A OR CAST IRON IN ACCORDANCE WITH ASTM A 48, CLASS 30B. LIFT HANDLE MAY BE SOLID ROD OR HOLLOW TUBING WITH ADJUSTABLE HOOK AS REQUIRED. NEOPRENE RUBBER GASKET REQUIRED BETWEEN RISER MOUNTING FLANGE AND GATE FLANGE. MATING SURFACES OF LID AND BODY SHALL BE MACHINED FOR PROPER FIT.
9. FLANGE MOUNTING BOLTS SHALL BE "... DIAMETER STAINLESS STEEL.
10. SHEAR GATE MAXIMUM OPENING SHALL BE CONTROLLED BY LIMITED HINGE MOVEMENT, STOP TAB OR SOME OTHER DEVICE.
11. ALTERNATE SHEAR GATES DESIGNS ARE ACCEPTABLE, IF MATERIAL SPECIFICATIONS ARE MET AND FLANGE BOLT PATTERN MATCHES.
12. MANHOLE CERTIFICATION REQUIRED FOR TRAFFIC LOADING.



ELBOW DETAIL



RESTRICTOR PLATE, ORIFICE "A"



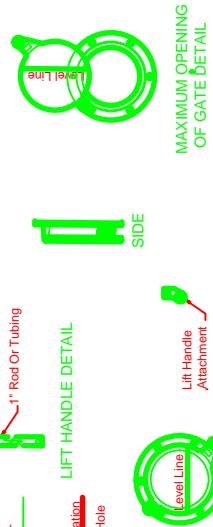
SECTION A-A

ELEVATION

FLOW CONTROL STRUCTURE DETAIL
NTS

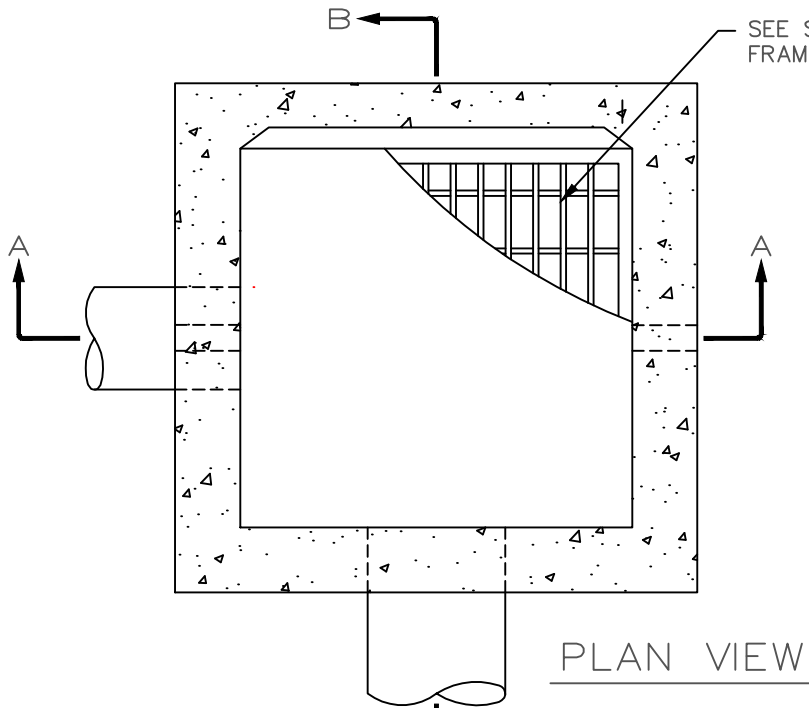
FLOW CONTROL
STRUCTURE TABLE

Diameter Of Manhole (In.)	
F.L. (In)	
F.L. (Out)	
Outlet Pipe Diameter (In.)	
Number Of Orifice	
Orifice A Elevation	
Diameter Of Orifice A (In.)	
Orifice B Elevation	
Diameter Of Orifice B (In.)	
Orifice C Elevation	
Diameter Of Orifice C (In)	
Overflow Elevation	
Rim Elevation	
Riser Diameter (In.)	

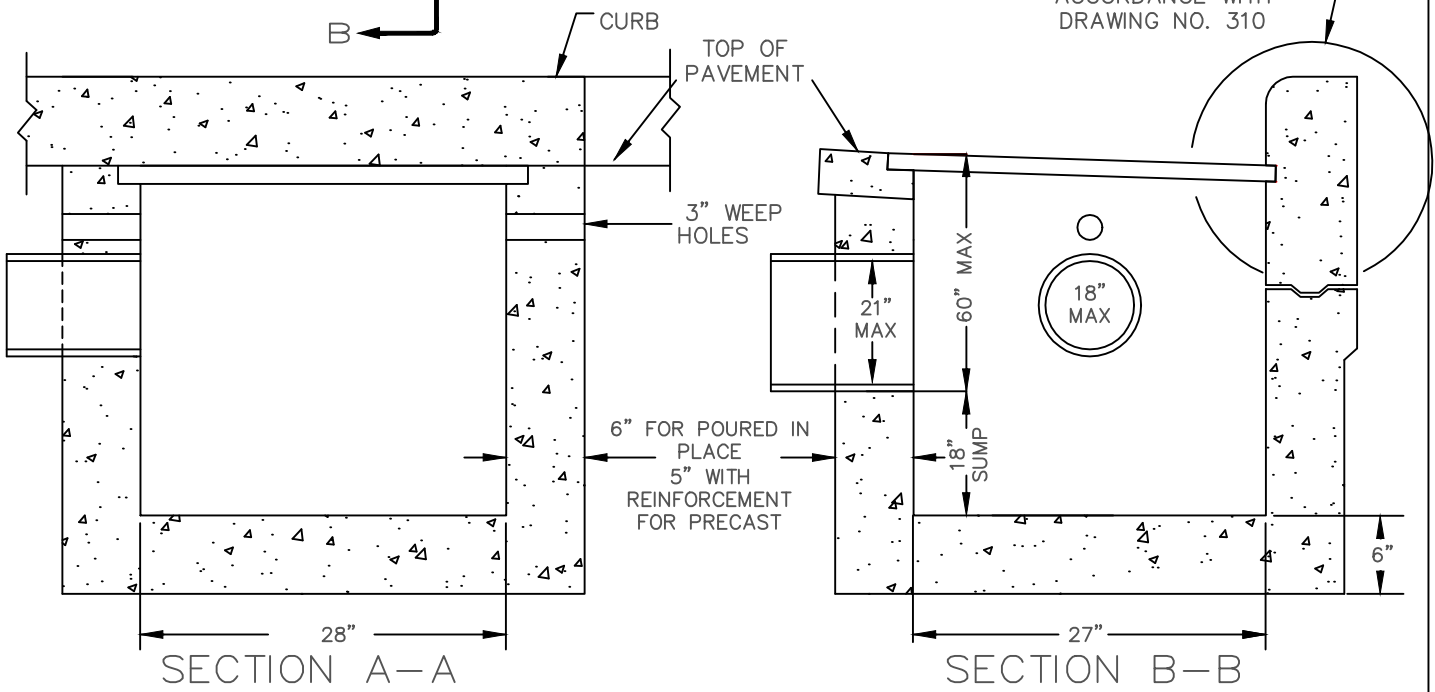


SHEAR GATE
AS MANUFACTURED BY KENNEDY VALVE OR EQUAL

SEE STANDARD DRAWING NO. 320 FOR
FRAME AND COVER.

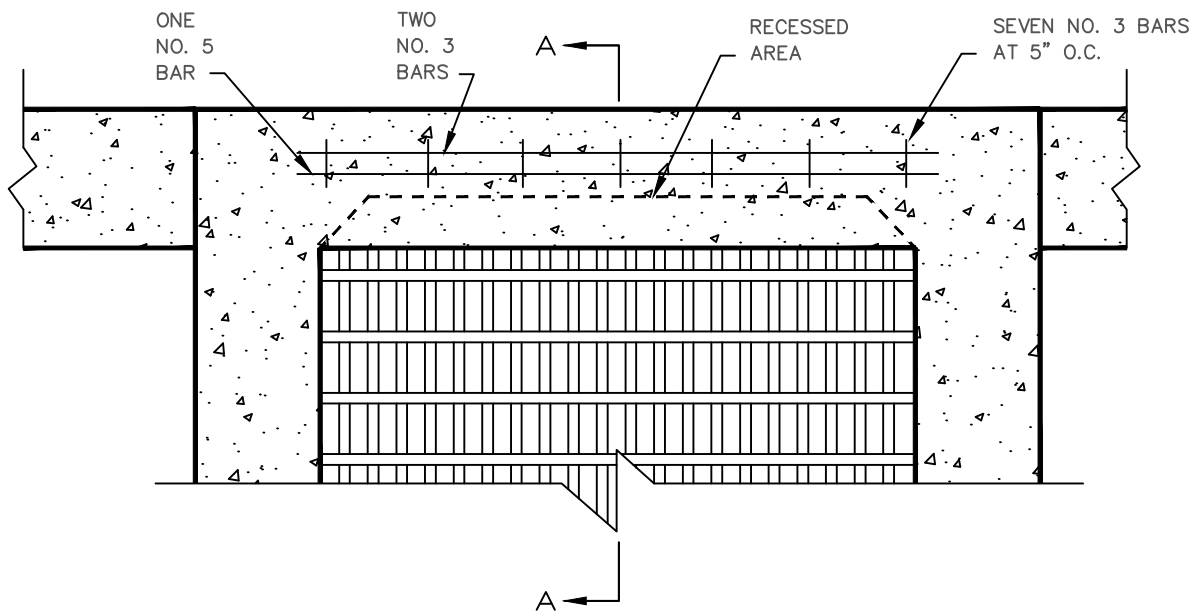


RECESSED CURB INLETS
TO BE REINFORCED
CONCRETE INSTALLED IN
ACCORDANCE WITH
DRAWING NO. 310



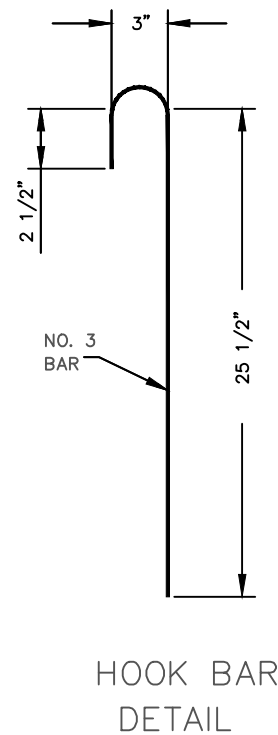
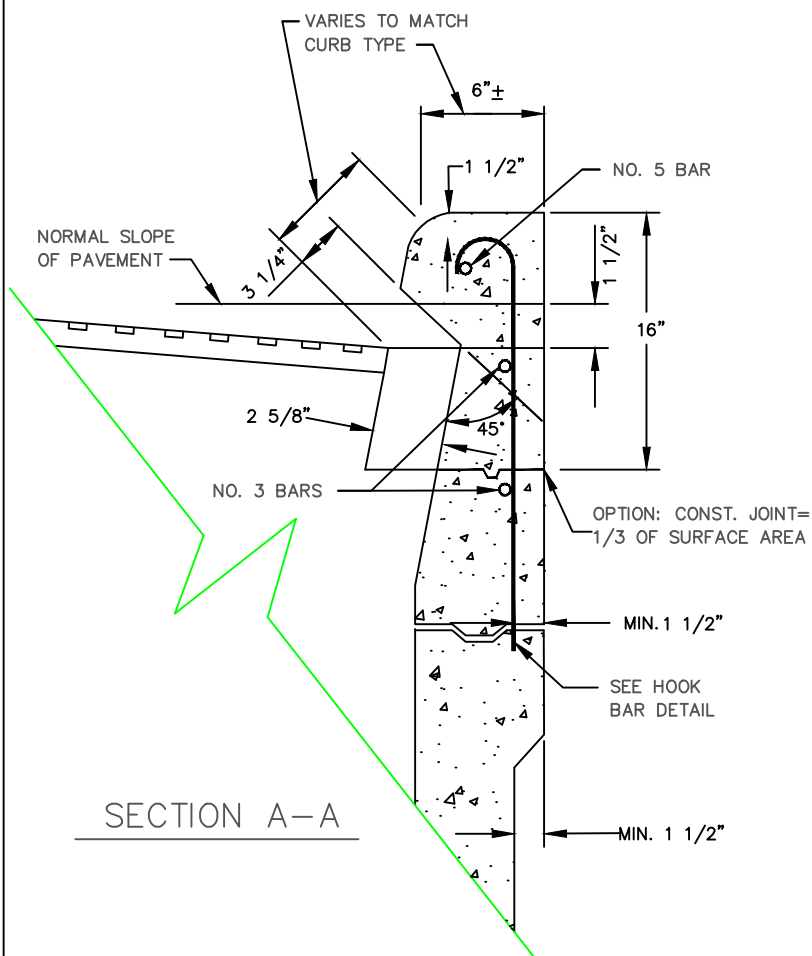
NOTES:

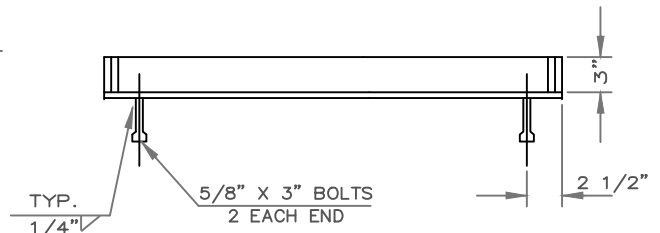
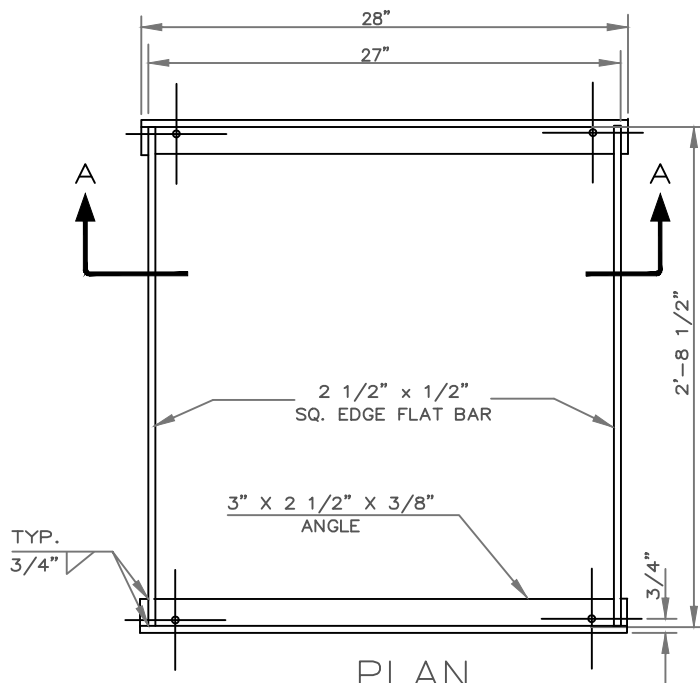
1. CATCH BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C-478.
2. INSTALL STEPS WHEN DISTANCE FROM TOP OF GRATE TO FLOW LINE OF PIPE IS GREATER THAN 48". SEE STANDARD DRAWING NO. 100. SET FIRST STEP 12" FROM TOP OF GRATE.
3. INSTALL STRUCTURE ON MINIMUM OF 8" OF $\frac{3}{4}$ "-0" COMPACTED BASE MATERIAL.
4. REINFORCEMENT FOR PRE CAST CATCH BASIN SHALL BE REBAR MEETING ASTM A-615 GRADE 60 OR WELDED WIRE MEETING ASTM A-497.
5. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 P.S.I. AND A SLUMP OF 2" TO 4".
6. CHANNEL REQUIRED IN FLOW THROUGH APPLICATIONS, AS APPROVED. ALL OTHER APPLICATIONS REQUIRE AN 18" SUMP BELOW LOWEST PIPE INVERT.
7. FULL CURB EXPOSURE REQUIRED CANNOT BE LOCATED IN SIDEWALK RAMPS OR RAMP WINGS.



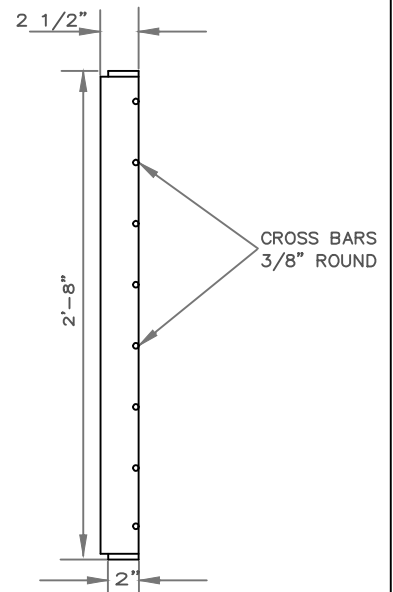
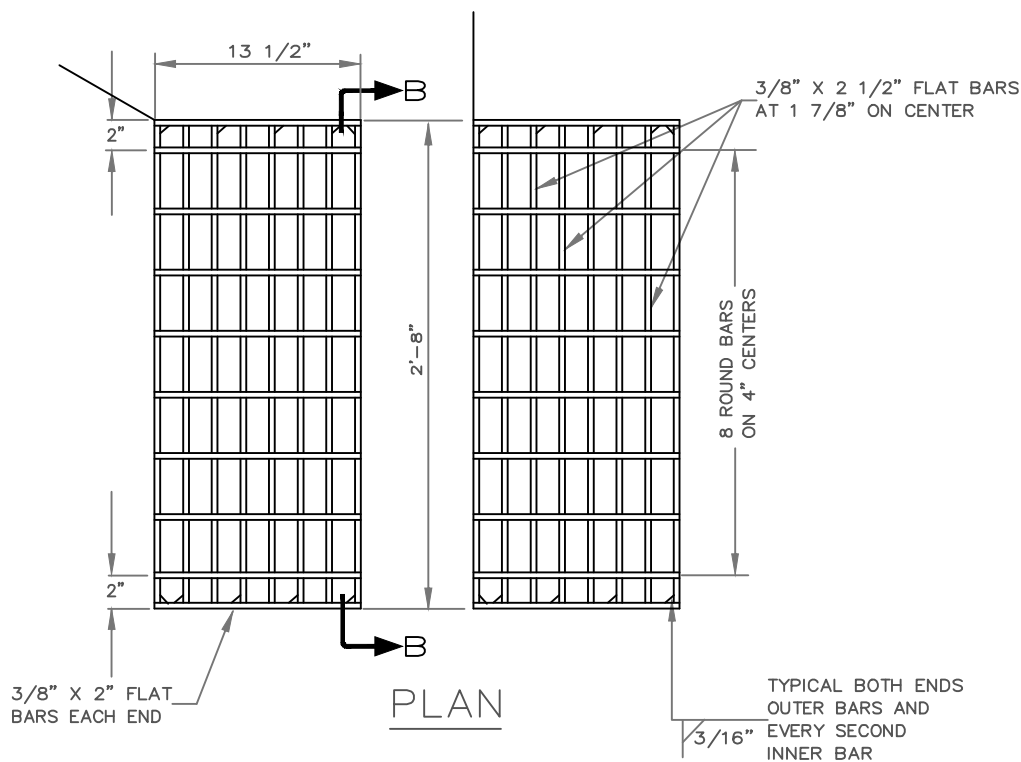
PLAN

SEE STD DRAWING NO. 320
FOR FRAME AND COVER.





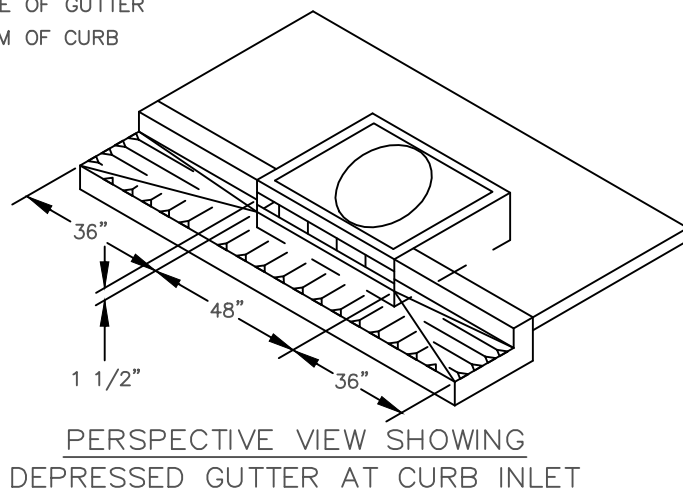
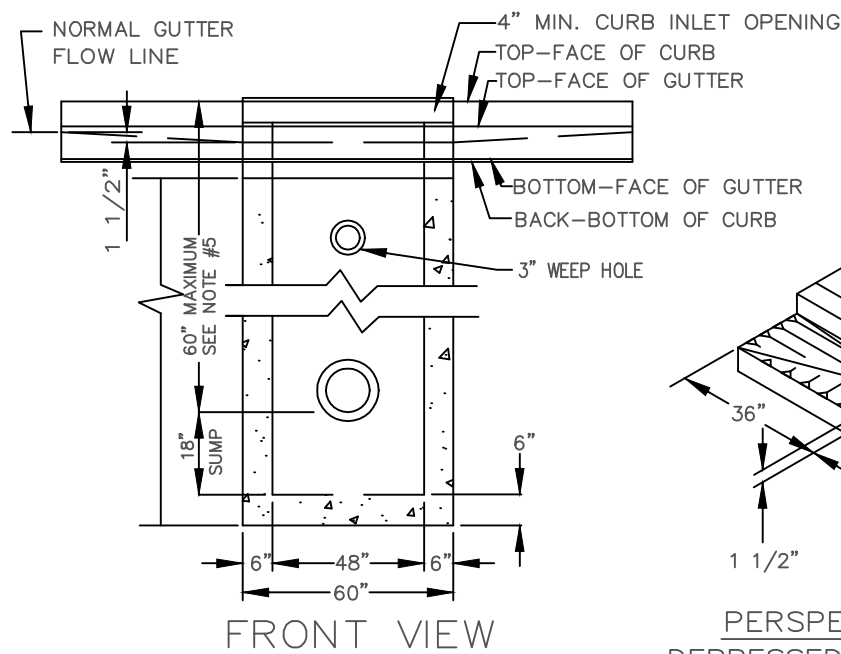
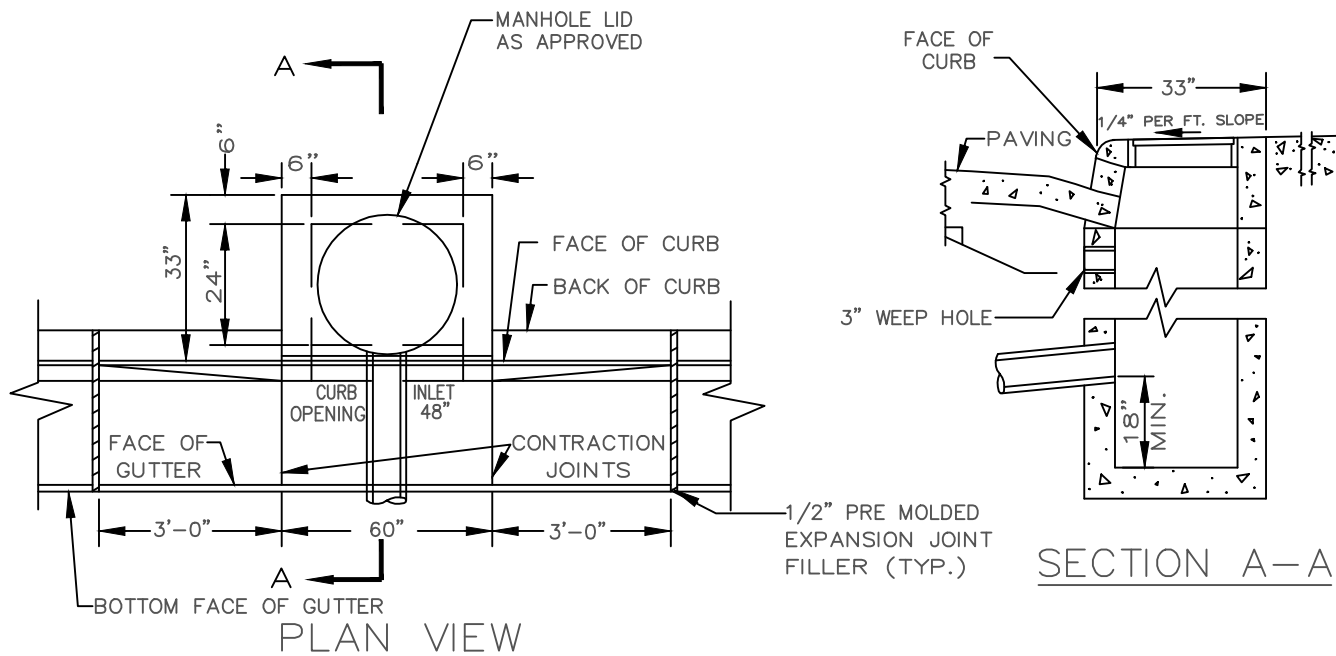
SECTION A-A



SECTION B-B

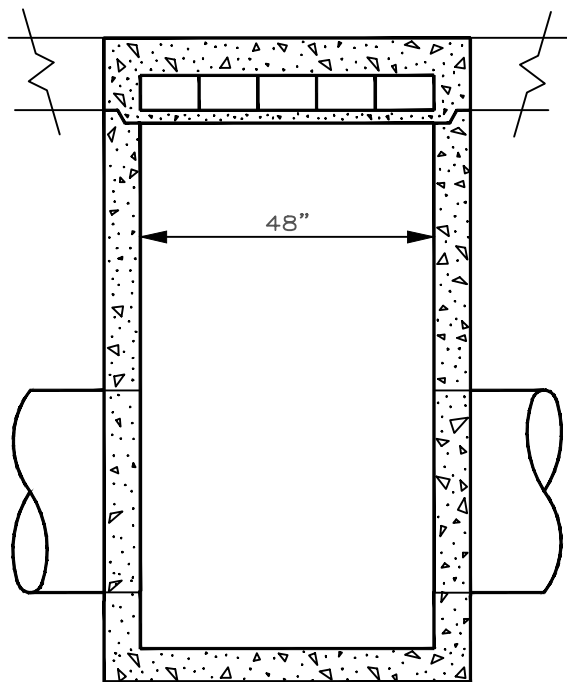
NOTE:
FRAME AND GRATE TO BE NEW STRUCTURAL ASTM A-36 FLAT BAR STEEL OR APPROVED EQUAL.
ADDITIONAL THICKNESS AND REINFORCEMENT SHALL BE REQUIRED FOR STATE HIGHWAY APPLICATIONS.





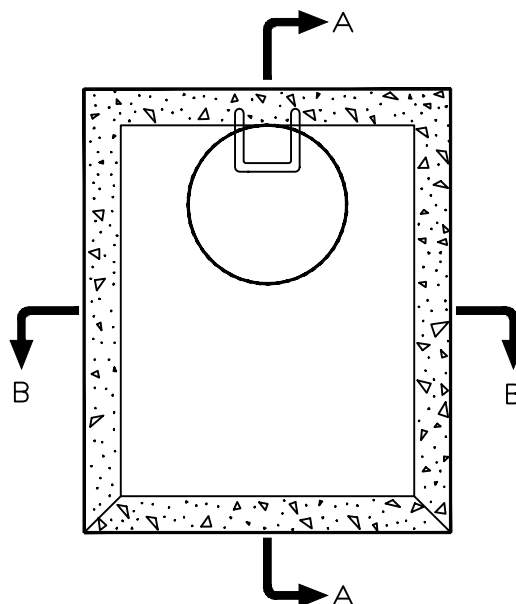
NOTES:

1. ALL FABRICATED METAL PARTS SHALL BE NEW STRUCTURAL, ASTM A-36 STEEL, AND BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
2. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 P.S.I. AND A SLUMP OF 2" TO 4".
3. INSTALL STEPS WHEN DISTANCE FROM TOP OF LID TO FLOW LINE IS GREATER THAN 48", SEE DRAWING NO. 100. SET FIRST STEP 12" FROM TOP OF GRATE AND ALIGN WITH LID OPENING.
4. INSTALL STRUCTURE ON MINIMUM OF 8" OF 3/4" TO 0" COMPACTED BASE MATERIAL.
5. 72" MAXIMUM ALLOWED WITH CITY APPROVAL, TO AVOID CONFLICTS WITH EXISTING UTILITIES.

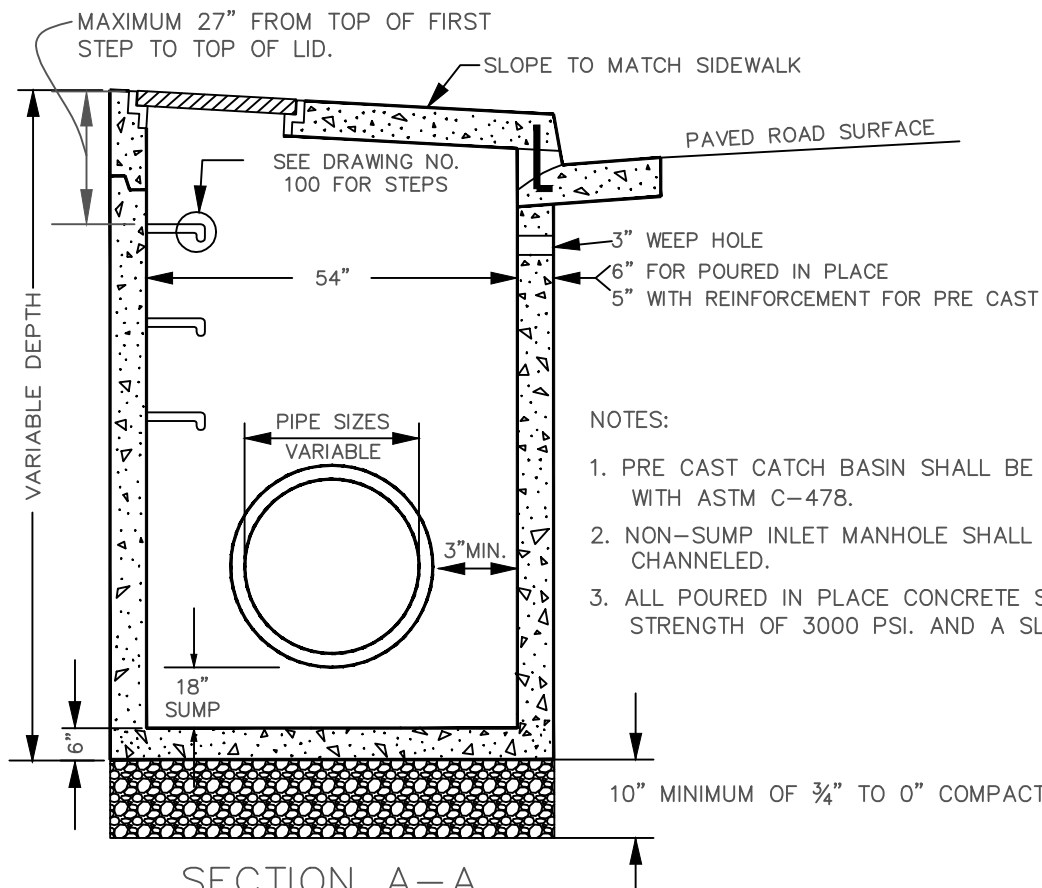


SECTION B-B

SEE DRAWING NO. 370
FOR TOP SECTION DETAILS



PLAN VIEW



NOTES:

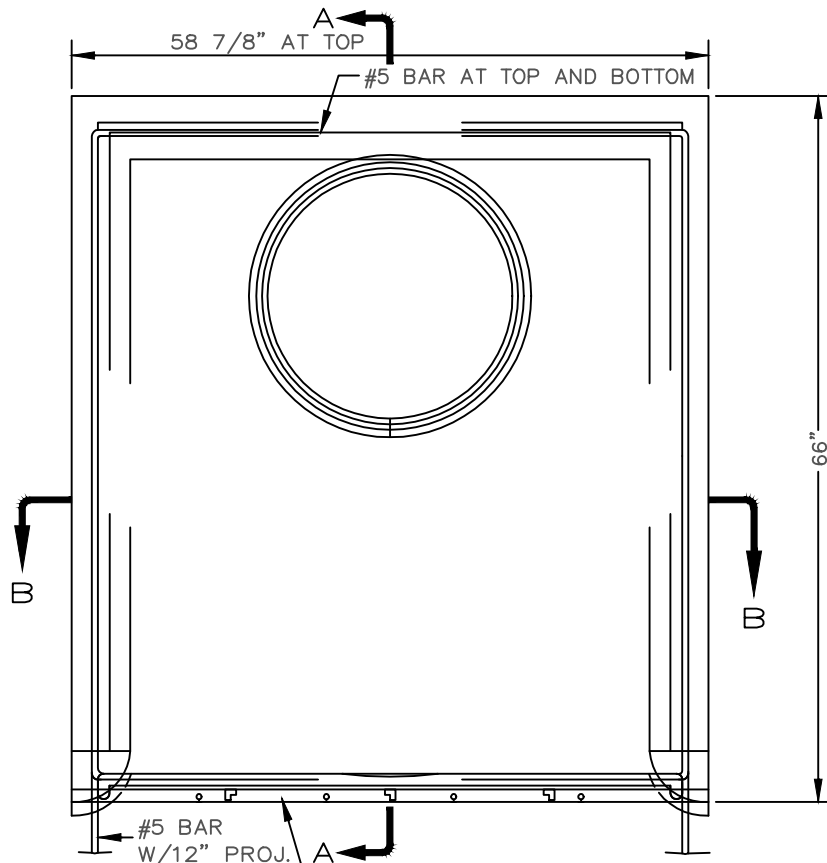
1. PRE CAST CATCH BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C-478.
2. NON-SUMP INLET MANHOLE SHALL BE CHanneled.
3. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI. AND A SLUMP OF 2" TO 4"

10" MINIMUM OF $\frac{3}{4}$ " TO 0" COMPACTED BASE MATERIAL.

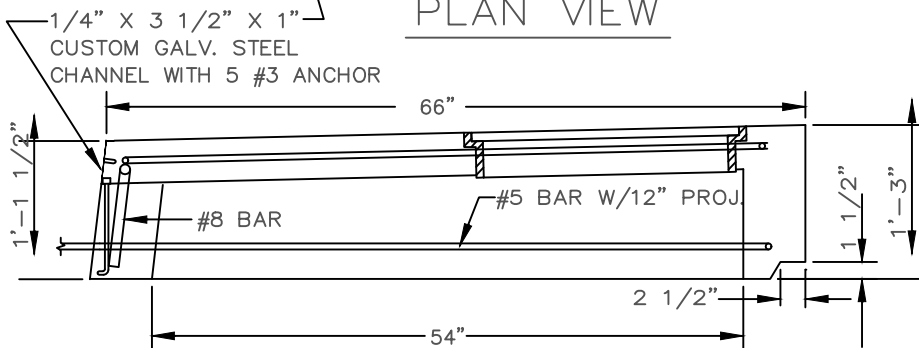
SECTION A-A

Technical drawing of a manhole section showing dimensions and construction details.

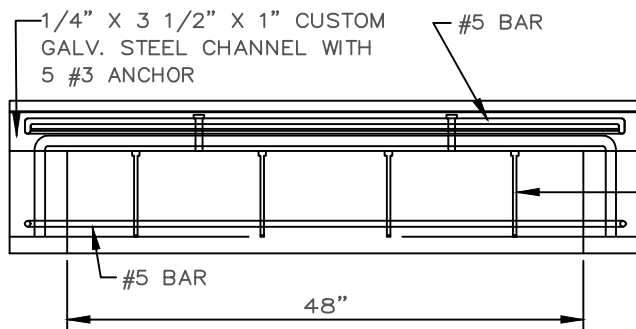
- SLOPE TOP TO MATCH SIDEWALK SLOPE**
- 66"** (width)
- DEPRESS GUTTER BAR 2-1/2" BELOW NORMAL AT FACE**
- PAVED ROAD SURFACE**
- CURB FACE**
- UPPER SECTION TO BE CG-48 DRAIN INLET. SEE DRAWING NO. 350.**
- MAXIMUM OF 27" FROM TOP OF FIRST STEP TO TOP OF GRATE.**
- MANHOLE STEPS SEE DRAWING NO. 100**
- 3" WEEP HOLE WITH DRAINAGE GEOTEXTILE AND DRAIN ROCK**
- 6"** (height)
- 4" MIN.** (width)
- 54"** (width)
- 4" MIN.** (width)
- SLOPE 2% MIN.**
- POURED CONCRETE BASE 3000 P.S.I. AT 28 DAYS (COMMERCIAL MIX)**
- ALL PRE CAST MANHOLE SECTIONS SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-478, AND APPLICABLE PROVISIONS OF STANDARD MANHOLE; DRAWING NO. 010.**
- ALL JOINTS TO BE RAM-NECK JOINT MATERIALS OR EQUIVALENT-ALT. GROUT**
- 6" MIN. 3/4"-0 AT 90% COMP.**
- 6" MIN.** (height)
- 5" MINIMUM** (width)
- SUMP 18"** (depth)
- 6"** (width)
- NOTE:**
 - CHANNEL BASE WHEN SUMP IS NOT REQUIRED.
 - SEE DRAWING NO. 370 FOR TOP SECTION DETAILS
- 10" 3/4"-0" BASE MATERIAL 90% COMPACTION**
- 24" MINIMUM** (height)



PLAN VIEW



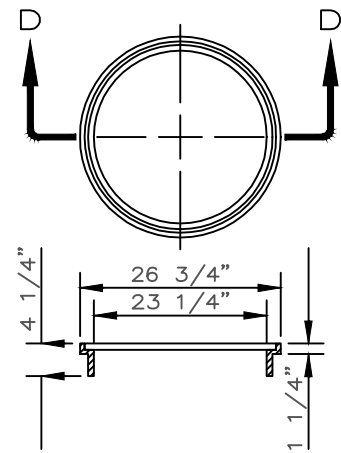
SECTION A-A



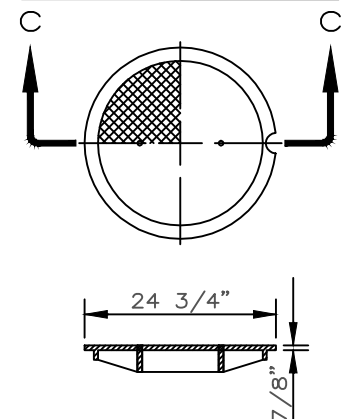
SECTION B-B

FOUR
1/2" DIA. X 8" X 1" J
BOLTS (GALV.)

MATERIAL SHALL BE NEW
STRUCTURAL ASTM A-36
STEEL

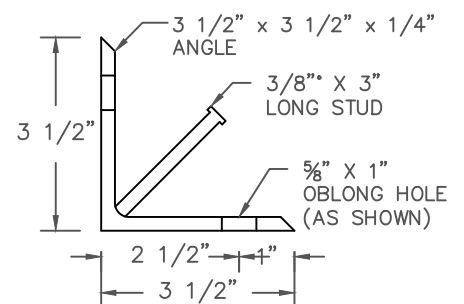


SECTION D-D

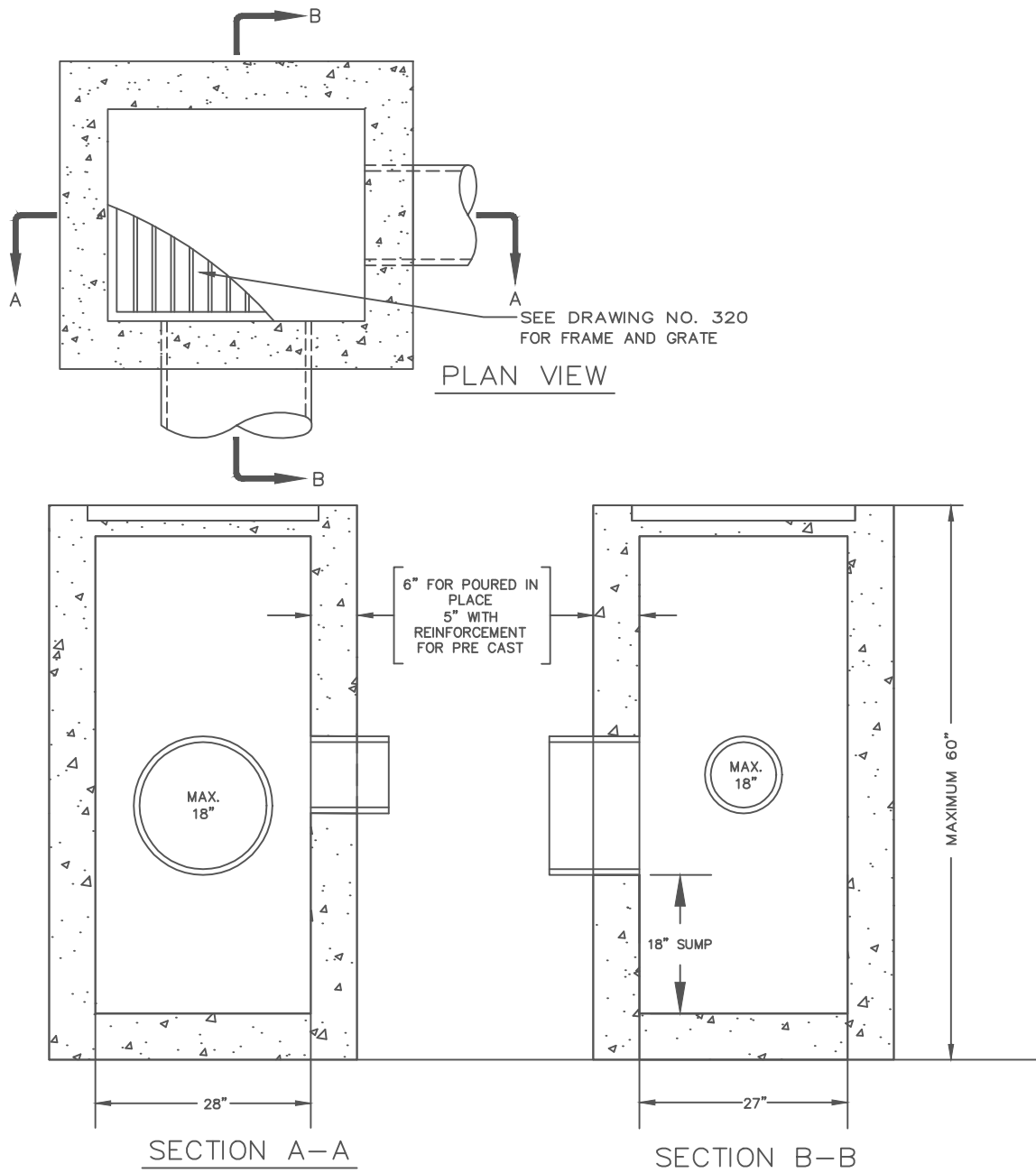


SECTION C-C

MANHOLE FRAME AND COVER

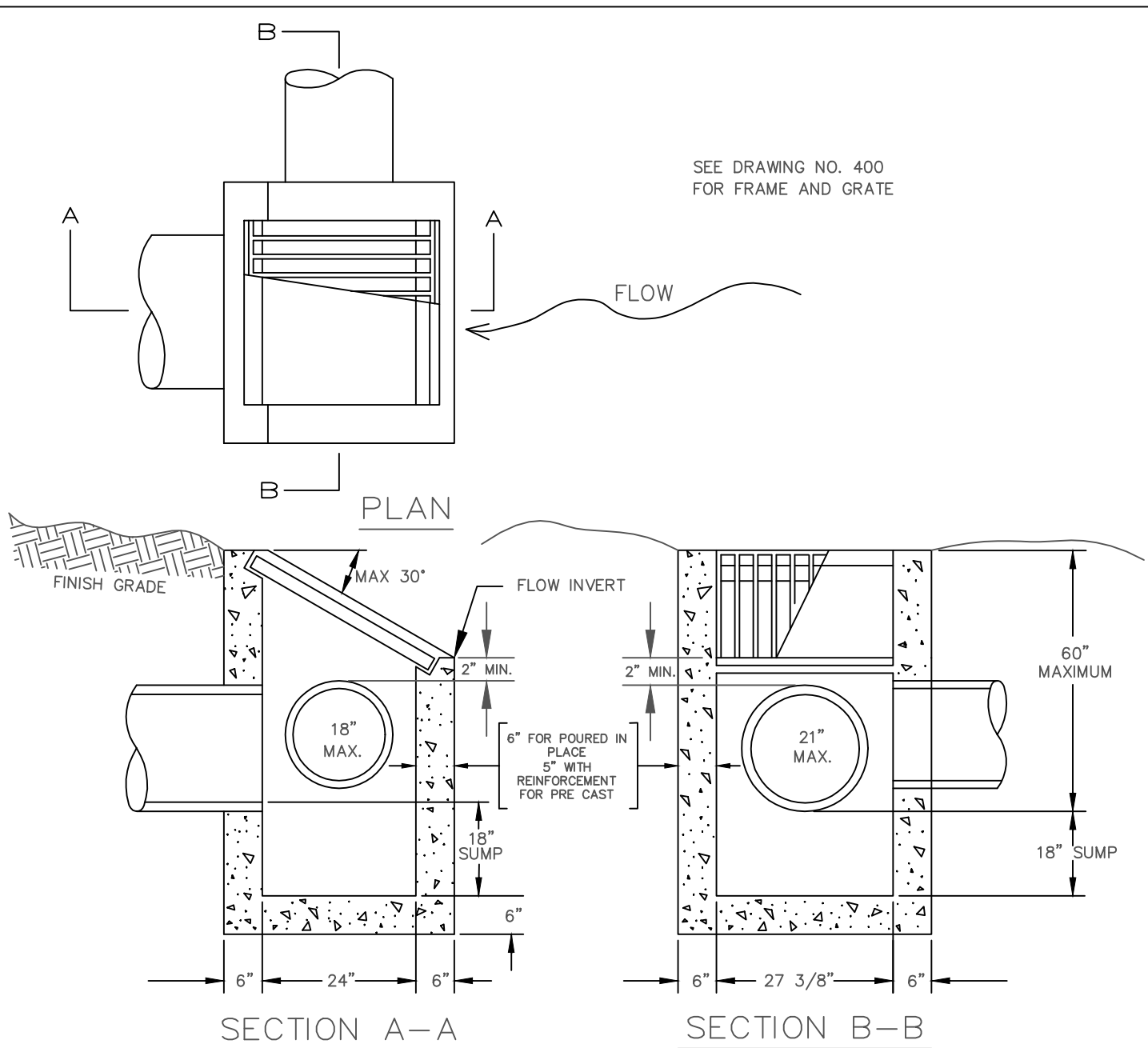


STEEL CHANNEL DETAIL



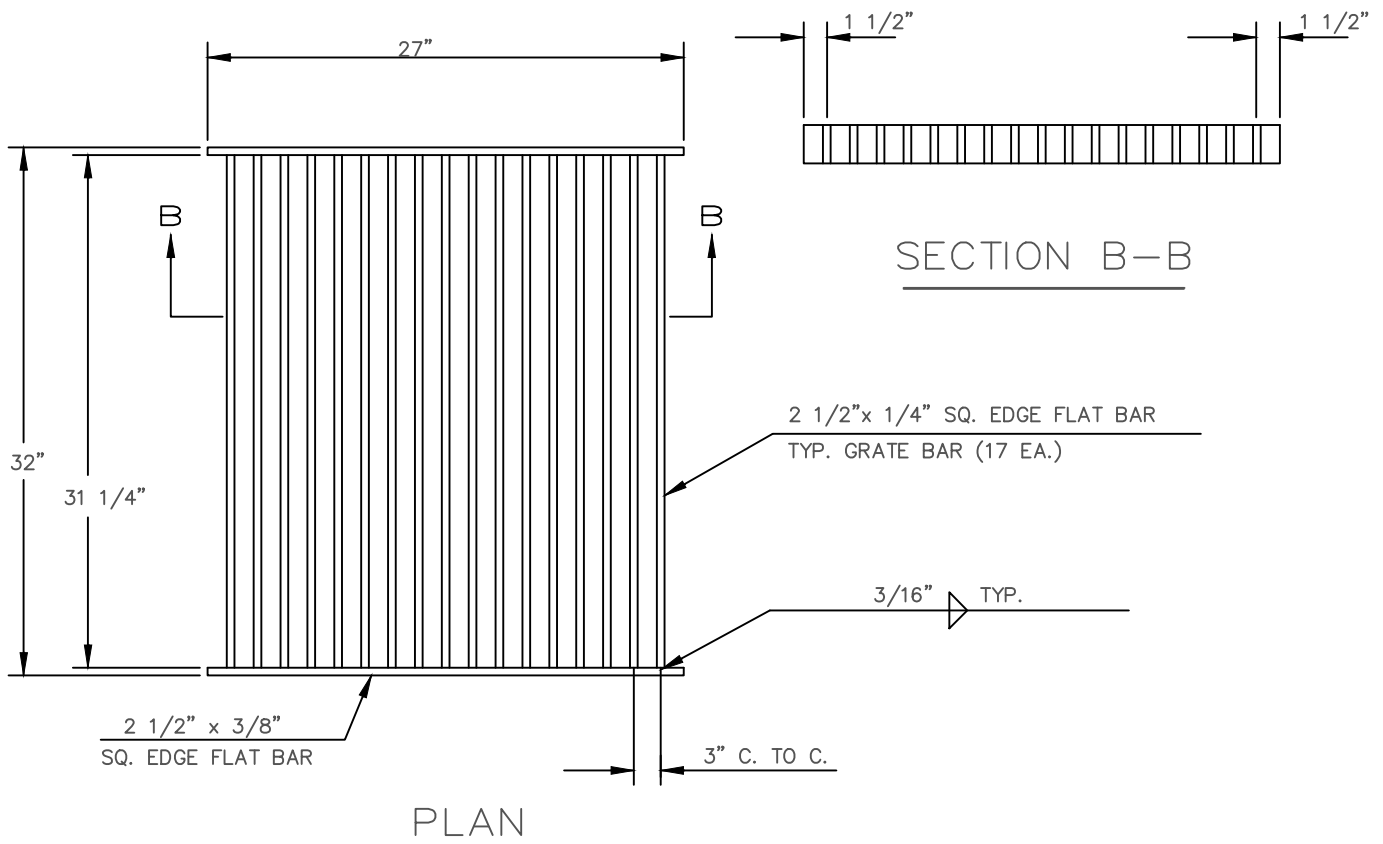
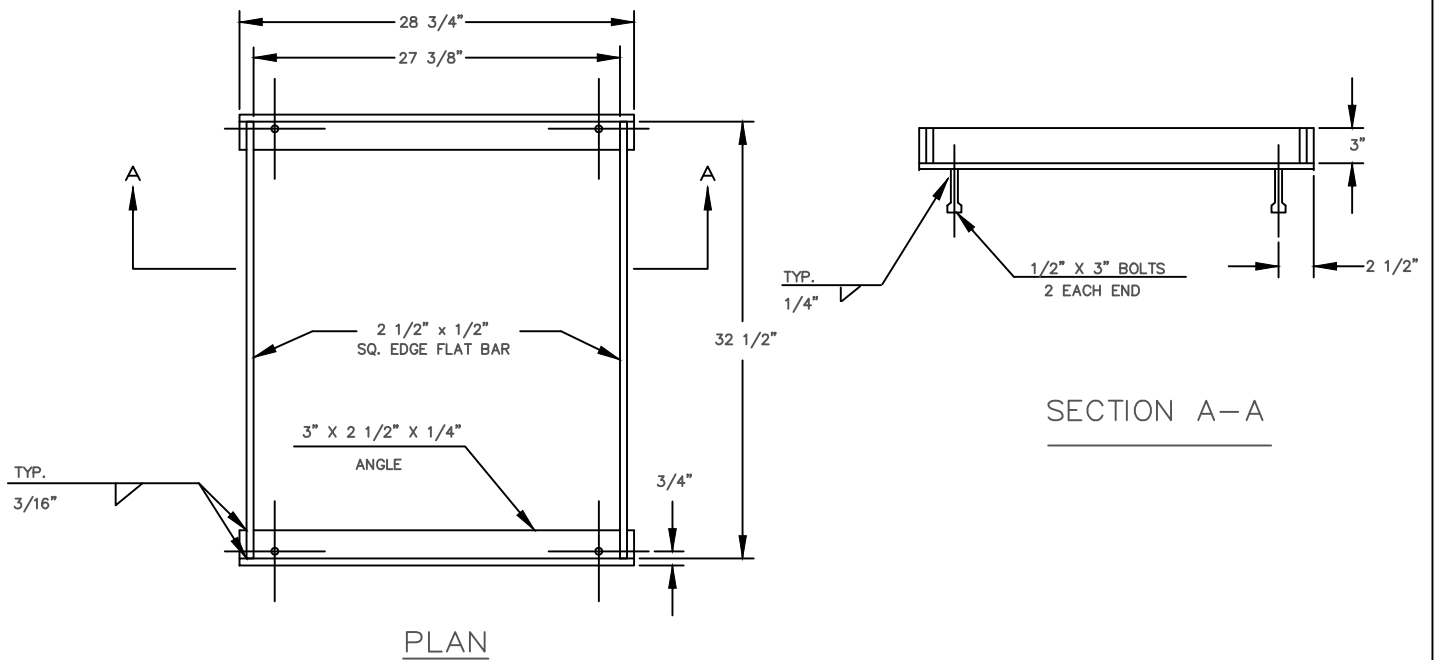
NOTES:

1. ALL PRE CAST SECTIONS SHALL CONFORM TO REQUIREMENTS OF ASTM C-478.
2. INSTALL STRUCTURE ON MIN. OF 8" OF $\frac{3}{4}$ "-0" COMPACTED BASE MATERIAL.
3. PRE CAST REINFORCEMENT SHALL BE REBAR MEETING ASTM A615 GRADE OR WELDED WIRE MEETING ASTM A497.
4. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 P.S.I. AND A SLUMP OF 2" TO 4".
5. CHANNEL REQUIRED IN FLOW THROUGH APPLICATIONS, AS APPROVED. ALL OTHER APPLICATIONS REQUIRE AN 18" SUMP BELOW LOWEST PIPE INVERT.
6. INSTALL STEPS WHEN DISTANCE FROM TOP OF GRATE TO FLOW LINE OF PIPE IS GREATER THAN 48". SEE DRAWING NO. 100. SET FIRST STEP 12" FROM TOP OF GRATE.
7. PRE-CAST STRUCTURE'S CONFORMING TO O.D.O.T. TYPE G-2 CATCH BASIN INLET ARE AN ACCEPTABLE ALTERNATE. (ALL GRATE MATERIALS SHALL MEET STANDARDS AS SHOWN ON DETAIL #320)

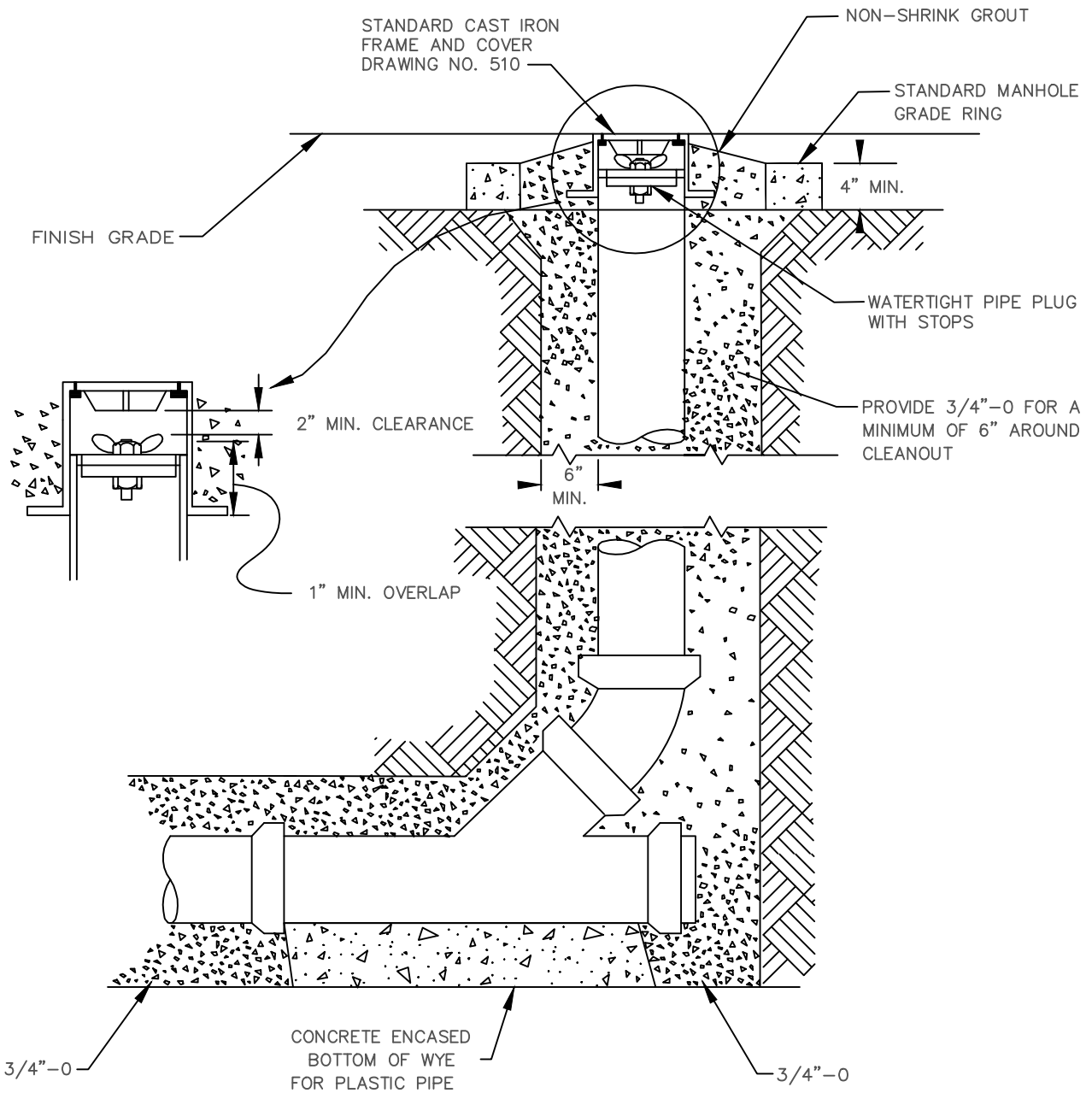


NOTES:

1. ALL PRE CAST SECTIONS SHALL CONFORM TO REQUIREMENTS OF ASTM C-478.
2. INSTALL STRUCTURE ON MINIMUM OF 8" OF 3/4" - 0" COMPACTED BASE MATERIAL.
3. PRE CAST REINFORCEMENT SHALL BE REBAR MEETING ASTM A615 GRADE 60 OR WELDED WIRE MEETING ASTM A497
4. ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI AND SLUMP OF 2" TO 4".
5. PRE-CAST STRUCTURE'S CONFORMING TO O.D.O.T. TYPE G-2 CATCH BASIN DESIGN/WITH DITCH INLET TOP ARE AN ACCEPTABLE ALTERNATE. ALL GRATE MATERIALS SHALL MEET STANDARDS AS SHOWN ON DETAIL NO. 400.

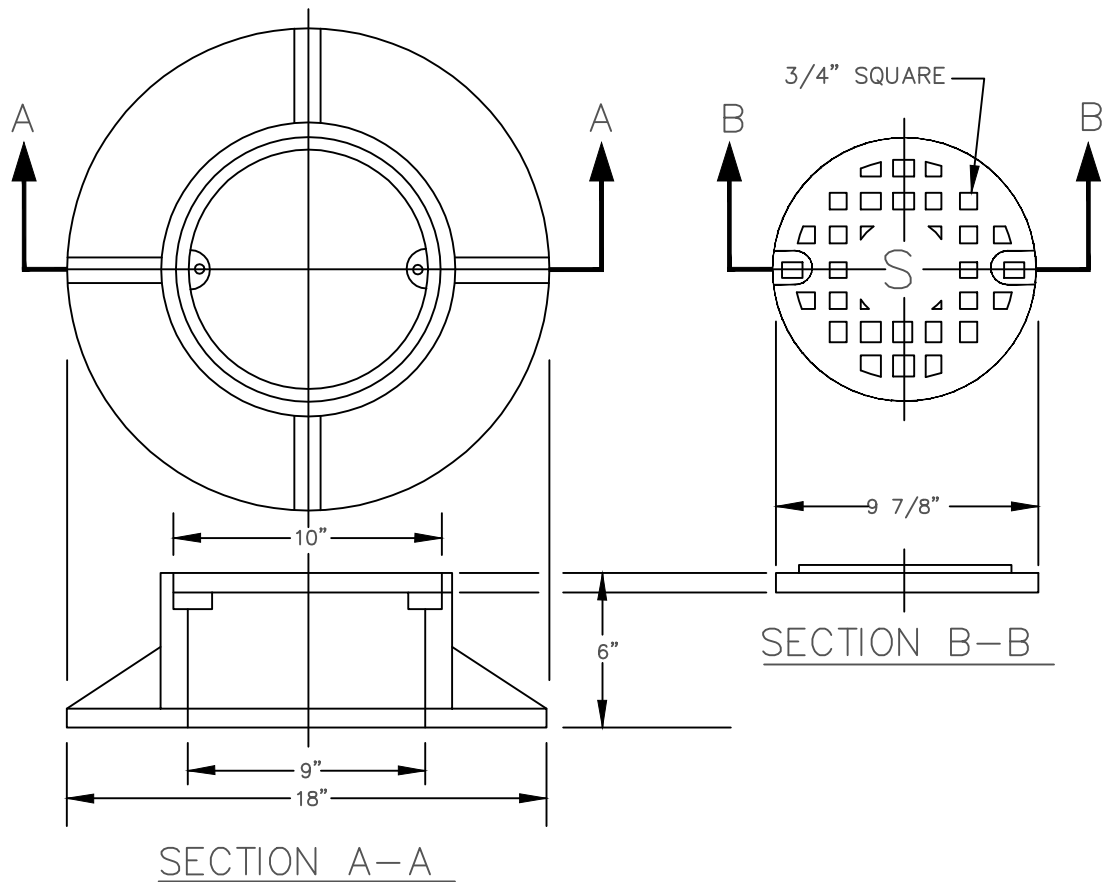


NOTE:
FRAME AND GRATE SHALL BE NEW STRUCTURAL ASTM A-36 FLAT BAR STEEL OR APPROVED EQUAL.



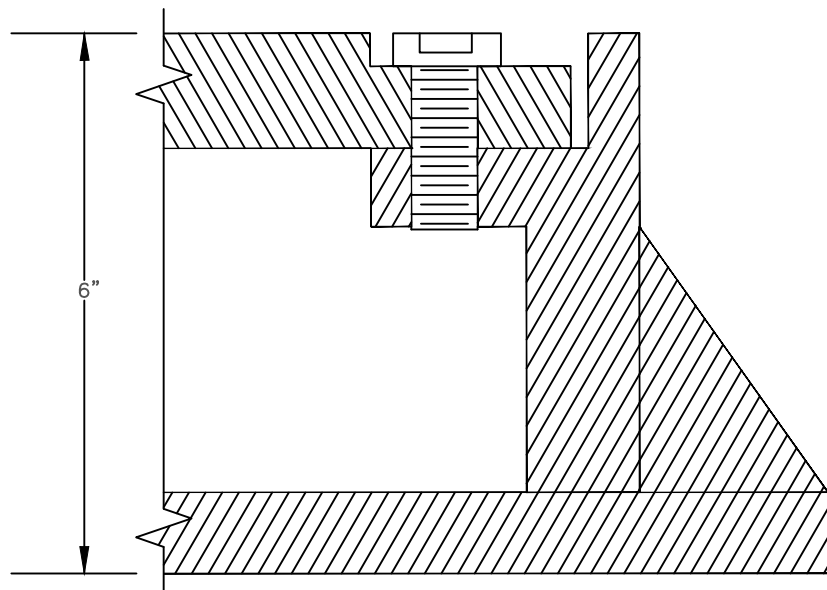
NOTE:

1. CONCRETE ENCASE ENTIRE WYE SECTION AND 45° BEND IF CONCRETE PIPE
2. STAND PIPE TO BE SAME SIZE AS MAINLINE UP TO AND INCLUDING 8" PIPE.
MAINLINE GREATER THAN 8" SHALL HAVE A 8" STANDPIPE.



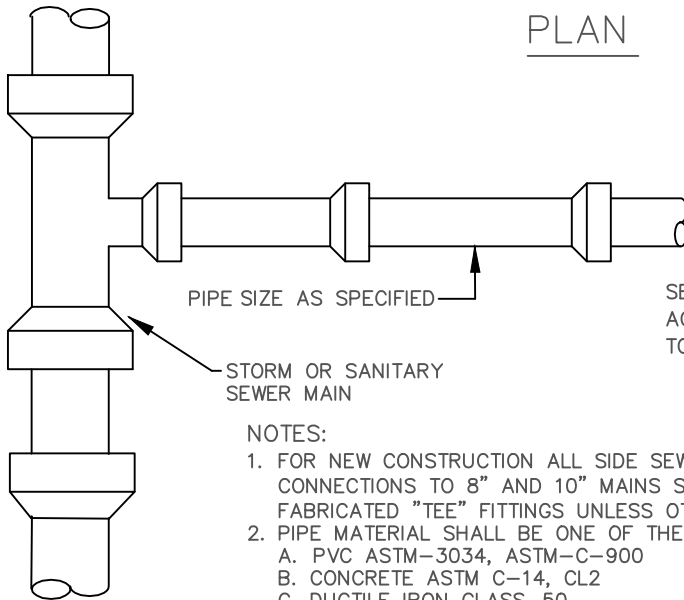
NOTES:

1. $\frac{1}{4}$ " ALLEN HEAD BOLTS
1" LONG RECESSED.
2. ALL PERMANENT CLEANOUTS
TO HAVE BOLT DOWN COVERS.
3. MATERIAL SHALL BE GRAY
CAST-IRON, ASTM A-48,
CLASS 30.



DETAIL

PLAN

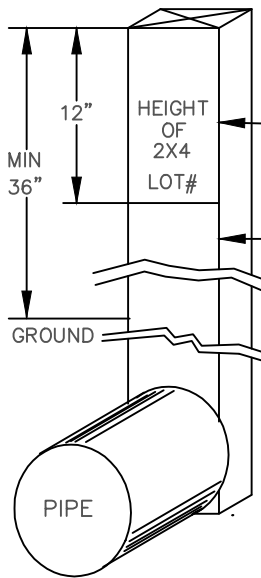


PROPERTY LINE OR
UTILITY EASEMENT

SECURE 2X4 IN PLACE
AGAINST PLUG W/ BACKFILL
TO PREVENT PLUG BLOWOFF

NOTES:

1. FOR NEW CONSTRUCTION ALL SIDE SEWER AND SIDE STORM PIPELINE CONNECTIONS TO 8" AND 10" MAINS SHALL BE WITH FACTORY FABRICATED "TEE" FITTINGS UNLESS OTHERWISE APPROVED.
2. PIPE MATERIAL SHALL BE ONE OF THE FOLLOWING
 - A. PVC ASTM-3034, ASTM-C-900
 - B. CONCRETE ASTM C-14, CL2
 - C. DUCTILE IRON CLASS-50
- STORM ONLY
 - D. A-2000 PVC ASTM 949
 - E. PVC RIB MEETING ASTM D 1784
 - F. CPP MEETING AASHTO M252
3. ALL PIPE SHALL BE COLOR CODED:
 - GREEN FOR SANITARY SIDE SEWERS
 - WHITE FOR STORM SIDE PIPELINES



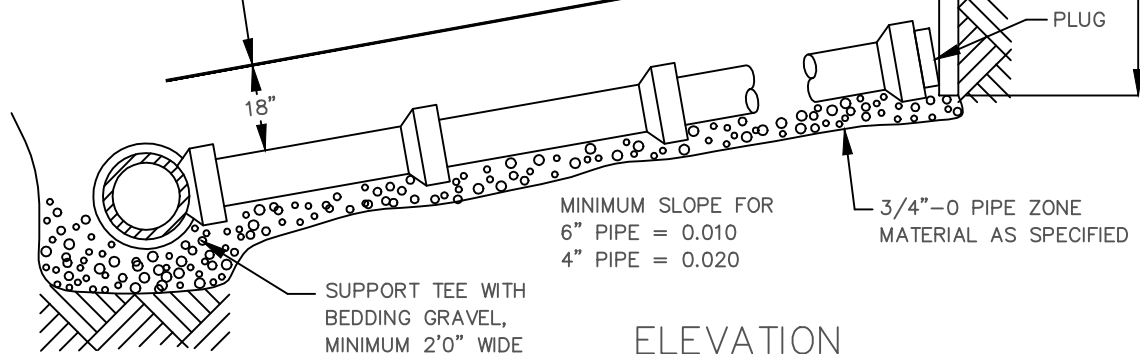
HEIGHT: TOTAL LENGTH OF 2X4
LOT#: AS SHOWN ON APPROVED SET OF PLANS
MARKINGS TO FACE STREET

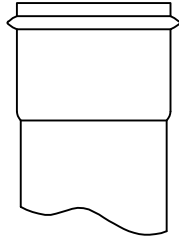
GROUND
SURFACE

MAGNETIC
TAPE

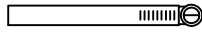
LABEL MAGNETIC TAPE WITH BLACK LETTERING
SANITARY: "CAUTION SEWER BURIED BELOW."
STORM: "CAUTION STORM DRAIN BURIED BELOW."
PLACE 18" ABOVE TOP OF PIPE AND AGAINST 2X4.

TOTAL LENGTH OF 2X4 IS VARIABLE

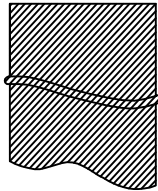




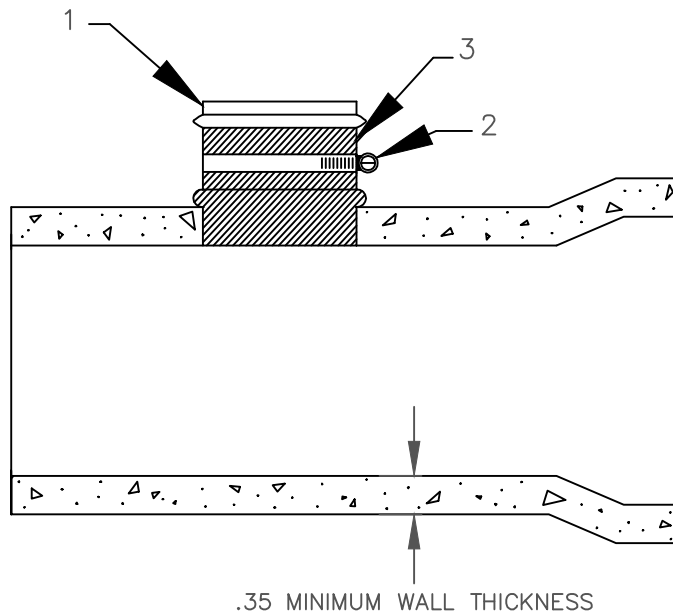
1. PVC HUB SHALL CONFORM TO ASTM 3034, SDR 35 DRIVE INTO CENTER OF RUBBER SLEEVE AFTER SLEEVE IS PLACED IN HOLE.



2. STAINLESS STEEL BAND SECURES UPPER HALF OF RUBBER SLEEVE TO THE PVC HUB. STAINLESS STEEL BAND SHALL BE 300 SERIES, $\frac{9}{16}$ " BAND WIDTH, CADMIUM PLATED CARBON STEEL, AND ATTACHED WITH HEX HEAD SLOTTED SCREW.

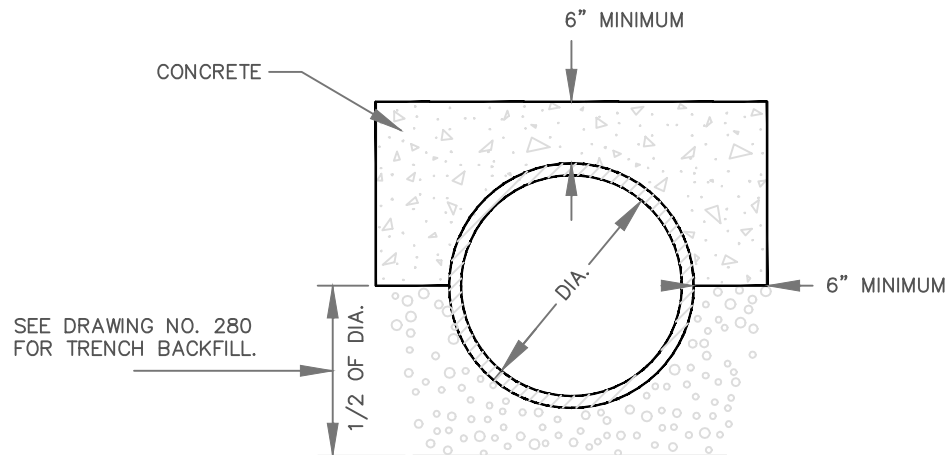


3. COMPLETE RUBBER SLEEVE INCLUDES A MOLDED SEGMENT THAT HOLDS IT IN PLACE.



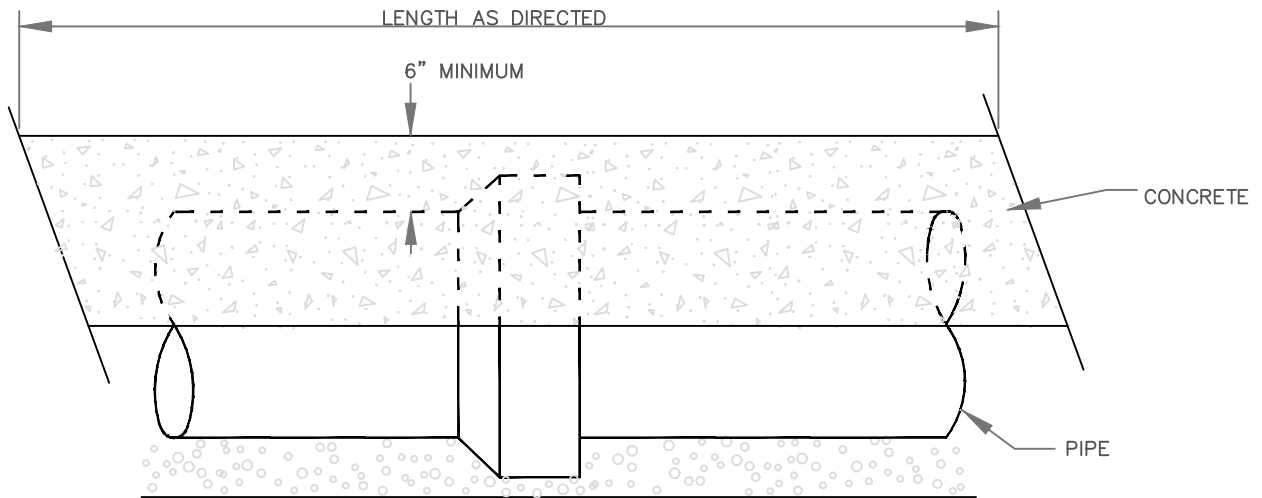
NOTE:

1. ALL INSERTA-TEE HOLES SHALL BE MACHINE DRILLED AND CORED.
2. INSERTA-TEES ARE ALLOWED IN NEWLY CONSTRUCTED SEWER MAINS 12" AND LARGER INSIDE DIAMETER (I.D.).
3. SEWER MAIN SHALL BE TWO SIZES (NOMINAL I.D.) LARGER THAN THE INSERTA-TEE.
4. HOST PIPE SHALL BE MINIMUM .35" WALL THICKNESS.

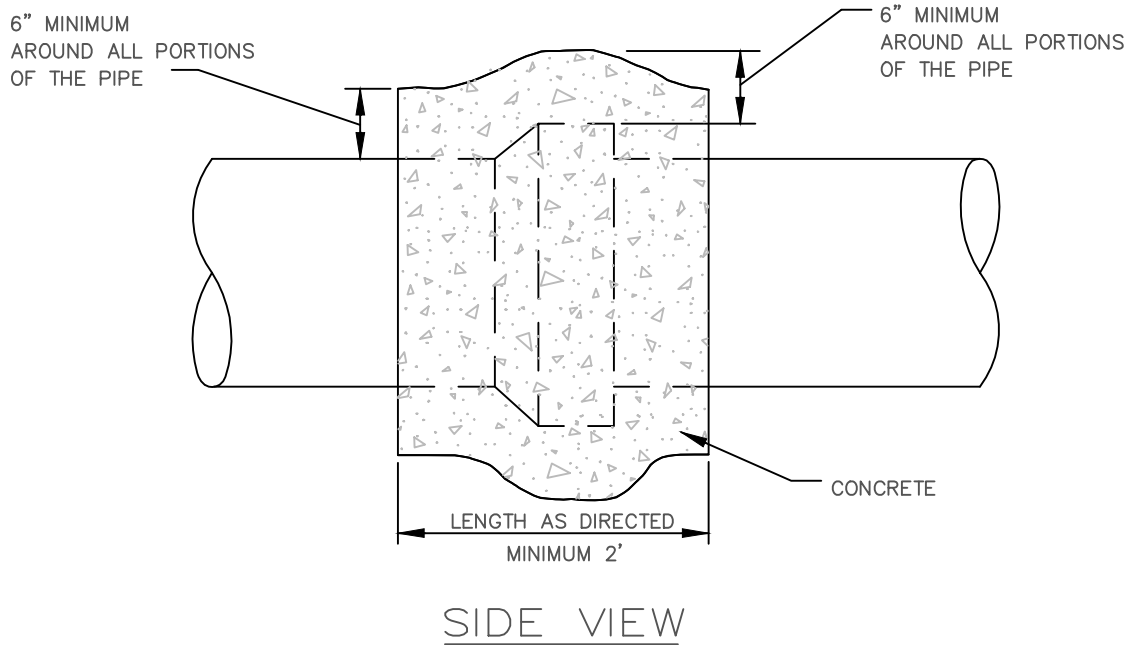
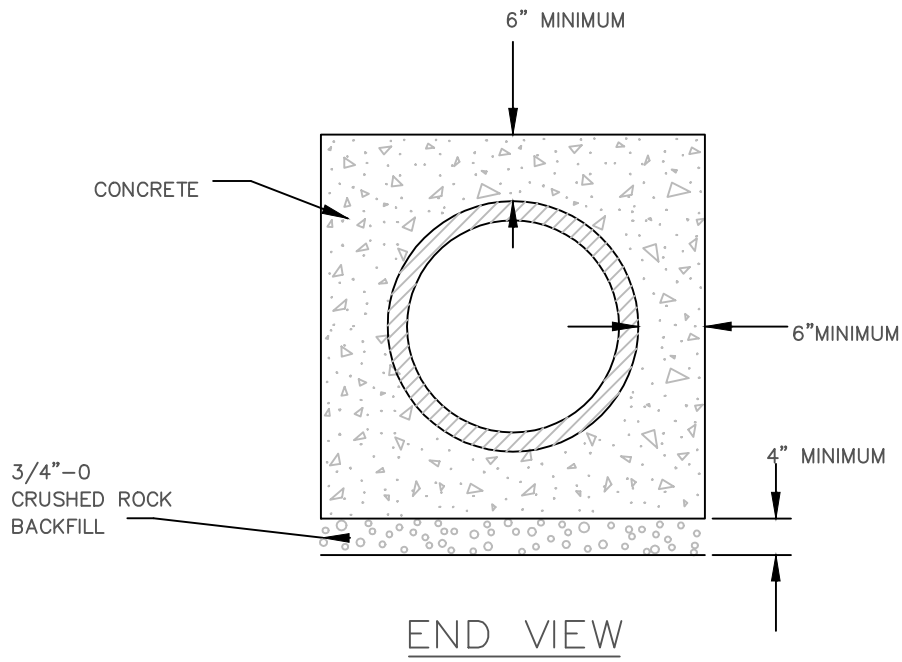


END VIEW

NOTE:
CONCRETE SHALL HAVE A 28
DAY STRENGTH OF 3000 PSI
AND 2" TO 4" SLUMP.



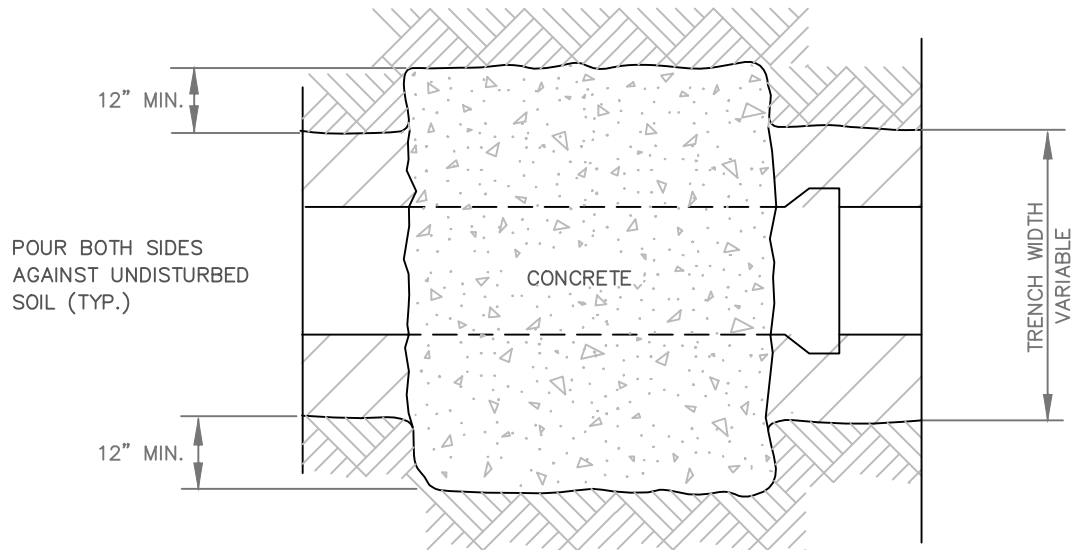
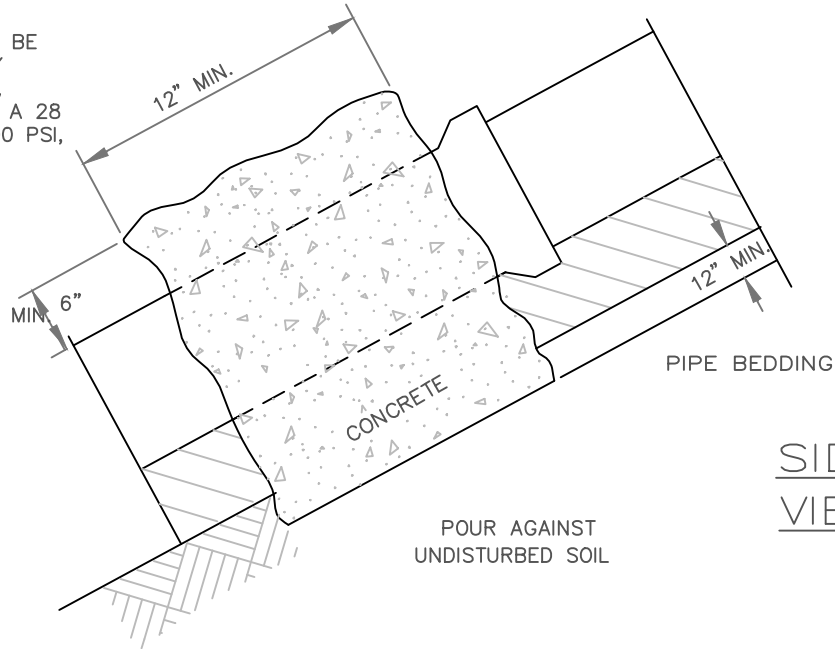
SIDE VIEW



NOTE:
CONCRETE SHALL HAVE A
28 DAY STRENGTH OF 3000 PSI
AND, 2" TO 4" SLUMP.

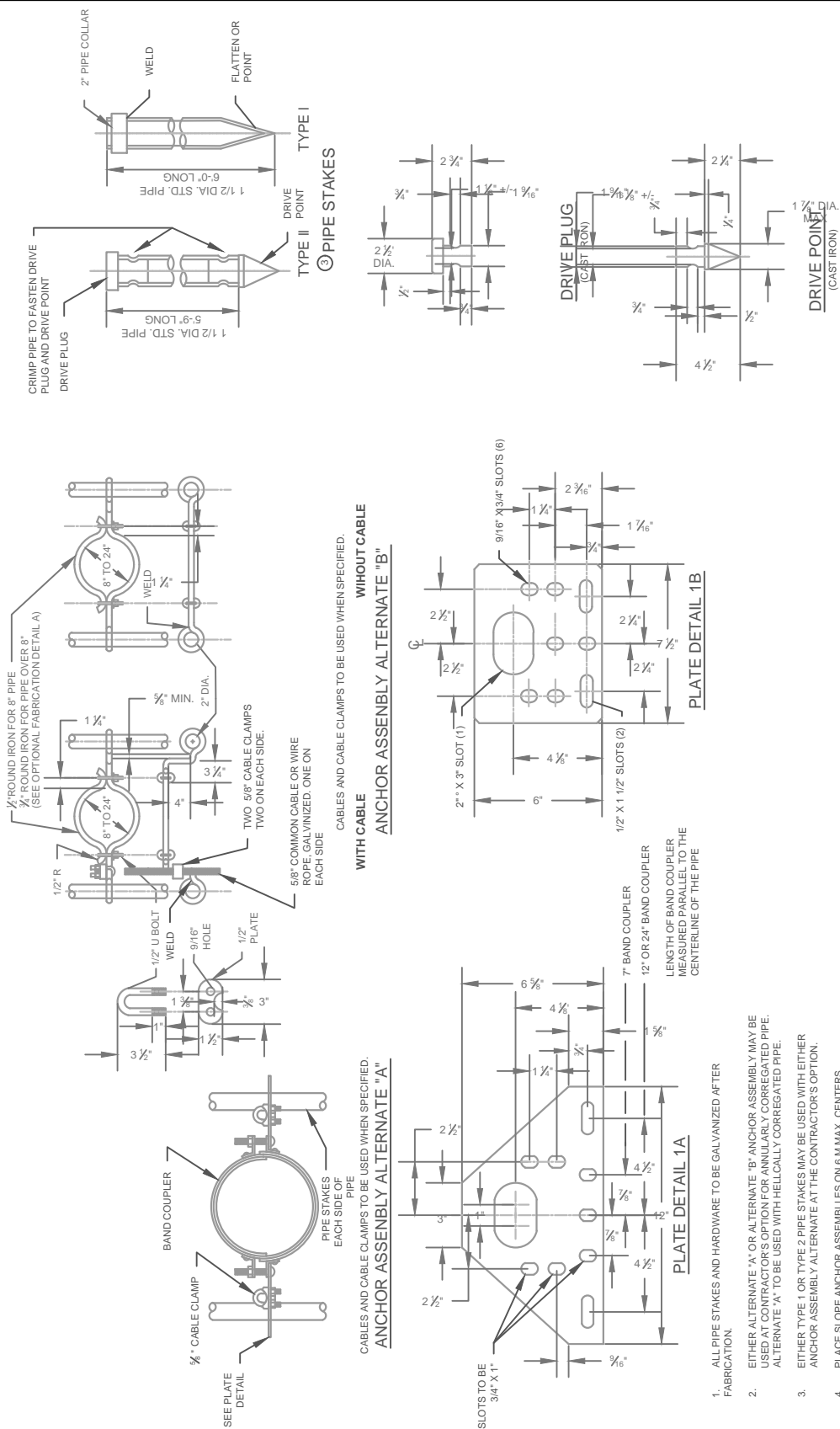
NOTE:

1. CONCRETE ANCHORS TO BE INSTALLED IMMEDIATELY DOWNHILL OF PIPEBELL,
2. CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3000 PSI, AND 2" TO 4" SLUMP.



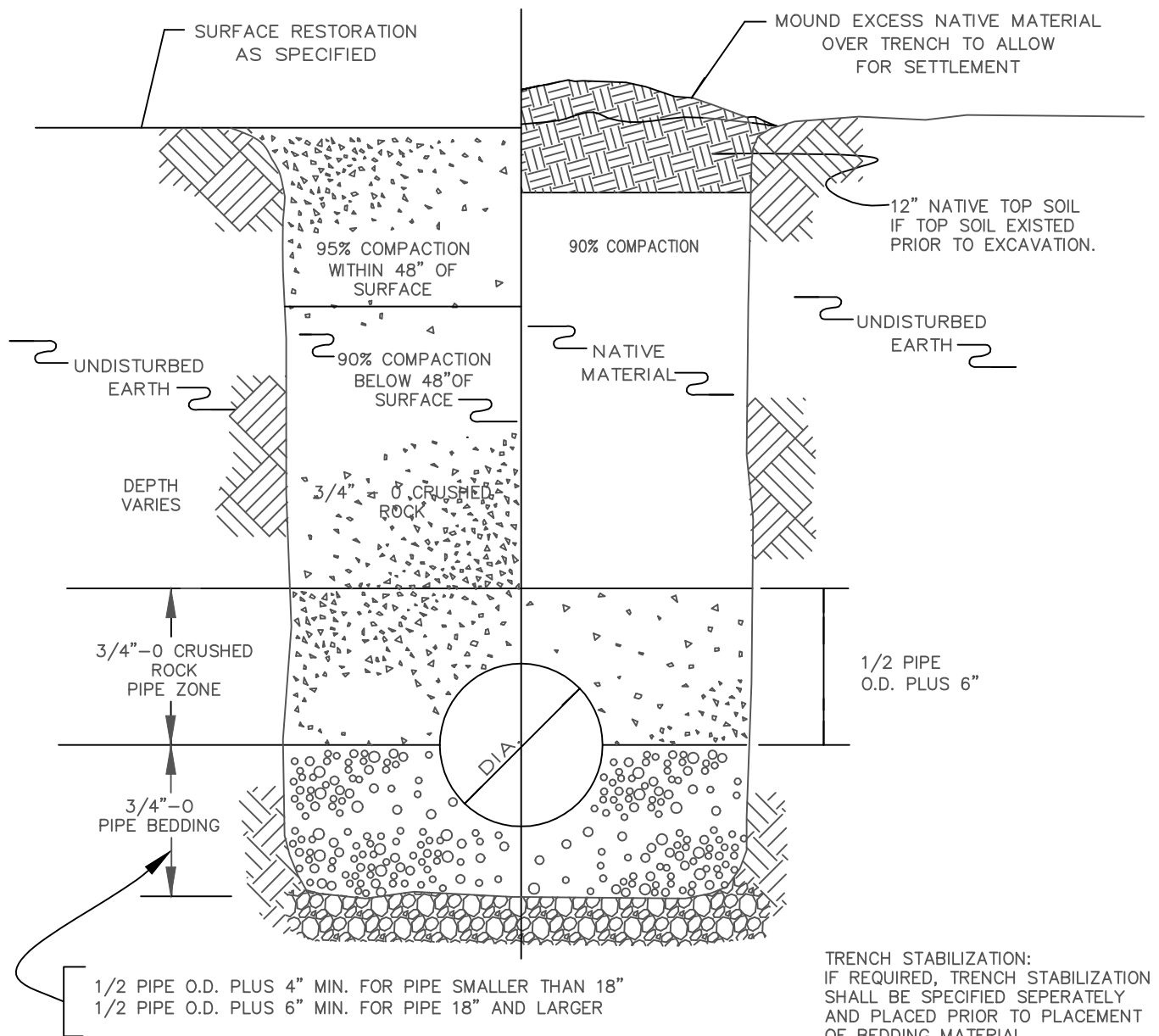
SLOPE	MIN. ANCHOR SPACING CENTER TO CENTER
20% - 34%	35'
35% - 50%	25'
51% +	15' OR CONC. ENCASEMENT

ODOT "METAL PIPE SLOPE ANCHORS" IS A ACCEPTABLE ALTERNATIVE SEE DETAIL NO. 580.



CLASS "B"

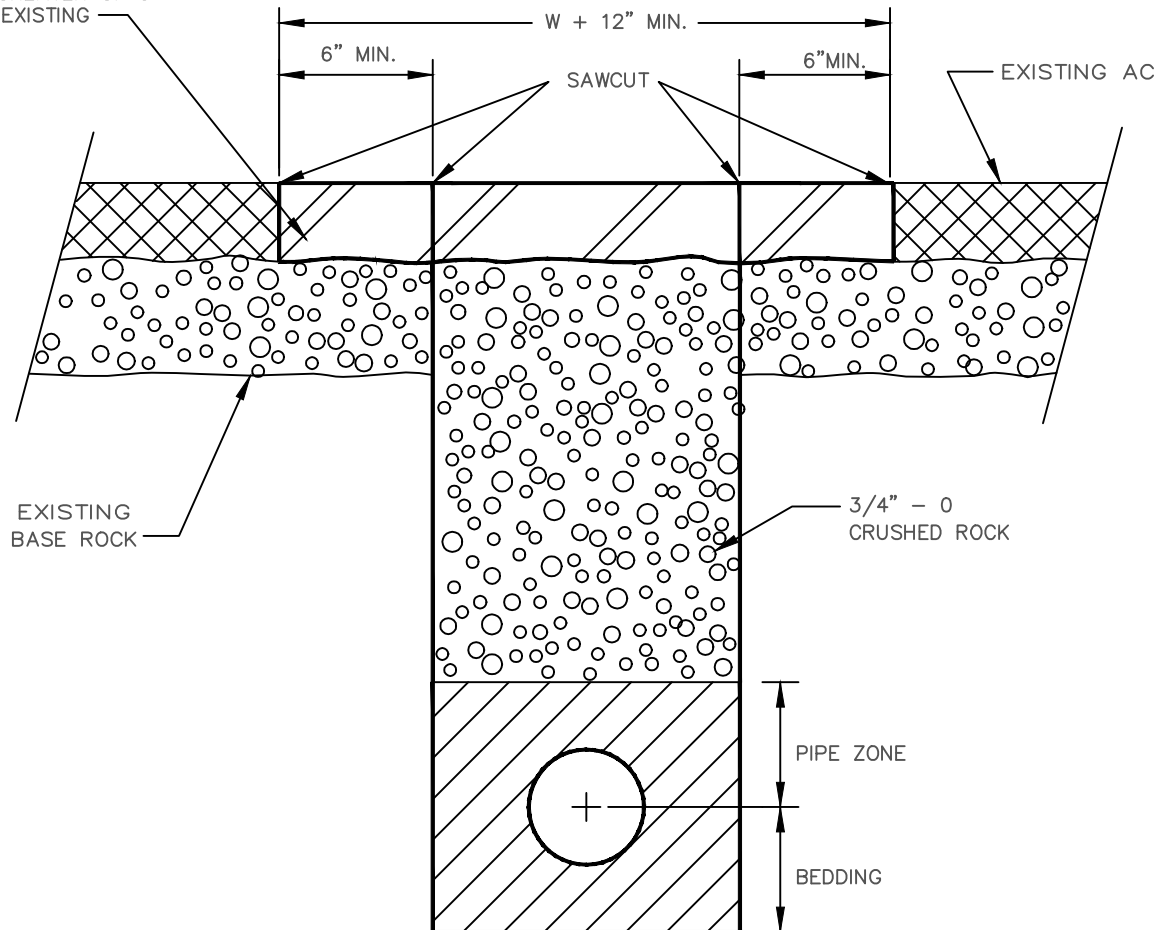
CLASS "A"



NOTE:

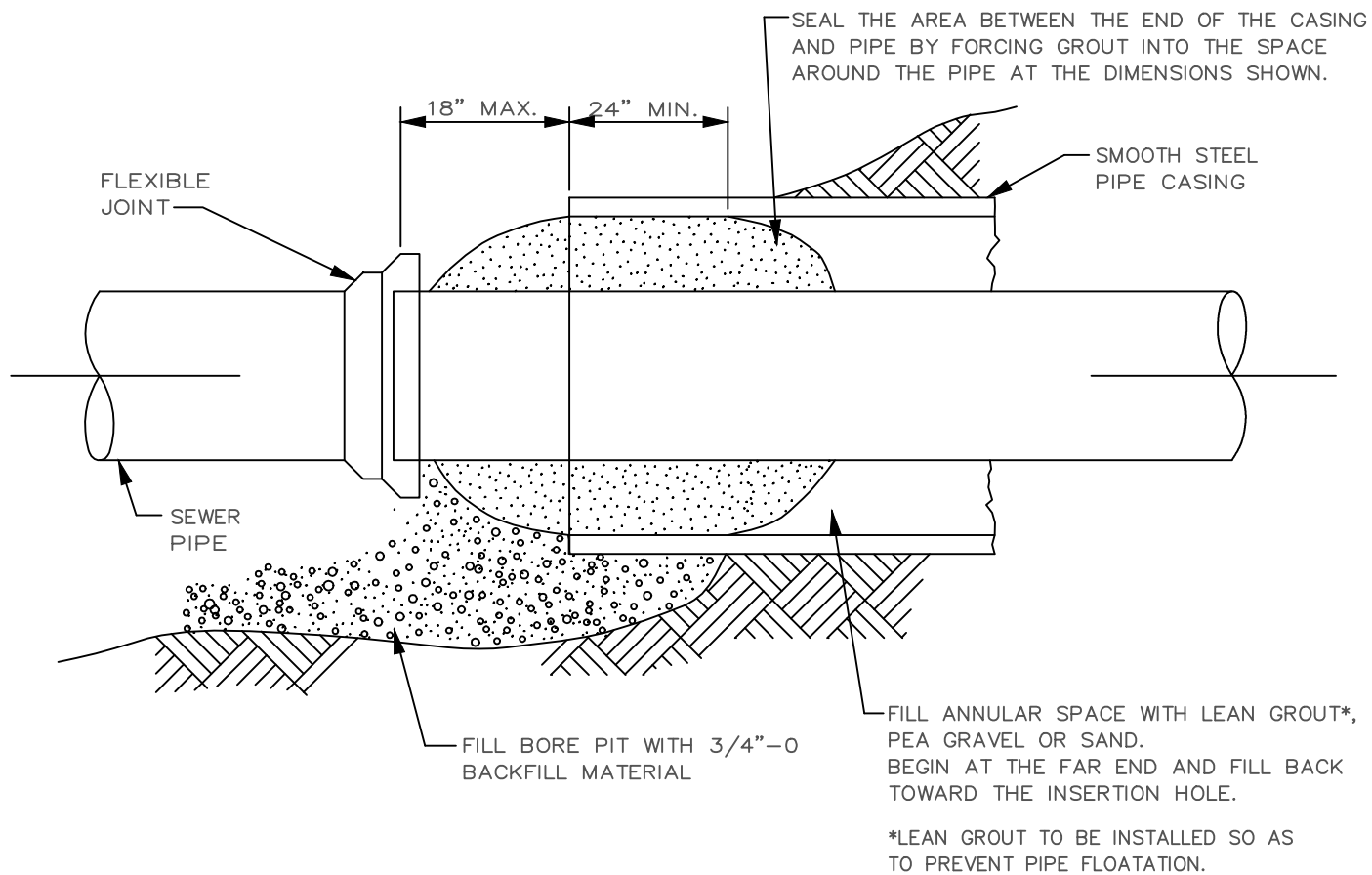
ALL COMPACTION REQUIREMENTS PER
AASHTO T-99 AND ODOT/APWA SPEC 00405.

TACK ALL EXPOSED MATERIAL
PATCH AC TO GREATER OF 3"
THICKNESS OR EXISTING

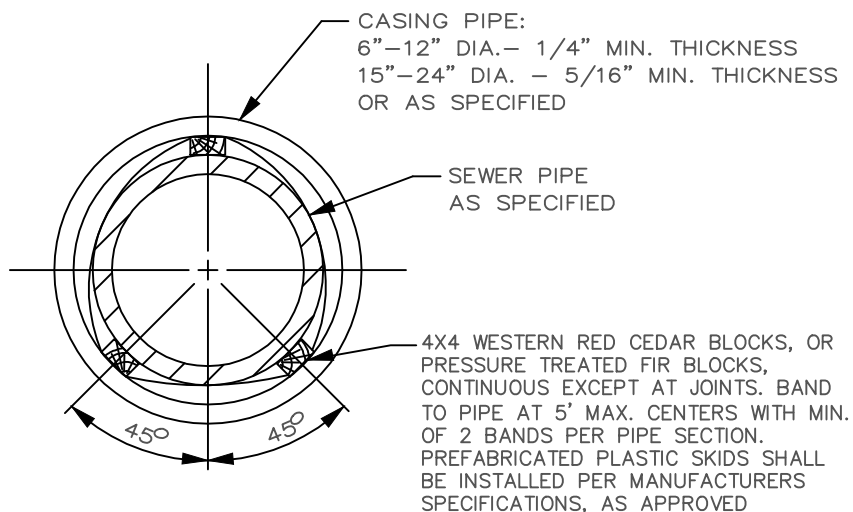


NOTE:

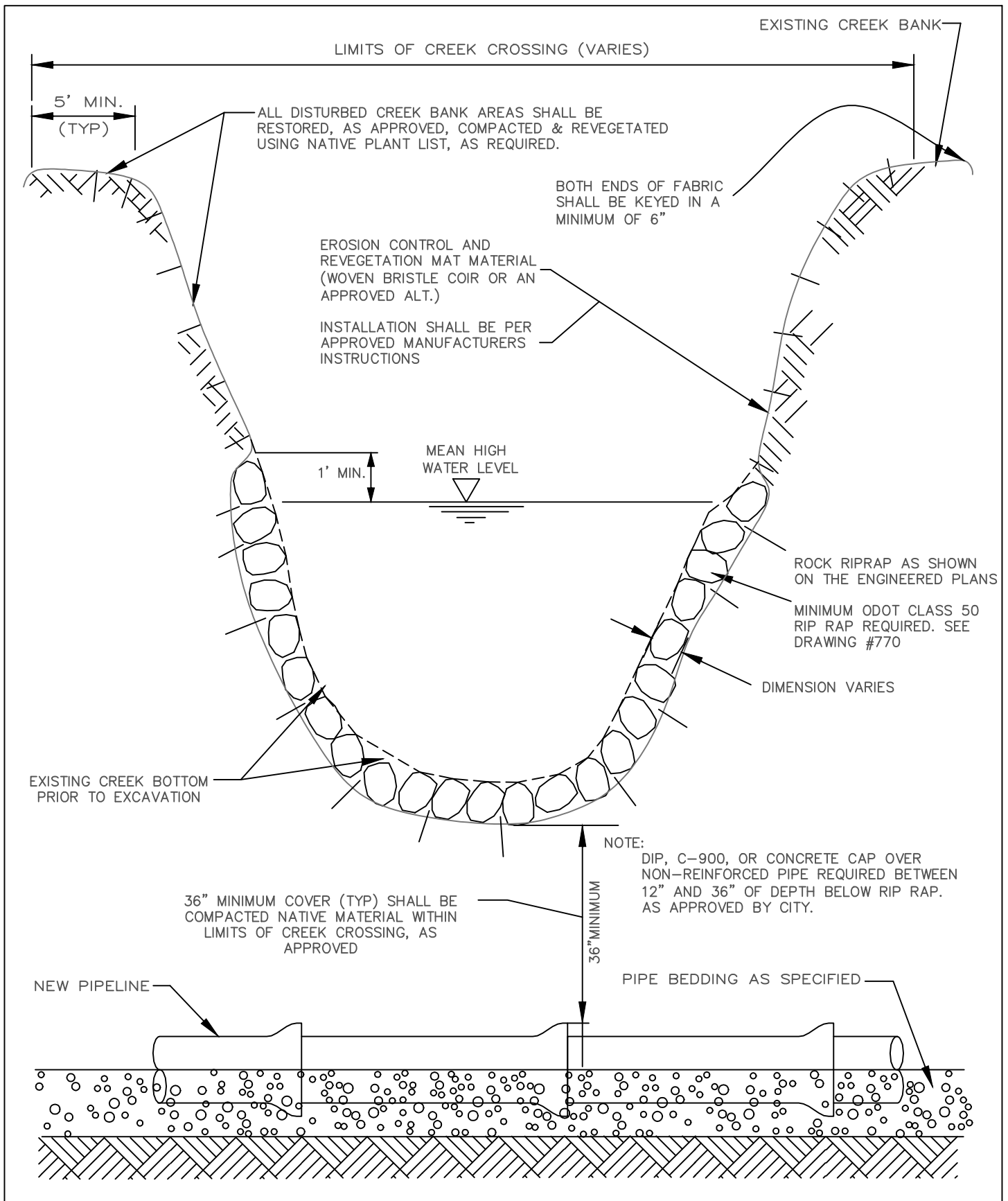
1. TEE CUT TO BE DONE AFTER EXCAVATION AND BACKFILL OF TRENCH.
2. SEE DRAWING NO. 590 FOR BEDDING, PIPE ZONE, AND TRENCH BACKFILL.

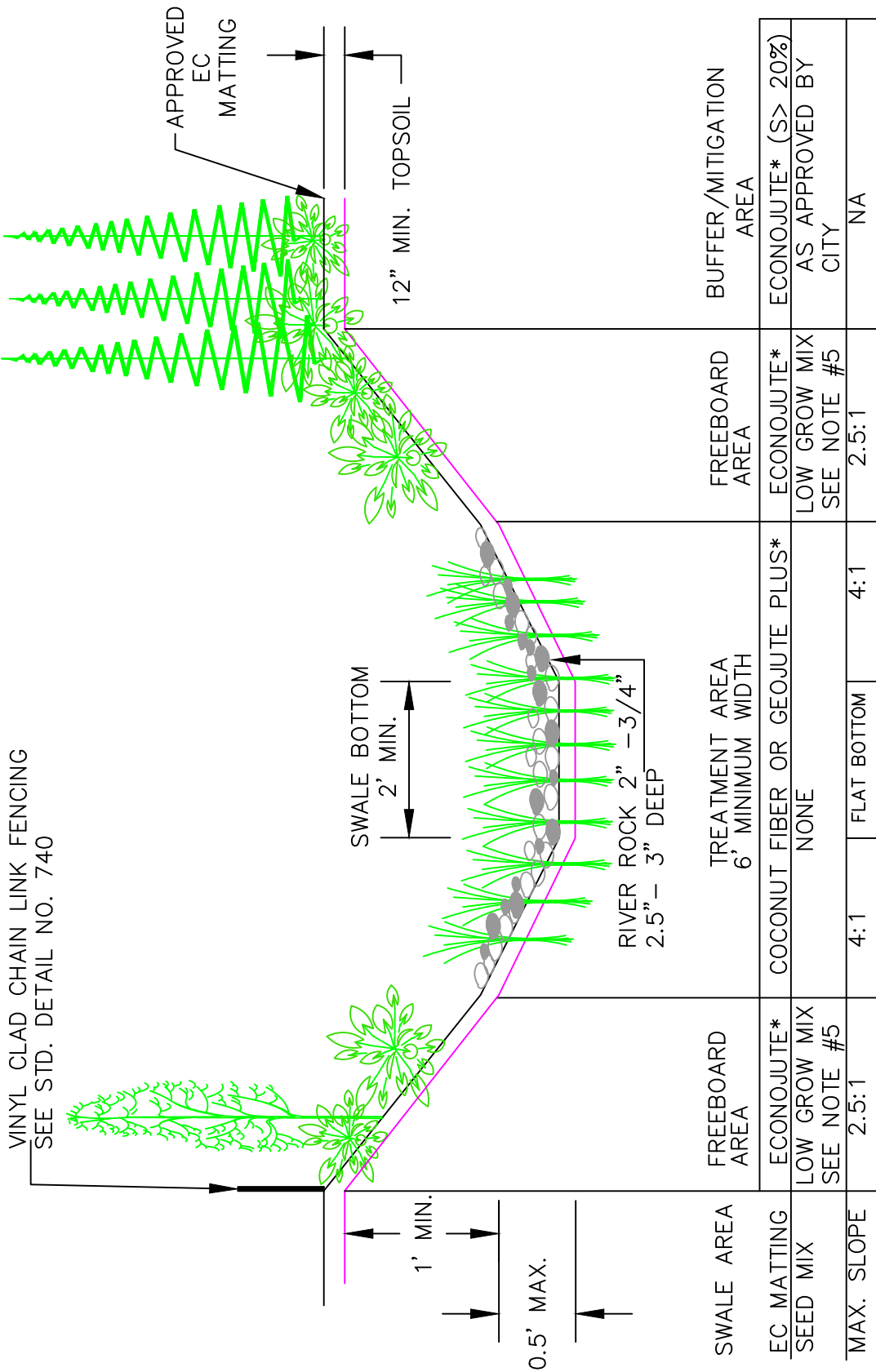


PIPE SEAL DETAIL



CASING SECTION





* OR AS APPROVED

NOTES:

1. REFER TO APPENDIX A, CWS DESIGN & CONSTRUCTION STANDARDS, FOR LANDSCAPING REQUIREMENTS INCLUDING TREE PLACEMENT, TOPSOIL AND PLANTING SPECIFICATIONS.
2. PROVIDE IRRIGATION AS APPROVED BY CITY.
3. JUTE MATTING- GEOJUTE PLUS IN TREATMENT AREA, ECONOJUTE FOR ALL OTHER AREAS, OR SIMILAR FABRICS. COCONUT FIBER IS ALSO ACCEPTABLE.
4. 12-INCHES OF TOPSOIL SHALL BE PLACED THROUGHOUT THE WATER QUALITY TRACT.
5. FREEBOARD AREA SEED MIX, DWARF TALL FESCUE 40%, DWARF PERENNIAL RYE 30%, CREEPING RED FESCUE 25%, COLONIAL BENT GRASS 5%. APPLY AT A RATE OF 120# / ACRE.

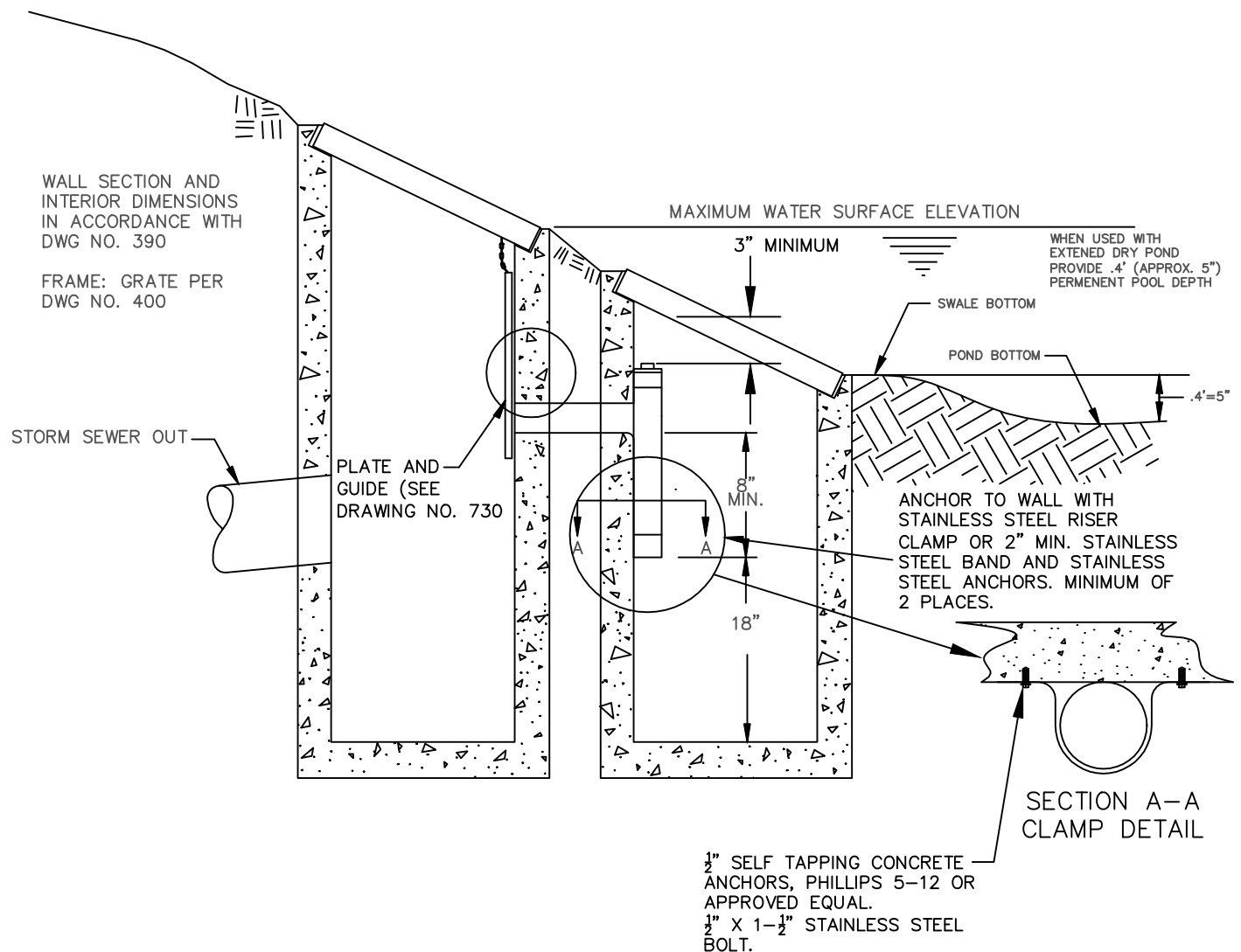
CONSTRUCTION

1. Water Quality Swale shall be over-excavated and filled to final grade with 12-inch amended topsoil. Topsoil amendments shall be garden compost, not conventional fertilizer amendments.
2. A biodegradable Erosion Control Matting shall be placed over the topsoil throughout the swale cross section, fabric shall be held in place in accordance with the manufacturer's installation requirements. Anchor spacing shall be based on 3 fps flow over the fabric.
 - a. Treatment area - high-density jute matting (Geojute Plus or other approved equal)
 - b. All other areas - low-density jute matting (Econojute or other approved equal)
3. 2.5-3 inches of 2"- $\frac{3}{4}$ " river run rock shall be placed over the matting evenly throughout the length and width of the swale.
4. Plant materials shall be placed in accordance with the plan and plant table as shown on approved plans.
5. The water quality swale treatment area plantings can be deemed "substantially complete" once active green growth has occurred to an average growth of 3" and plant density is an average of approx. 6 plants (minimum 1-inch plugs or equivalent) per square foot.
6. The facility shall be deemed acceptable to begin the maintenance period when plant growth and density matches the engineer's design as shown on the approved plans and all other requirements have been met. The engineer must certify the facility to be functional, in accordance with the approved plan design to begin the two-year maintenance period.

MAINTENANCE

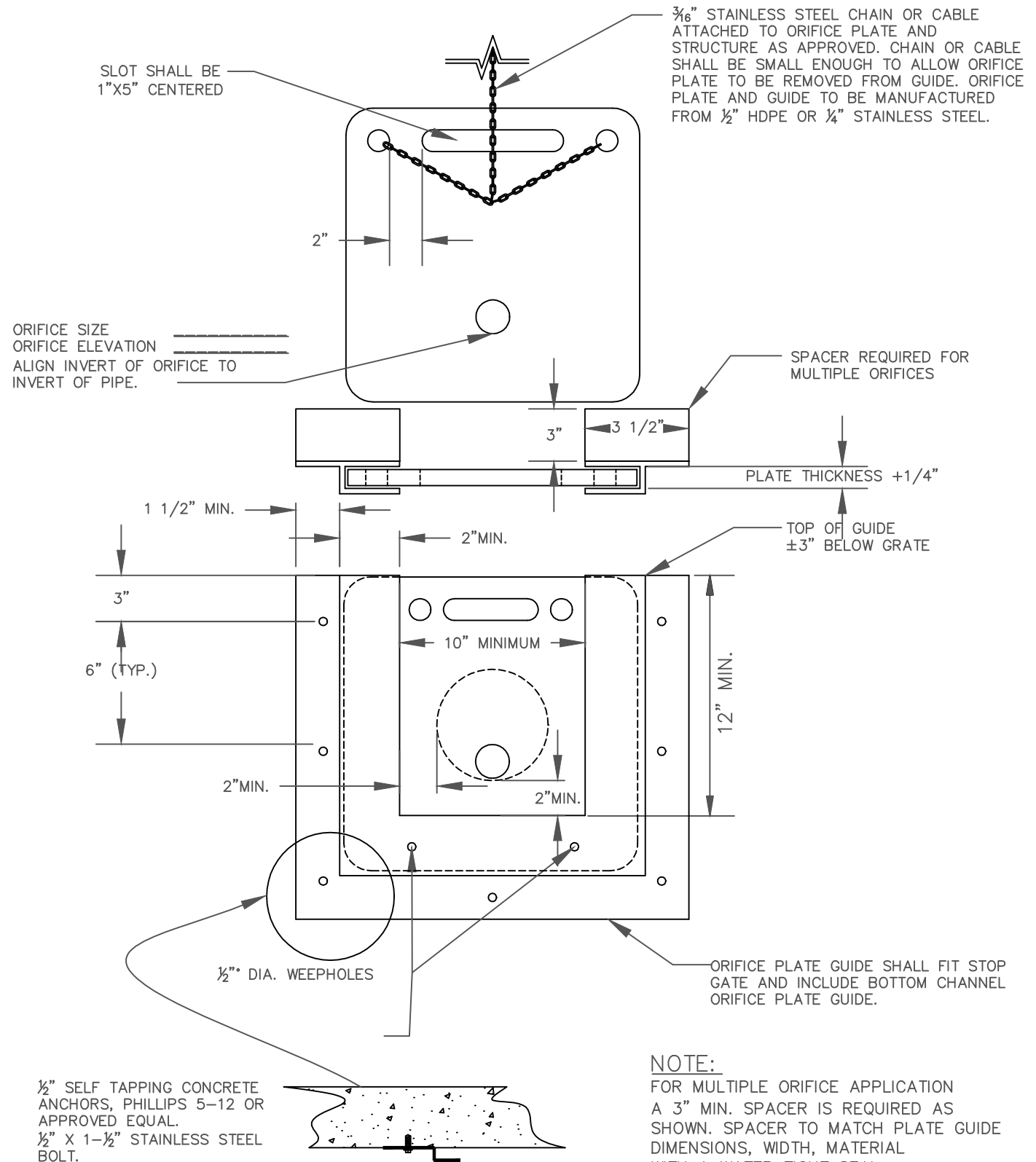
1. The permittee is responsible for the maintenance of this facility for a minimum of two years following construction and acceptance of this facility.
2. Irrigation is to be provided per separate irrigation plan as approved.

Note: Irrigation needs are to be met using a temporary irrigation system with a timer during the dry season. Systems should be winterized during the wet season to assure longevity and guard against damage from freezing temperatures. Water source shall be as shown on the approved plans.
3. Engineer or Owners Representative is to visit and evaluate the site a minimum of twice annually (Spring and Fall). The landscaping shall be evaluated and replanted as necessary to ensure a minimum of 80% survival rate of the required vegetation and 90% aerial coverage. Non-native, invasive plant species shall be removed when occupying more than 20% of the site.
4. The facility shall be re-excavated and planted if siltation greater than 3 inches in depth occurs within the two-year maintenance period.



NOTES:

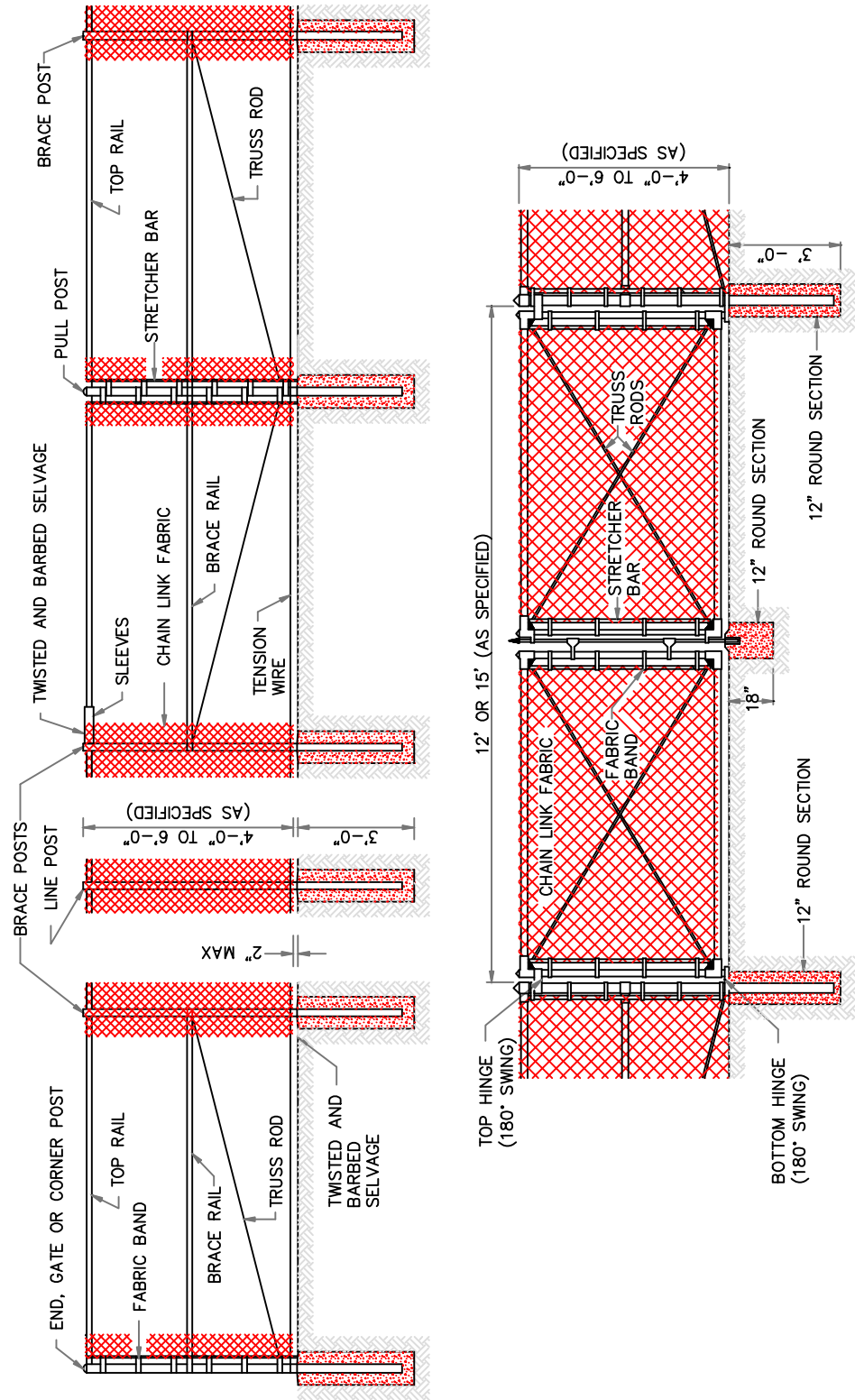
1. CONNECTING PIPE AND TEE SHALL BE 4", 6", OR 8" AWWA C-900 OR ASTM 3034 PVC, AND ONE SIZE LARGER THAN THE ORIFICE OPENING.
2. MAXIMUM ORIFICE OPENING SHALL BE 6" DIAMETER.
3. STRUCTURES SHALL CONFORM TO DRAWING NO. 390 DITCH INLET.
4. FRAME AND GRATE SHALL CONFORM TO DRAWING NO. 400, DITCH INLET FRAME AND GRATE.
5. PLATE AND GUIDE SHALL BE SECURED FLUSH AGAINST WALL OF STRUCTURE AS APPROVED.
6. MAINTAINANCE ACCESS REQUIRED TO WITHIN 10' OF CENTER OF BOTH STRUCTURES.

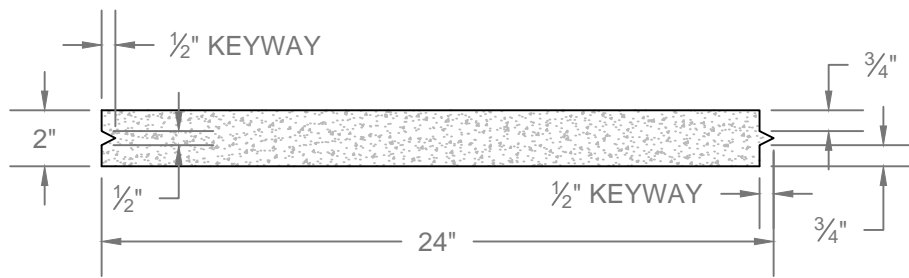


NOTES:

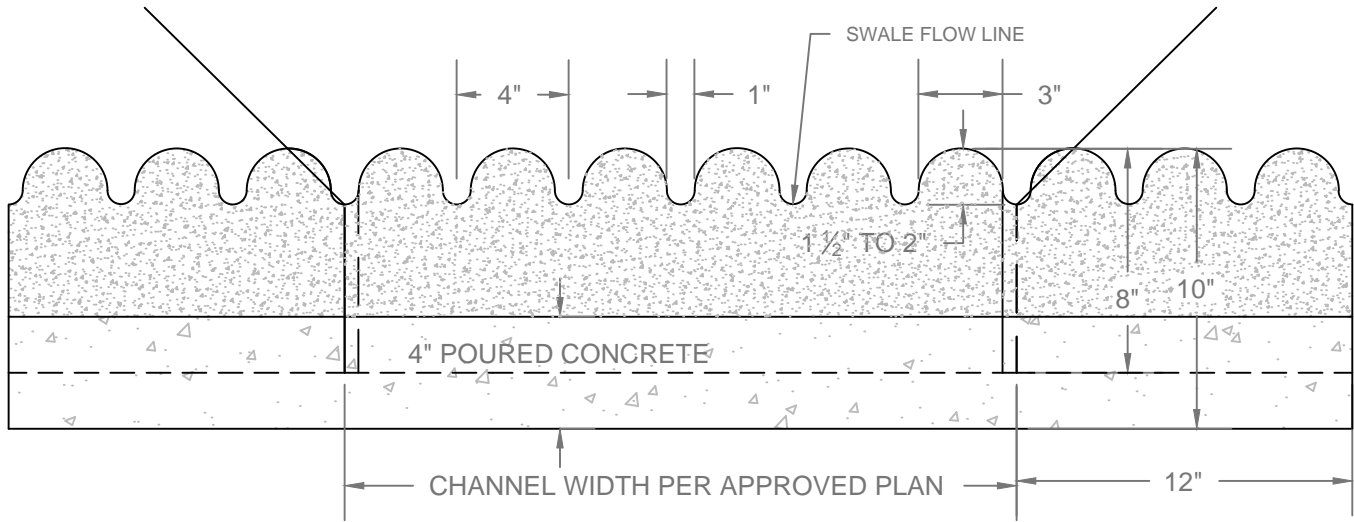
1. ALL FITTINGS, FASTENERS, & AND FABRIC TIES SHALL BE HOT DIP GALV.
2. CONC SHALL BE MIN 2500 PSI @ 28 DAYS.
3. PROVIDE BRACE RAIL BETWEEN END POSTS AND LINE POSTS. LENGTHS AS REQ'D.
4. PROVIDE GATE STOPS AND DROP RECEIVERS SET IN CONCRETE, EACH GATE.
5. PROVIDE EXTENSION ARMS ON LINE, END AND CORNER POSTS & GATE POSTS AS REQ'D.
6. PROVIDE SIGHT OBSCURING SLATS WITH ALL WASTEWATER PUMP STATIONS.
7. CENTER BRACE RAIL NOT REQUIRED WITH FENCE HEIGHT OF 5' OR LESS.
8. ALL POSTS AND RAILS TO MATCH FENCE COLOR.

MEMBER	NOMINAL DIA (IN)	MATERIAL
BRACE RAIL	1.660	GALV TUBULAR STL
GATE FRAME	2.00	GALV TUBULAR STL
LINE POSTS	2.375	GALV TUBULAR STL
END & CORNER POST	2.875	GALV TUBULAR STL
CHAIN LINK FABRIC	9 GA. W/GREEN OR BLACK PVC COATING.	
GATE POST	GATE OPENING (ft)	NOMINAL DIA (IN)
	12' OR 15'	4
		MATERIAL
		GALV TUBULAR STL

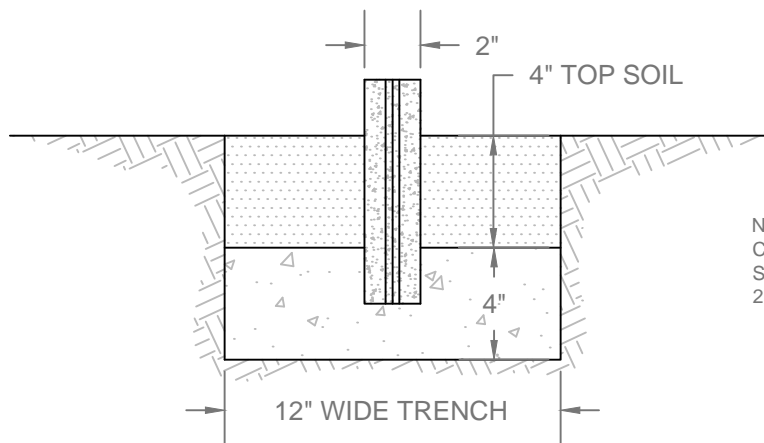




TOP VIEW



FRONT VIEW



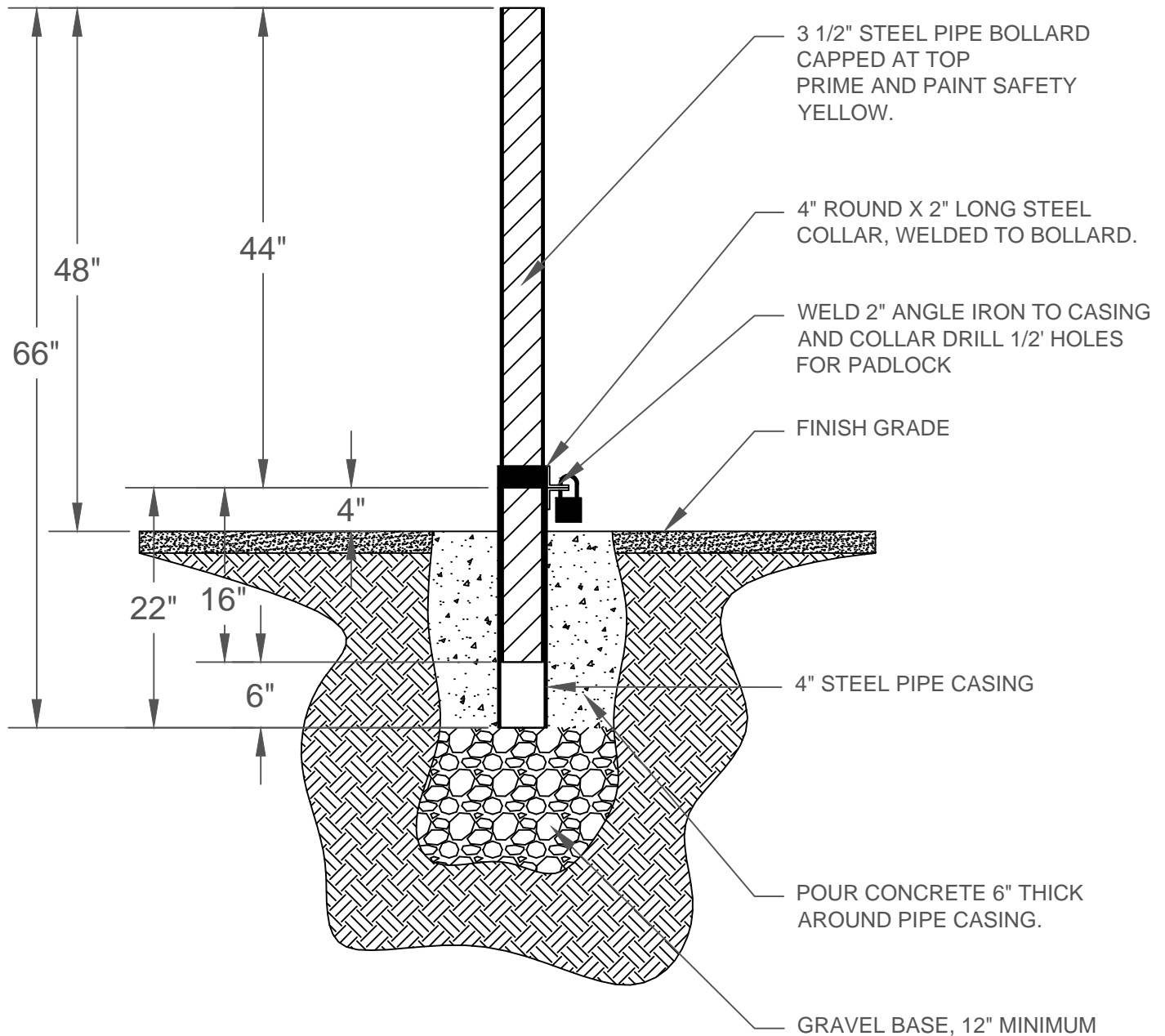
SIDE VIEW

NOTE:
CONCRETE SHALL HAVE 28 DAY
STRENGTH OF 3,000 P.S.I. AND
2" TO 4" SLUMP.

STEEL PIPE SPECIFICATIONS

ASTM A-53 STEEL, SCHEDULE 40, BLACK, HOT DIPPED, ZINC-COATED, WELDED, SEAMLESS

4-INCH STEEL PIPE	O.D. = 4.500"	I.D. = 4.026	THICKNESS = 0.237
3 1/2-INCH STEEL PIPE	O.D. = 4.000"	I.D. = 3.549"	THICKNESS = 0.226"



RIPRAP:

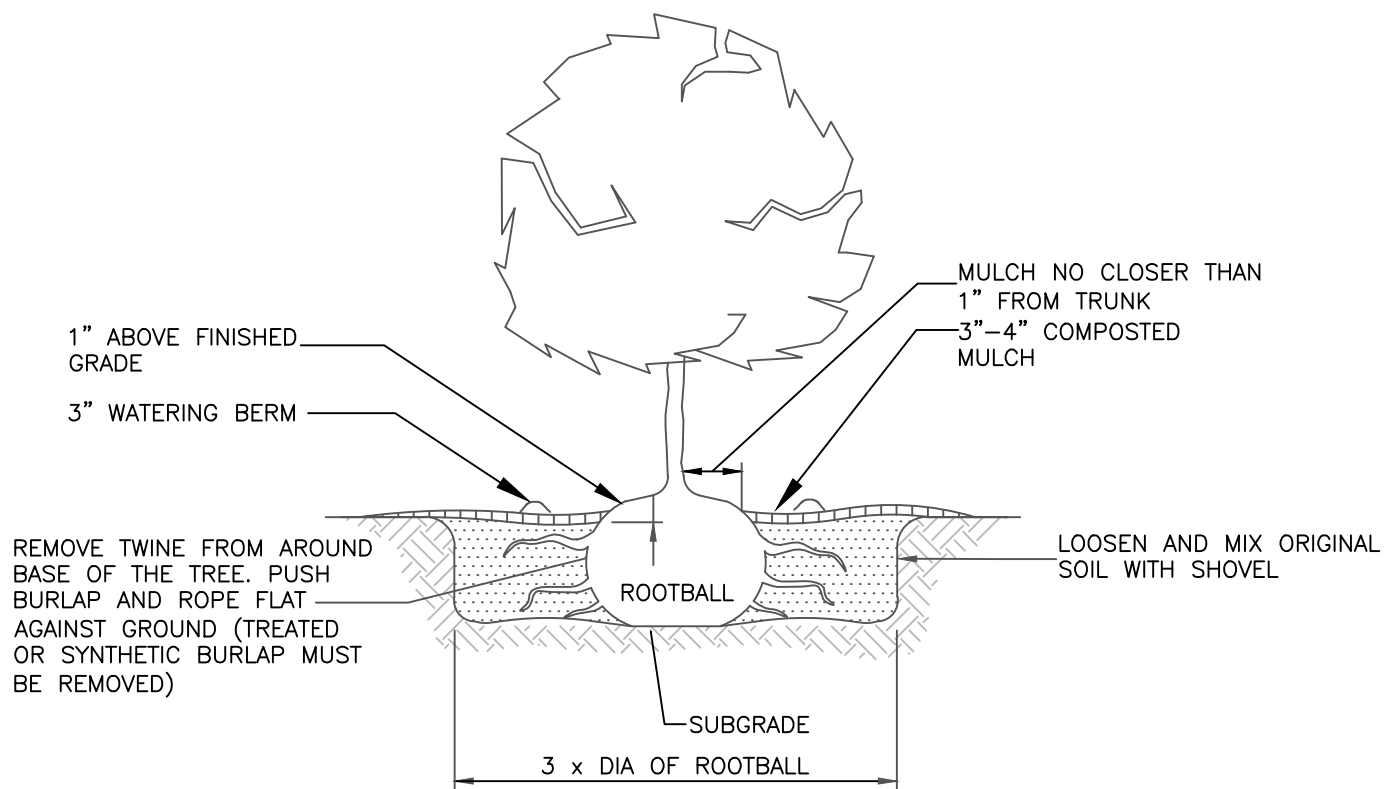
- ROCK FOR RIPRAP SHALL BE ANGULAR IN SHAPE.
- THICKNESS OF A SINGLE ROCK SHALL NOT BE LESS THAN ONE-THIRD ITS LENGTH.
- ROUNDED ROCK WILL NOT BE ACCEPTED UNLESS APPROVED BY THE CITY.

RIPRAP INSTALLATION:

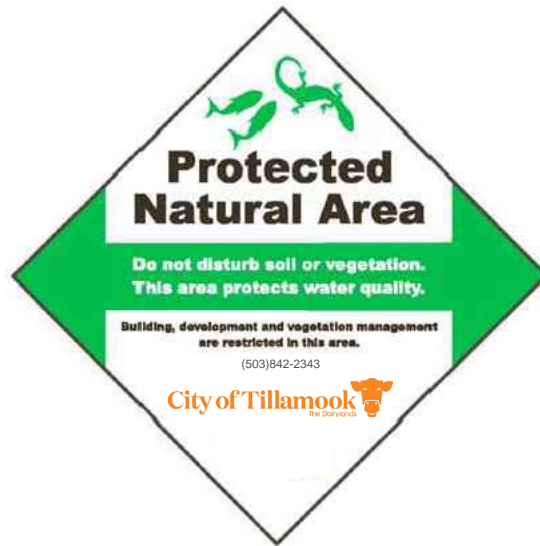
- EXCAVATE BELOW FINISH GRADE TO DEPTH & DIMENSIONS SHOWN ON APPROVED PLANS.
- INSTALL WOVEN GEOTEXTILE FABRIC.
- PLACE RIP RAP TO FINISH GRADE.

- GRADE RIPRAP SHALL BE THE CLASS AND SIZE OF ROCK ACCORDING TO THE FOLLOWING:

CLASS	CLASS	CLASS	CLASS	CLASS	
50	100	200	700	2000	
WEIGHT OF ROCK (LBS)					PERCENT (BY WEIGHT)
50-30	100-60	200-140	700-500	2000-1400	20
30-15	60-25	140-80	500-200	1400-700	30
15-2	25-2	80-8	200-20	700-40	40
2-0	2-0	8-0	20-0	40-0	10



NOTE: IF TREE IS CONTAINER GROWN STOCK, BREAK ROOT BALL APART BEFORE PLACING IN PLANTING HOLE. IF PLANT IS ROOT BOUND MAKE A VERTICAL CUT THROUGH THE LOWER 1/4 OF THE SOIL MASS. PULL OUT AND STRAIGHTEN LARGE, CIRCLING ROOTS.



12"X18" SIGNS SHALL BE PLACED IN A MANNER AS TO CLEARLY IDENTIFY THE SENSITIVE AREA AND VEGETATED CORRIDOR AS WELL AS AT ALL POINTS OF ENTRY SUCH AS THE BEGINNING OF PATHS. TRAIL HEADS AND ANY PLACE THAT THE PUBLIC MAY WANT OR BE ABLE TO ENTER AREA.



4"X4" SIGNS SHALL BE USED FOR AREAS WHERE A LARGE NUMBER OF SIGNS ARE NEEDED SUCH AS THE BACK OR SIDE YARDS ON EACH LOT ADJACENT TO THE SENSITIVE AREA OR VEGETATED CORRIDOR IN NEW SUBDIVISIONS OR PARTITIONS.

Wastewater Pump Station and Force Main
Design Data Summary Table

BASIN CHARACTERISTICS	
Location	Address and Cross Street
Basin Area	XXX Acres
Equivalent Dwelling Units (EDU) Per Acre	X.X
Persons Per EDU	X.X
Population Equivalent	XXXX
Average Per Capita Flow	XX GPD
Infiltration and Inflow, Peak Wet Weather Flow (PWWF)	XXX,XXX GPD
Average Daily Flow (ADF)	XXX,XXX GPD
Peak Hourly Flow	XXX GPM

PUMP STATION	
Type	As shown on project drawings
Capacity (per pump)	XXX gpm @ XX feet TDH (static head = XX ft)
Horsepower, HP	XX HP Each, Constant speed/VFD
Motor Data	Xxx volt xphase xx cycle
Firm Capacity of Pump Station	X.XX MGD (XXX GPM)
Maximum Pump Starts Per Hour	X
Wet Well Volume	XXXX Gallons (pumps off to lead pump on)
Level Control Type	Bubbler with duplex Compressors and backup floats
Overflow Point	Manhole Number and Elevation
Overflow Location	Description
Average Time to Overflow	Time and Description xx hours at yy gpm Design Average Influent Flow
Telemetry	Auto-Dialer
Transfer Switch	Automatic
Standby Power Type	XXX kW stationary diesel-powered standby generator.
Fuel Tank Capacity	xx Hrs (XXX Gallons)
EPA Reliability Class	1
Flow Meter	X" Magnetic (Description)
Control	Constant Speed or VFD

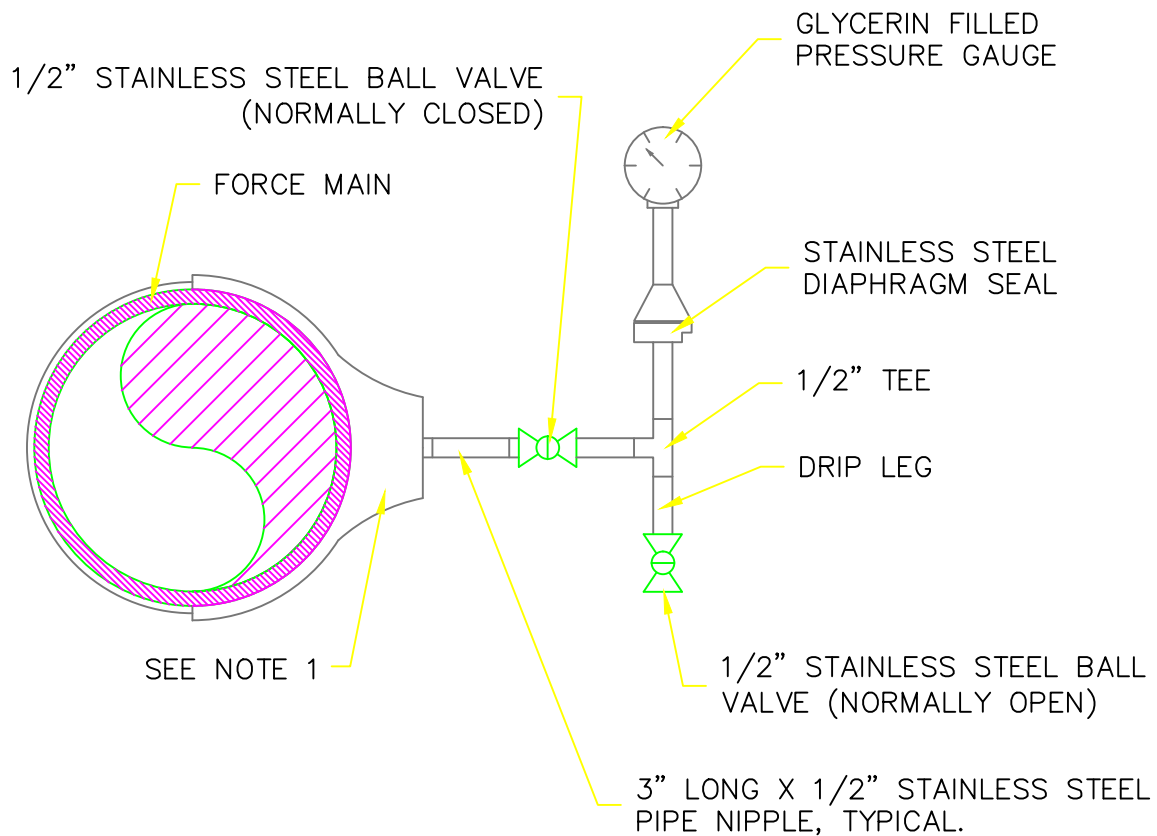
DATA TABLE SHEET 1 OF 2



WATER PUMP STATION
AND FORCE MAIN
DESIGN DATA TABLE

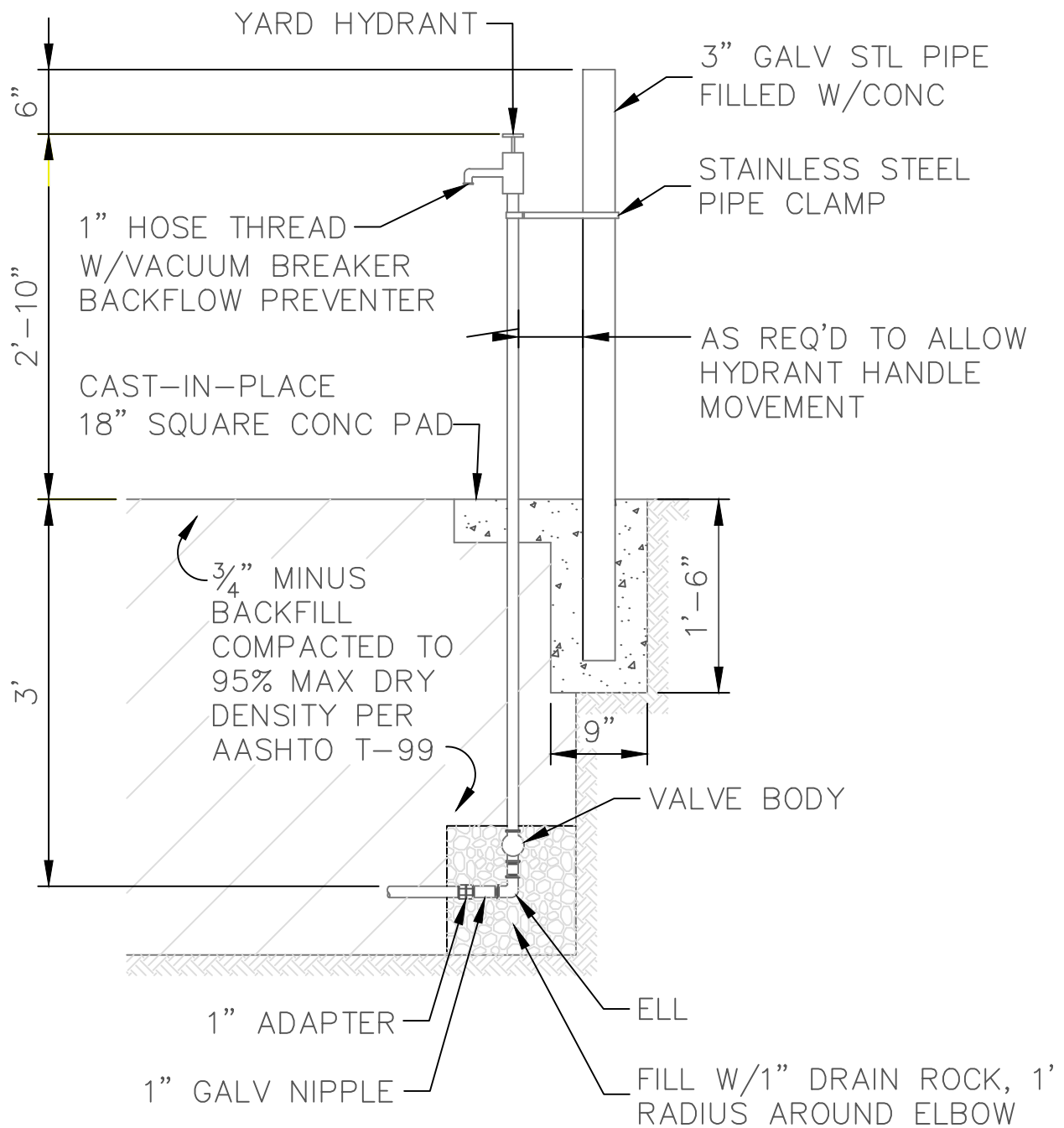
DRAWING NO. 1001

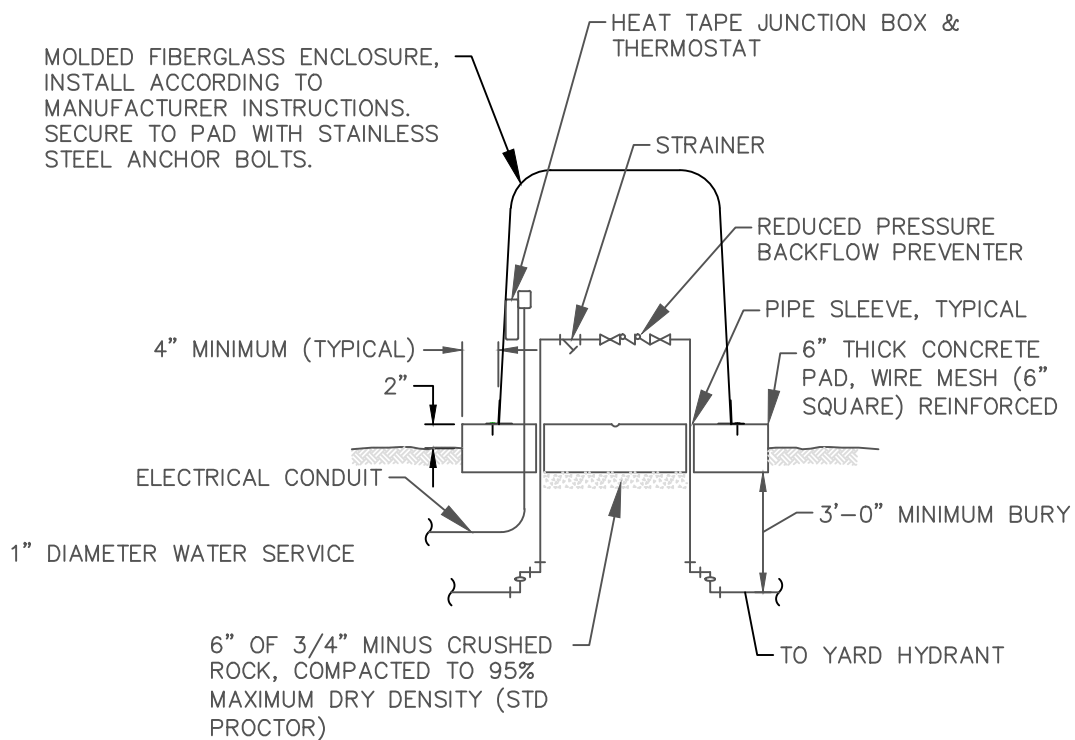
REVISED 10-2014



NOTES:

1. INSTALL GAUGE AS SHOWN ON 1/2" DUCTILE IRON PIPE SADDLE WITH STAINLESS STEEL STRAP.
2. ALL PIPE AND FITTINGS SHALL BE SCHEDULE 80 STAINLESS STEEL WITH THREADED ENDS.
3. INSTALL PRESSURE GAUGE AND DIAPHRAGM SEAL PER MANUFACTURERS' REQUIREMENTS.
4. ACCEPTABLE ALTERNATIVE IS FLANGED ANNULAR SEAL, RED VALVE SERIES 45 OR APPROVED EQUAL WITH GLYCERIN FILL.





NOTE:

1. WRAP EXPOSED WATER PIPE WITH HEAT TAPE AND PVC COATED PIPE INSULATION.

CITY OF TILLAMOOK

AIR TEST

PROJECT _____

DATE _____

CONTRACTOR _____

PROJECT # _____

TESTING COMPANY _____

INSPECTOR _____

DATE	LINE	DSHM #	USHM #	DIA. (IN.)	LENGTH (FT.)	TIME (MIN.:SEC.)	START TEST	STOP TEST	PAS/FAIL

NOTE All air test will be performed in accordance with ASTM C924.

Inspector's Signature _____



AIR TEST FORM

DRAWING NO. 1200

REVISED 10-2014

CITY OF TILLAMOOK

MANHOLE VACUUM TEST

PROJECT: _____ DATE: _____

CONTRACTOR: _____ PROJ #: _____

TESTING COMPANY: _____ INSPECTOR _____

DATE	M.H. #	SIZE	DEPTH	REQD. TIME	TIME		NOTES / COMMENTS
					START	END	

NOTES: ALL MANHOLE VACUUM TESTS WILL BE CONDUCTED IN ACCORDANCE WITH ASTM STANDARDS.

INSPECTOR'S SIGNATURE: _____



MANHOLE VACUUM
TEST FORM

CITY OF TILLAMOOK

MANHOLE HYDROSTATIC TEST

PROJECT: _____

DATE: _____

CONTRACTOR: _____

PROJ #: _____

TESTING COMPANY: _____

INSPECTOR: _____

DATE	M.H. #	DEPTH	ALLOWABLE LOSS / HR.	ACTUAL LOSS / HR.	TIME		PASS / FAIL
					START	END	

COMMENTS:

NOTE: ALL MANHOLE HYDROSTATIC TEST WILL BE CONDUCTED IN ACCORDANCE WITH ASTM STANDARDS, ALLOWABLE LEAKAGE SHALL NOT EXCEED 0.2 GALLONS PER HOUR PER FOOT OF HEAD MEASURED FROM INVERT TO TOP OF FRAME.

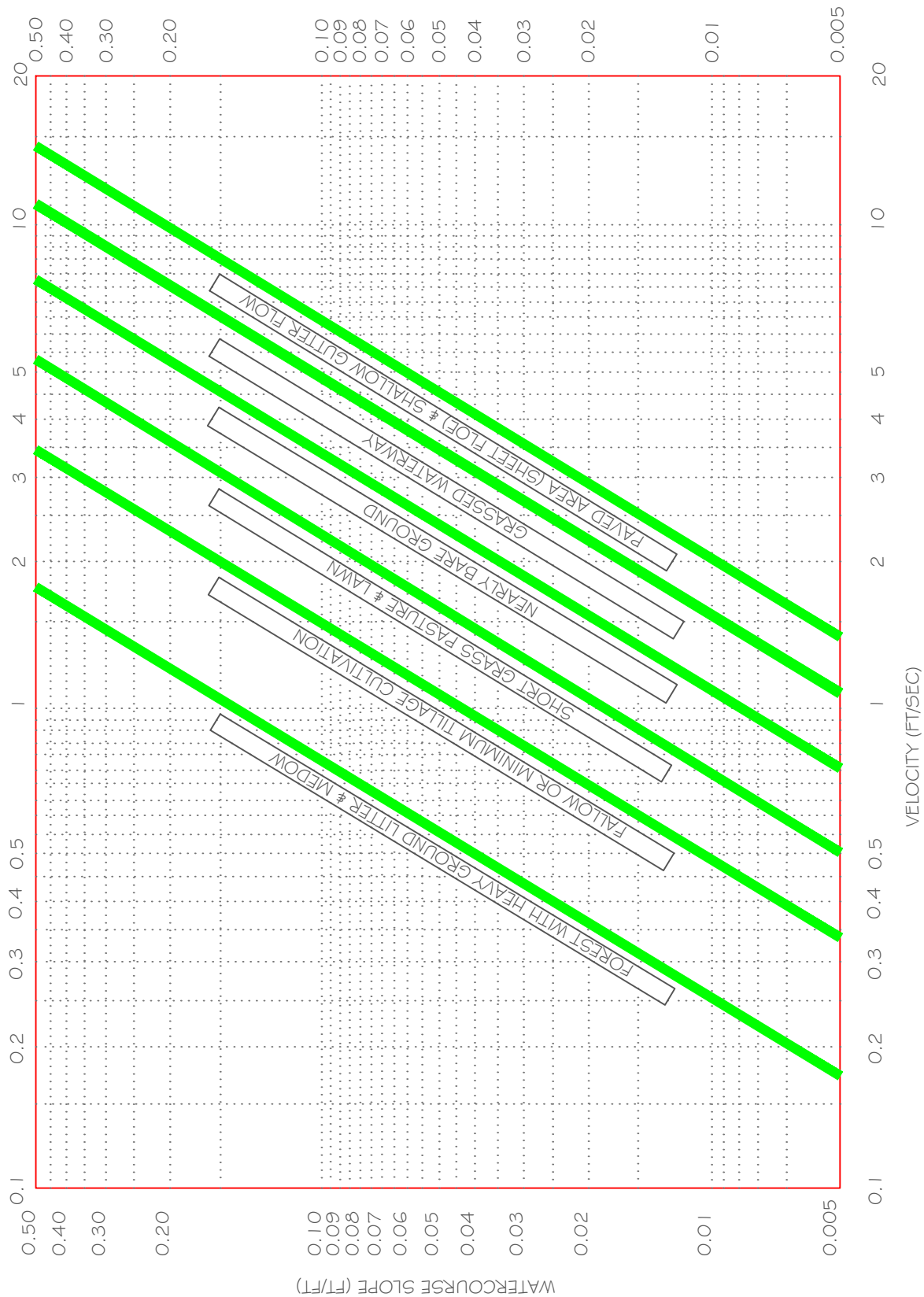
INSPECTOR'S SIGNATURE: _____



MANHOLE HYDROSTATIC
TEST FORM

DRAWING NO. 1215

REVISED 10-2014



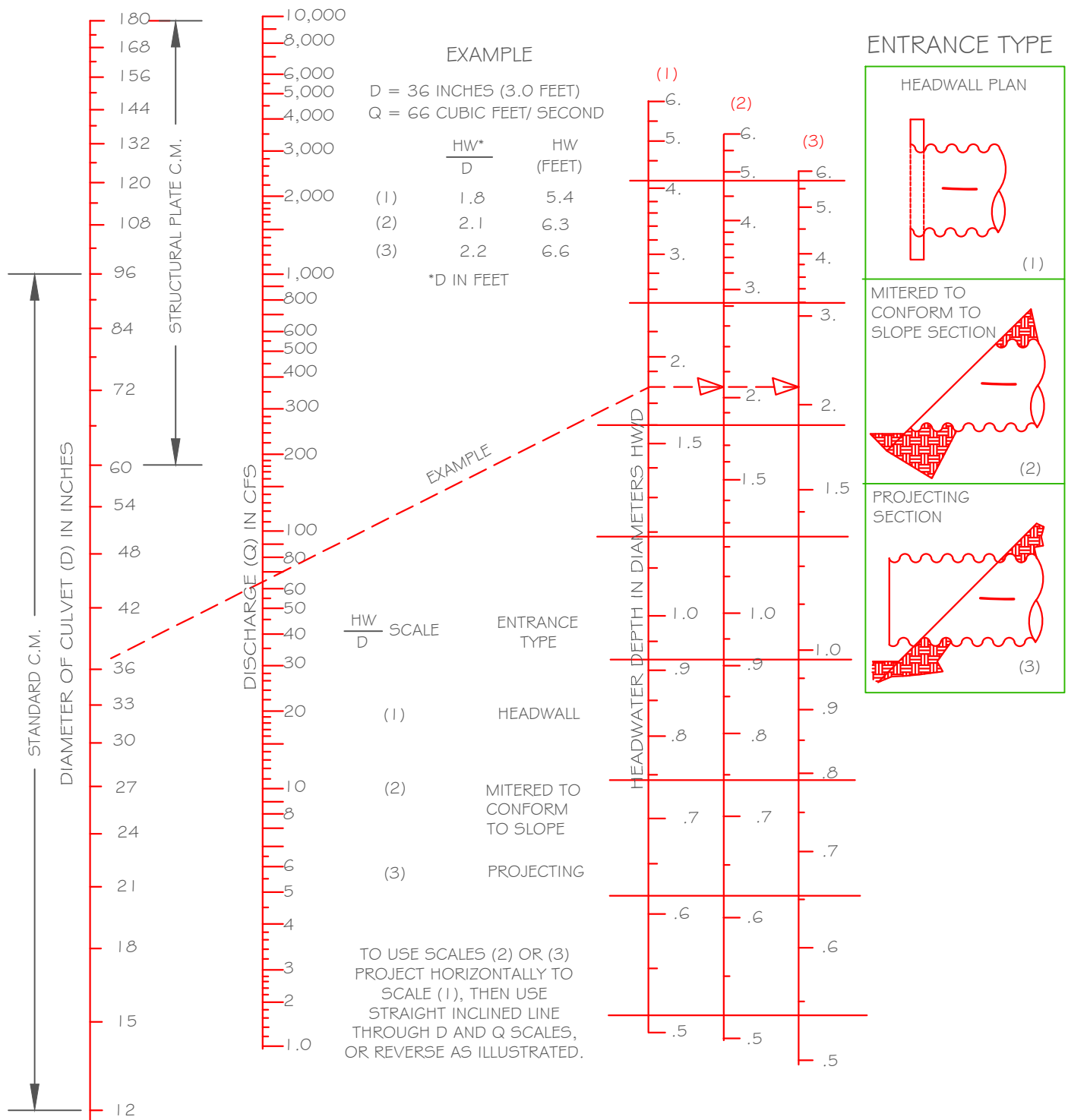
* FOR USE WITH THE RATIONAL METHOD ONLY, FARM SOIL CONSERVATION SERVICE, TECH. RELEASE NO. 55, JANUARY 1975

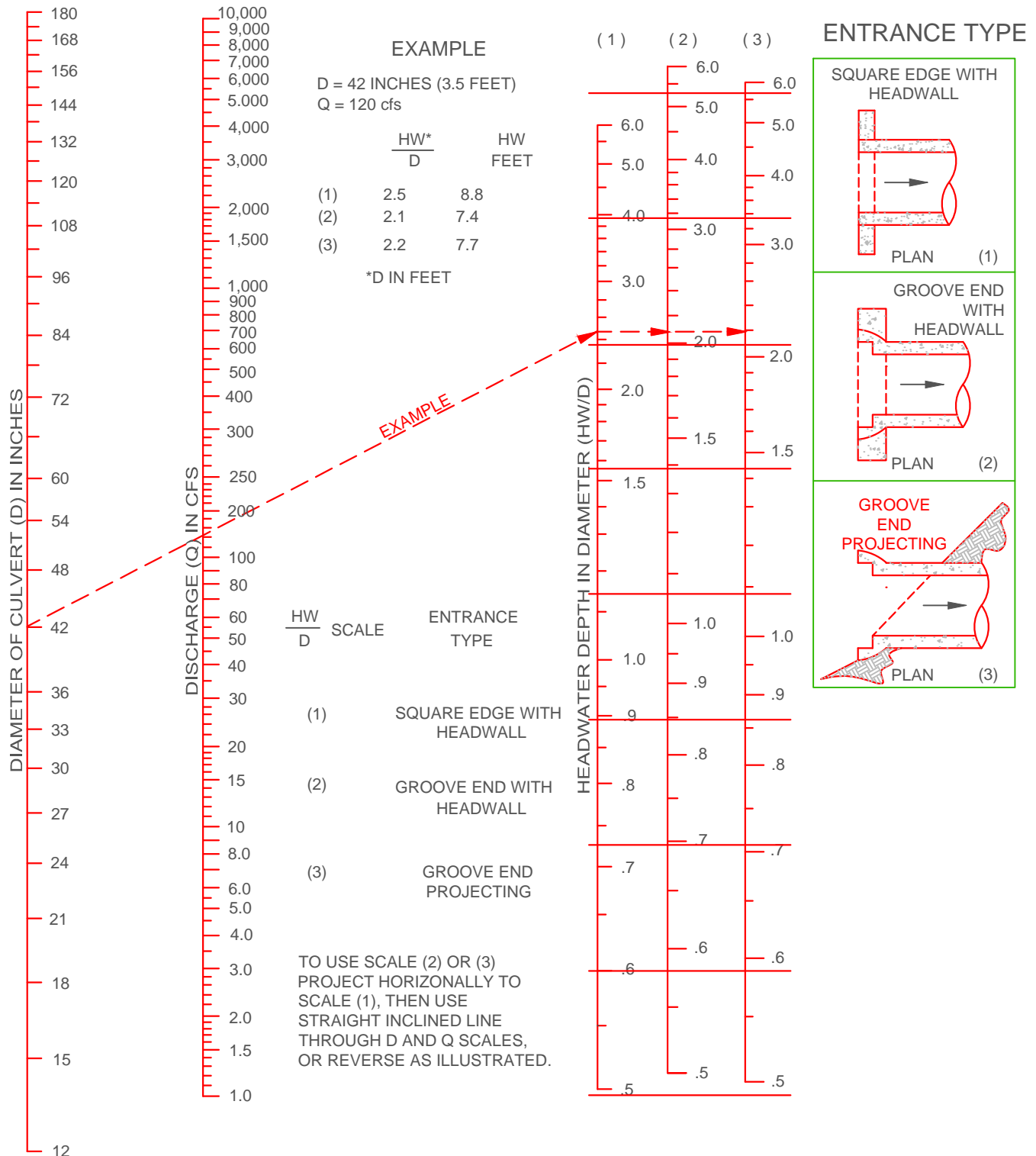


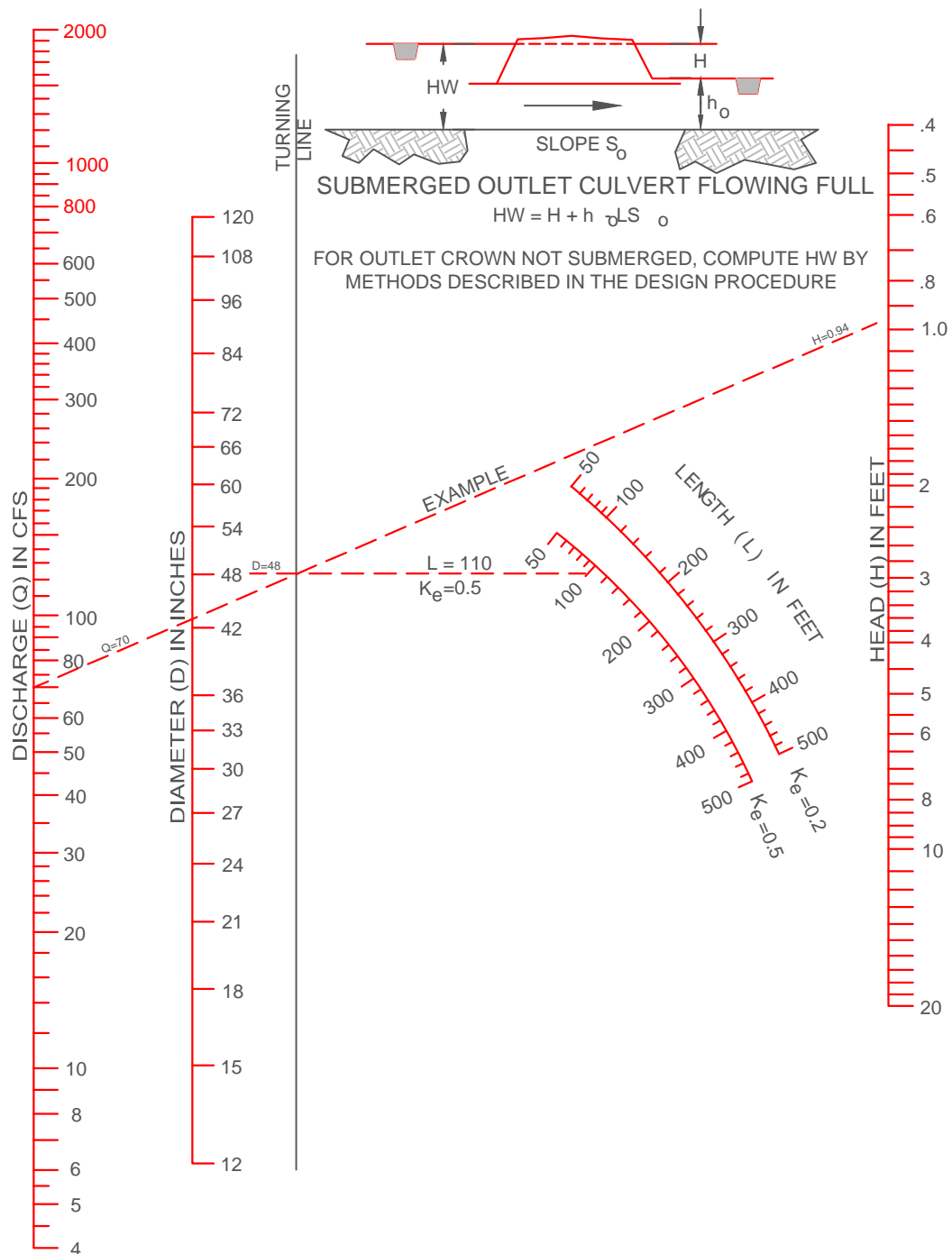
AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME FOR OVERLAND FLOWS*

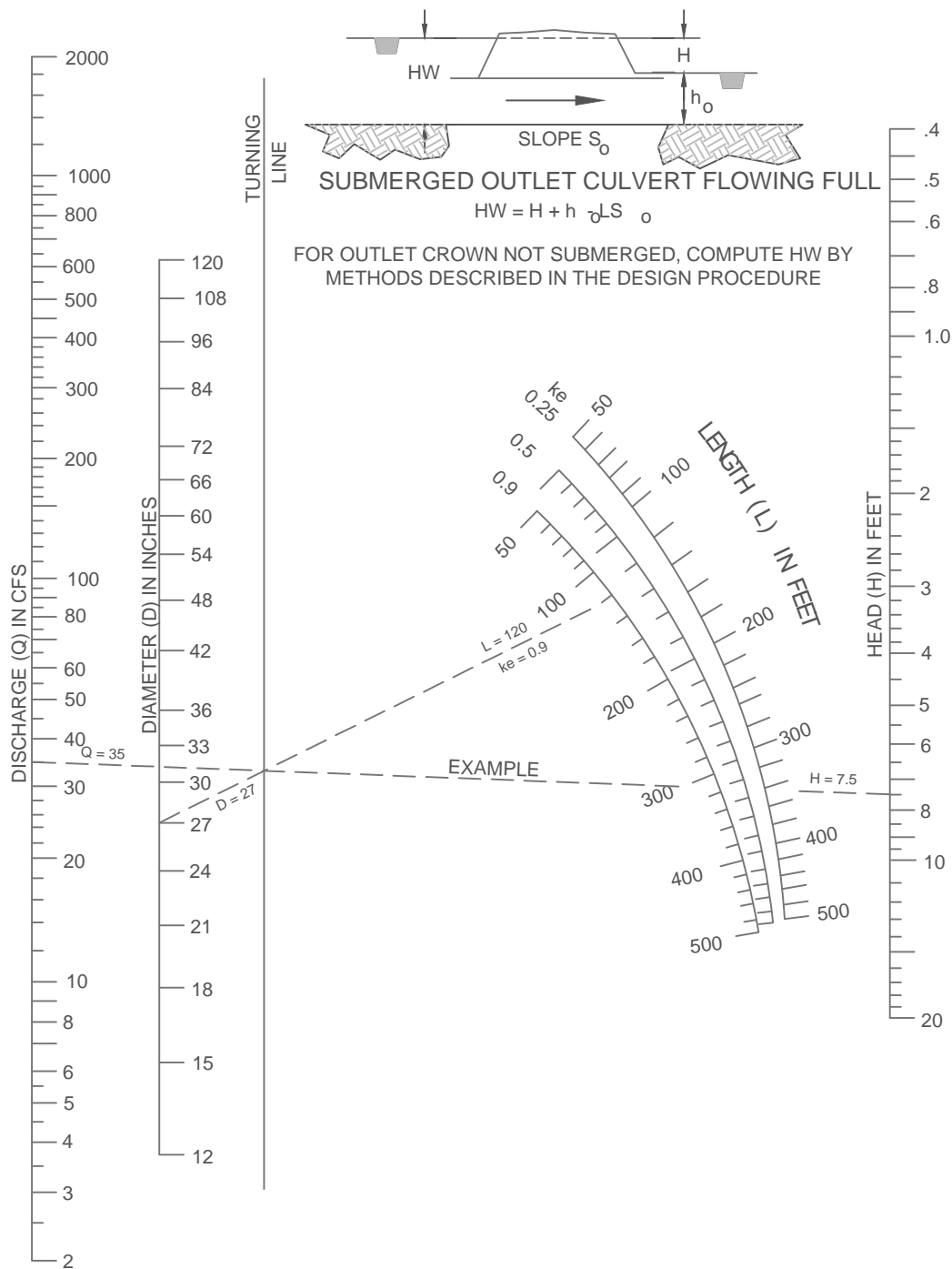
DRAWING NO. 1250

REVISED 10-2014









RATIONAL METHOD RAINFALL INTENSITIES

Rainfall intensity is for Zone 2 (ODOT) which includes Tillamook
(shown as inches per hour)

TIME OF CONCENTRATION (MINUTES)	STORM EVENT: YEAR AND PROBABILITY					
	2 50%	5 20%	10 10%	25 4%	50 2%	100 1%
0	2.00	2.40	2.70	3.10	3.47	3.85
5	2.00	2.40	2.70	3.10	3.47	3.85
10	1.49	1.88	2.10	2.40	2.70	3.00
15	1.27	1.58	1.79	2.05	2.27	2.53
20	1.09	1.37	1.52	1.77	1.98	2.19
30	0.88	1.09	1.22	1.43	1.58	1.77
40	0.74	0.89	1.01	1.18	1.30	1.48
50	0.64	0.76	0.88	1.05	1.12	1.28
70	0.55	0.64	0.73	0.84	0.92	1.06
100	0.48	0.56	0.64	0.73	0.81	0.85
180 >	0.38	0.47	0.53	0.61	0.68	0.73

24-HOUR RAINFALL DEPTHS

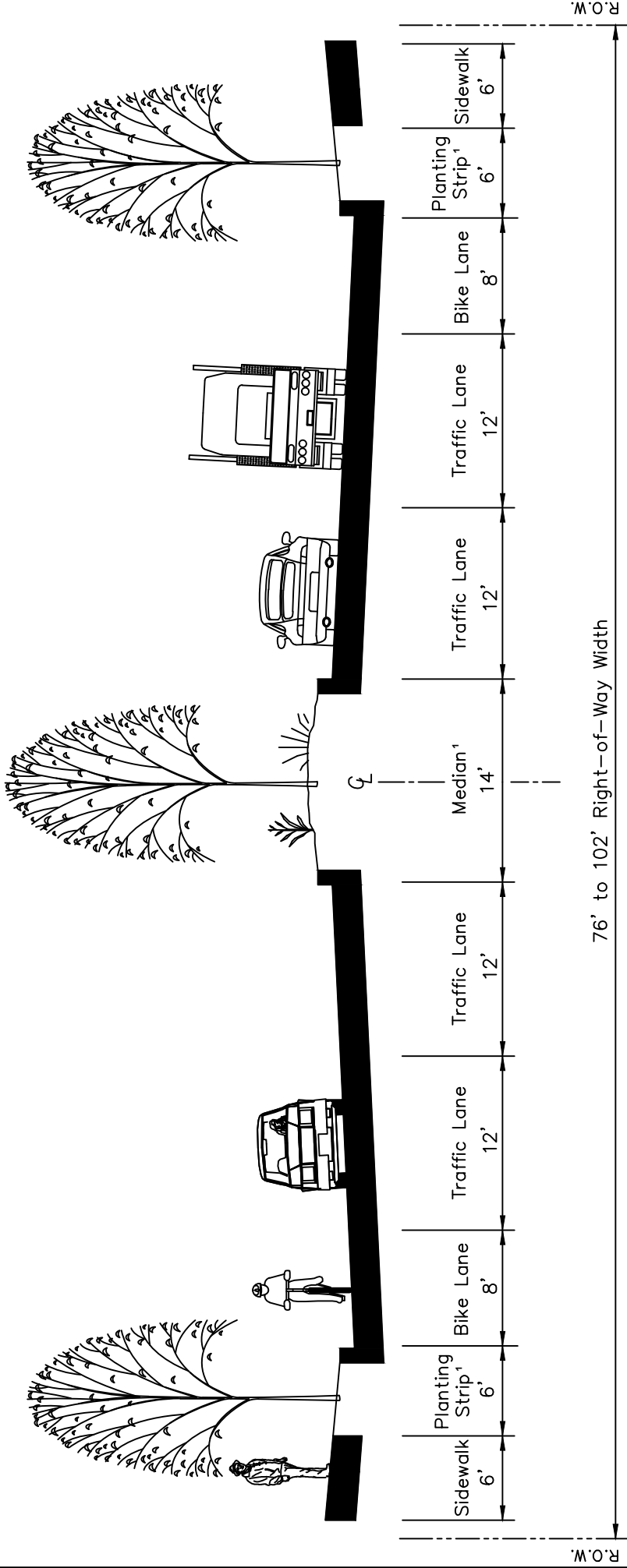
RECURRENCE INTERVAL (YEARS)	TOTAL PRECIPITATION DEPTH (INCHES)
2	3.70
5	4.60
10	5.00
25	5.90
50	6.40
100	6.80

Based on NOAA Atlas 2, Volume X, Figures 25-30.

DESIGN STORM DISTRIBUTION CHART

THE FOLLOWING TABLE CONTAINS THE NRCS TYPE 1A PRECIPITATION DISTRIBUTION. THE TABLE IS FROM THE "SUB BASIN HYDROLOGIC MODELING CRITERIA" BY KRAMER, CHIN, & MAYO INC., 1991

HOUR	PERCENT RAINFALL INCREMENTAL CUMULATIVE		RAINFALL DEPTH (INCHES)					
			2 YEAR 3.70	5 YEAR 4.60	10 YEAR 5.00	25 YEAR 5.90	50 YEAR 6.40	100 YEAR 6.80
1	2.40	2.40	0.09	0.11	0.12	0.14	0.15	0.16
2	2.60	5.00	0.10	0.12	0.13	0.15	0.17	0.18
3	3.20	8.20	0.12	0.15	0.16	0.19	0.20	0.22
4	3.80	12.00	0.14	0.17	0.19	0.22	0.24	0.26
5	4.44	16.44	0.16	0.20	0.22	0.26	0.28	0.30
6	5.18	21.62	0.19	0.24	0.26	0.31	0.33	0.35
7	6.48	28.10	0.24	0.30	0.32	0.38	0.41	0.44
8	16.44	44.54	0.61	0.76	0.82	0.97	1.05	1.12
9	7.58	52.12	0.28	0.35	0.38	0.45	0.49	0.52
10	5.28	57.40	0.20	0.24	0.26	0.31	0.34	0.36
11	4.96	62.36	0.18	0.23	0.25	0.29	0.32	0.34
12	4.32	66.68	0.16	0.20	0.22	0.25	0.28	0.29
13	4.02	70.70	0.15	0.18	0.20	0.24	0.26	0.27
14	3.42	74.12	0.13	0.16	0.17	0.20	0.22	0.23
15	3.28	77.40	0.12	0.15	0.16	0.19	0.21	0.22
16	3.00	80.40	0.11	0.14	0.15	0.18	0.19	0.20
17	2.80	83.20	0.10	0.13	0.14	0.17	0.18	0.19
18	2.40	85.60	0.09	0.11	0.12	0.14	0.15	0.16
19	2.40	88.00	0.09	0.11	0.12	0.14	0.15	0.16
20	2.40	90.40	0.09	0.11	0.12	0.14	0.15	0.16
21	2.40	92.80	0.09	0.11	0.12	0.14	0.15	0.16
22	2.40	95.20	0.09	0.11	0.12	0.14	0.15	0.16
23	2.40	97.60	0.09	0.11	0.12	0.14	0.15	0.16
24	2.40	100.00	0.09	0.11	0.12	0.14	0.15	0.16

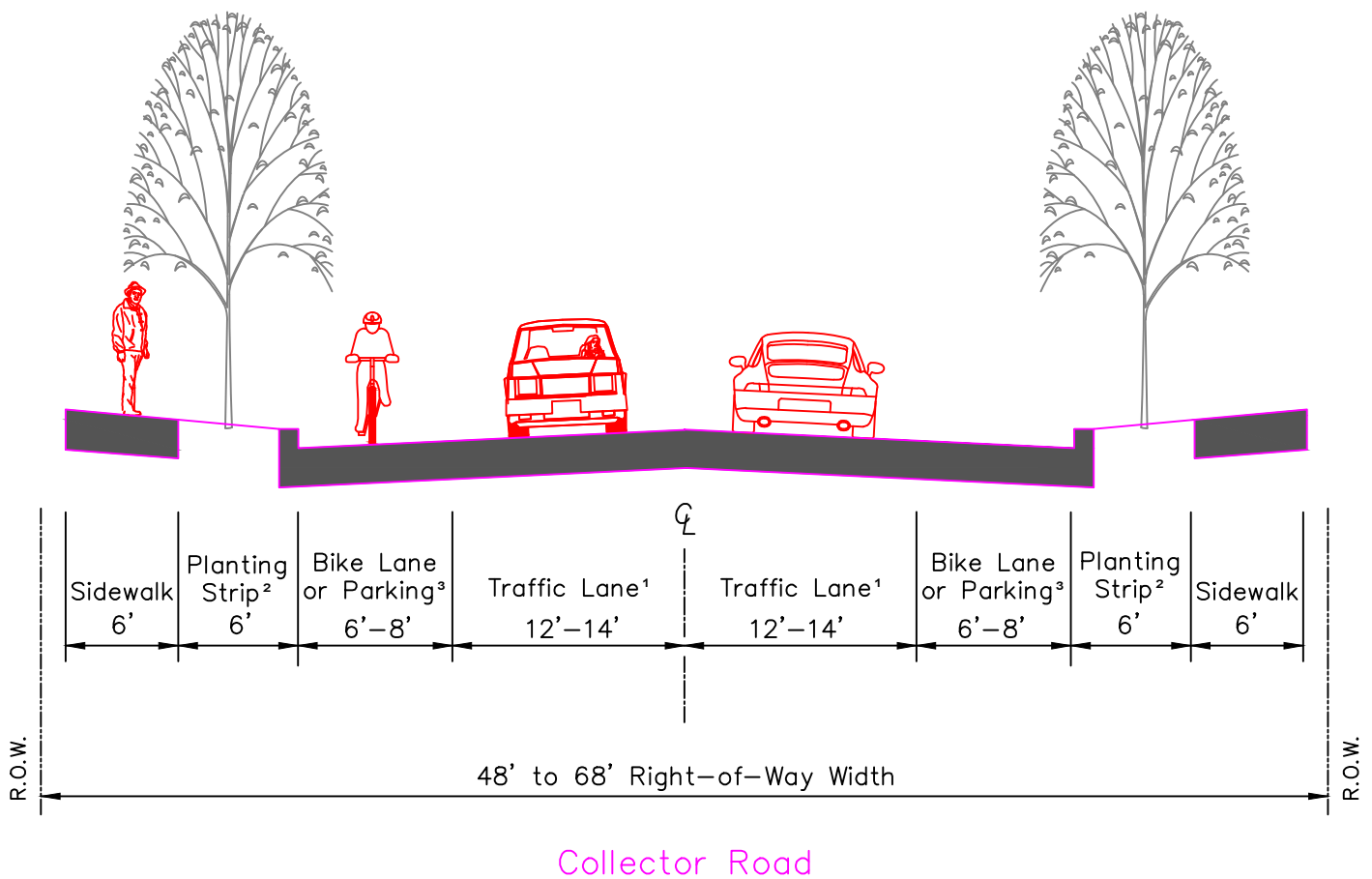


4-Lane Arterial Road (U.S. 101 North of Downtown)

Notes:

¹Optional features

	<p>CITY OF TILLAMOOK DEPARTMENT OF PUBLIC WORKS</p>	<p>EXHIBIT 2 4-LANE ARTERIAL ROAD CROSS SECTION</p> <p>DRAWING NO. EXHIBIT 2</p> <p>REVISED 1-2014</p>
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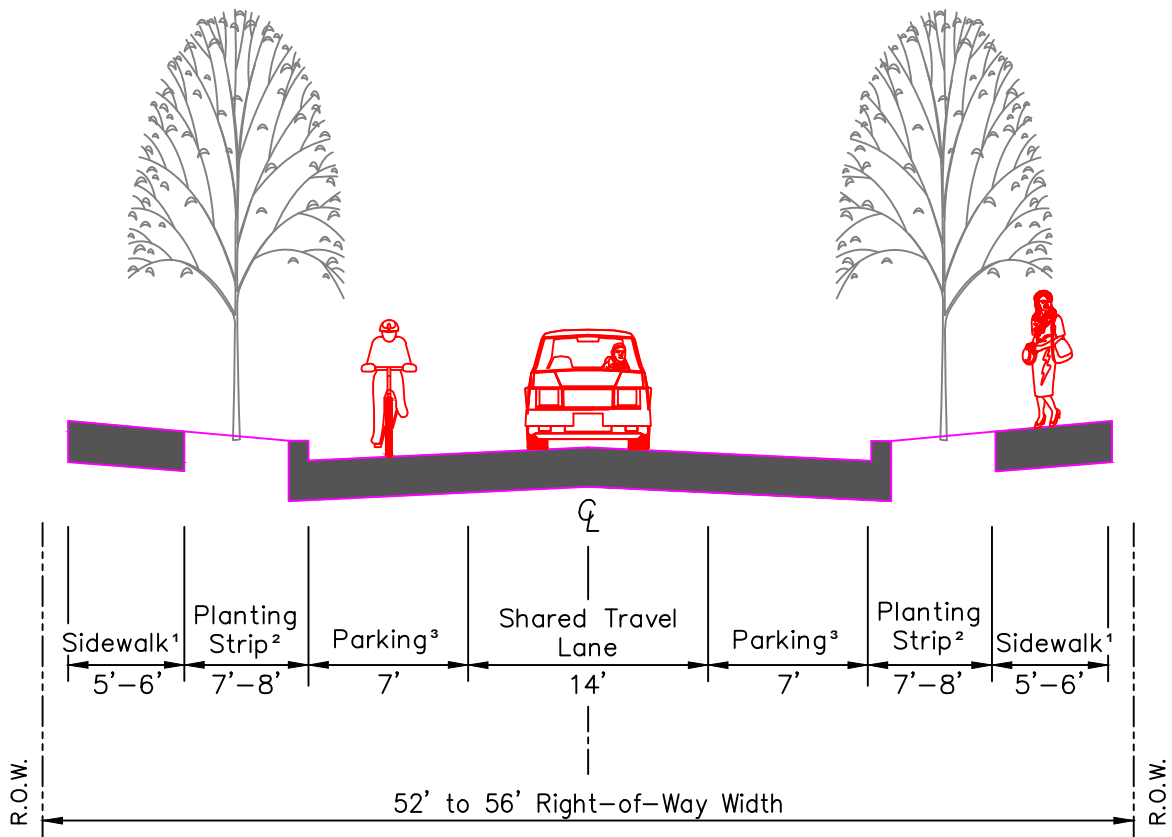


Notes:

¹Where parking is constructed next to a travel lane, the travel lane width shall be increased to 14' to function as a shared roadway and accommodate bikes.

²Optional features

³Width for parking shall be 8' wide. Width for bike lane shall be 6' wide.

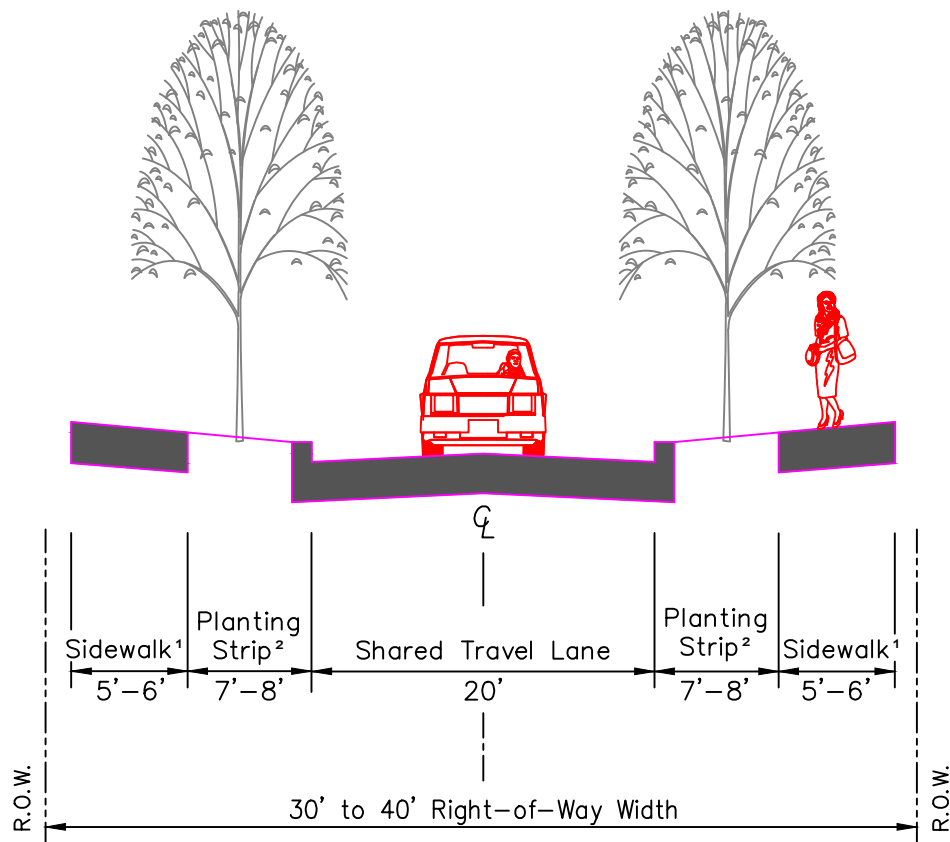


Notes:

¹If sidewalks are not provided, a separated pedestrian walkway (eg. crushed aggregate separated by curb stops) is required on at least one side of the street.

²Optional features

³Where appropriate, parking may be provided on one side only, for a paved width of 24' (7' parking + 17' travel lane).



Alternative Local Road³

Notes:

¹If sidewalks are not provided, a separated pedestrian walkway (eg. crushed aggregate separated by curb stops) is required on at least one side of the street.

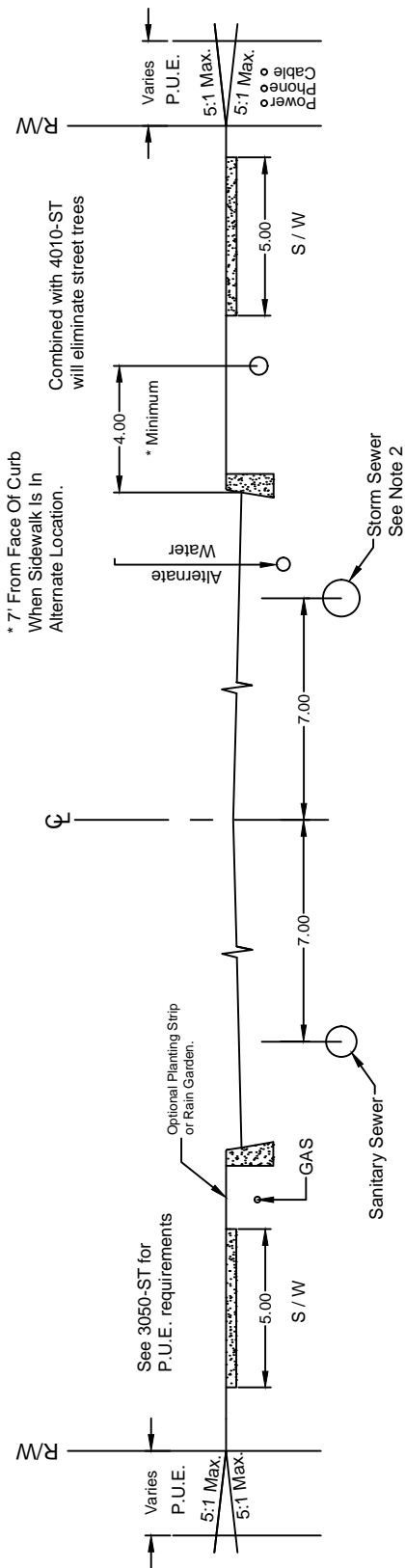
²Optional features

³The alternative local road standard may be used when approved by the City of Tillamook. The standard is intended to apply under one of the following circumstances:

1. The local road will serve 18 or fewer dwelling units upon buildout of adjacent property.
2. The ADT volume of the road is less than 250 vehicles/day.
3. Significant topographical or environmental constraints are present.

The alternative local road standard may be used provided:

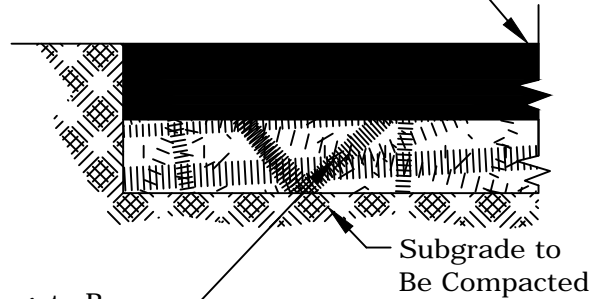
- A. Use of the alternative local road standard will not create gaps in connectivity or roadway standards with adjacent roadway sections (i.e. sidewalk, parking, travel lane widths).
- B. The City of Tillamook and Emergency Service Providers have reviewed and accepted usage of the alternative local roadway standard.



Notes:

1. Sanitary Sewer On The North And West, Water And Storm Sewer On The South And East.
2. The Tops Of The Manholes Shall Be Located So They Don Not Fall In The Wheel Track or In The Bike Lane.
3. Alternate Water Location Shown Above By City Approval Only.
4. Maintain Minimum Required Separation Between Sanitary Sewer And Water
5. Sidewalk One Side Is Allowable If Fully Connected To Other Sidewalks At Each Terminus.
6. See Drawing No. 4010-ST (Important)

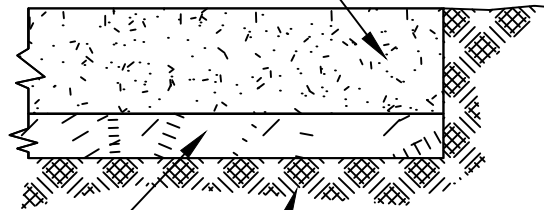
HMAC Level 2 1/2" Dense
 Nom. Thkn. - 3" (Residential)
 Nom. Thkn. - 4" (Commercial)



Aggregate Base
 Nom. Comp. Thkn. - 6" (Residential)
 Nom. Comp. Thkn. - 12" (Commercial)

ASPH. CONC. DWY. CONN.

P.C. Conc. Thkn.
 8" - Commercial
 6" - Residential



Aggregate Base Nom.
 Comp. Thkn. - 4"

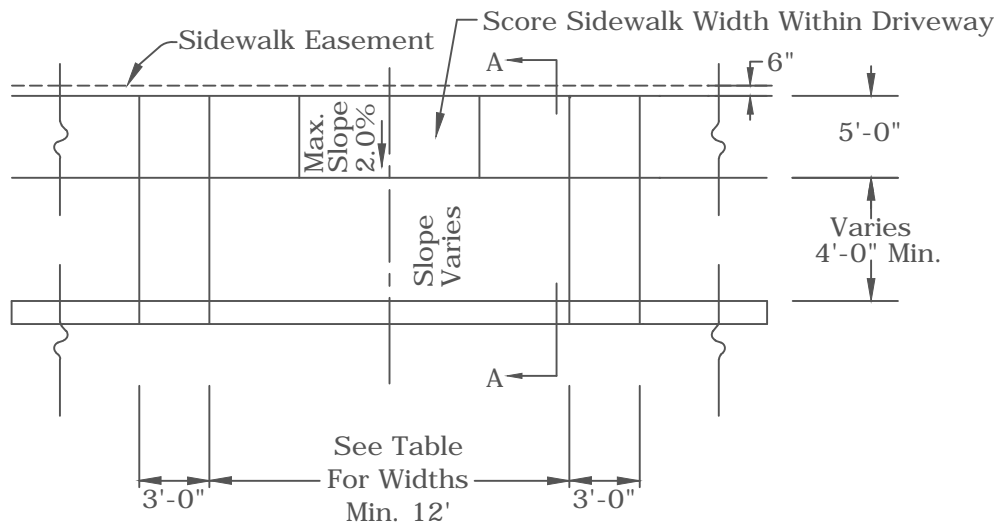
Subgrade to be Compacted

P.C. CONC. DWY. AND APPROACHES

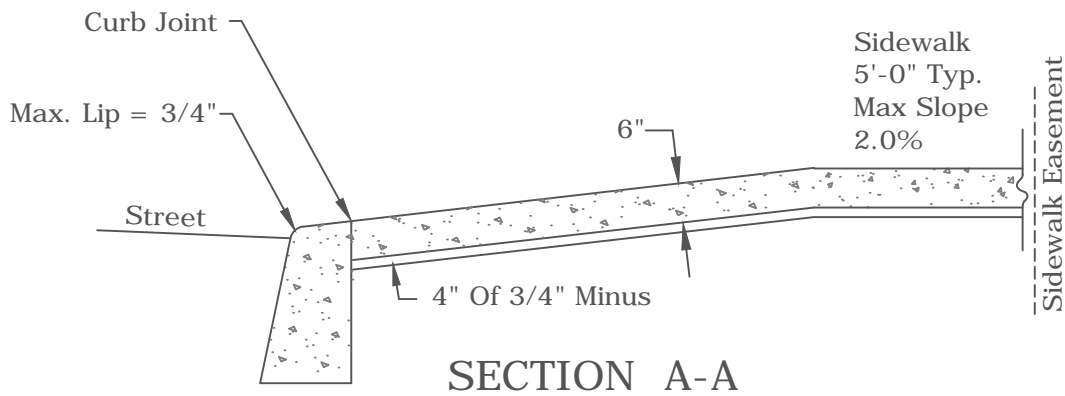
- Sidewalk and Driveway Concrete Specifications To Be Oregon Standard Commercial Grade (3,000 psi).
- Subgrade To Be Sterilized.
- Aggregate Base To Be Compacted to 100% Density Of AASHTO T-99.
- Subgrade To Be Compacted to 95% Density Of AASHTO T-99.

DRIVEWAY PAVEMENT SECTION

Not to Scale



PLAN SIDEWALK AWAY FROM CURB (Preferred)

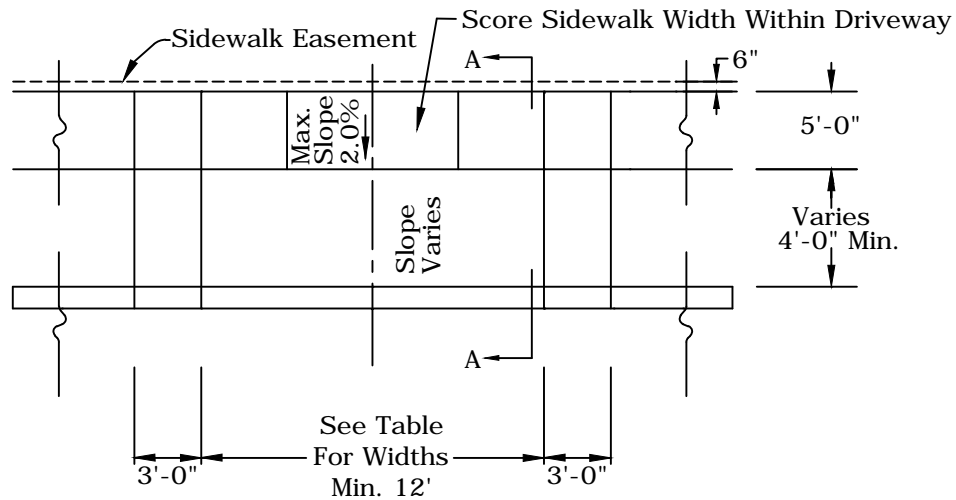


Vertical curb preferred. see (2020-ST & 2030-ST).
See 2010-ST for mountable curb and gutter if warranted.

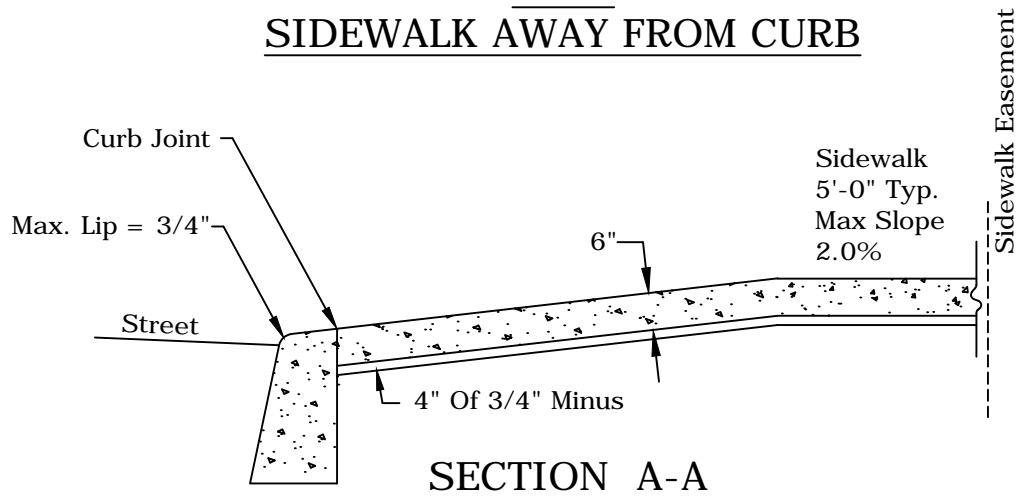
NOTE: RESIDENTIAL DRIVEWAYS

- 1) Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
- 2) Curb Joints Shall Be Troweled With A Minimum 1/2" Radius Along Back Of Curb.
- 3) Expansion Joints Shall Be 1/2" Premolded Asphalt Impregnated Material Or Equal, Extending From Subgrade To Finish Grade.
- 4) Contraction Joint Spacing Shall Be A Max. Of 10'.

DRIVEWAY WIDTH TABLE		
LAND USE	MINIMUM DRIVEWAY WIDTH	MAXIMUM DRIVEWAY WIDTH
	10 Feet	24 Feet
		See Code of Ord. 155.022 Detail on Driveway Spacing.



PLAN SIDEWALK AWAY FROM CURB

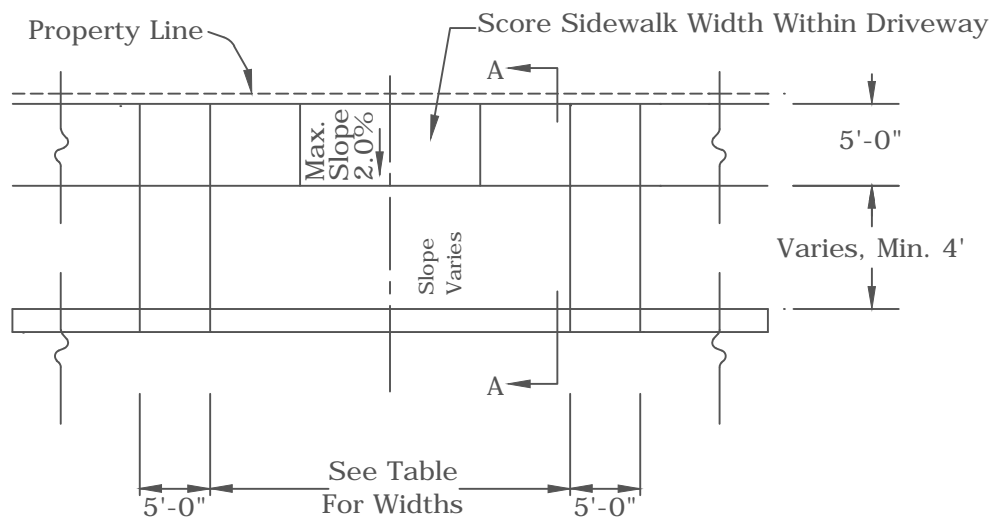


Vertical curb preferred. see (2020-ST & 2030-ST).
See 2010-ST for mountable curb and gutter if warranted.

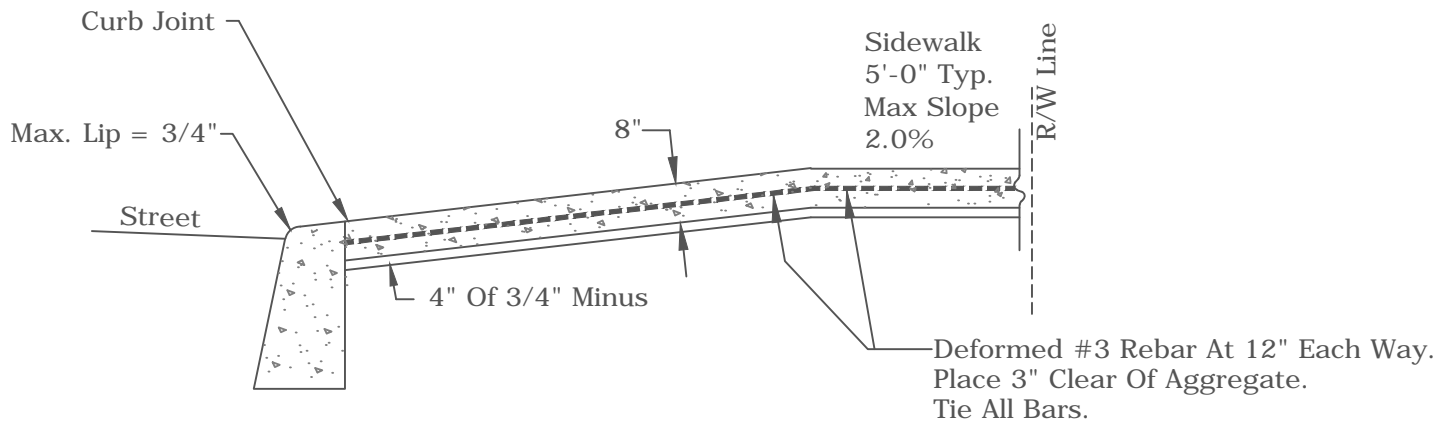
DRIVEWAY WIDTH TABLE		
LAND USE	MINIMUM DRIVEWAY WIDTH	MAXIMUM DRIVEWAY WIDTH
See Code of Ord. 155.022 Detail on Driveway Spacing.	10 Feet	24 Feet

NOTE: RESIDENTIAL DRIVEWAYS

- 1) Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
- 2) Curb Joints Shall Be Troweled With A Minimum 1/2" Radius Along Back Of Curb.
- 3) Expansion Joints Shall Be 1/2" Premolded Asphalt Impregnated Material Or Equal, Extending From Subgrade To Finish Grade.
- 4) Contraction Joint Spacing Shall Be A Max. Of 10'.



PLAN SIDEWALK AWAY FROM CURB (Preferred)

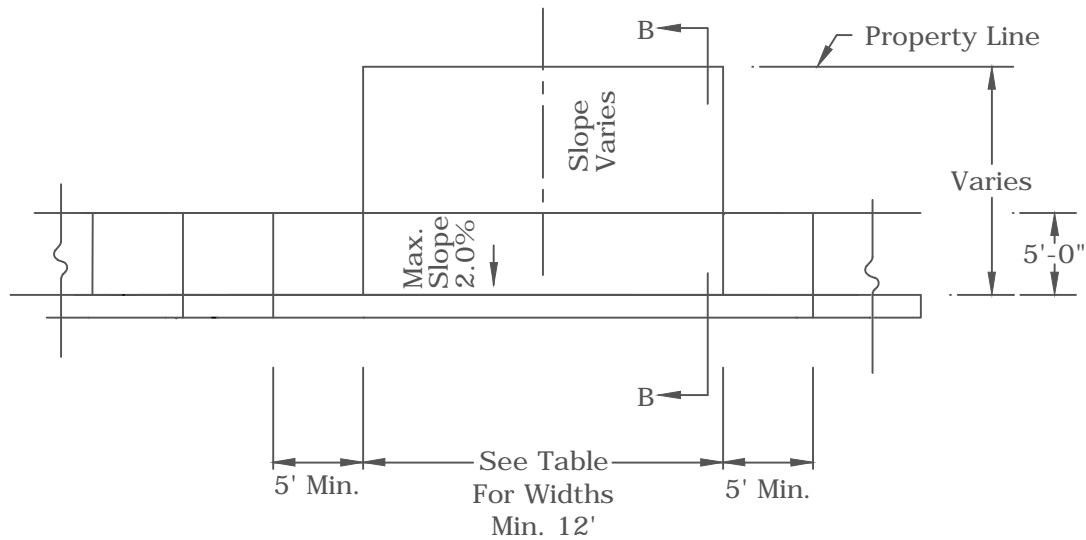


SECTION A-A

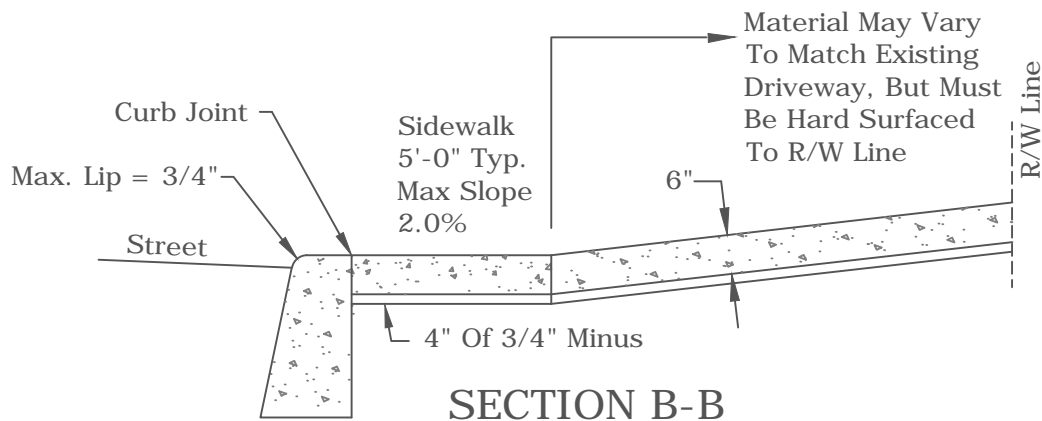
NOTE: COMMERCIAL DRIVEWAYS

NOTE: Vertical Curb preferred.
See 2020-ST & 2030-ST, also
2010-ST for mountable curb and gutter
if warranted.

- 1) Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
- 2) Curb Joint Shall Be Troweled With A Minimum 1/2" Radius Along Back Of Curb.
- 3) Expansion Joints Shall Be 1/2" Premolded Asphalt Impregnated Material Or Equal. Extending From Subgrade To Finish Grade.
- 4) Contraction Joint Spacing Shall Be A Max. Of 10'.



PLAN SIDEWALK NEXT TO CURB (Where Warranted)

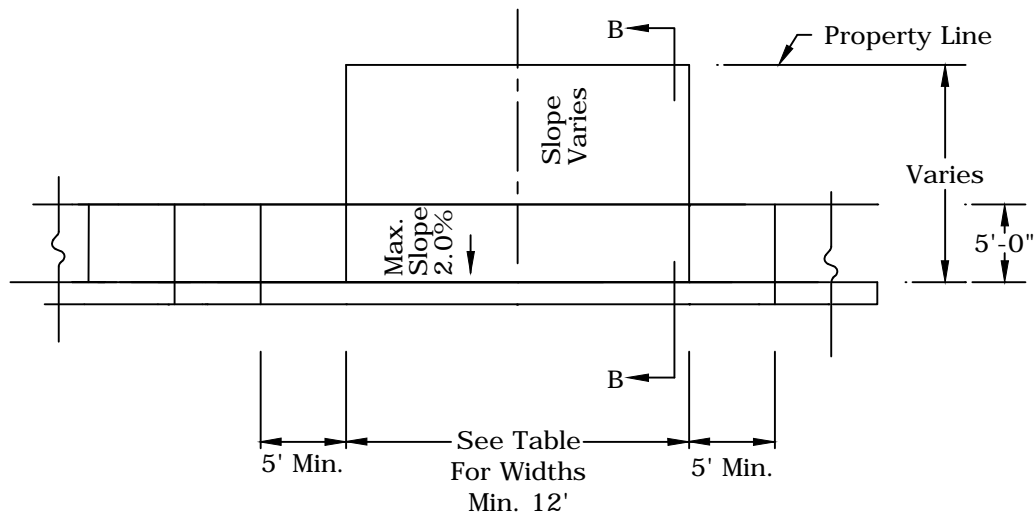


SECTION B-B

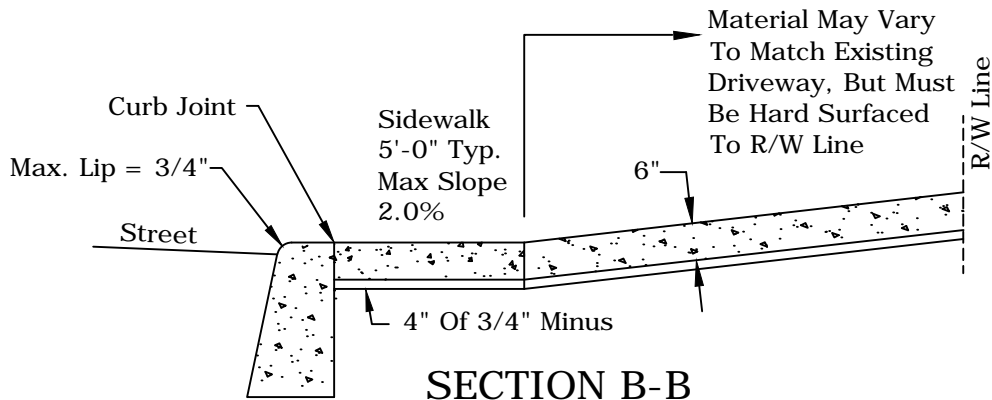
NOTE: RESIDENTIAL DRIVEWAYS

DRIVEWAY WIDTH TABLE		
LAND USE	MINIMUM DRIVEWAY WIDTH	MAXIMUM DRIVEWAY WIDTH
	10 Feet	24 Feet

- 1) Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
- 2) Curb Joints Shall Be Troweled With A Minimum 1/2" Radius Along Back Of Curb.
- 3) Expansion Joints Shall Be 1/2" Premolded Asphalt Impregnated Material Or Equal, Extending From Subgrade To Finish Grade.
- 4) Contraction Joint Spacing Shall Be A Max. Of 10'.
- 5) 15' Minimum Separation Between Driveways.



PLAN SIDEWALK NEXT TO CURB

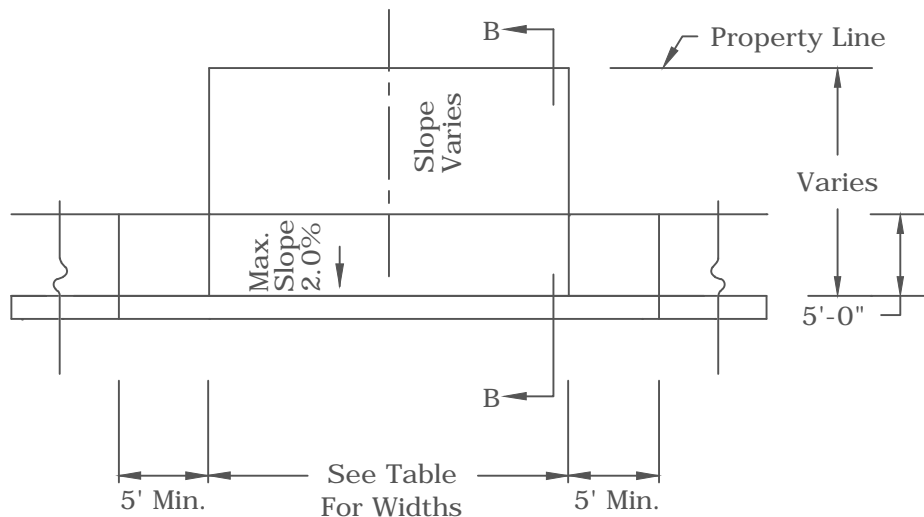


SECTION B-B

NOTE: RESIDENTIAL DRIVEWAYS

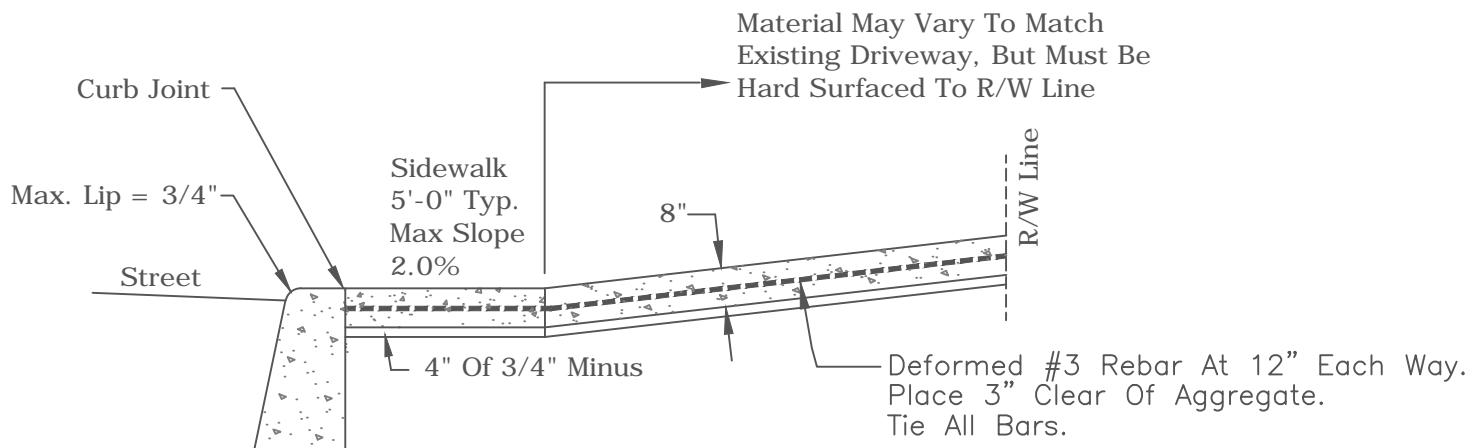
DRIVEWAY WIDTH TABLE		
LAND USE	MINIMUM DRIVEWAY WIDTH	MAXIMUM DRIVEWAY WIDTH
See Code of Ord. 155.022 Detail on Driveway Spacing.	10 Feet	24 Feet

- 1) Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
- 2) Curb Joints Shall Be Troweled With A Minimum 1/2" Radius Along Back Of Curb.
- 3) Expansion Joints Shall Be 1/2" Premolded Asphalt Impregnated Material Or Equal, Extending From Subgrade To Finish Grade.
- 4) Contraction Joint Spacing Shall Be A Max. Of 10'.
- 5) 15' Minimum Separation Between Driveways.



PLAN

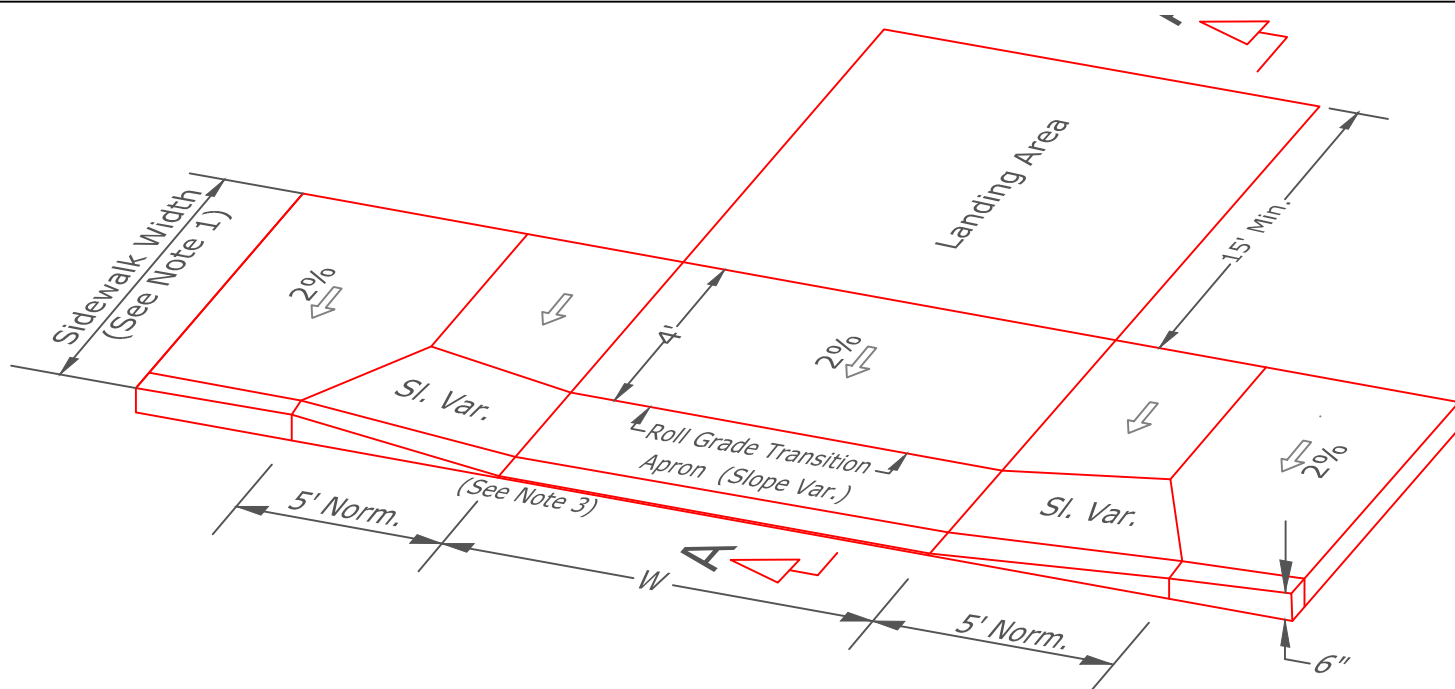
SIDEWALK NEXT TO CURB (Where Warranted)



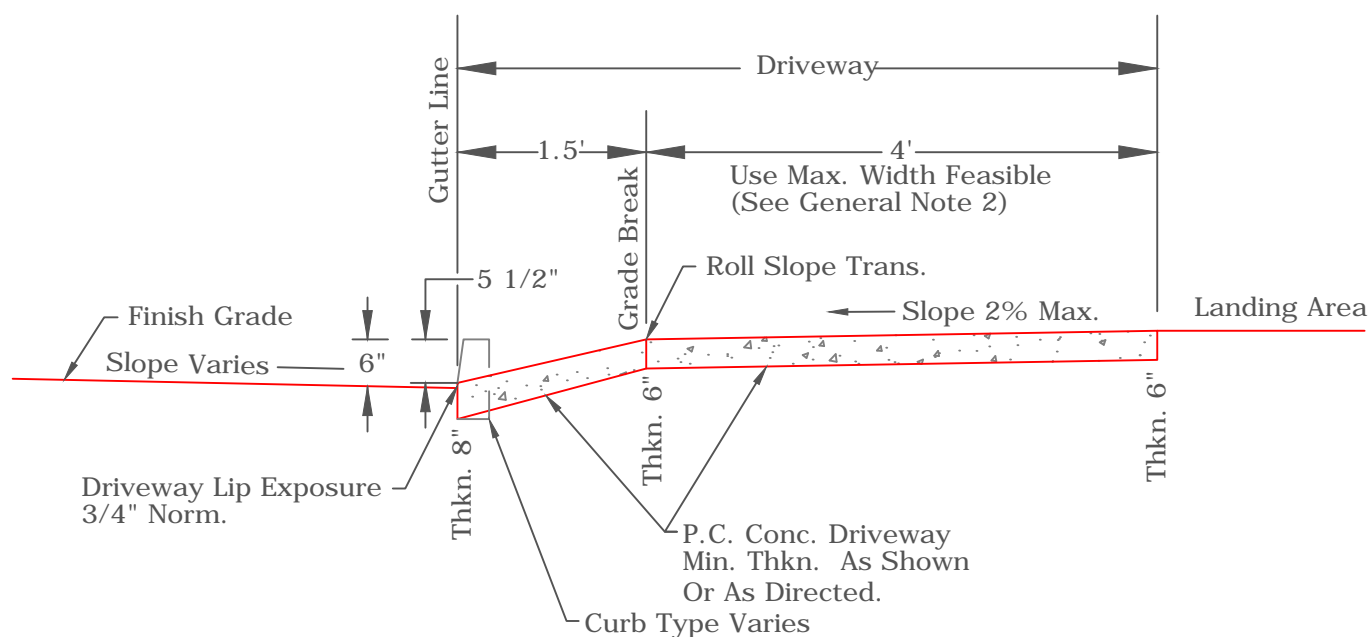
SECTION B-B

NOTE: COMMERCIAL DRIVEWAYS

- 1) Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
- 2) Curb Joint Shall Be Troweled With A Minimum 1/2" Radius Along Back Of Curb.
- 3) Expansion Joints Shall Be 1/2" Premolded Asphalt Impregnated Material Or Equal. Extending From Subgrade To Finish Grade.
- 4) Contraction Joint Spacing Shall Be A Max. Of 10'.
- 5) 15' Minimum Separation Between Driveways.



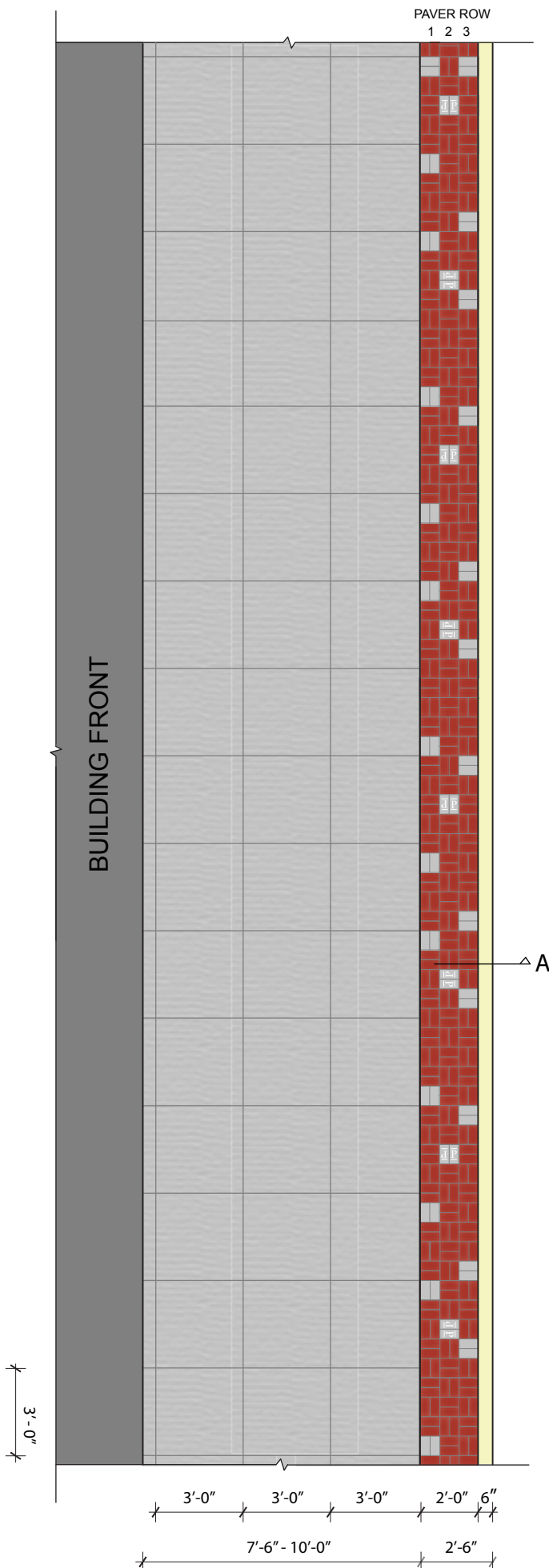
OPTIONAL EXTG. SIDEWALK MODIFICATION (Where Warranted)



SECTION A - A

Notes:

1. 4 Feet Of Unobstructed Clear Passage With Slope Of 2% Max. Is Required Behind Driveway Apron.
2. Check The Gutter Flow Depth At Driveway Locations To Assure That The Design Flood Does Not Overtop The Back Of The Sidewalk. If It Does An Inlet May Be Needed For Mitigation.
3. This Driveway Configuration Shall Only Be Used When No Other Driveway Configuration Is Feasible. Use Of This Detail To Be Approved In Advance By The City Engineer.

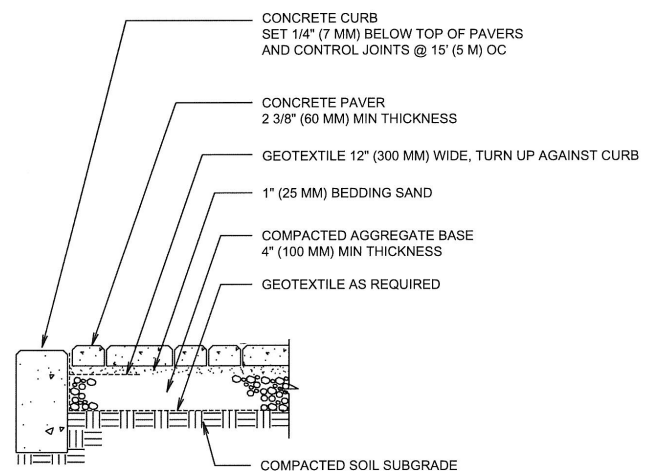


CONCRETE SIDEWALK

- ① UNIFORM BROOM FINISH
- ② SCORE LINES 3'-0" X 3'-0" APART

CONCRETE PAVER STRIP

- ① ROW 1. FIRST GRAY PAVERS INSTALLED AT START POINT; GRAY PAVER SPACING: 5'-4", 2'-8", 4'-0", REPEAT
- ② ROW 2. GRAY PAVERS MAY BE CUSTOMIZED BY SPONSOR, FIRST GRAY PAVERS LAID 2' FROM STARTING POINT THEN SPACED EVENLY EVERY 3'-0"
- ③ ROW 3. FIRST GRAY PAVERS INSTALLED 2'-8" FROM START POINT; GRAY PAVER SPACING: 2'-8", 5'-4", 4'-0", REPEAT



SECTION A: SIDEWALK PAVER AND CURB

NOTE:

1. 18" - 24" COVER OF ROCK COMPACTED BACKFILL OVER WATER AND ELECTRICAL LINES

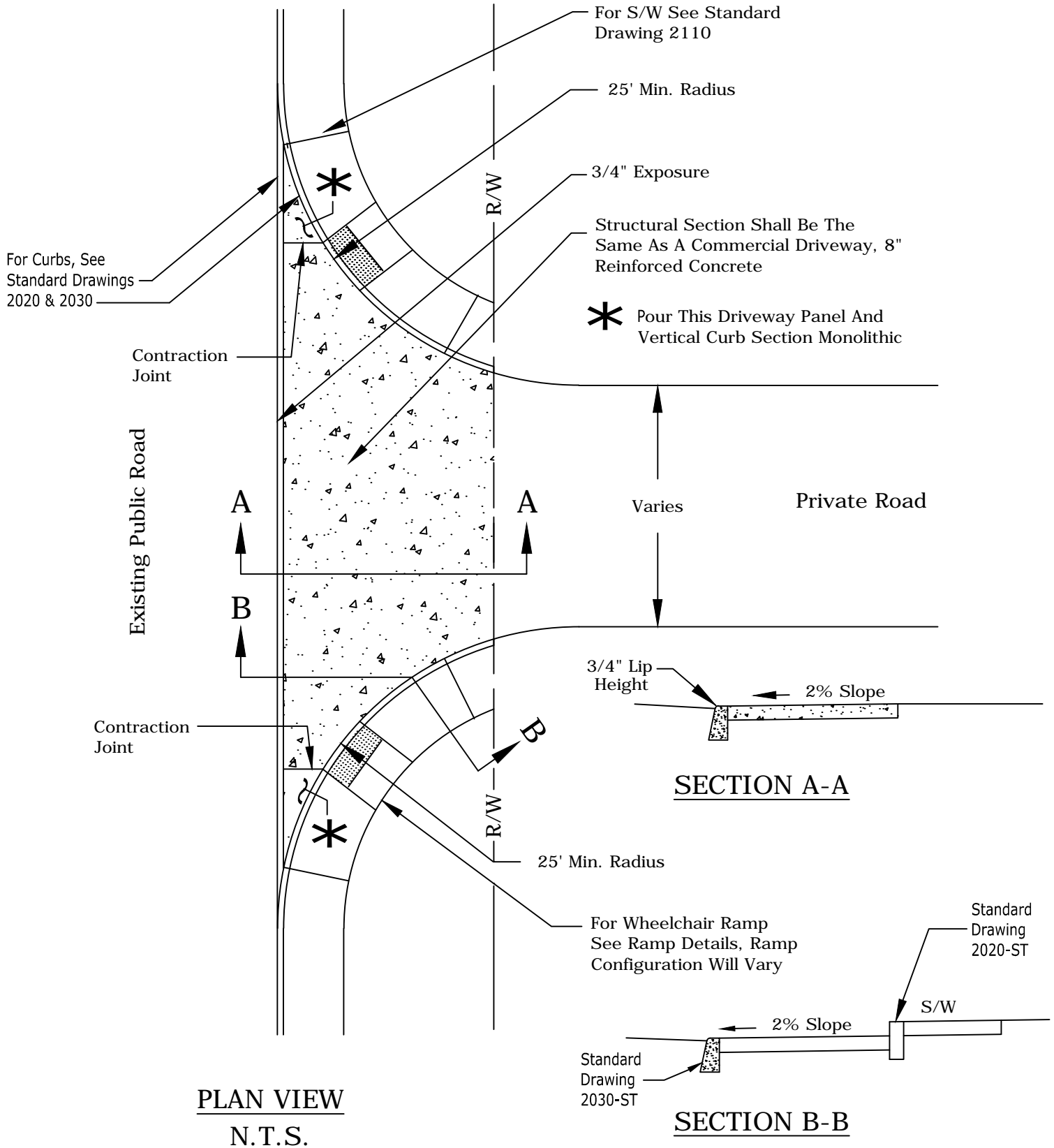
2. 7 7/8" X 3 7/8" x 2 3/8" CONCRETE PAVER (60MM)

*SECTION FROM INTERLOCKING CONCRETE PAVER INSTITUTE (ICPI)

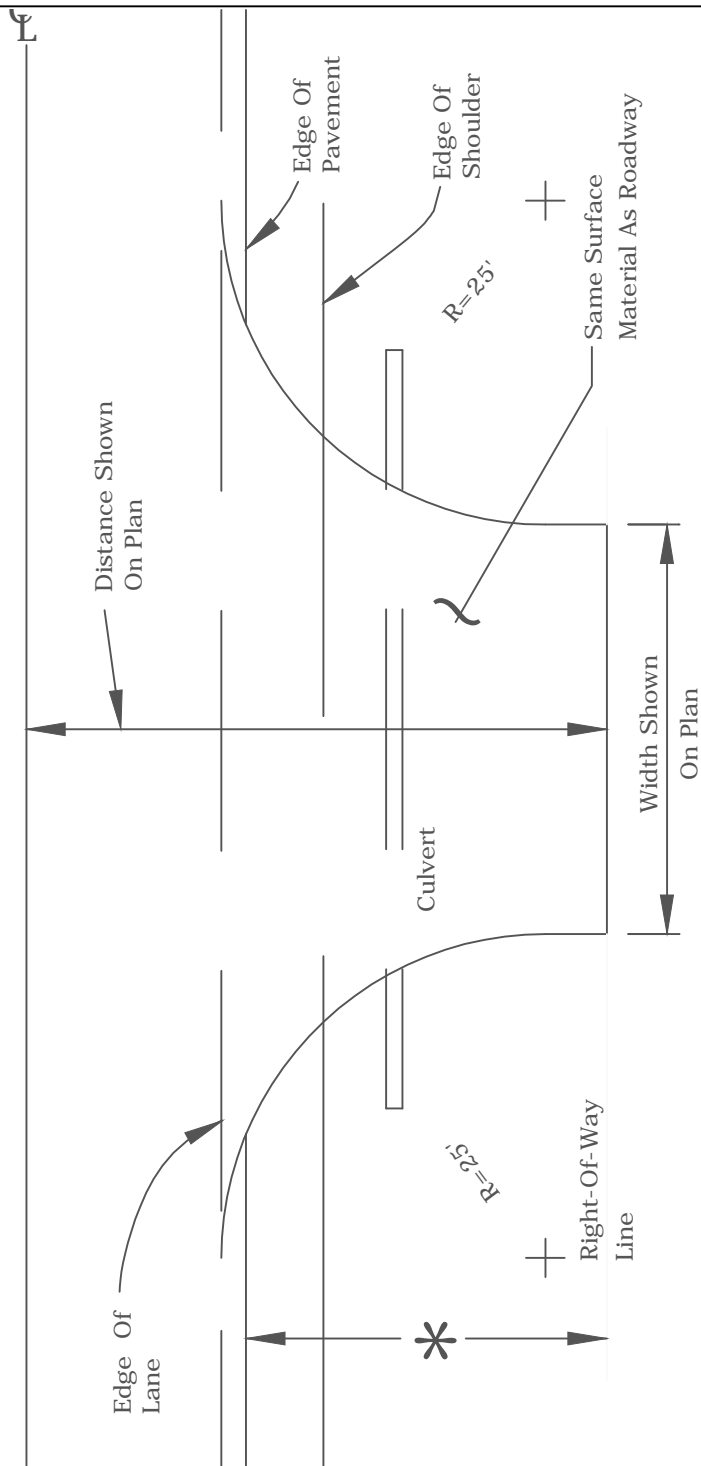
STREET SCAPE - SIDEWALK SECTION

DRAWING NO.1065-ST REVISED 12-2014

City of Tillamook
The Dairylands



PRIVATE ROAD ENTRANCE

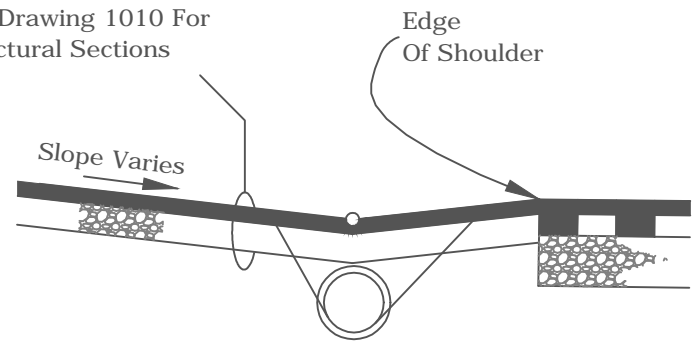


TYPICAL PLAN A.C. OR GRAVEL DRIVEWAY

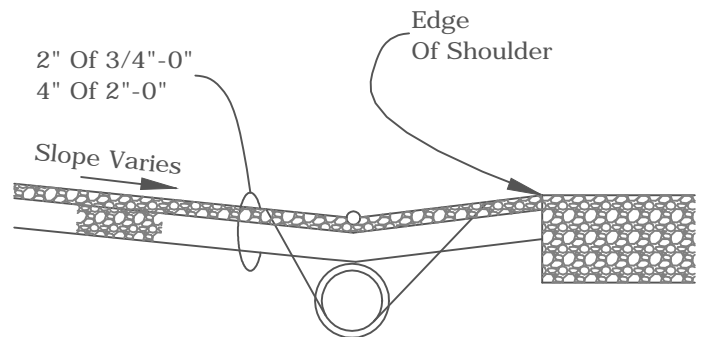
* Driveway Surface Material Shall Be The Same As The Roadway Surface Material From The Greater Of Either The Edge Of Pavement To The Property Line Or The Edge Of Pavement To 10'.

See Standard Drawings 1081-ST & 1082-ST For Culvert Installation.

See Drawing 1010 For Structural Sections



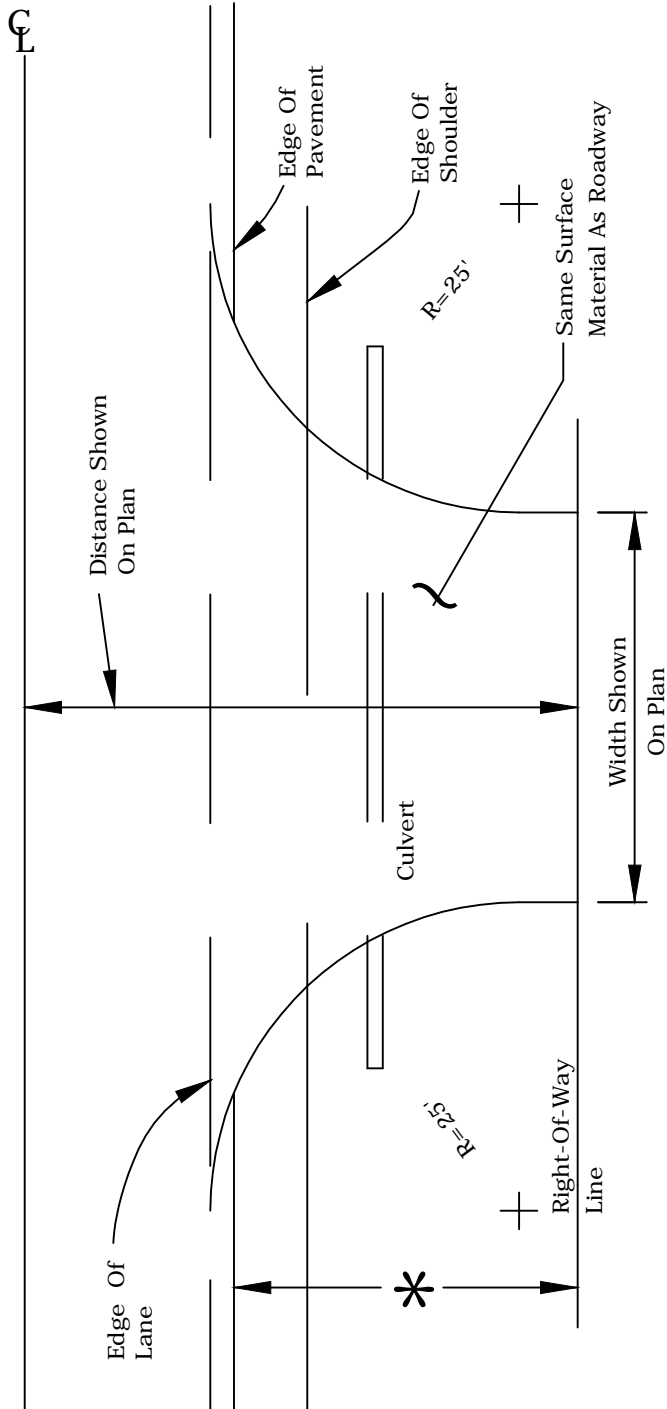
TYPICAL SECTION A.C. DRIVEWAY AT A.C. ROAD



TYPICAL SECTION GRAVEL DRIVEWAY AT GRAVEL ROAD

DRIVEWAY WIDTH TABLE

LAND USE	MINIMUM DRIVEWAY WIDTH	MAXIMUM DRIVEWAY WIDTH
	10 Feet	24 Feet

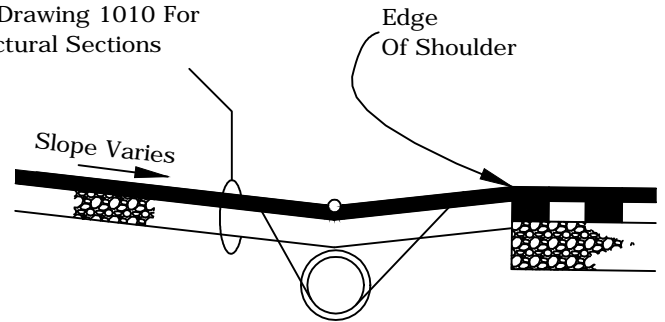


TYPICAL PLAN A.C. OR GRAVEL DRIVEWAY

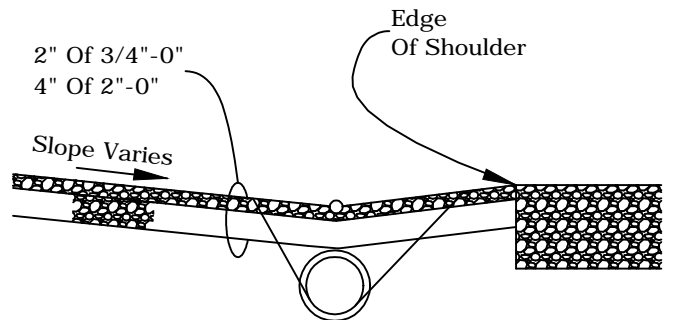
- * Driveway Surface Material Shall Be The Same As The Roadway Surface Material From The Greater Of Either The Edge Of Pavement To The Property Line Or The Edge Of Pavement To 10'.

See Standard Drawings 1081-ST & 1082-ST For Culvert Installation.

See Drawing 1010 For Structural Sections



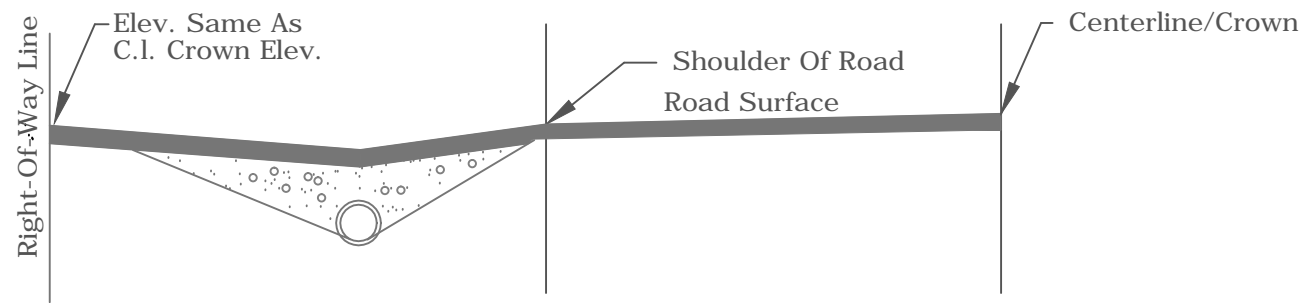
TYPICAL SECTION A.C. DRIVEWAY AT A.C. ROAD



TYPICAL SECTION GRAVEL DRIVEWAY AT GRAVEL ROAD

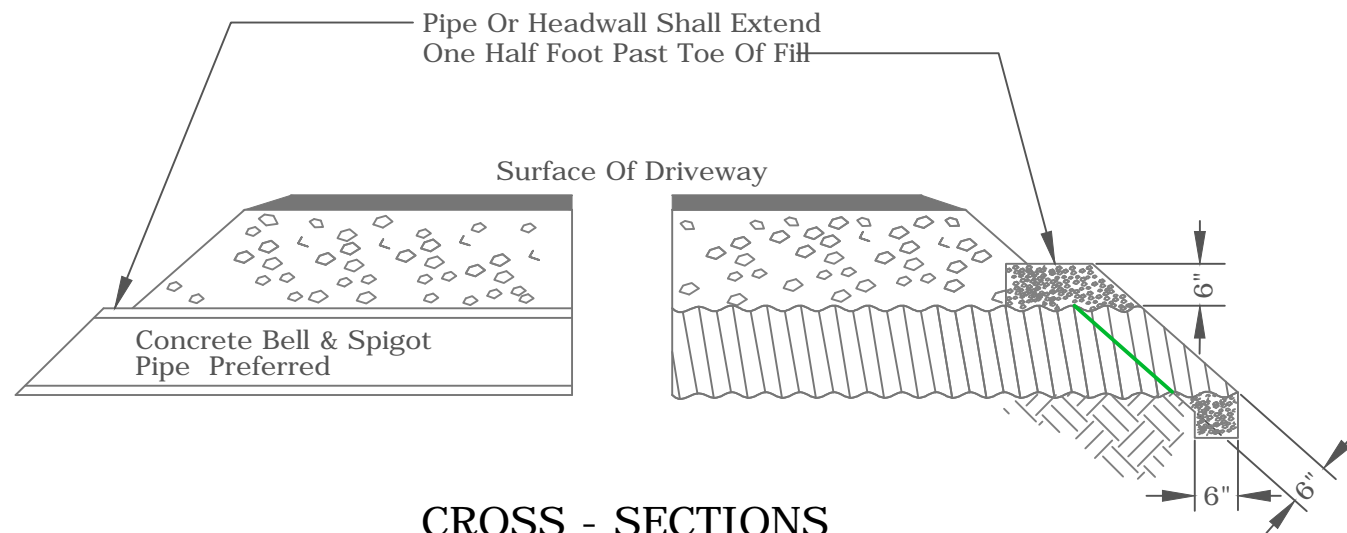
DRIVEWAY WIDTH TABLE

LAND USE	MINIMUM DRIVEWAY WIDTH	MAXIMUM DRIVEWAY WIDTH
See Code of Ord. 155.022 Detail on Driveway Spacing.	10 Feet	24 Feet

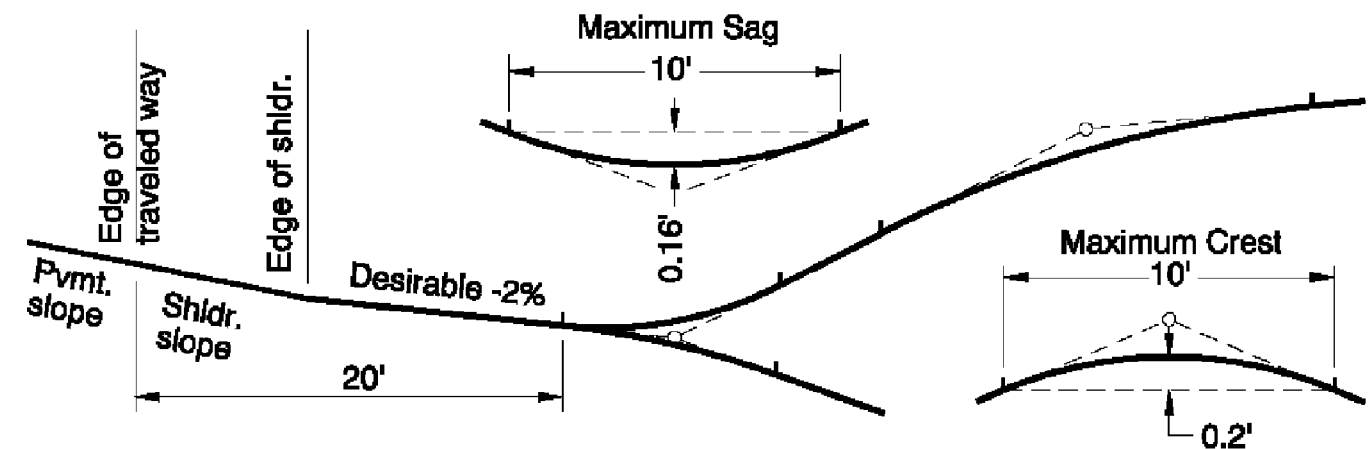


- Notes:
1. See Drawing No. 1080-ST For Alternatives.
 2. For Structural Sections See Drawing No. 1010-ST.

PROFILE

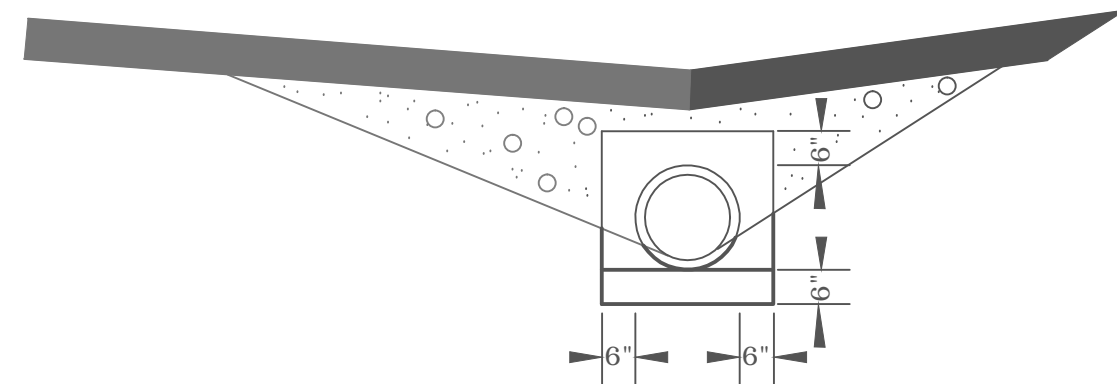


CROSS - SECTIONS



APPROACH PROFILE

NOTE:
When grades on approaches meet without vertical curves the maximum algebraic difference on crests should be 8% and on sags 12%. Grades steeper than 15% should not be used without prior approval of the engineer of record. Any driveways with slopes exceeding 12% shall be paved.



END VIEW OF HEADWALL

Notes:

1. Pipe Size Is To Be Determined Per Hydraulics Study. Minimum Pipe Inner Diameter is 12".
2. For Pipe Materials, See Drawing No. 1082-ST.
3. Pipe To Be Layed At The Grade Of The Ditch - No Slumps. Ditch May Require Regrading To Maintain Positive Drainage.
4. Fill Slopes and Culvert End Bevels Shall Be Per Tables On Drawing 1082.
5. Metal Pipe Requires Coating Where Contact With Concrete May Occur At Headwalls.
6. Shoulder And Approach Shall Be Graded To Drain Runoff To The Ditch.
7. Headwall Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).

DRIVEWAY CULVERTS				CROSS CULVERTS			
Materials				Materials			
Min. Pipe Size 12"				Min. Pipe Size 12"			
STREET CLASSIFICATION	< 3.0' Cover			< 3.0' Cover			Mitred End To Match Side Slope
	Reinforced Concrete	DIP	PVC C900/C905	Reinforced Concrete	DIP	PVC C900/C905	
	25 MPH	35 MPH	45 MPH	Reinforced Concrete	DIP	PVC C900/C905	
	2.5:1	2.5:1		Reinforced Concrete	DIP	PVC C900/C905	
local	X	X	X		X	X	X
neighborhood route	X	X	X		X	X	X
collector	X	X	X		X	X	X
arterial	X	X	X		X	X	X
Headwall Required						X	

Pipe Specifications:

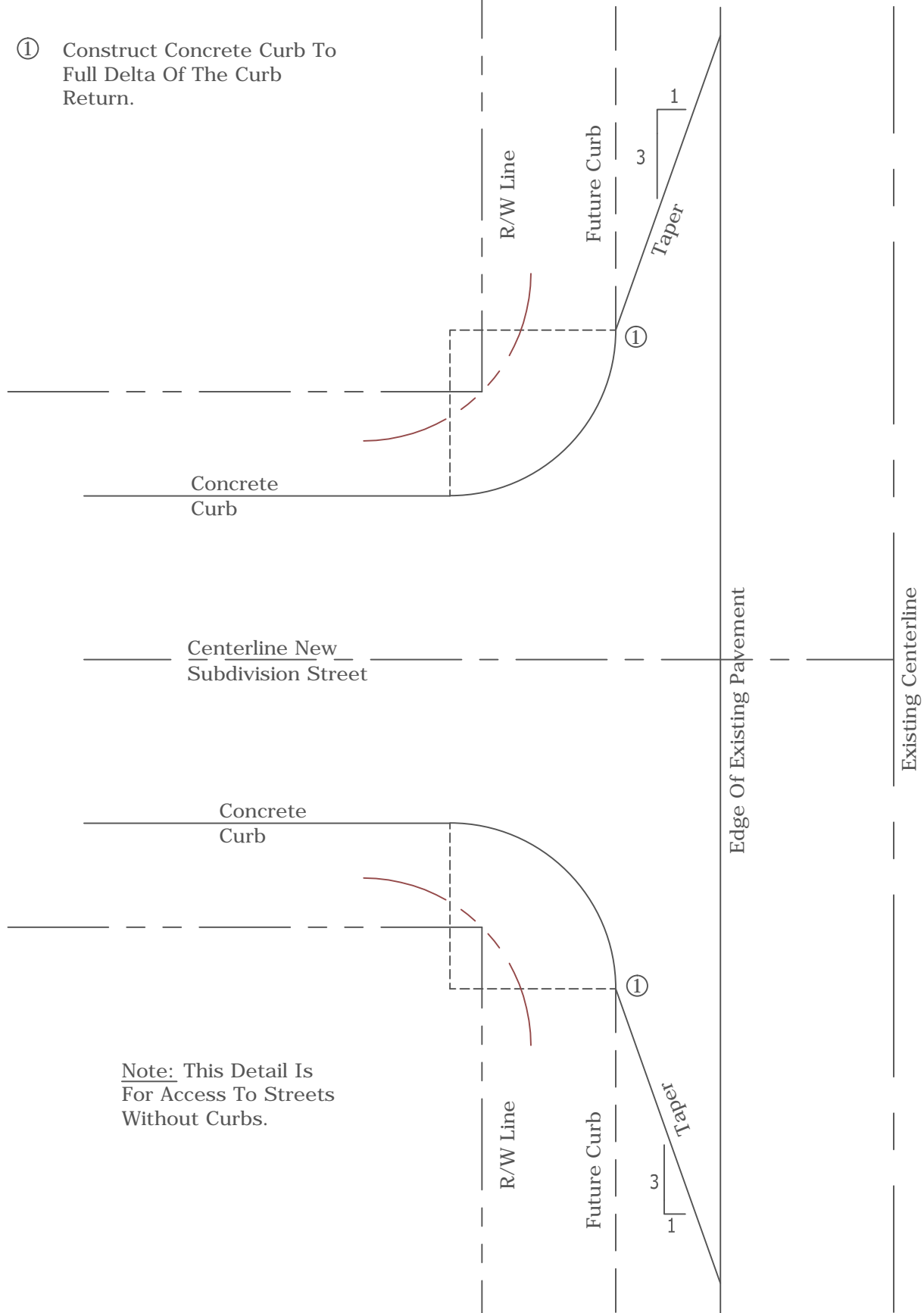
Reinforced Concrete
PVC

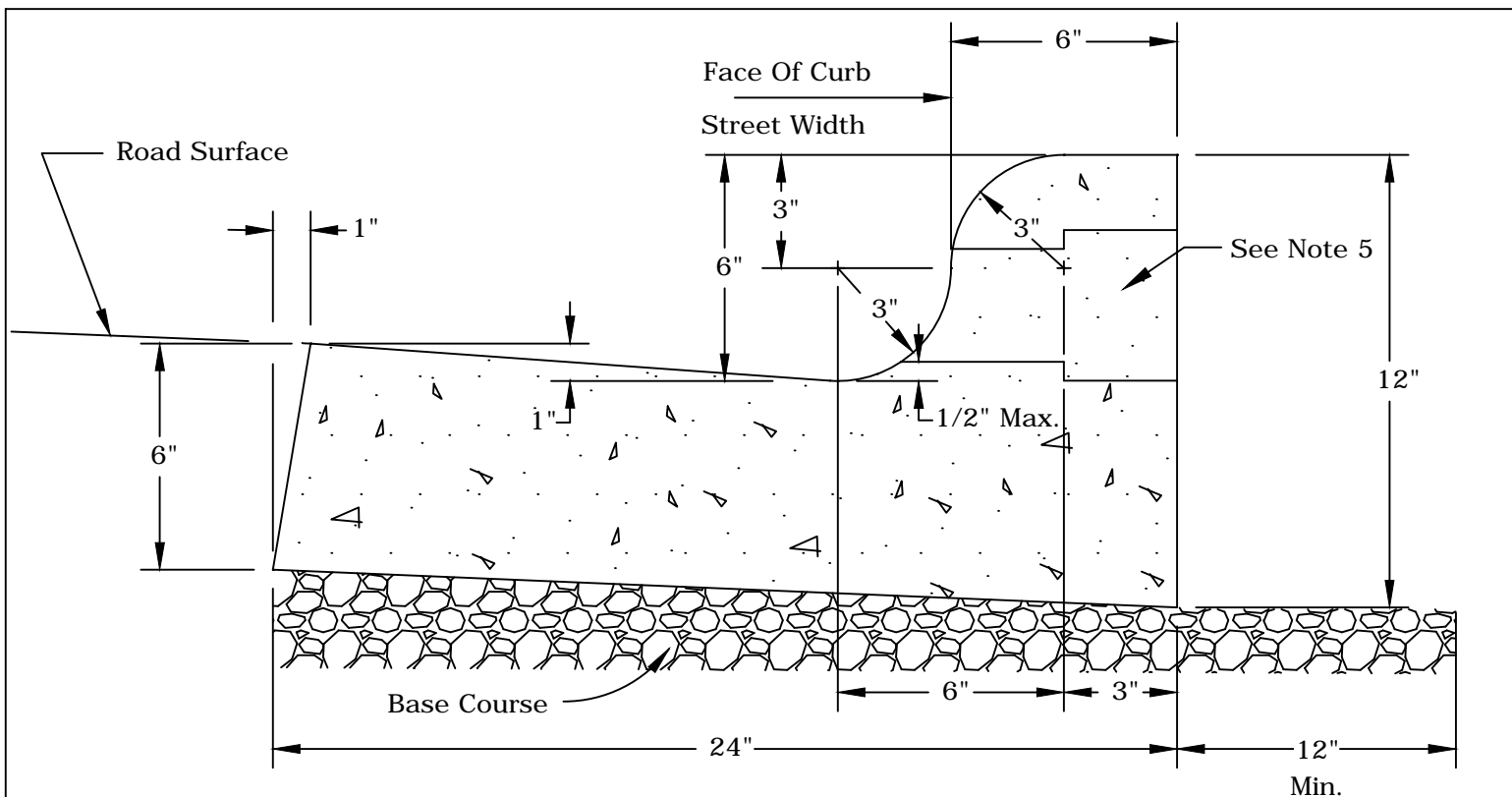
ASTM C-76 (bell and spigot)
ASTM D 3034
AWWA C 900/C905

Ductile Iron Pipe
Corrugated Aluminized Steel
Corrugated Aluminum

AWWA C150 Class 50 or 51
ASTM A 760, 10 Gage, 75 Year Life
ASTM B 745 Type 1-3 with Protective Coating, 10 Gage, 75 Year Life

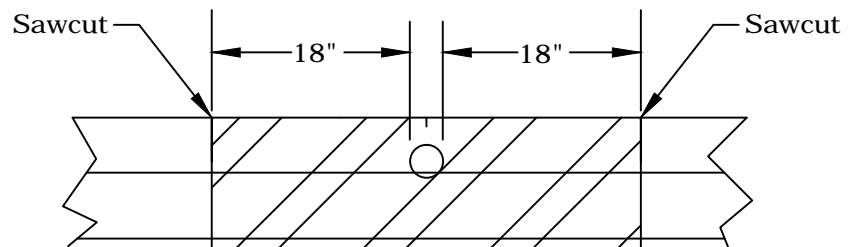
- ① Construct Concrete Curb To Full Delta Of The Curb Return.



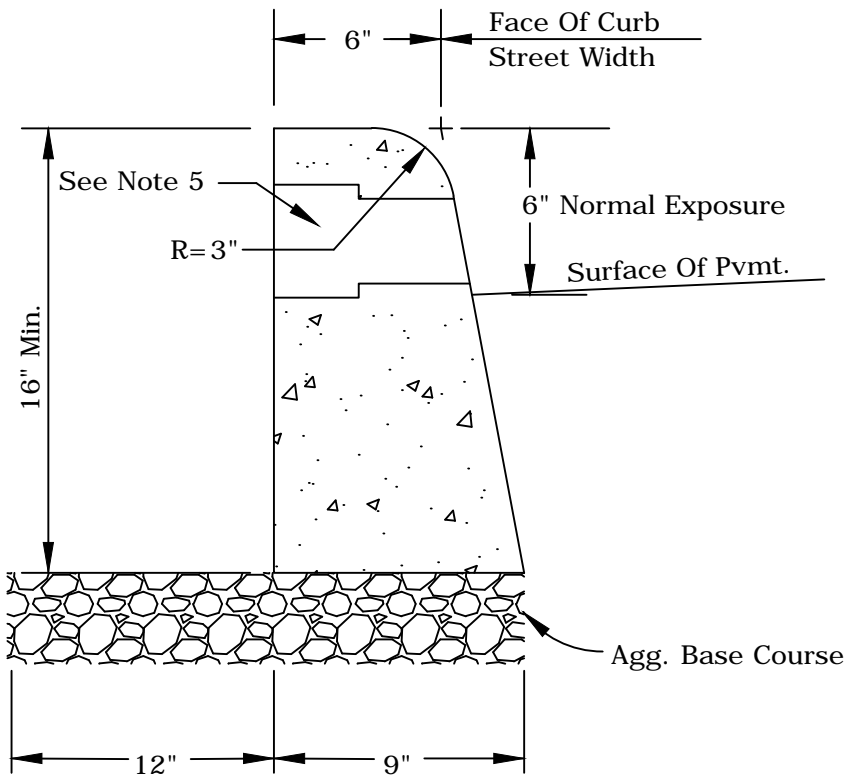


Notes:

1. Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
 - A. Broom Finish
2. Expansion Joints.
 - A. To Be Provided:
 - 1) At Each Cold Joint.
 - 2) At Each End Of Driveways.
 - 3) At Each Side Of Inlet Structures.
 - 4) At Each Point Of Tangency Of The Curb.
 - 5) At Locations Necessary To Limit Spacing To 200 Feet.
3. Contraction Joints.
 - A. Spacing To Be Not More Than 10 Feet.
 - B. The Depth Of The Joint Shall Be At Least 1/3 Depth Of Concrete.
 - C. Weepholes To Be Centered With Contraction Joints.
 - D. Weepholes To Be Located As Close As Possible To Property Lines.
4. Base Rock To Be 1-1/2" - 0" Or 3/4" - 0" Compacted To 100% Of AASHTO T-99 And Shall Be To Subgrade, Street Structure, Or 4" In Depth, Whichever Is Greater And Extend At Least 12" Behind The Curb.
5. Drainage Blockout
 - A. 3" I.D. Plastic Pipe With Coupling.
 - B. Drainage Access Thru Existing Curb Shall Be Core Drilled Or Curb Saw Cut Vertically 18" Each Side Of Drain And Repoured To Full Depth Of Curb (See Detail - A).
6. Vertical Curb is Preferred. Use Of This Detail To Be Approved In Advance By The City Engineer.

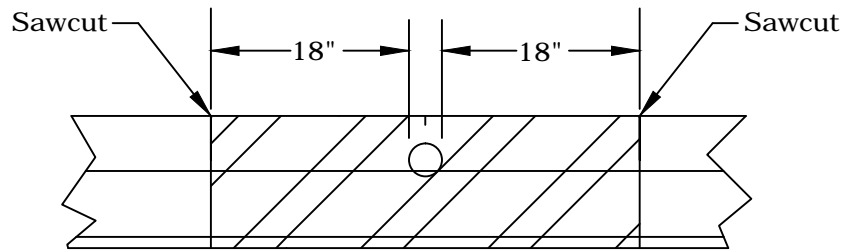


DETAIL - A

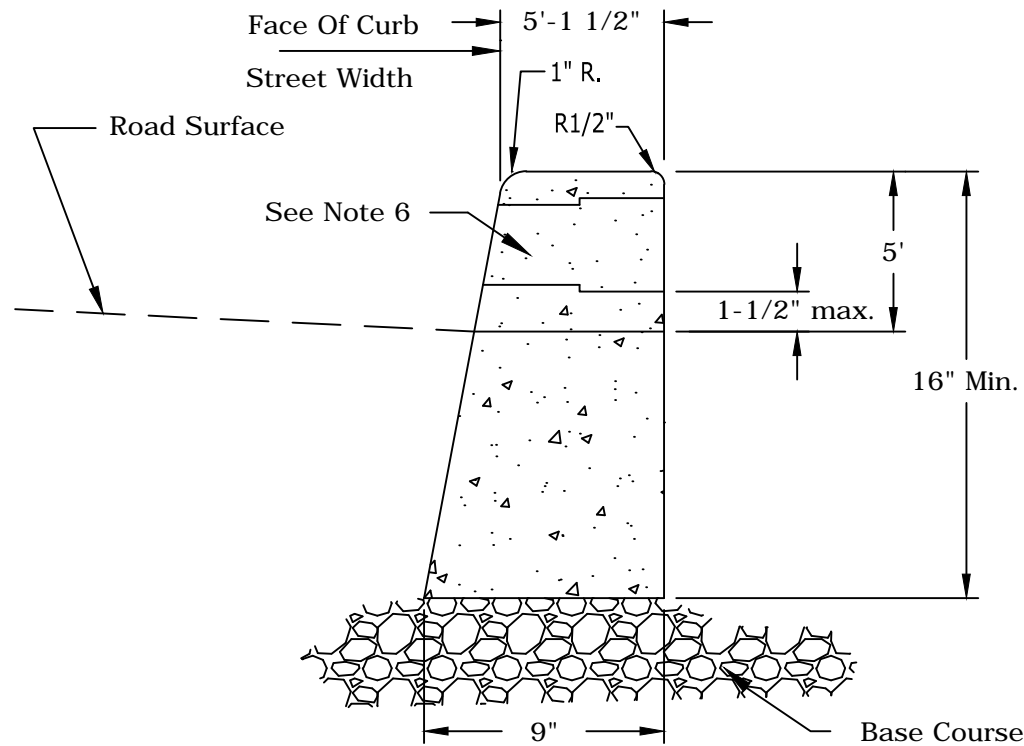


Notes:

1. Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
 - A. Broom Finish
2. Expansion Joints.
 - A. To Be Provided:
 - 1) At Each Cold Joint.
 - 2) At Each End Of Driveways.
 - 3) At Each Side Of Inlet Structures.
 - 4) At Each Point Of Tangency Of The Curb.
 - 5) At Locations Necessary To Limit Spacing To 200 Feet.
 - B. Material To Be Pre-Molded, Asphalt Impregnated, Non-Extruding, With A Thickness of 1/2 Inch.
3. Contraction Joints.
 - A. Spacing To Be Not More Than 10 Feet.
 - B. The Depth Of The Joint Shall Be At Least 1/3 Depth Of Concrete.
 - C. Weepholes To Be Centered With Contraction Joints.
 - D. Weepholes To Be Located As Close As Possible To Property Lines.
4. Base Rock To Be 1-1/2" - 0" Or 3/4" - 0" Compacted To 100% Of AASHTO T-99 And Shall Be To Subgrade, Street Structure, Or 4" In Depth, Whichever Is Greater And Extend At Least 12" Behind The Curb.
5. Drainage Blockout
 - A. 3" I.D. Plastic Pipe With Coupling.
 - B. Drainage Access Thru Existing Curb Shall Be Core Drilled Or Curb Saw Cut Vertically 18" Each Side Of Drain And Repoured To Full Depth Of Curb (See Detail - A).

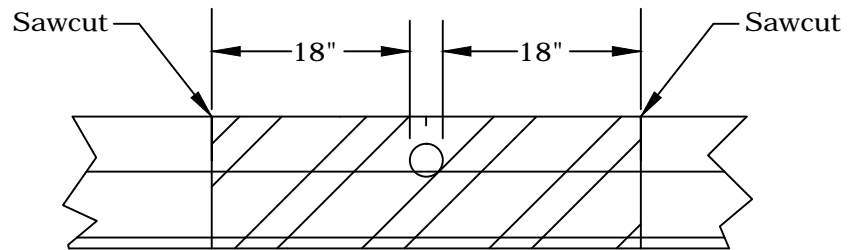


DETAIL - A

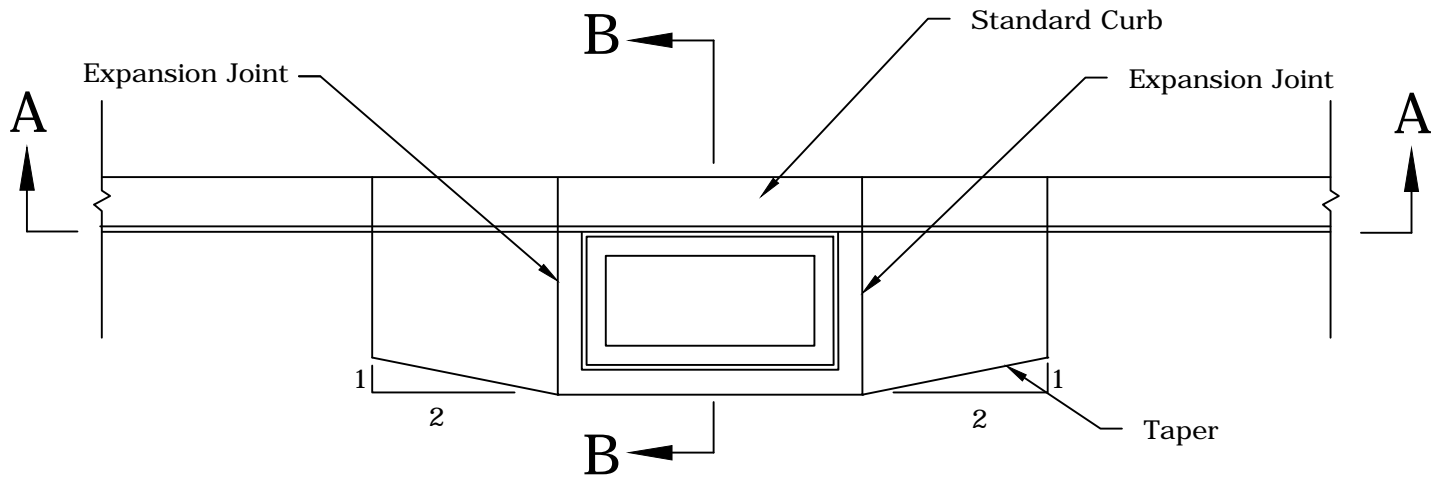


Notes:

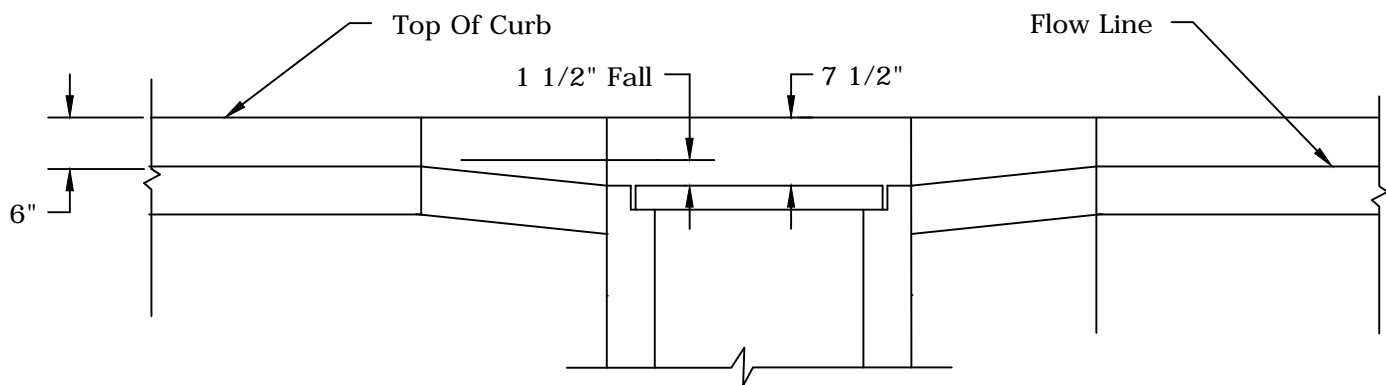
1. For Design Speeds Greater Than 40 M.P.H.,
The Emergency Mountable Curb, Drawing No. 2020-ST, Shall Be Used.
2. Concrete Shall Be Oregon Standard
Commercial Grade Concrete (3,000 psi).
A. Broom Finish
3. Expansion Joints.
A. To Be Provided:
 - 1) At Each Cold Joint.
 - 2) At Each End Of Driveways.
 - 3) At Each Side Of Inlet Structures.
 - 4) At Each Point Of Tangency Of The Curb.
 - 5) At Locations Necessary To Limit Spacing To 200 Feet.
 B. Material To Be Pre-Molded, Asphalt Impregnated, Non-Extruding,
With A Thickness of 1/2 Inch.
4. Contraction Joints.
A. Spacing To Be Not More Than 10 Feet.
B. The Depth Of The Joint Shall Be At Least 1/3 Depth Of Concrete.
C. Weepholes To Be Centered With Contraction Joints.
D. Weepholes To Be Located As Close As Possible To Property Lines.
5. Base Rock To Be 1-1/2" - 0" Or 3/4" - 0" Compacted To 100% Of AASHTO
T-99 And Shall Be To Subgrade, Street Structure, Or 4" In Depth,
Whichever Is Greater.
6. Drainage Blockout
A. 3" I.D. Plastic Pipe With Coupling.
B. Drainage Access Thru Existing Curb Shall Be Core Drilled Or Curb Saw
Cut Vertically 18" Each Side Of Drain And Repoured To Full Depth
Of Curb (See Detail - A).



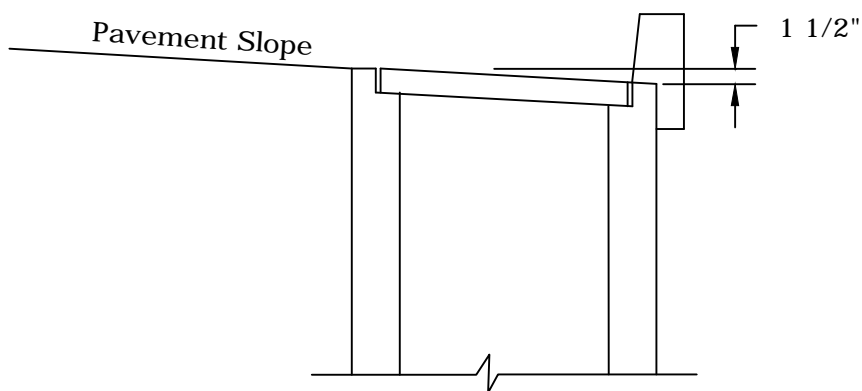
DETAIL - A



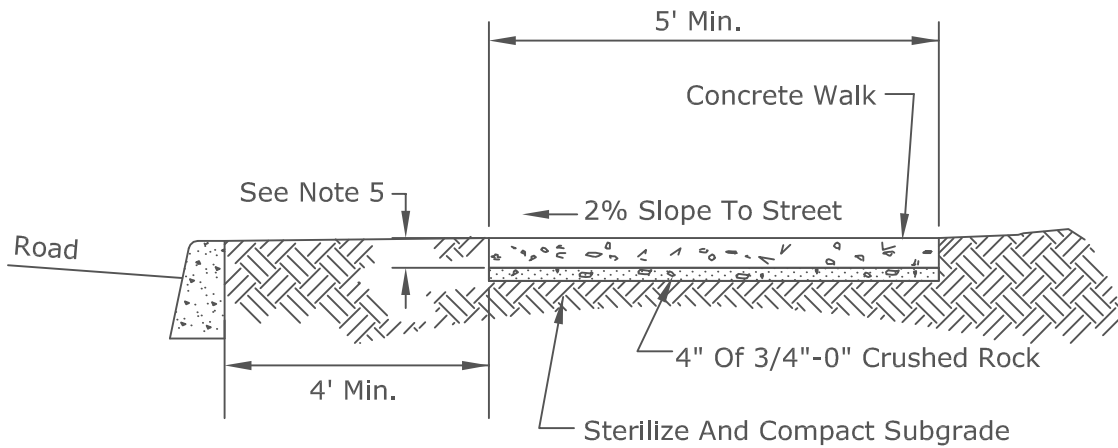
PLAN VIEW - STANDARD CURB AND GUTTER



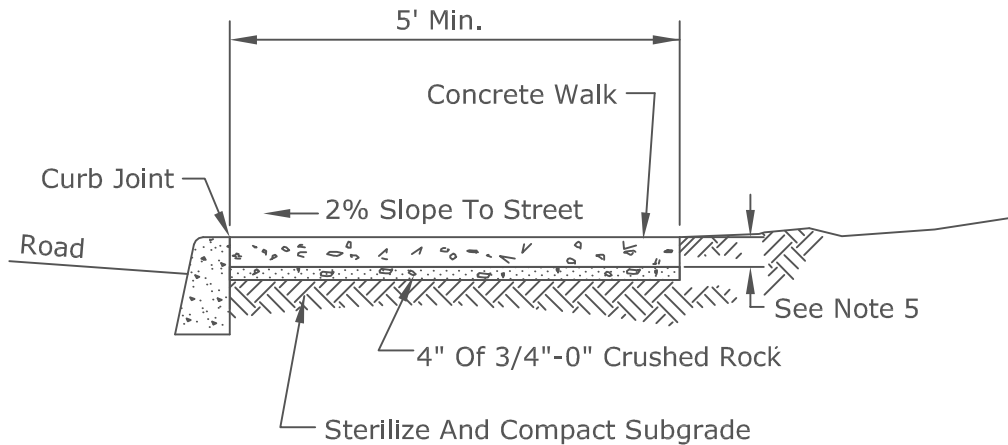
SECTION A-A



SECTION B-B



SIDEWALK AWAY FROM CURB



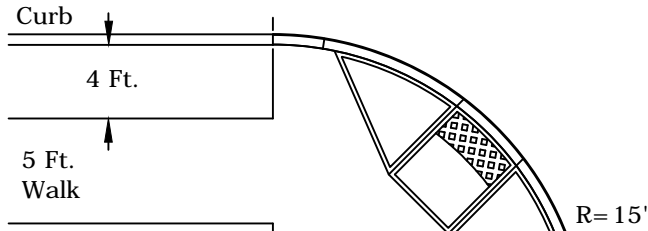
SIDEWALK ADJACENT TO CURB

Notes:

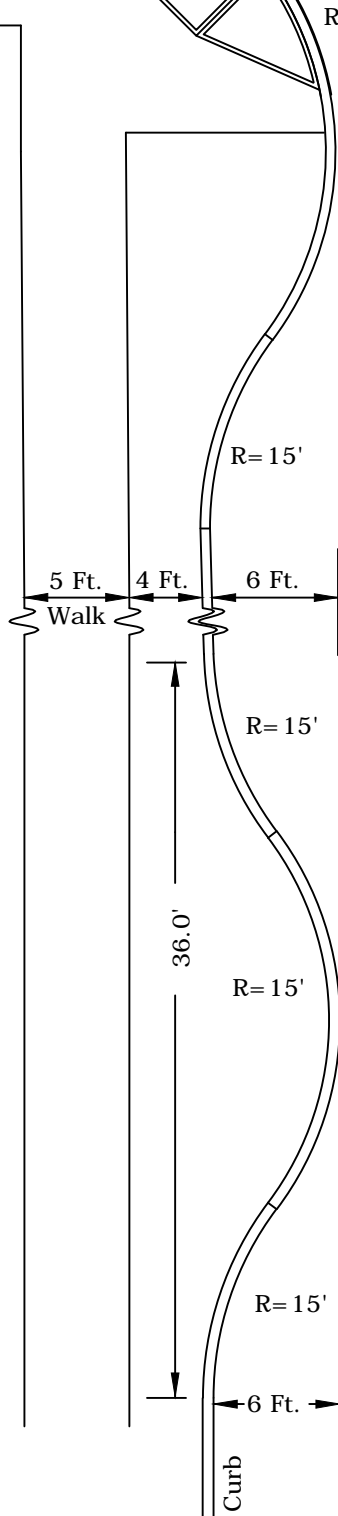
1. Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
2. Panel Dimensions To Be Nominal 5 Feet Or As Directed By Engineer. Perimeters Of Each Panel Shall Be Trowel Finished (shined). All Panels Shall Have A Broom Finish. Panels shall be scored in 2', 2.25' or 2.5' squares.
3. Expansion Joints To Be Placed Adjacent To Driveway Approaches, Utility Vaults, Drainage Inlets, Sidewalk Ramps, Curb Joints And At Spacing Not To Exceed 200 Feet.
4. Sidewalk Edges Shall Be Troweled With A Minimum 1/2" Radius.
5. Sidewalk Shall Have A Minimum Thickness Of 6 Inches (See Structural Sections In Standard Drawings 1020-ST And 1030-ST) If Mountable Curb Is Used, Or If Sidewalk Is Intended As Portion Of Driveway. Otherwise Sidewalk Shall Have Minimum Thickness Of 4 Inches.
6. Drain Blockouts In Curbs Shall Be Extended To Back Of Sidewalk With 3" Dia. Plastic Pipe At 2% Slope. Construction Joint To Be Placed Over Pipe.
7. At Each CG-30 And CG-48 Inlet Location, Place A 10 Ft. Long #4 Bar Centered Between Back Of The Inlet Structure And Back Of Walk. Install Joints And Rebar At Direction Of Engineer.

CURB EXTENSION

CORNER CURB EXTENSION

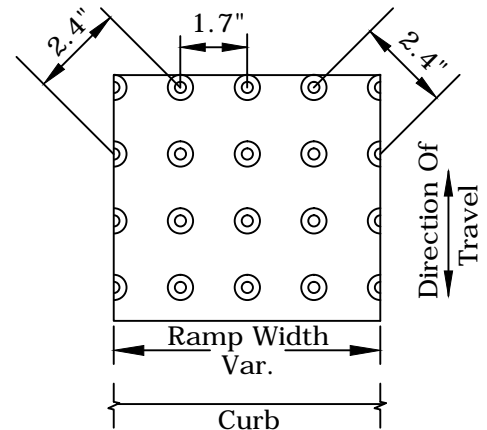


MID-BLOCK CURB EXTENSION



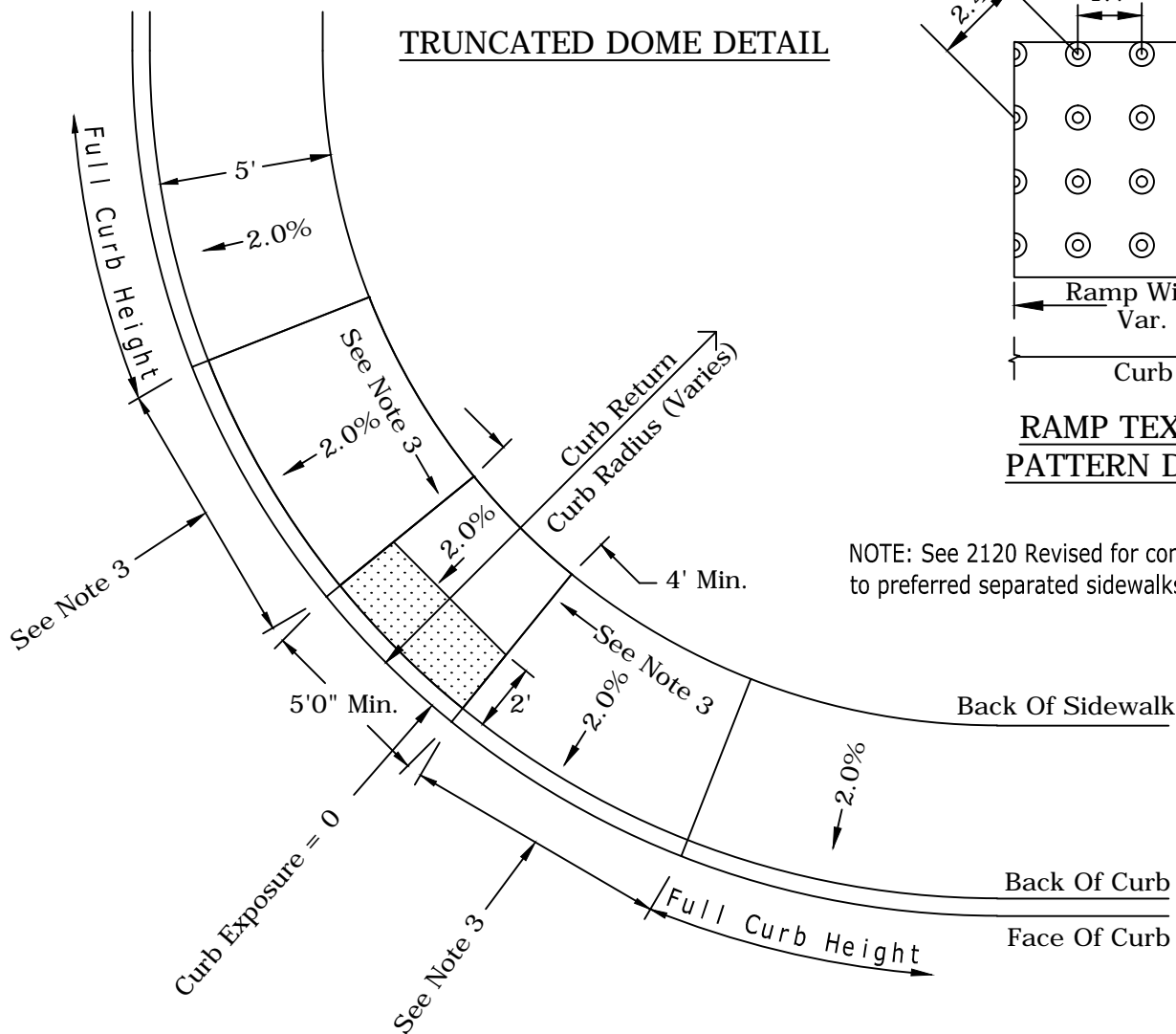
NOTES:

- 1) Extensions Are Intended To Simulate A Parked Vehicle, Therefore Shall Only Be Allowed In Conjunction With On-Street Parking.
- 2) Extensions Shall Be Landscaped With Low Growing Vegetation So As To Not Restrict Sight Distance.
- 3) Intersection Radii Shall Be Checked To Assure Safe Passage Of The Design Vehicle. In All Cases, Emergency Vehicles Shall Be Accomodated.
- 4) Drainage Shall Be Addressed With The City.
- 5) On 28 Ft. Wide Streets, Curb Extensions Will Not Be Allowed Within 50 Ft. Of The Intersection Due To The Turning Radius For Emergency Vehicles.

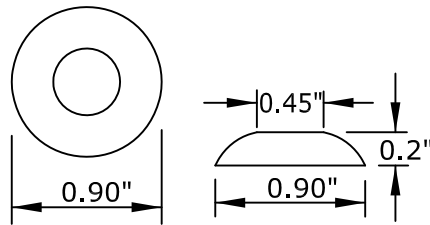


RAMP TEXTURE PATTERN DETAIL

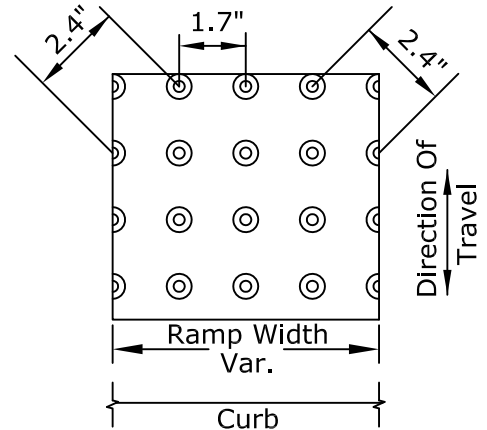
NOTE: See 2120 Revised for connectivity to preferred separated sidewalks.



- 1) Place Truncated Dome Detectable Warning Texture In The Lower 24" Of The Throat Of The Ramp Only. Arrange Domes Using In-line Pattern Only As Shown In Detail. Color Of Texture To Be Safety Yellow. For Construction Of Sidewalk Ramps Outside Of Public Right-of-Way, Check With State Building Codes.
- 2) For Alternate Curb Ramp Designs See Oregon Standard Drawings. Alternate Curb Ramp Designs Requires The City Engineer of Record's Approval Of A Design Exception.
- 3) The Curb Ramp Sidewalk Wing Slopes Shall Not Be Steeper Than 12H:1V Relative To The Horizontal Plane And The Longitudinal Length Of The Wings Shall Be A Minimum Of 3' To A Maximum Of 15'. If These Parameters Cannot Be Met, A Design Exception May Be Submitted for review by City Engineer of Record.

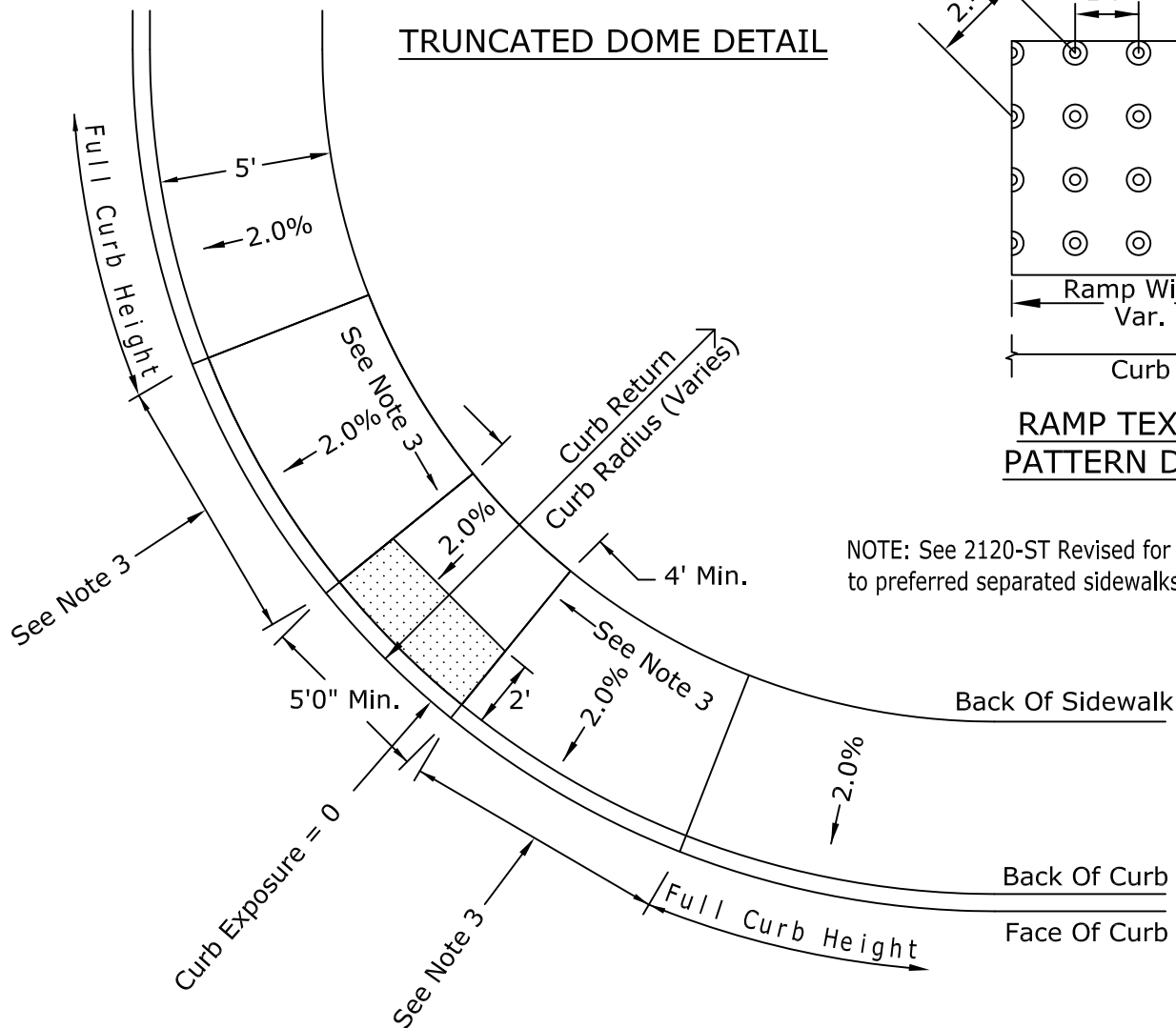


TRUNCATED DOME DETAIL



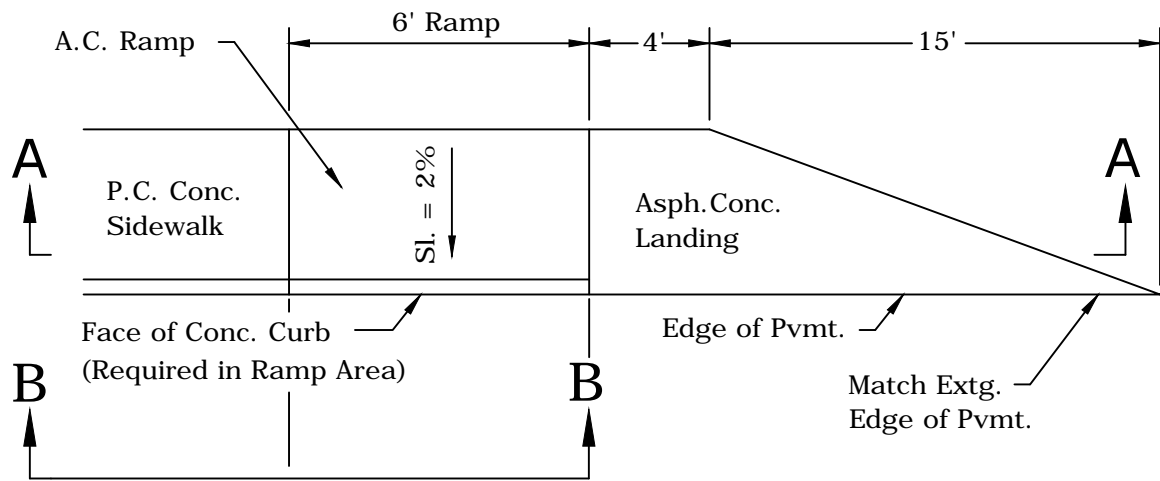
RAMP TEXTURE PATTERN DETAIL

NOTE: See 2120-ST Revised for connectivity to preferred separated sidewalks.

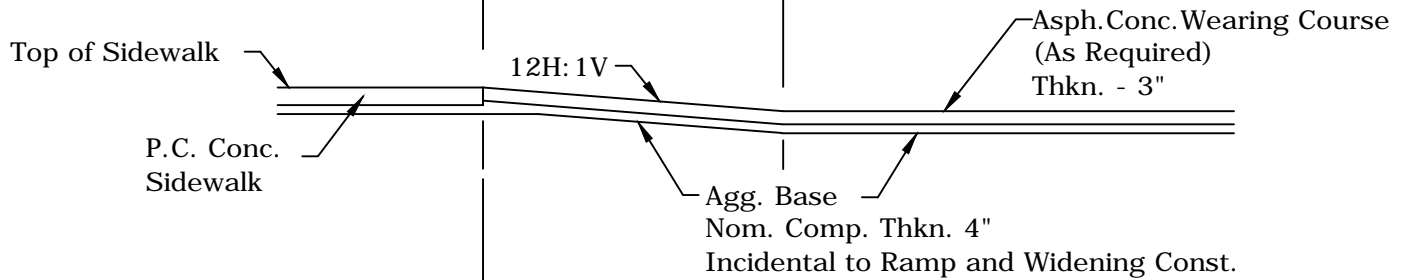


NOTES:

- 1) Place Truncated Dome Detectable Warning Texture In The Lower 24" Of The Throat Of The Ramp Only. Arrange Domes Using In-line Pattern Only As Shown In Detail. Color Of Texture To Be Safety Yellow or Brick Red per PW Director approval. For Construction Of Sidewalk Ramps Outside Of Public Right-of-Way, Check With State Building Codes.
- 2) For Alternate Curb Ramp Designs See Oregon Standard Drawings. Alternate Curb Ramp Designs Requires The City Engineer of Record's Approval Of A Design Exception.
- 3) The Curb Ramp Sidewalk Wing Slopes Shall Not Be Steeper Than 12H:1V Relative To The Horizontal Plane And The Longitudinal Length Of The Wings Shall Be A Minimum Of 3' To A Maximum Of 15'. If These Parameters Cannot Be Met, A Design Exception May Be Submitted for review by City Engineer of Record.



PLAN



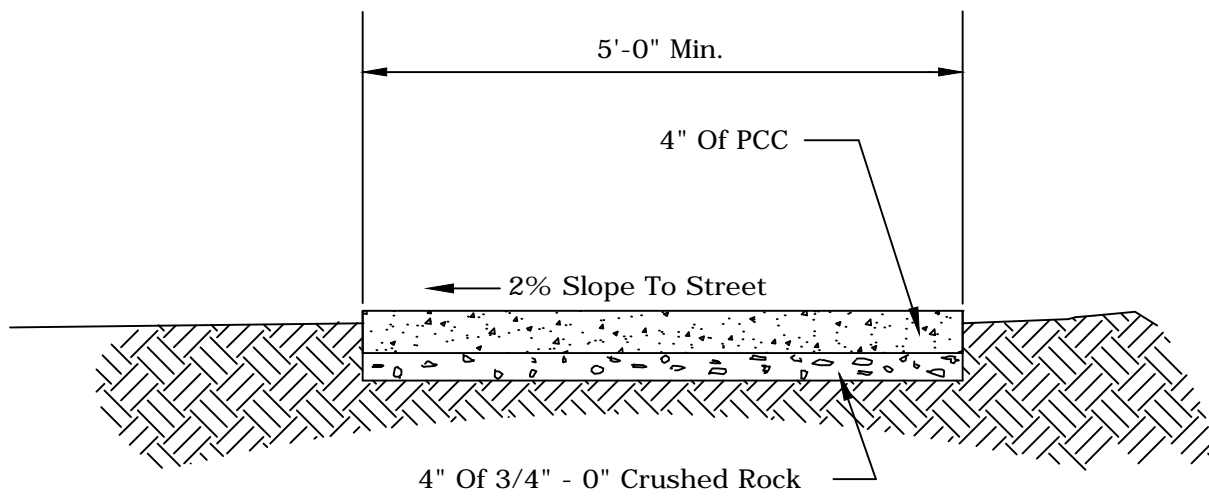
SECTION A-A



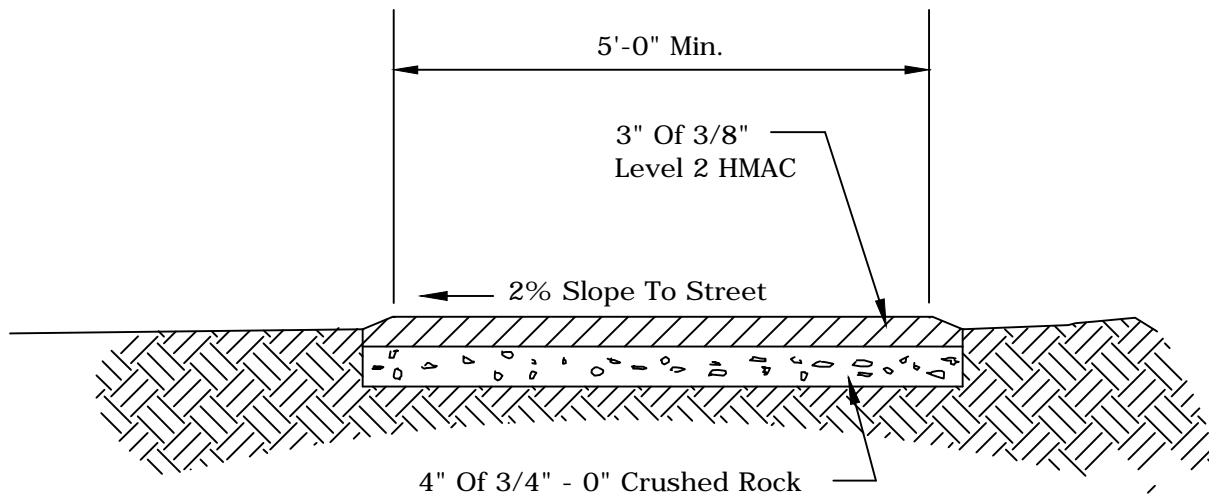
CURB ELEVATION B-B

ASPHALT CONCRETE SIDEWALK RAMP (FOR ENDS OF SIDEWALKS)

N.T.S.



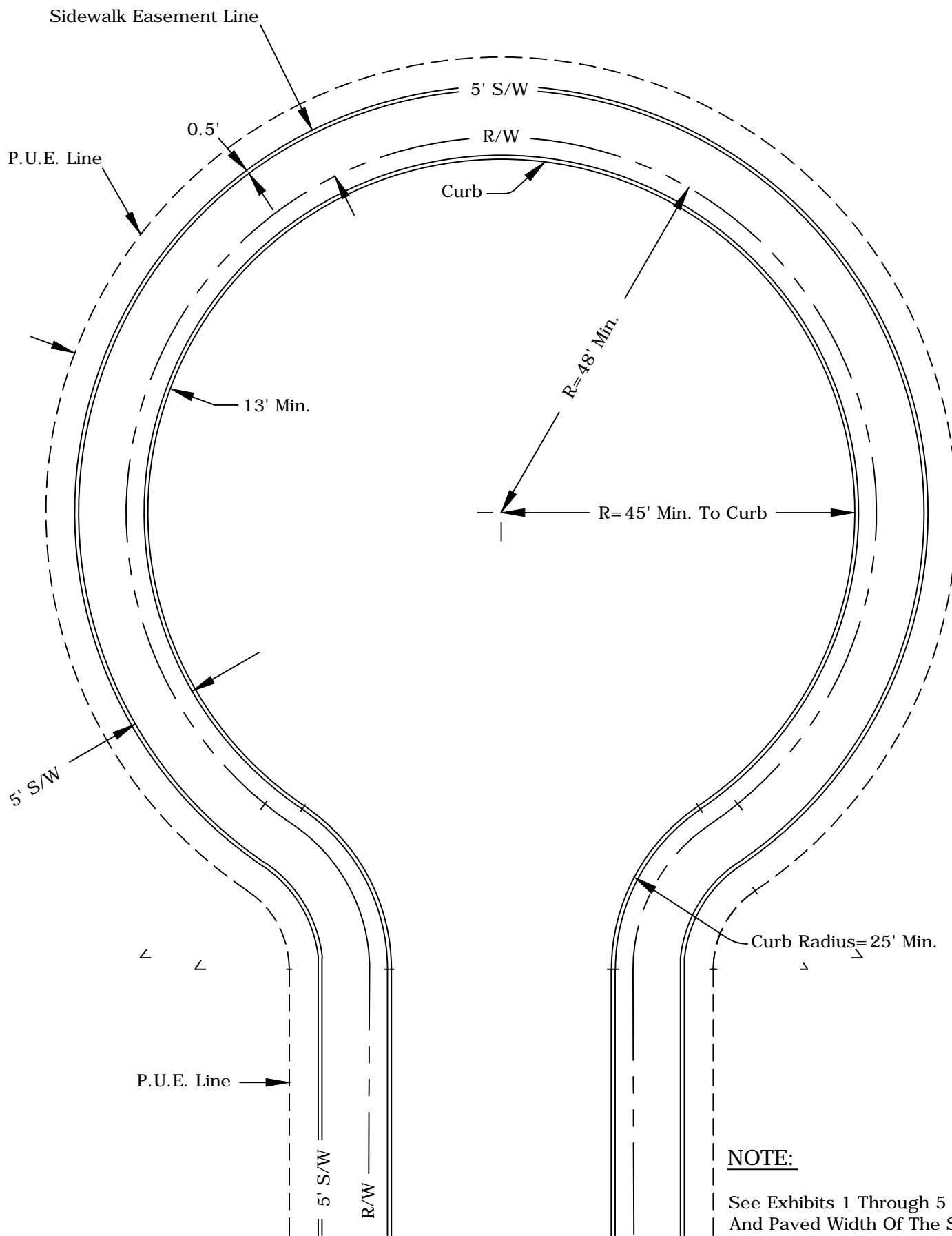
PORTLAND CEMENT CONCRETE



ASPHALTIC CONCRETE

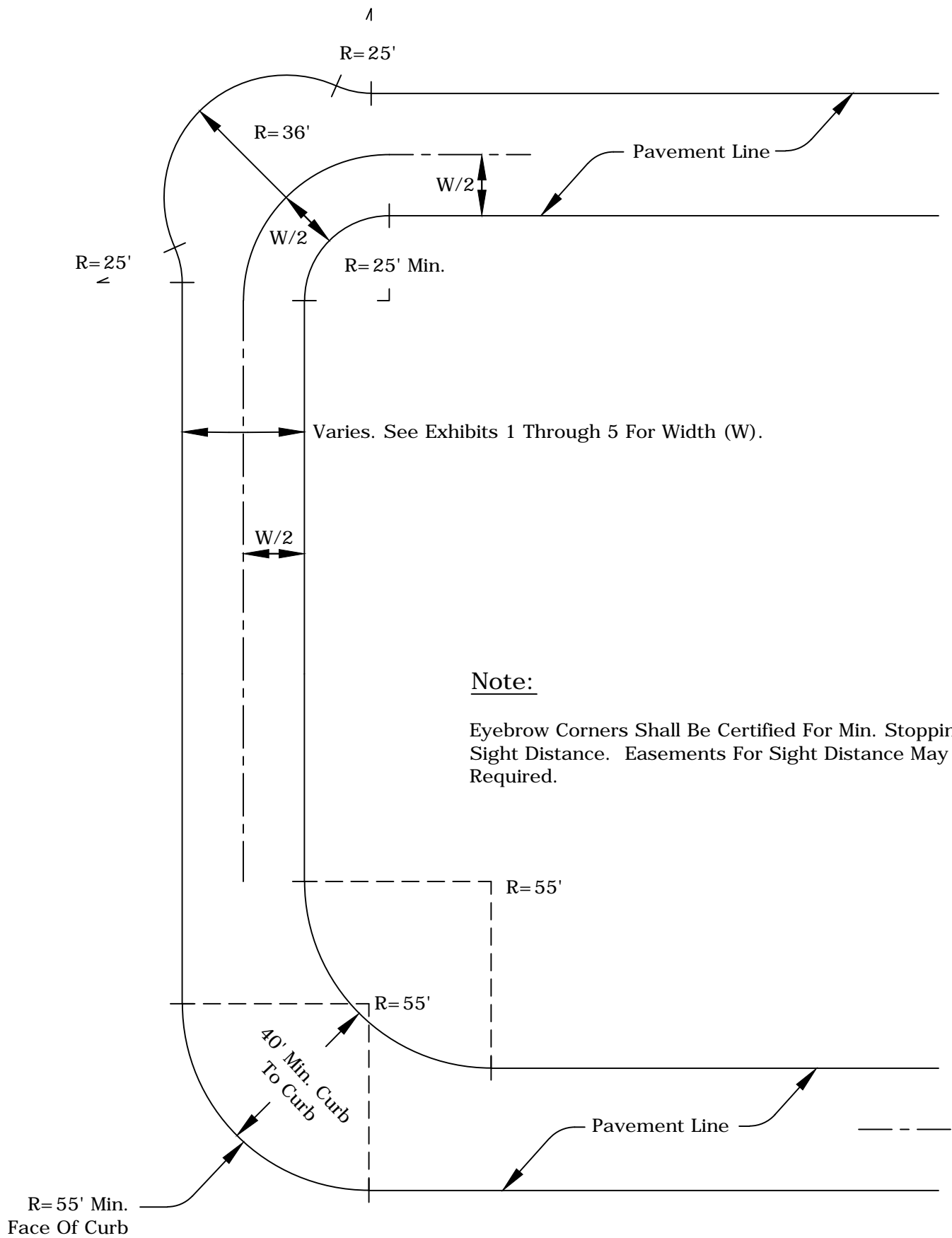
NOTES:

1. Concrete Shall Be Oregon Standard Commercial Grade Concrete (3,000 psi).
2. P.C. Concrete Panels Shall Be Square, Deep Cut Contraction Joints At 5 Foot Intervals, Edged On 4 Sides And Have A Light Broom Finish.
3. In Both Cases Sterilize And Compact Subgrade.



NOTE:

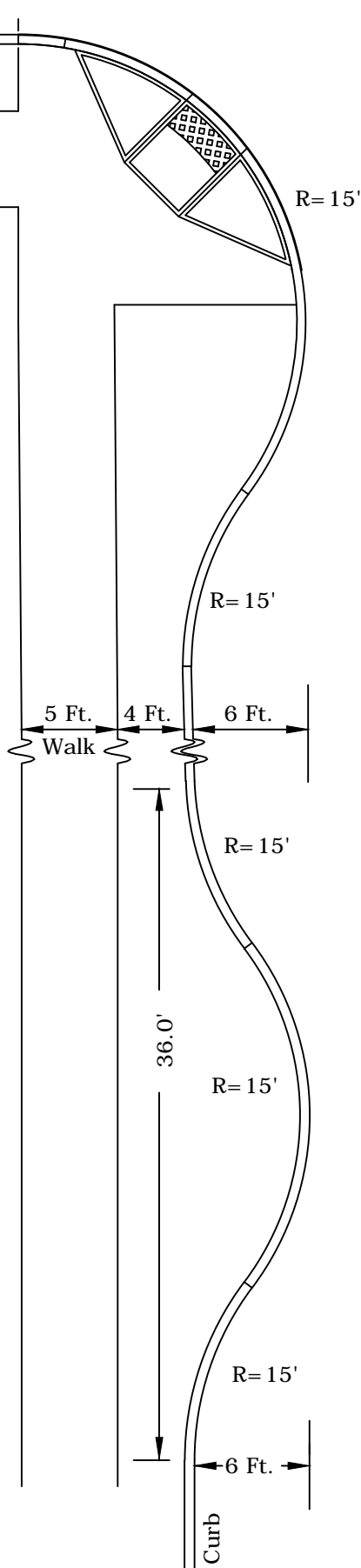
See Exhibits 1 Through 5 for R/W
And Paved Width Of The Street.



CURB EXTENSION

CORNER CURB EXTENSION

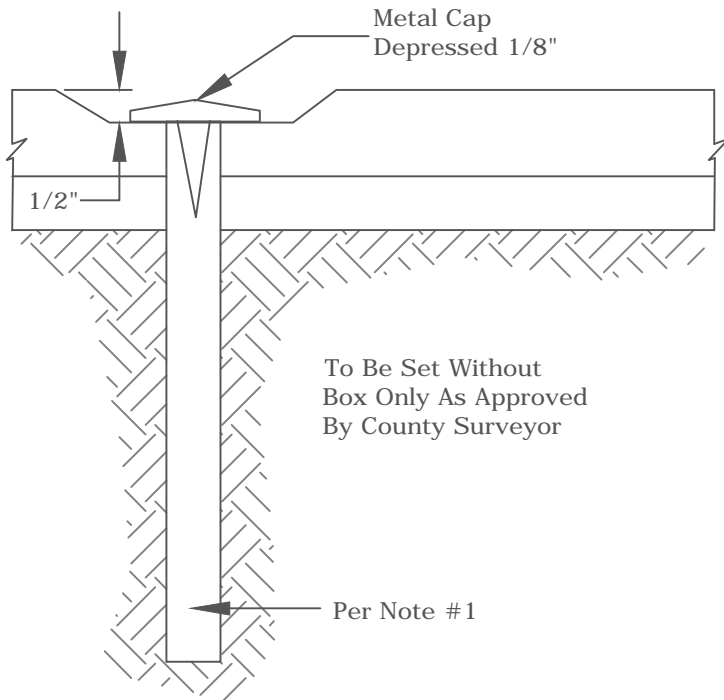
MID-BLOCK CURB EXTENSION



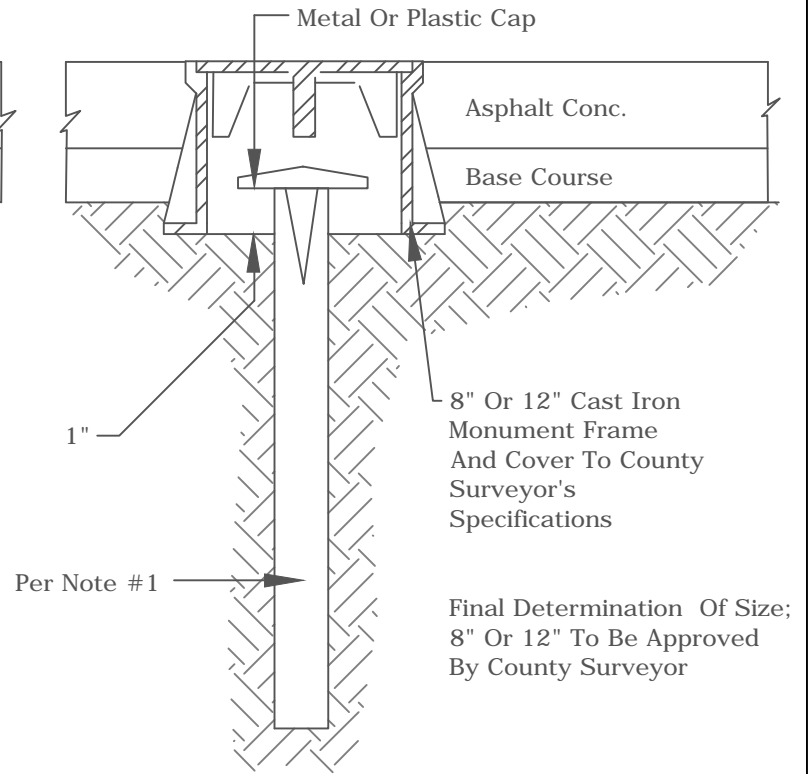
NOTES:

- 1) Extensions Are Intended To Simulate A Parked Vehicle, Therefore Shall Only Be Allowed In Conjunction With On-Street Parking.
- 2) Extensions Shall Be Landscaped With Low Growing Vegetation So As To Not Restrict Sight Distance.
- 3) Intersection Radii Shall Be Checked To Assure Safe Passage Of The Design Vehicle. In All Cases, Emergency Vehicles Shall Be Accomodated.
- 4) Drainage Shall Be Addressed With The City.
- 5) On 28 Ft. Wide Streets, Curb Extensions Will Not Be Allowed Within 50 Ft. Of The Intersection Due To The Turning Radius For Emergency Vehicles.

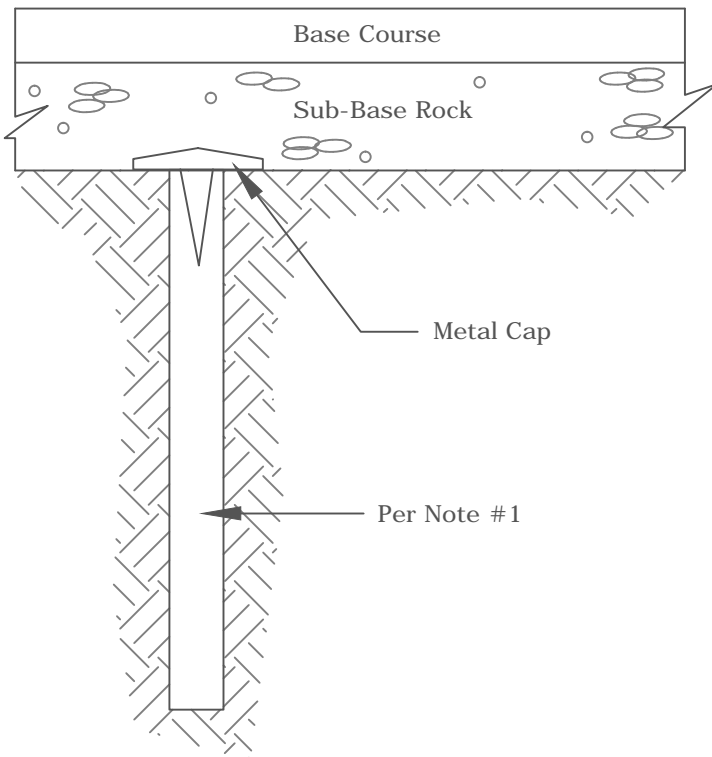
A. FOR USE IN PAVED ROADS



B. FOR USE IN PAVED ROADS



C. FOR USE IN GRAVEL ROADS



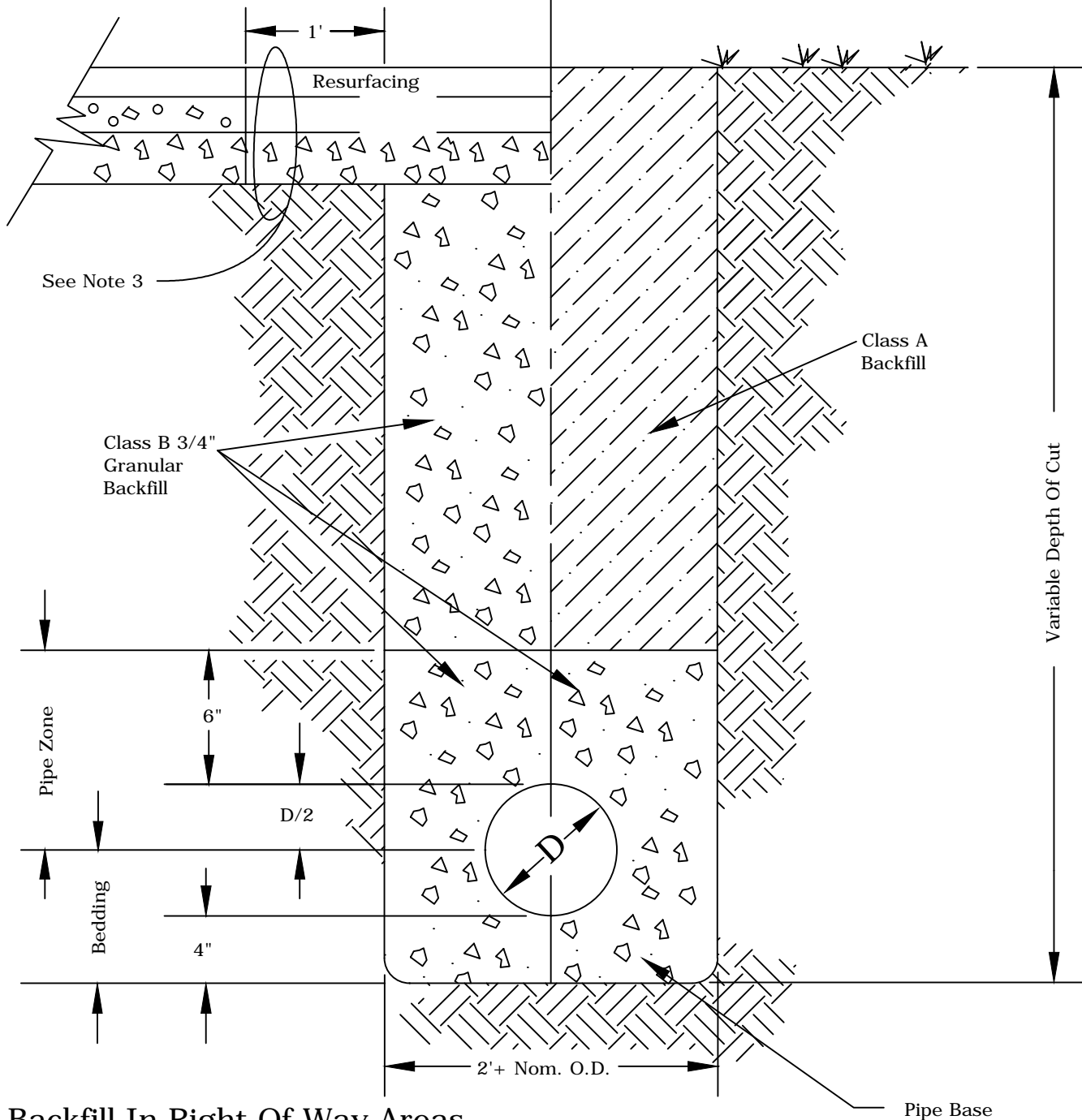
Note #1:

All Monuments Shall Use Either 5/8" Dia. X 30" Long Iron Rod Or 3/4" Inside Dia. X 30" Long Galvanized Iron Pipe.

Any Monuments That May Be Subject To Destruction Or Disturbance Shall Be Protected In Accordance With ORS 140, ORS 150 And ORS 155.

RIGHT-OF-WAY AREAS

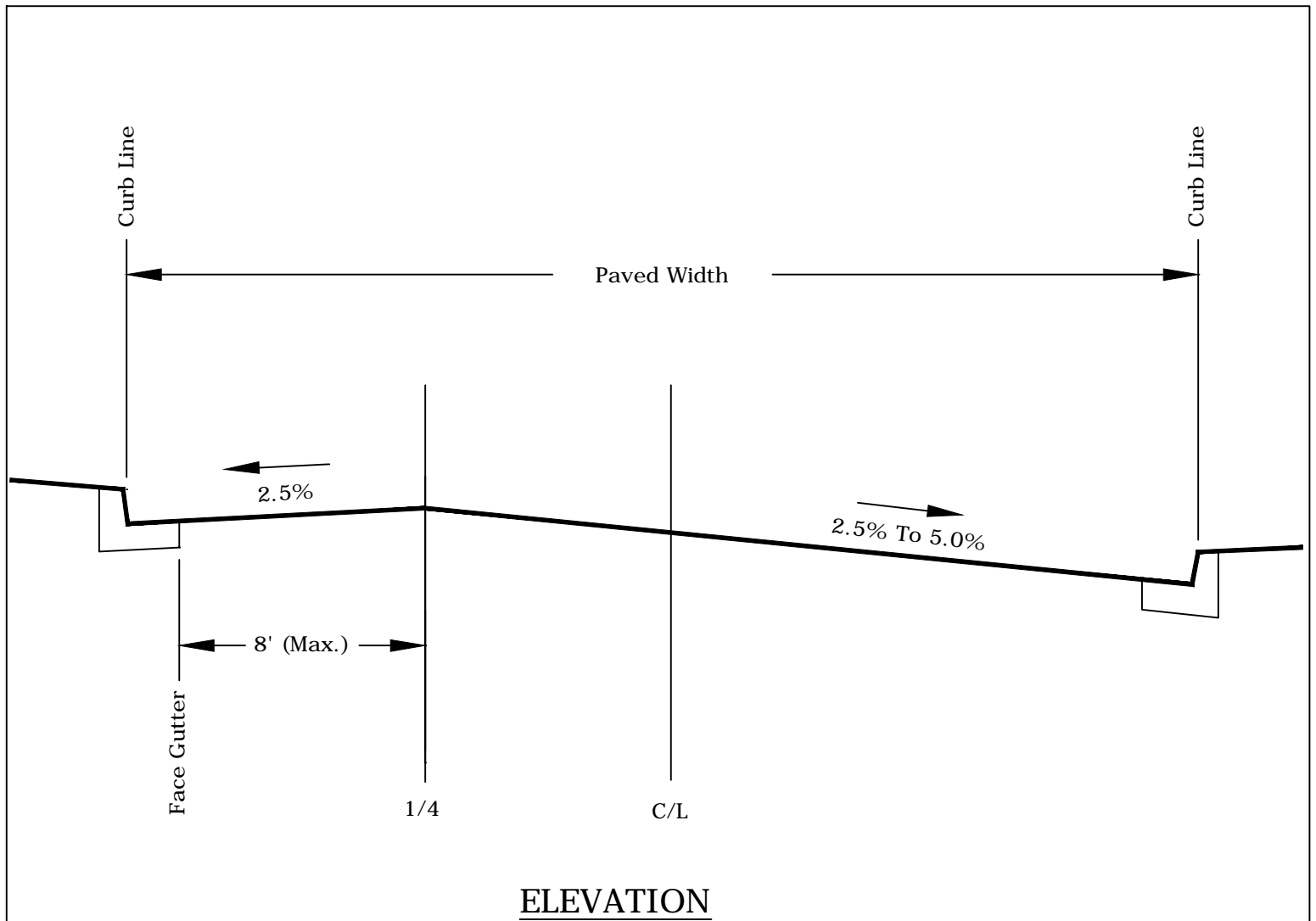
OUT OF RIGHT-OF-WAY AREAS



Backfill In Right Of Way Areas

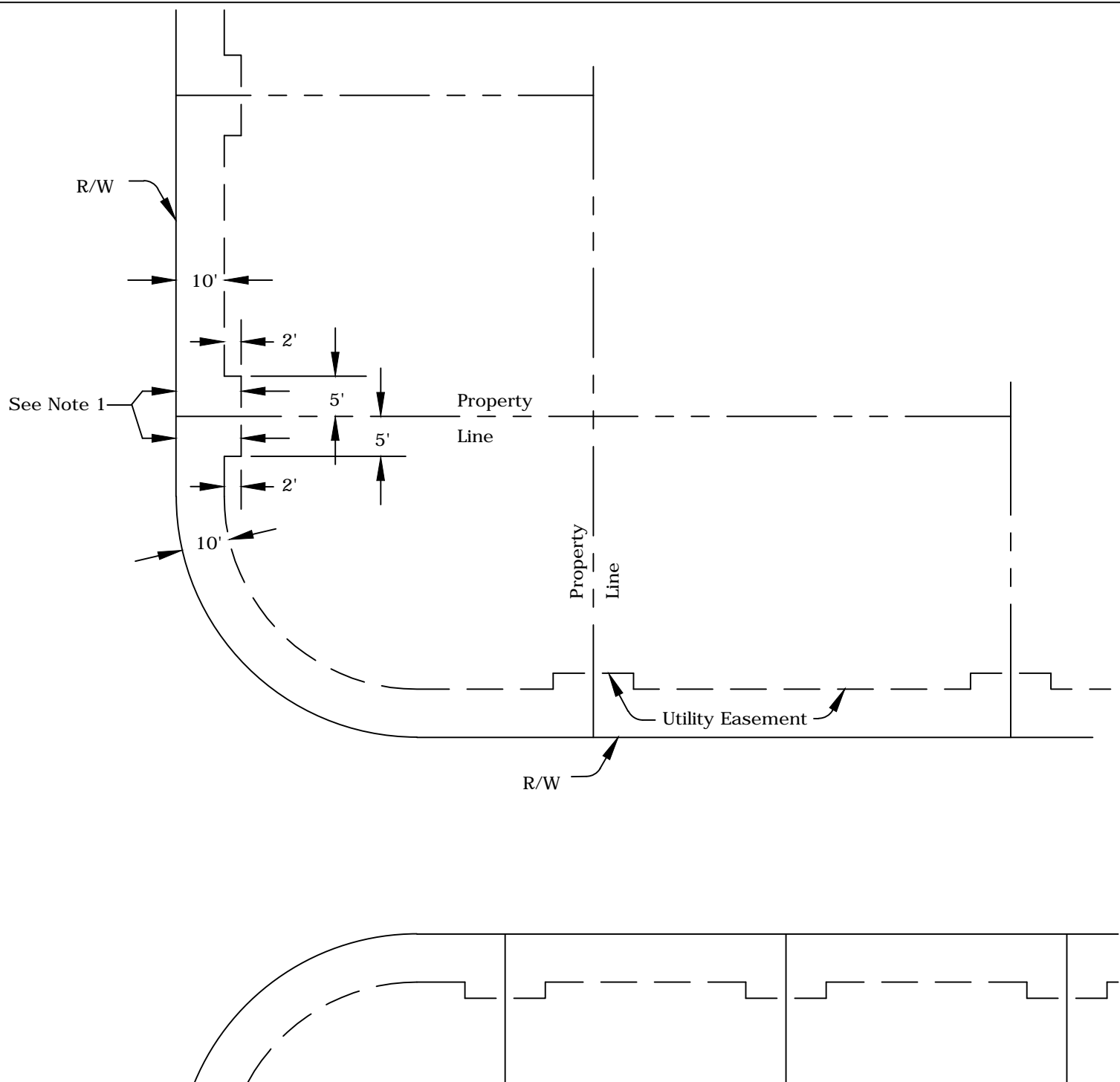
NOTE:

1. Minimum Backfill Compaction Requirements: Top 3' Of Backfill, 95% Of T-99; Below 3', 90% Of T-99.
2. After Backfill And T-Cut Patch, A Mill And Fill 2" Thick May Be Required To Maintain The Travel Lane Integrity - Determined By City Engineer Of Record.
3. Restore With Design Or Existing Road Structural Section.



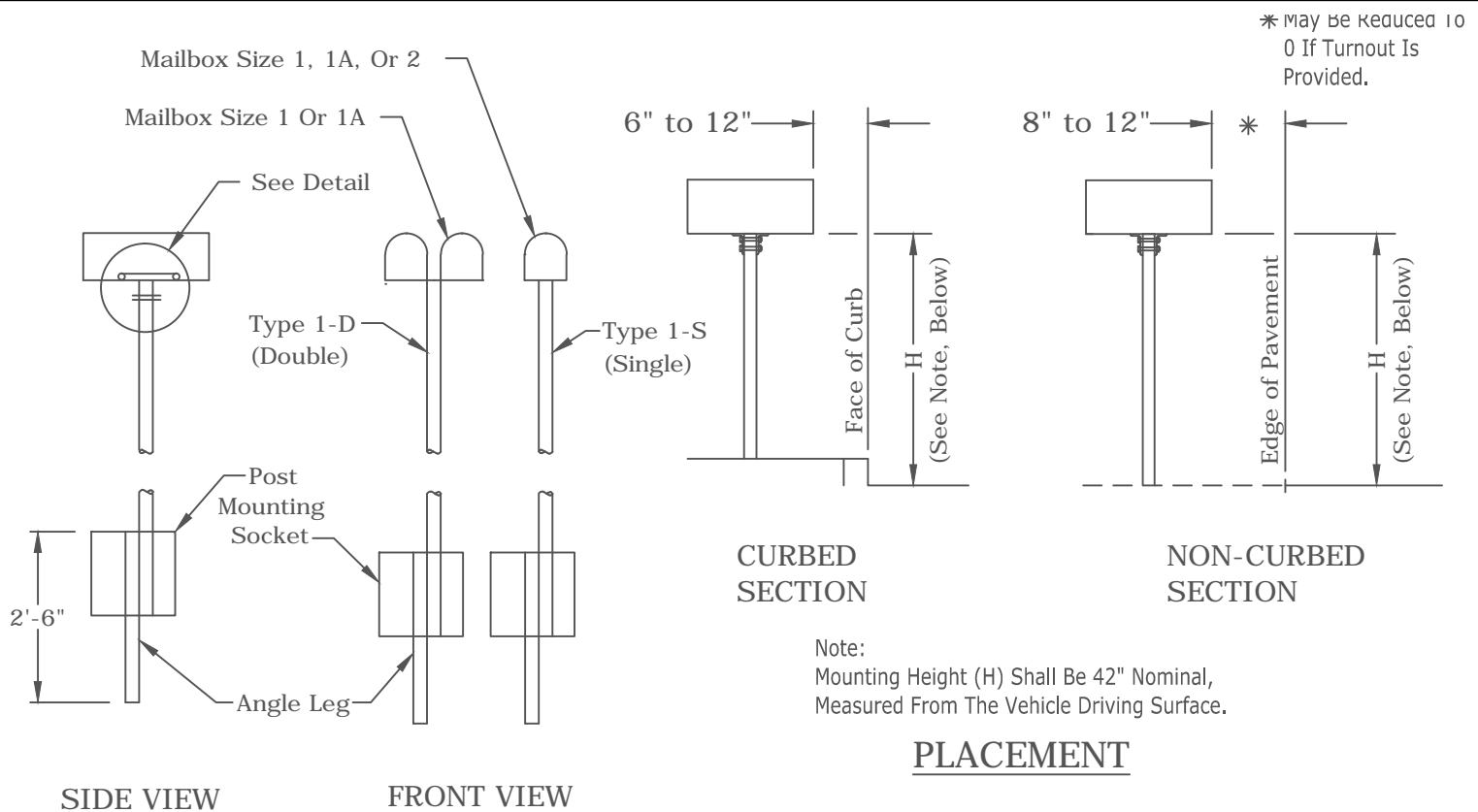
NOTES:

1. Offset Crown Cross-Sections May Be Used In Areas Of Substantial Cross Slope - At The Direction Of The City Engineer Of Record.
2. Offset Crown Cross-sections Shall Not Be Used To Increase Design Speed In Horizontal Curves. Superelevation Sections Shall Be Used For That Purpose.
3. Maximum Elevation Difference Of Curbs (Or Edge Of Pavement) Is Determined By Cross-Slopes And Width Of Street.



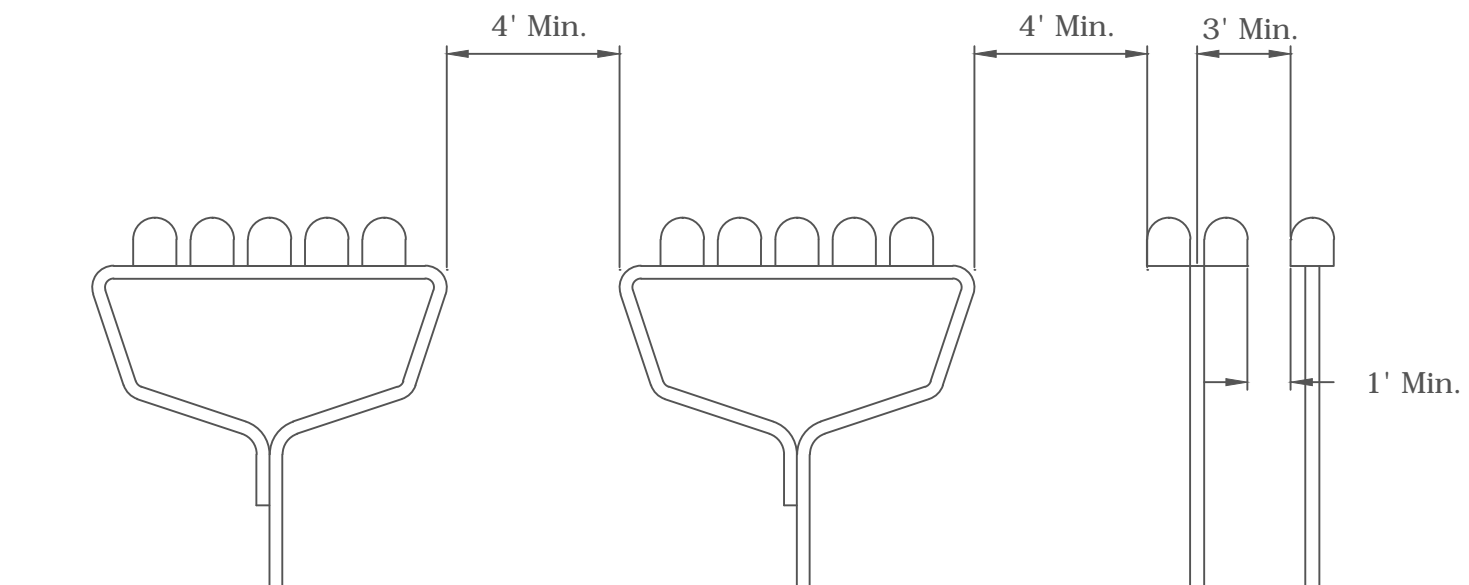
NOTE:

- 1) Easement Widths Are Minimums.
Easements Shall Be Sized To Contain Utility Facilities Installed Behind The Right-of-Way Line.



See Oregon Standard Drawings For Details And Notes.

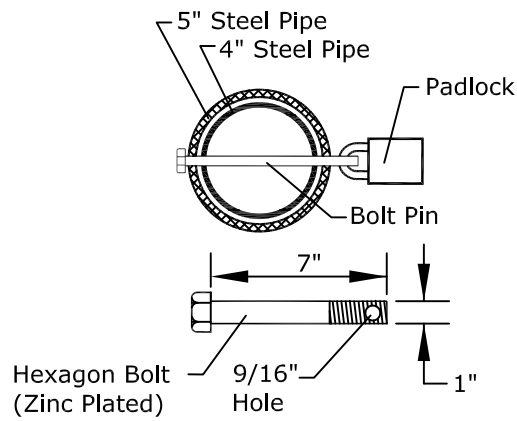
SINGLE OR DOUBLE SUPPORT



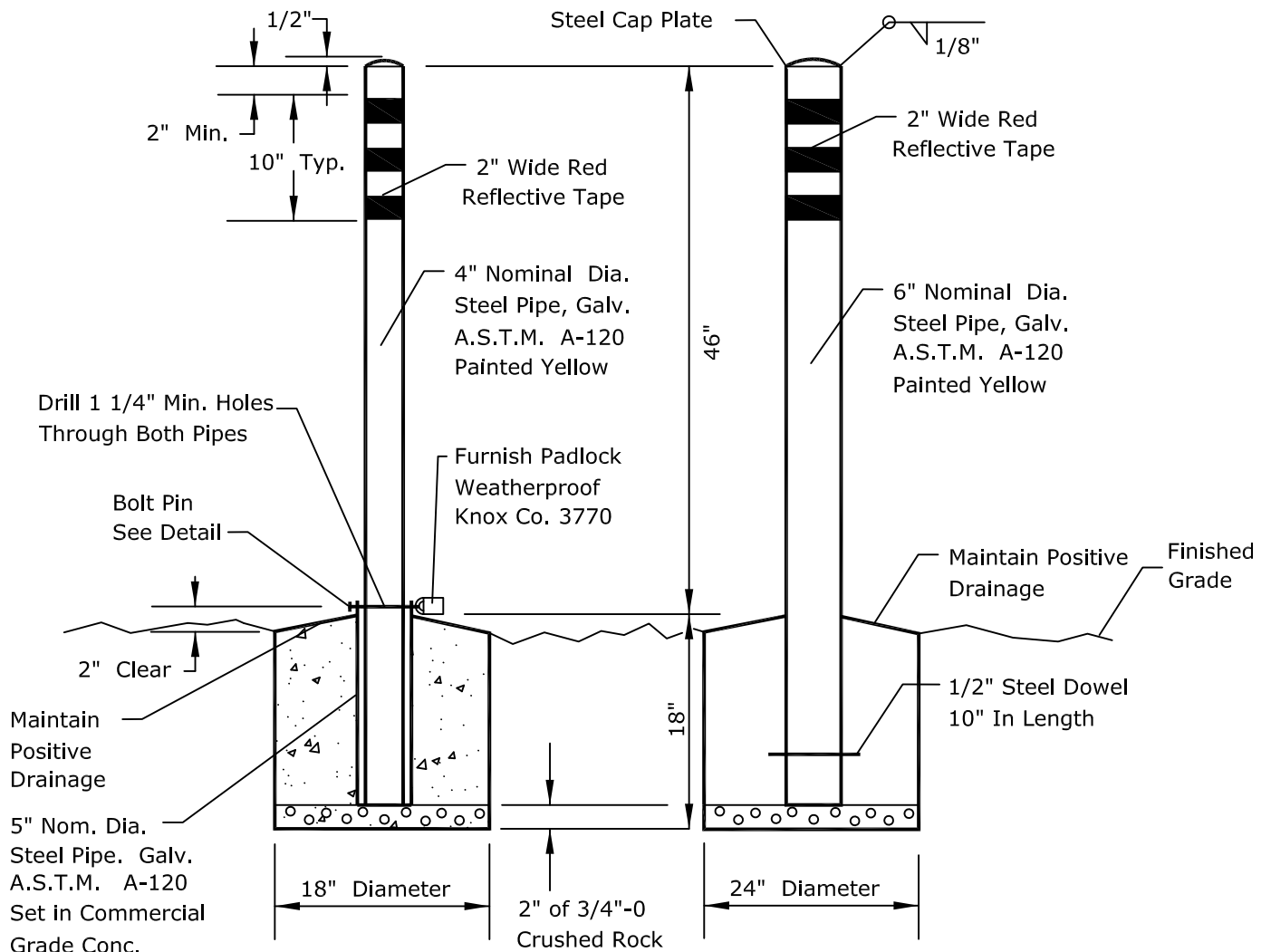
SUPPORT SPACING



REVISED 10-2014



BOLT PIN DETAIL
NTS



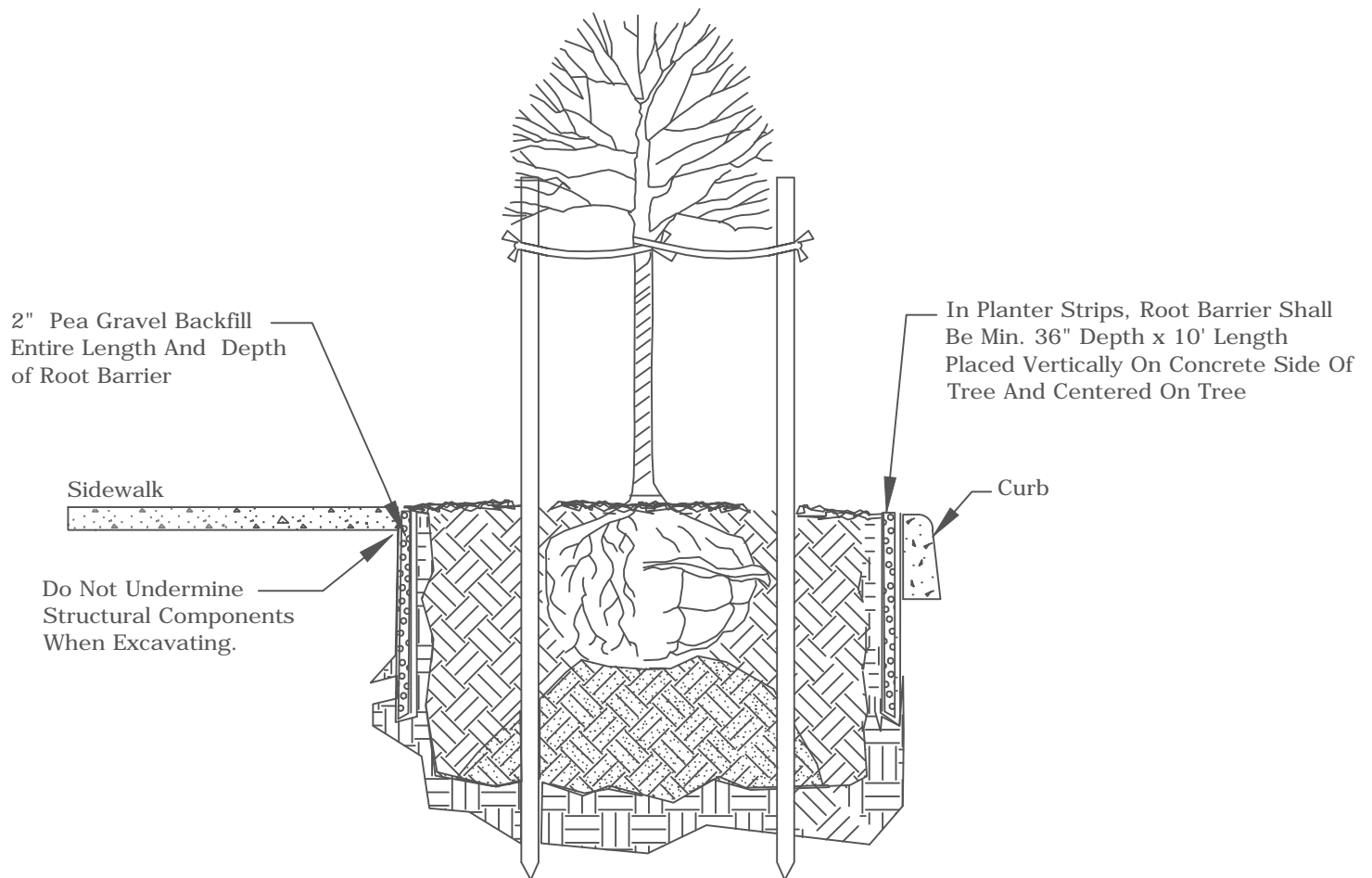
REMOVABLE

FIXED

VEHICLE BARRIER POST

NTS

NOTE: Brekaway alternatives may be approved by Public Works.



TREE ROOT BARRIER INSTALLATION

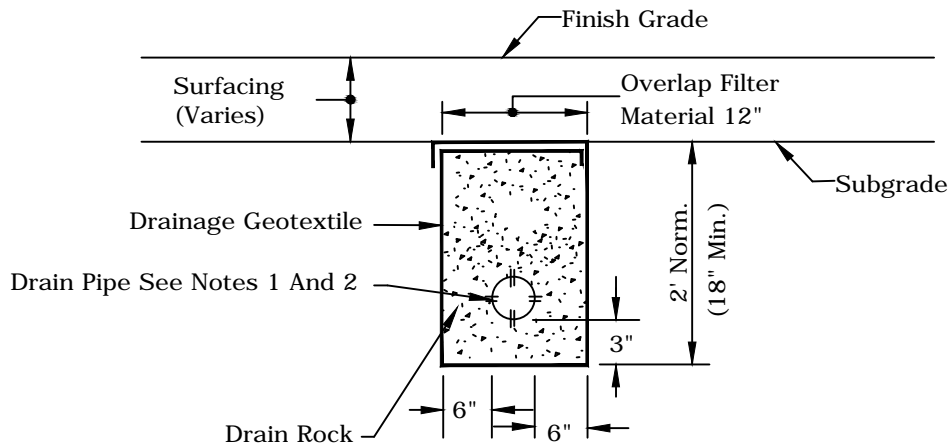
(Not to Scale)

NOTES:

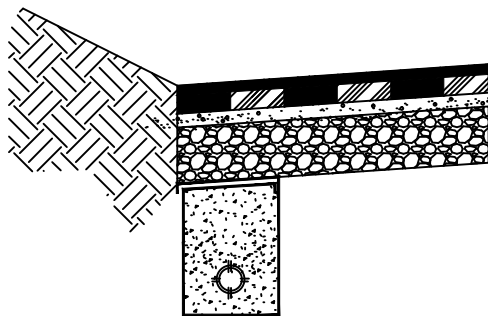
All Street Trees With Trunks Closer Than 4 Ft. To Paved Surfaces Shall Be Planted With Root Barrier Between the Root Ball And Paving.

Plantings Within Tree Wells Require Root Barriers Along All Sides Of The Tree Well.

Installation To Be Completed In Accordance With Manufacturer's Specifications.

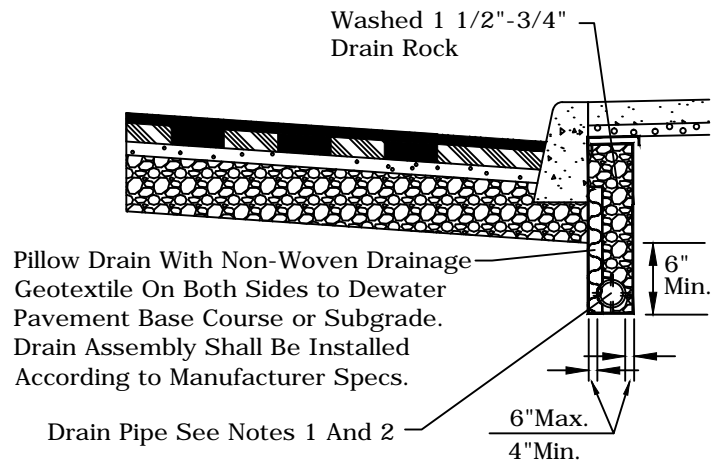


Note: Location Varies, Locate As Directed

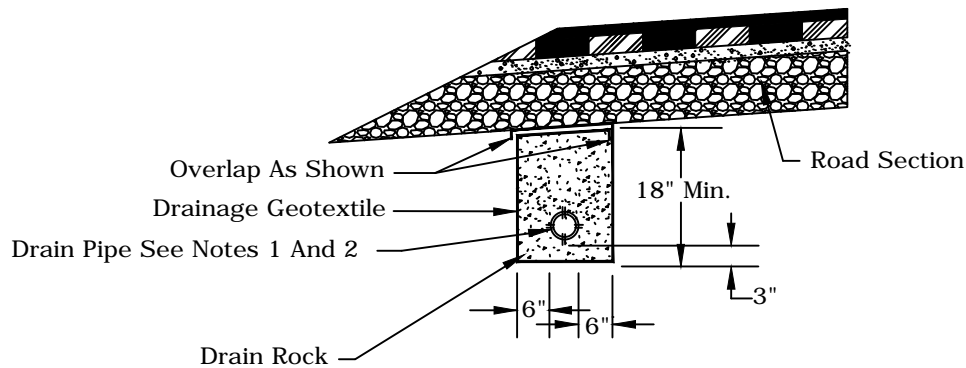


(For Subgrade Details See Rt.)

WITHOUT SHOULDER



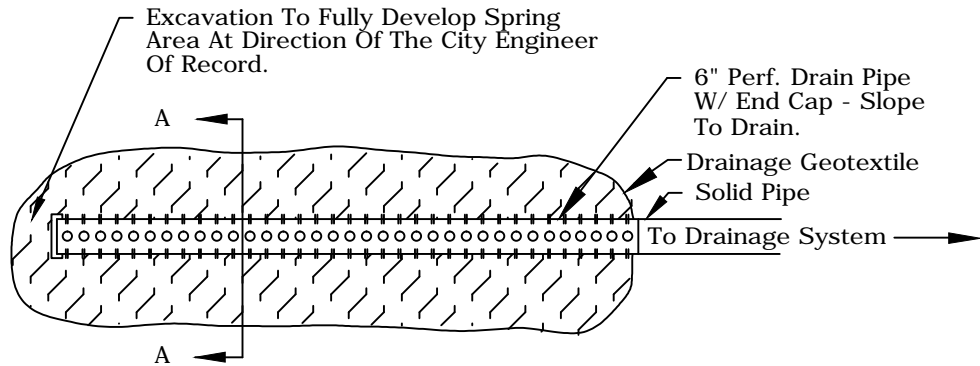
WITH CURB



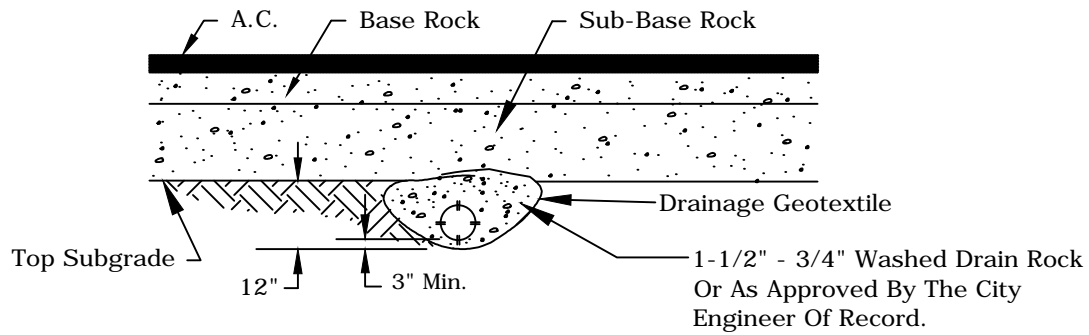
WITH SHOULDER
SUBGRADE DRAIN DETAIL
 N.T.S.

NOTES:

1. Use 4" Or 6" I.D. A.S.T.M. D-2729 Perforated P.V.C. Pipe As Directed By The City Engineer Of Record.
2. Connect Subgrade Drain Pipe To Drainage Structure Using Plastic Pipe With Coupling Matching The Drain Pipe Diameter.
3. Locate The Longitudinal Subgrade Drain On The Uphill Side Of The Road Or As Directed By The City Engineer Of Record.

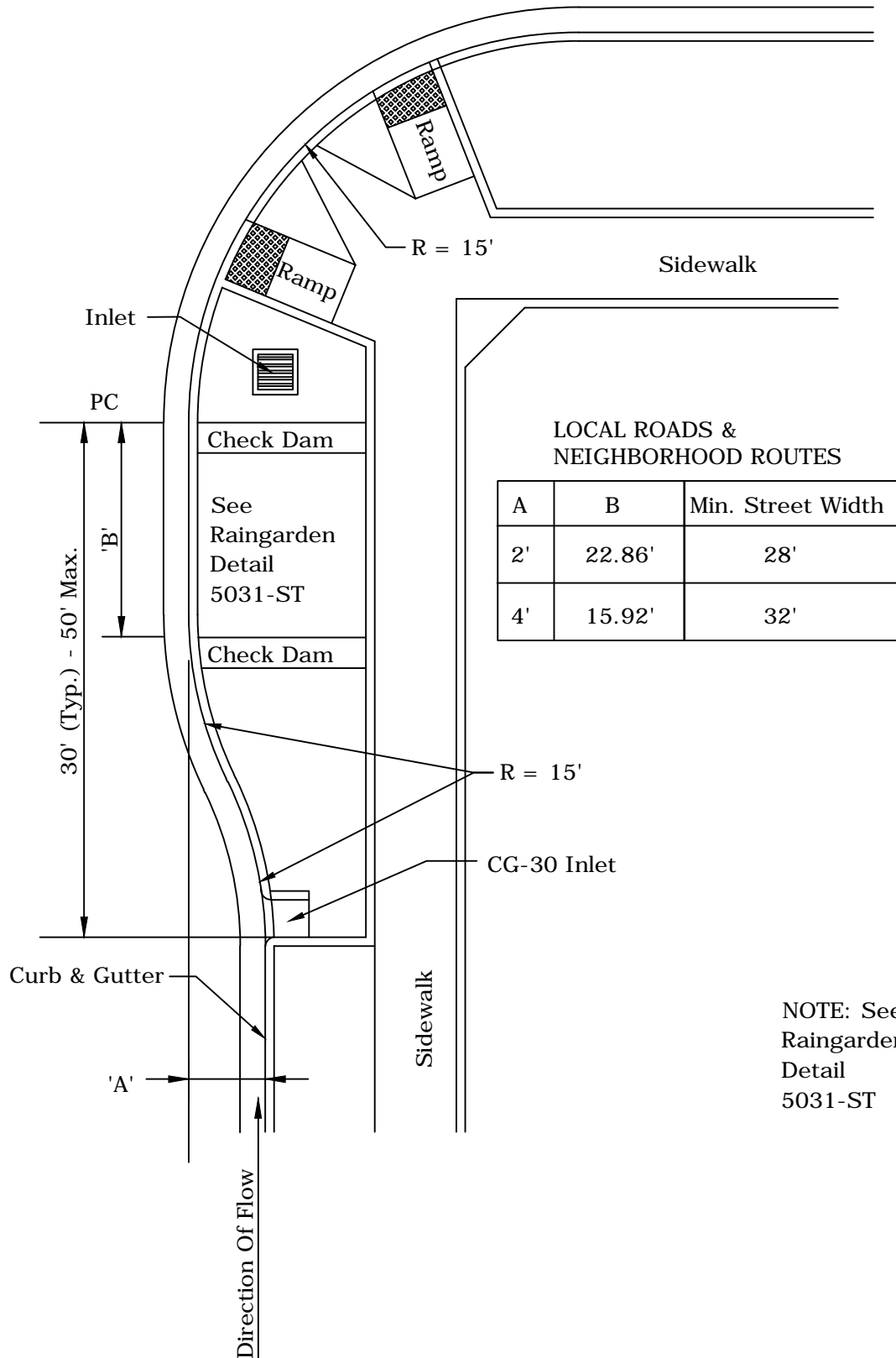


PLAN



SECTION A-A

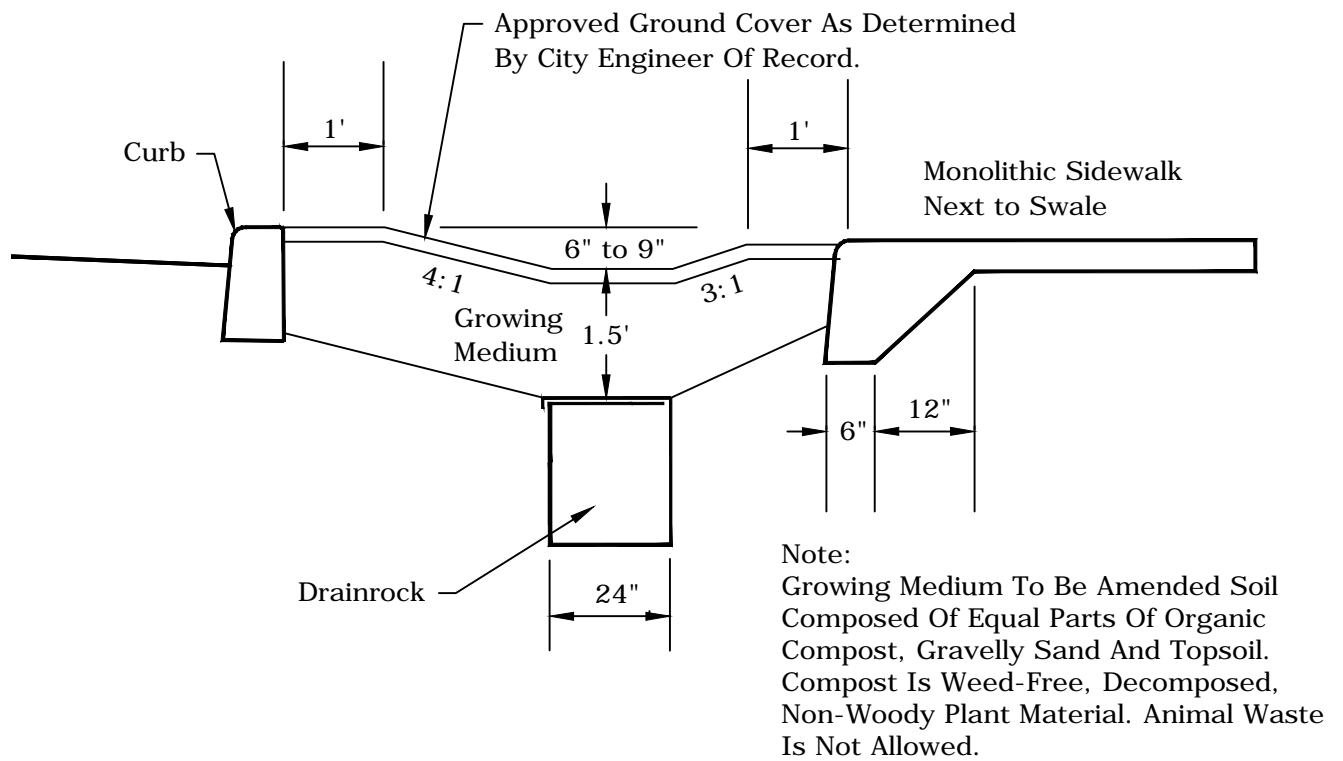
SPRING CATCHMENT DETAIL



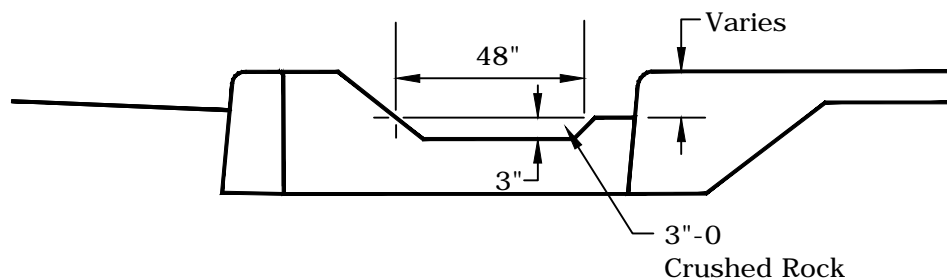
LOCAL ROADS & NEIGHBORHOOD ROUTES

A	B	Min. Street Width
2'	22.86'	28'
4'	15.92'	32'

NOTE: See
Raingarden
Detail
5031-ST

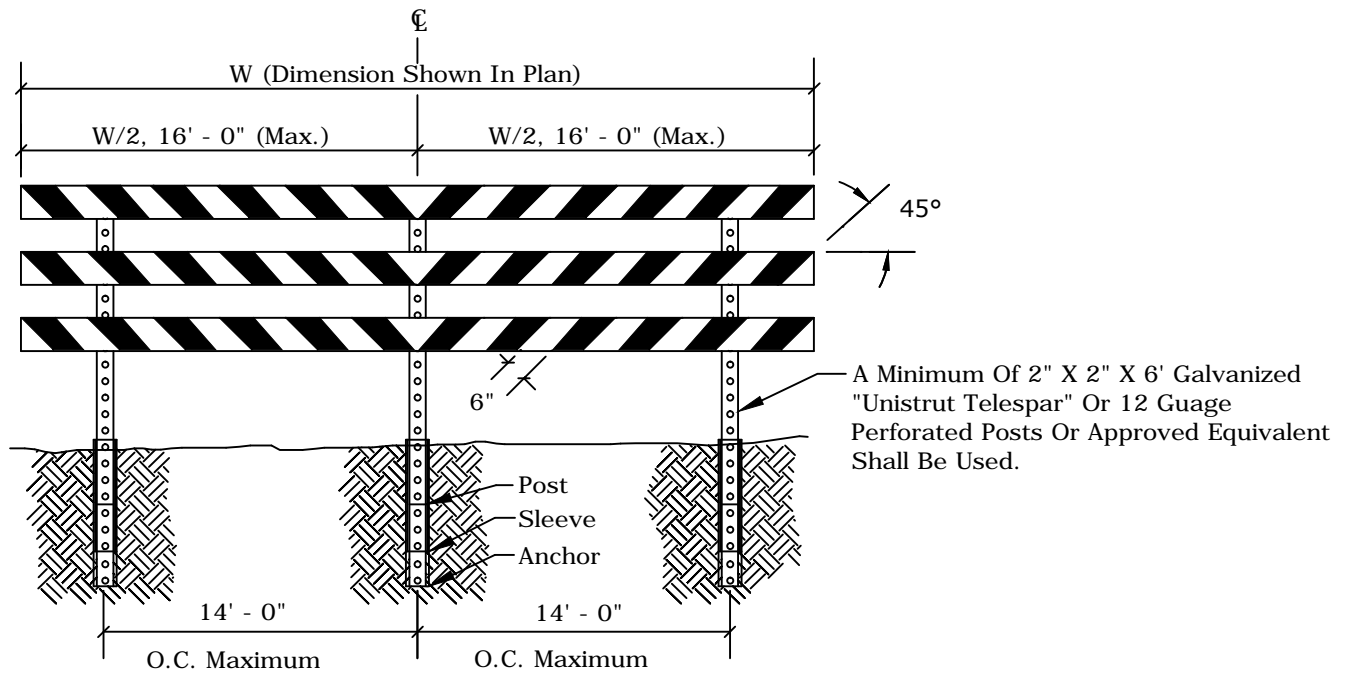


RAIN GARDEN TYPICAL SECTION

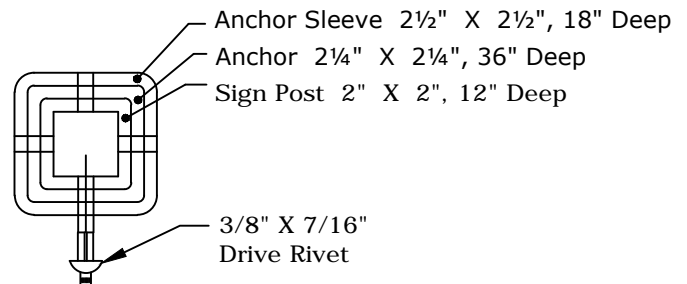


ROCK CHECK DAM DETAIL

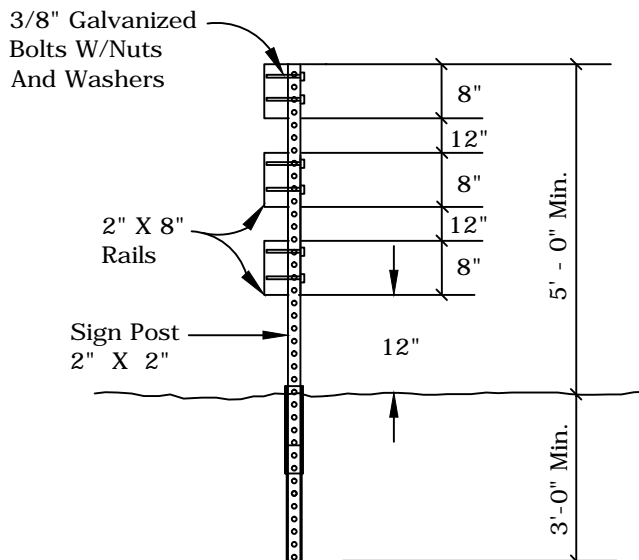
SEE 5030-ST Rain Garden



ELEVATION



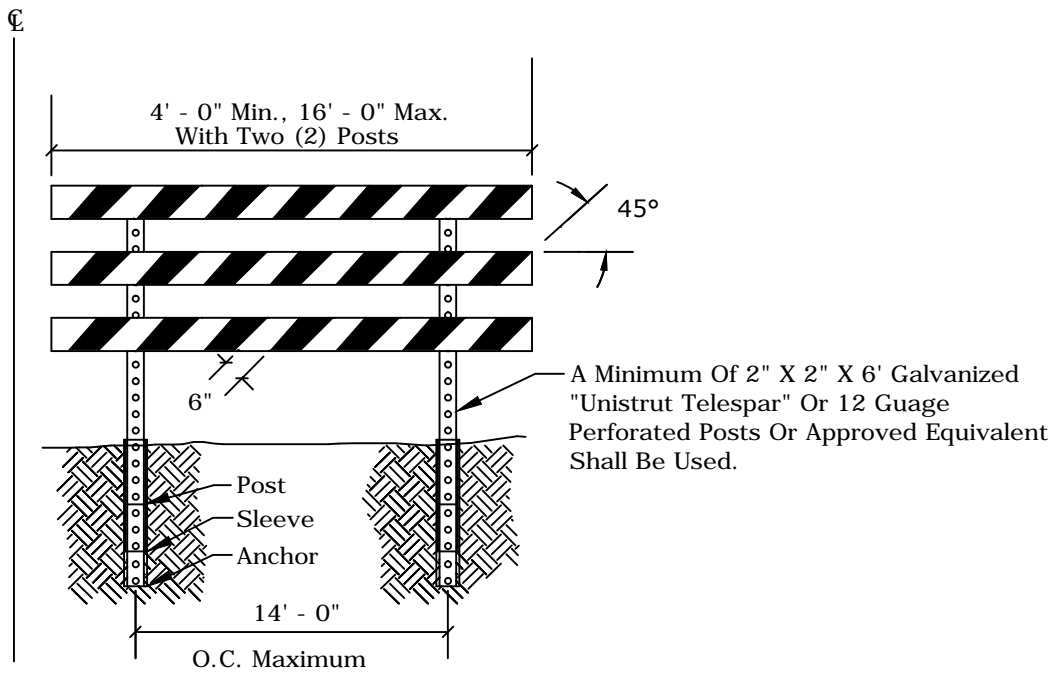
TYPICAL POST INSTALLATION



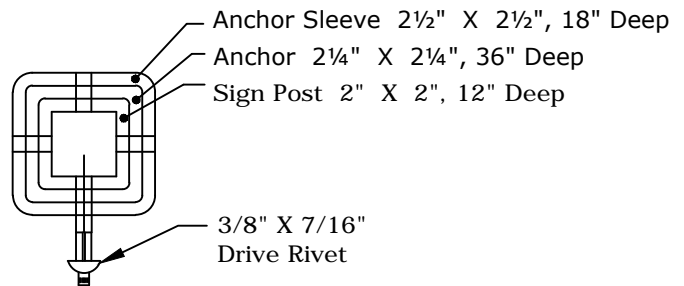
END VIEW

NOTES:

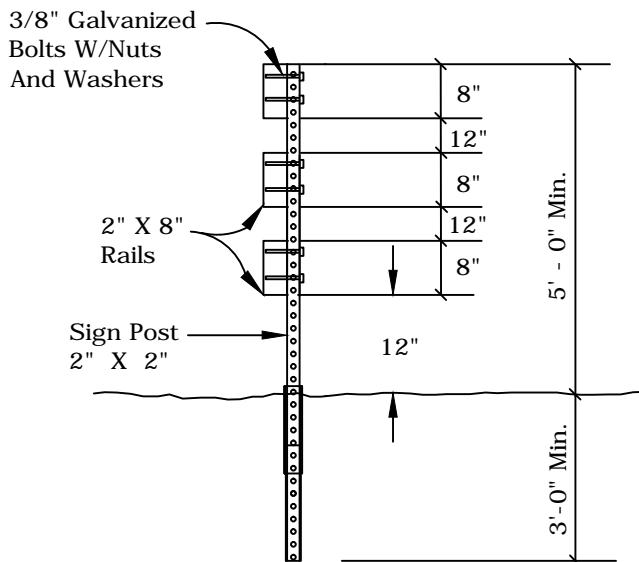
1. Rails To Have Alternating Red And White Stripes. All Stripes Shall Be ReflectORIZED.
2. See Manual On Uniform Traffic Control Devices For Streets And Highways And The Oregon Supplement.
3. See Drawing 6050-ST For Installation In A Hard Surface.
4. 1" Pan Head Sheet Metal Screws Shall Be Used If Sheet Panels Are To Be Fastened To The Face Of The Cross-Boards.
5. All Materials And Workmanship Shall Be In Accordance With The Current State Of Oregon Standard Specifications For Construction.



ELEVATION



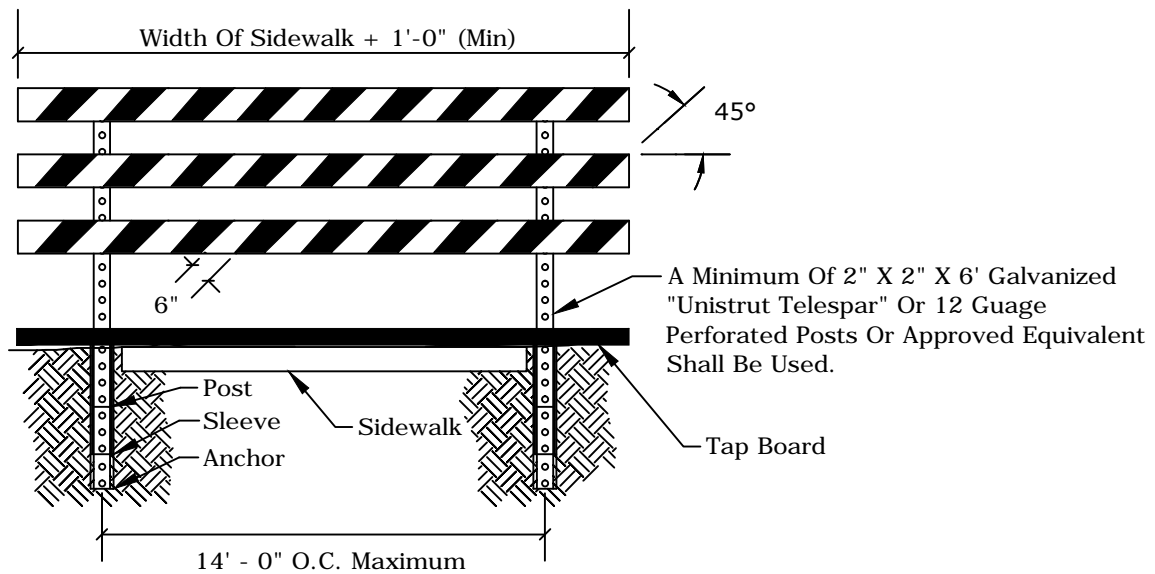
TYPICAL POST INSTALLATION



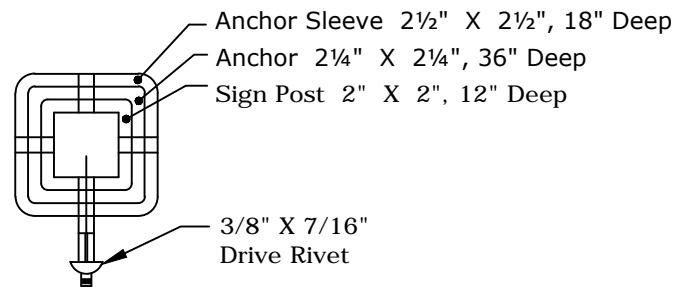
END VIEW

NOTES:

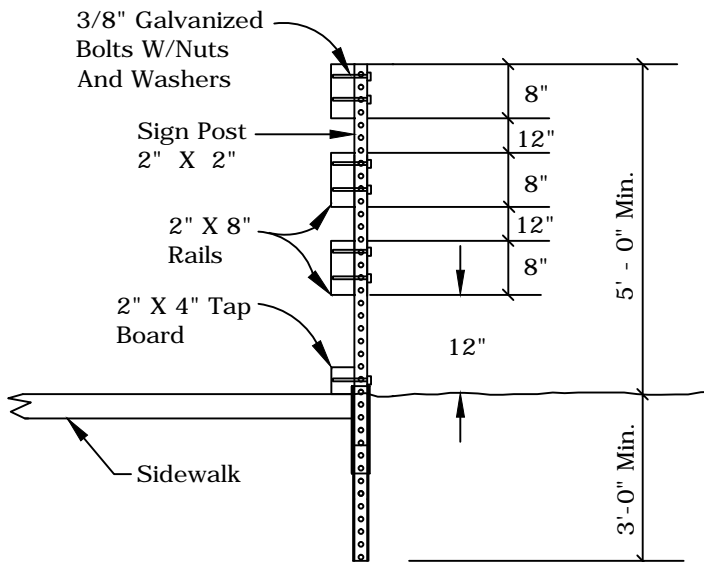
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2. See Manual On Uniform Traffic Control Devices For Streets And Highways And The Oregon Supplement.
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ELEVATION



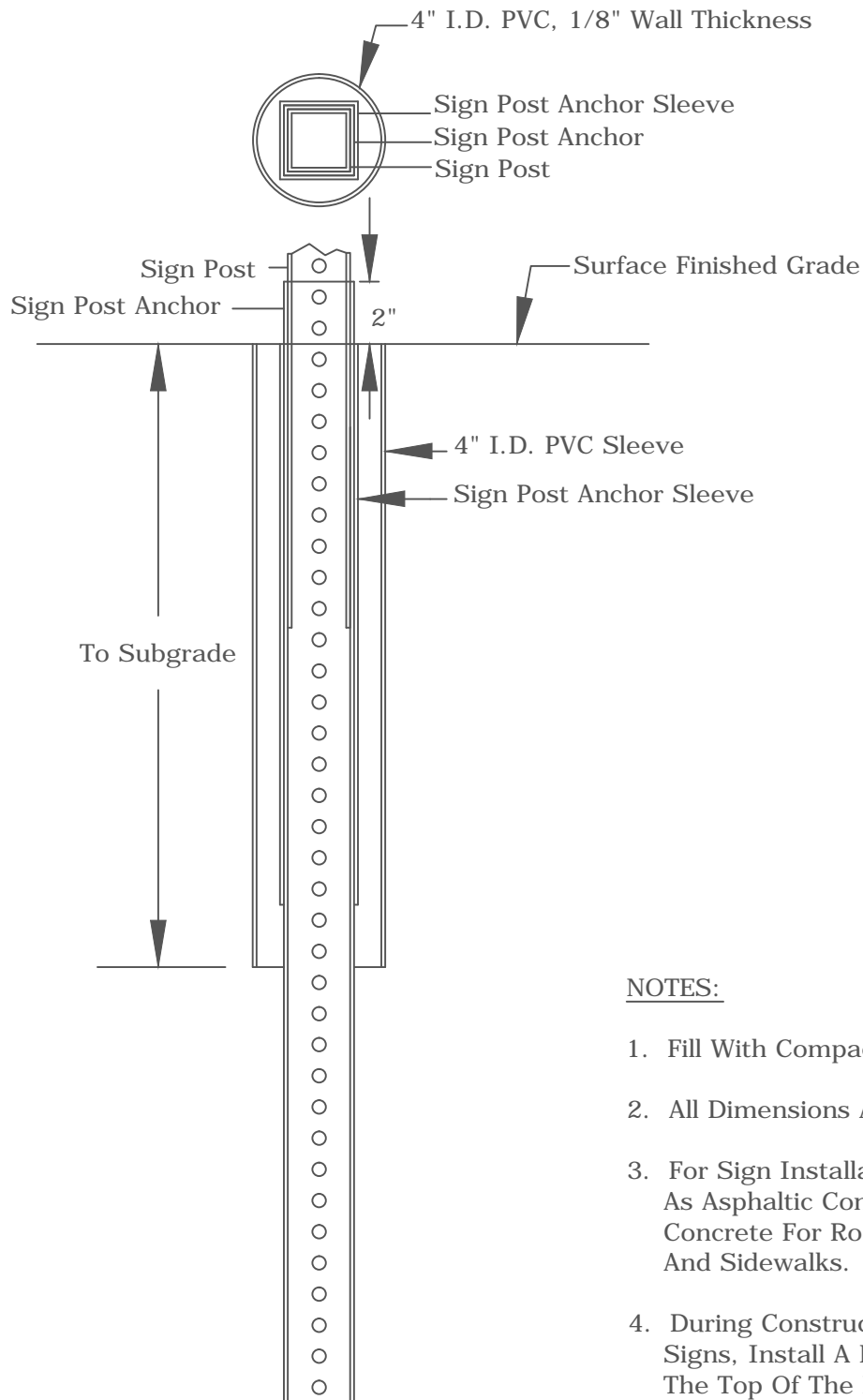
TYPICAL POST INSTALLATION



END VIEW

NOTES:

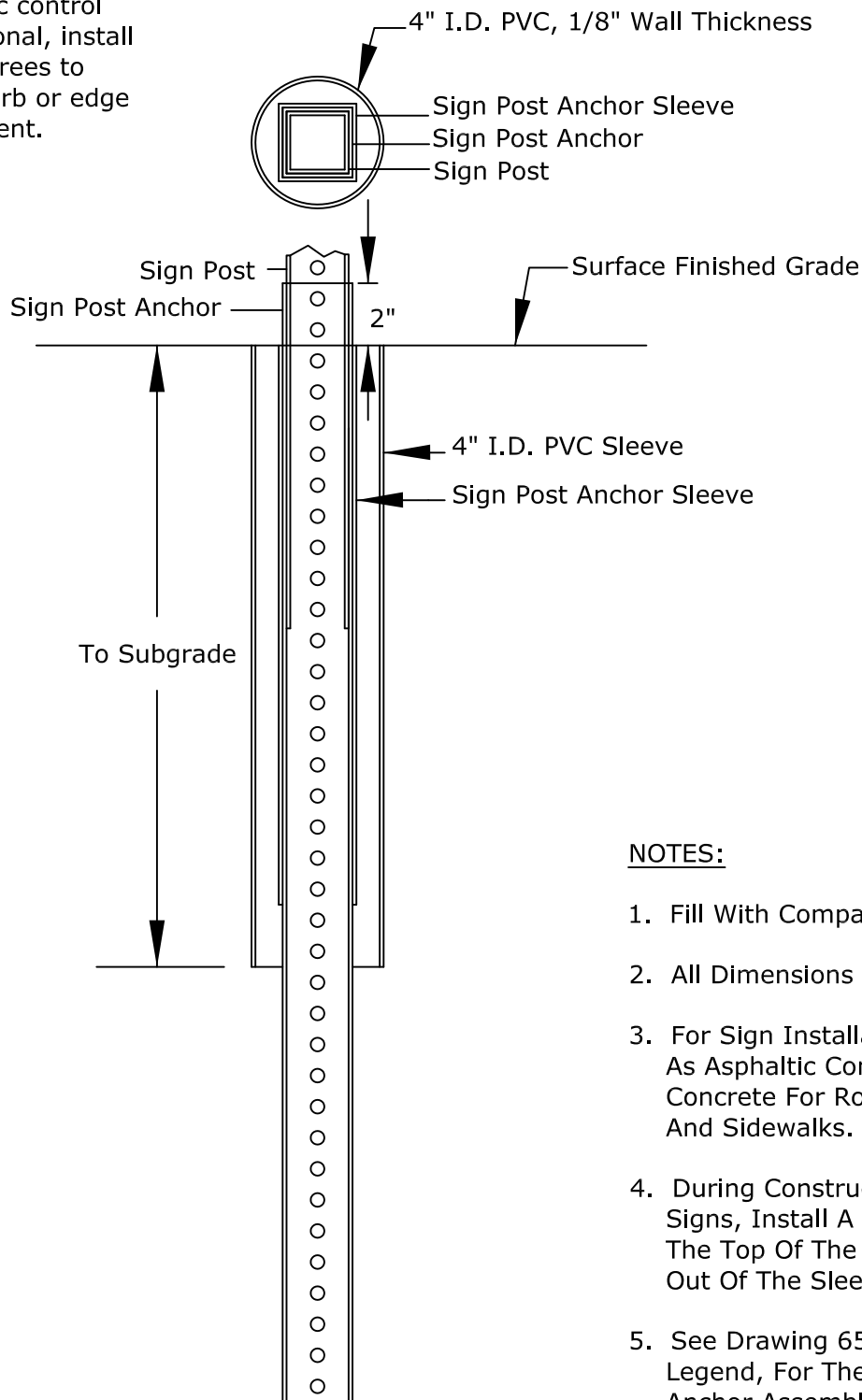
1. Rails To Have Alternating Red And White Stripes. All Stripes Shall Be Reflectorized.
2. See Manual On Uniform Traffic Control Devices For Streets And Highways And The Oregon Supplement.
3. See Drawing 6050-ST For Installation In A Hard Surface.
4. 1" Pan Head Sheet Metal Screws Shall Be Used If Sheet Panels Are To Be Fastened To The Face Of The Cross-Boards.
5. All Materials And Workmanship Shall Be In Accordance With The Current State Of Oregon Standard Specifications For Construction.
6. The Tap Board Shall Be White. Clearance Between Top Of Sidewalk And The Tap Board Shall Be 1". Tap Board Shall Overlap The Sidewalk.



NOTES:

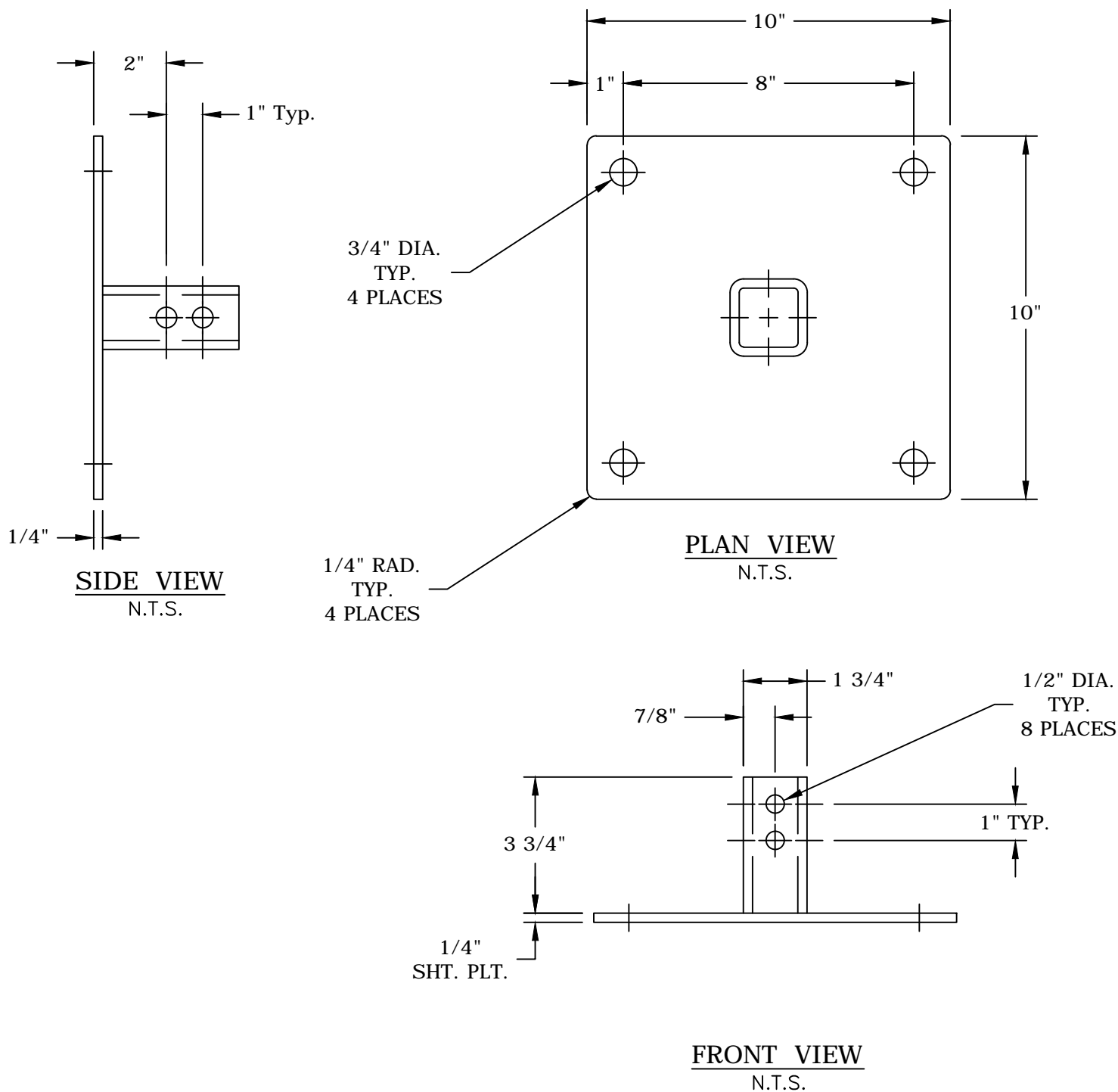
1. Fill With Compacted Sand.
2. All Dimensions Are In Inches.
3. For Sign Installation In Hard Surfaces Such As Asphaltic Concrete And Portland Cement Concrete For Roads, Raised Medians/Islands And Sidewalks.
4. During Construction, Prior To Installing The Signs, Install A Plug Into Or A Cap Onto The Top Of The PVC Sleeve To Keep Debris Out Of The Sleeve.
5. See Drawing 6510-ST, Permanent Signing Legend, For The Details Of The Sign Post Anchor Assembly.

If Parking Sign or non-traffic control informational, install at 30 degrees to face of curb or edge of pavement.



NOTES:

1. Fill With Compacted Sand.
2. All Dimensions Are In Inches.
3. For Sign Installation In Hard Surfaces Such As Asphaltic Concrete And Portland Cement Concrete For Roads, Raised Medians/Islands And Sidewalks.
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5. See Drawing 6510-ST, Permanent Signing Legend, For The Details Of The Sign Post Anchor Assembly.
6. See Manual on Uniform Traffic Control Devices (MUTCD) for streets and highways.

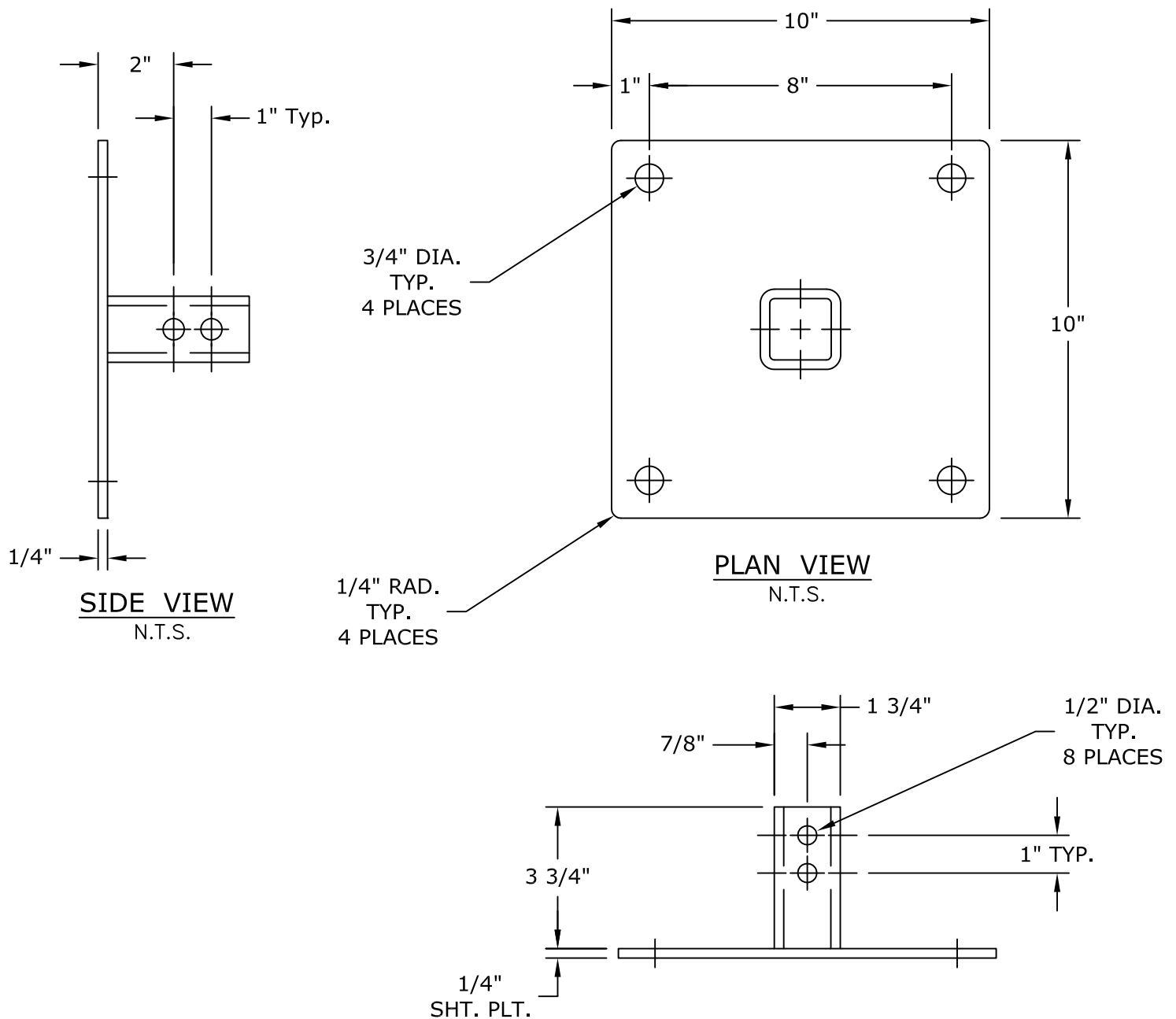


NOTE:

Post Base To Fit 2" X 2" "Unistruct Telespar" 12 Ga. Or Equal Sign Post.

Secure To Concrete Using Four (4) 5/8" - 11x4" Hot Dipped Galvanized Steel Hex Head Bolts And Zinc Finish Set-Bolt Anchors.

Trim The Corners Of The Bottom Plate To 1/4" Radius. Finish The Edges Of The Bottom Plate.



NOTE:

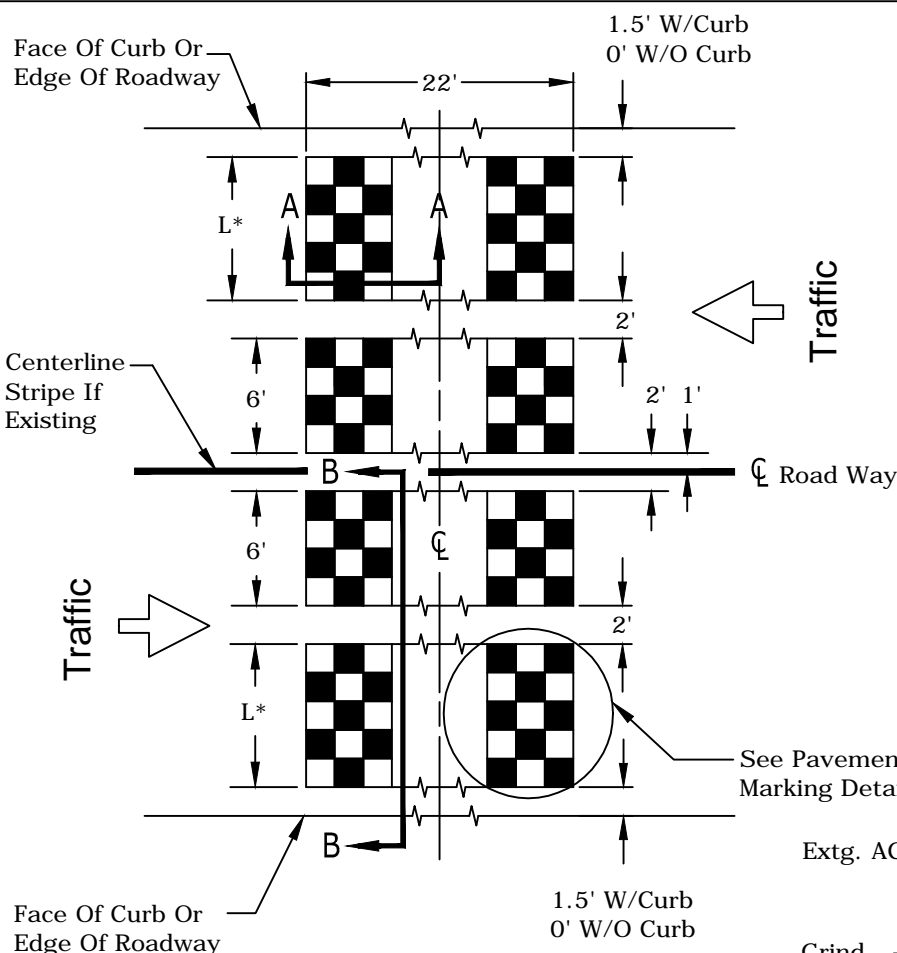
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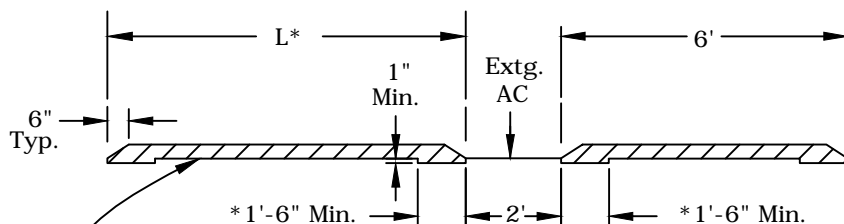
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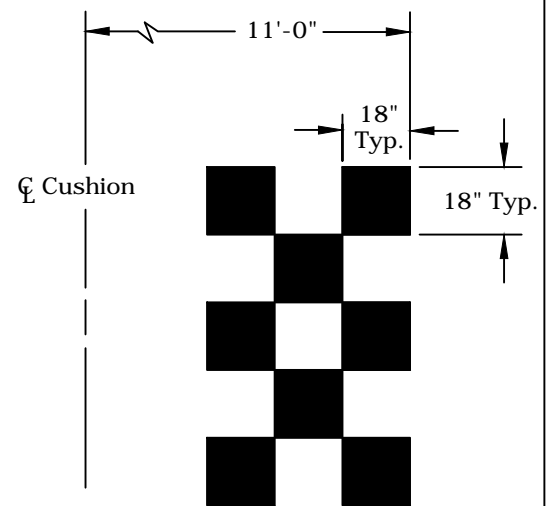


PLAN VIEW
N.T.S.

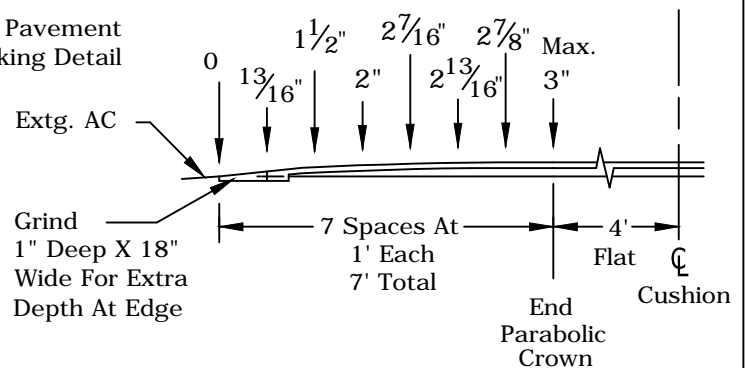


SECTION VIEW B - B
N.T.S.

* Length May Be From 7.5' To 4.5'
Depending On Roadway Width.
Do Not Install If L* Is Less Than 4'



PAVEMENT MARKING DETAIL
N.T.S.

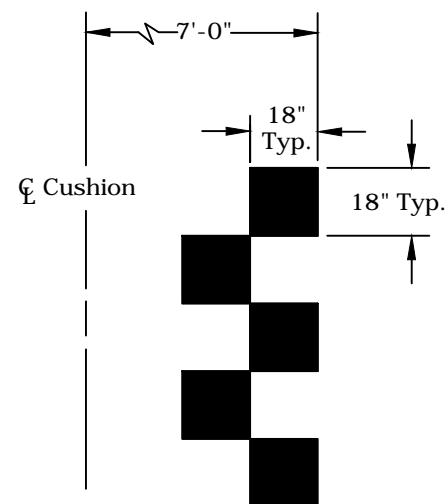


SECTION VIEW A - A
Symmetrical About C
N.T.S.

Notes:

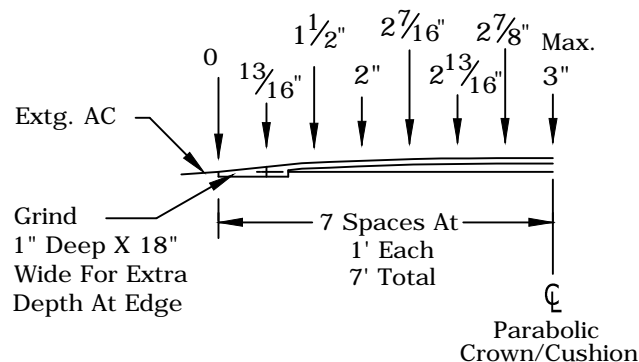
- 1) Asphalt Shall Be Rolled For Compaction Per Specifications. Finish Edges By Applying Tackcoat & Sand Sweepings.
- 2) Signs May Be Req'd At The Direction Of The City Engineer Of Record.
- 3) Cushion Shall Not Be Placed On Road Grades Greater Than 8%.
- 4) Pavement Markings Shall Be White Type B - Preformed Fused Thermoplastic Film.

ASPHALTIC CONCRETE SPEED CUSHION DETAILS



PAVEMENT MARKING DETAIL

N.T.S.



SECTION VIEW A - A
Symetrical About \mathbb{C}

N.T.S.

1) Asphalt Shall Be Rolled For Compaction Per Specifications. Finish Edges By Applying Tackcoat & Sand Sweepings.

- 2) Signs May Be Req'd At The Direction Of The City Engineer Of Record.
- 3) Cushion Shall Not Be Placed On Road Grades Greater Than 8%.
- 4) Pavement Markings Shall Be White Type B - Preformed Fused Thermoplastic Film.

SPEED CUSHION
ROAD 26' WIDE OR LESS
SPEED 25 M.P.H. OR LESS

<p>(A)</p> <p>RIGHT TURN LANE MARKINGS - ELONGATED ARROWS SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL, SEE ODOT DETAIL . USE ADDITIONAL ARROW AT THE MID POINT WHEN THE TURN LANE IS OVER 400 FT.</p>	<p>(B)</p> <p>LEFT TURN LANE MARKINGS - ELONGATED ARROWS SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL, SEE ODOT DETAIL . USE ADDITIONAL ARROW AT THE MID POINT WHEN THE TURN LANE IS OVER 400 FT.</p>	<p>(C)</p> <p>CROSSWALK - CROSSWALK SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL. SEE NOTE 2.</p>	<p>(D)</p> <p>RAILROAD CROSSING - LEGEND SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL. SEE NOTE 6. IF LANE WIDTH IS LESS THAN 12', USE ODOT'S NARROW RAILROAD CROSSING DETAIL IN 120 mil.</p>	<p>NOTES:</p> <ol style="list-style-type: none">1. LOCATE STOP BARS 10' BACK OF THE EXTENDED FOG LINE, EDGE OF PAVEMENT, OR CURB FACE. VERIFY SIGHT DISTANCE.2. LOCATE CROSSWALKS AS PER ADA RAMP LOCATIONS OR 5' BACK OF EXTENDED FOGLINE, EDGE OF PAVEMENT OR CURB FACE.3. REMOVAL OF EXISTING STRIPING IS TO BE DETERMINED IN THE FIELD. STRIPING SHALL BE REMOVED AS DIRECTED BY THE CITY ENGINEER OF RECORD.4. ALL THERMOPLASTIC PAVEMENT MARKING MATERIAL SHALL BE INSTALLED AS PER SECTION 00850 OF THE OREGON STANDARD SPECIFICATIONS FOR HWY. CONSTRUCTION.5. ALL PAVEMENT MARKING SHALL CONFORM TO THE MOST CURRENT ODOT SPECIFICATION. COPIES OF THE MATERIALS SPECIFICATIONS ARE AVAILABLE FROM: ENGINEER OF MATERIALS AND RESEARCH HWY. MATERIALS LABORATORY 600 AIRPORT ROAD S.E. SALEM, OR 97310 (503) 986-31006. THE ENGINEER MUST OBTAIN AUTHORIZATION FOR PLACEMENT OF "RAILROAD CROSSING" MARKINGS PRIOR TO PLAN APPROVAL. AUTHORIZATION SHALL BE OBTAINED FROM THE ODOT RAIL DIVISION AND THE CITY ENGINEER OF RECORD.7. FOR SCHOOL ZONE STENCILS, USE ODOT DETAIL 'SCHOOL' & 'X-ING', AS NEEDED, IN 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL. VERIFY LOCATIONS & STENCILS WITH CITY TRAFFIC ENGINEERING. WHEN BOTH ARE USED, SPACING IS 32 FEET.8. ALL PAVEMENT MARKINGS SHALL BE THERMOPLASTIC WITHIN THE URBAN GROWTH BOUNDARY.9. FOR DIAGONAL MARKERS, USE "PREMARK IN-LANE RUMBLE BARS" BY FLINT TRADING INC., OR EQUIVALENT. <p>X SUBSCRIPT FOR PAVEMENT MARKING. DENOTES COLOR. (Y) YELLOW OR (W) WHITE.</p> <p>* LANE MARKING DIMENSION LOCATION AT ϕ OF STRIPING UNLESS NOTED OTHERWISE.</p>
<p>(E)</p> <p>STOP BAR - SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL, SEE NOTE 1 .</p>	<p>(F)</p> <p>THRU AND TURN LANE MARKINGS - ELONGATED TURN AND THRU ARROWS SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL, SEE ODOT DETAIL . USE ADDITIONAL ARROW AT THE MID POINT WHEN THE TURN LANE IS OVER 400 FT.</p>	<p>(G)</p> <p>TYPICAL YIELD LANE - THERMOPLASTIC INSTALLATION.</p>	<p>(H)</p> <p>RAISED MEDIAN STRIPE - 4" YELLOW LINE WITH 4" YELLOW BI-DIRECTIONAL TYPE I REFLECTORS.</p>	
<p>(I)</p> <p>TURN LANE LINE - 8" WHITE LINE WITH 4" WHITE MONO-DIRECTIONAL TYPE I REFLECTORS.</p>	<p>(J)</p> <p>MEDIAN NOSE - TWO 4" YELLOW LINES WITH BI-DIRECTIONAL YELLOW TYPE I REFLECTORS.</p>	<p>(K)</p> <p>DIAGONAL MARKERS - 4" YELLOW OR WHITE RUMBLE BARS. CENTER BETWEEN LANE LINES.</p>	<p>(L)</p> <p>TWO WAY LEFT TURN STRIPE - 4" YELLOW LINES WITH 4" YELLOW BI-DIRECTIONAL TYPE I REFLECTORS.</p>	
<p>(M)</p> <p>BROKEN CENTER LINE - 4" YELLOW LINE WITH 4" YELLOW BI-DIRECTIONAL TYPE I REFLECTORS.</p>	<p>(N)</p> <p>MEDIAN STRIPE - TWO 4" YELLOW LINES WITH 4" YELLOW BI-DIRECTIONAL TYPE I REFLECTORS.</p>	<p>(O)</p> <p>EDGE LINE - 4" YELLOW OR WHITE LINE AS SHOWN ON PLANS.</p>	<p>(P)</p> <p>CENTER LINES - TWO 4" YELLOW LINES WITH 4" YELLOW BI-DIRECTIONAL TYPE I REFLECTORS.</p>	
<p>(R)</p> <p>BIKE LANE LINE - 8" WHITE LINE.</p>	<p>(S)</p> <p>BIKE LANE DOTTED LINE - 8" WHITE LINE.</p>	<p>(T)</p> <p>DOTTED LINE EXTENSIONS THRU INTERSECTION - WHITE OR YELLOW LINE. WIDTH AND COLOR SAME AS LINE BEING EXTENDED. SHALL BE 120 mil. THERMOPLASTIC PAVEMENT MARKING MATERIALS.</p>	<p>(U)</p> <p>BICYCLE LANE MARKING - SHALL BE 90 mil. WHITE PREFORMED HIGH SKID THERMOPLASTIC PAVEMENT MARKING MATERIAL.</p>	<p>(V)</p> <p>STAGGERED CONTINENTAL CROSSWALK - SHALL BE 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL.</p>

<div>(A)</div>	<div>(B)</div>	<div>(C)</div>	<div>(D)</div>	<div>NOTES:</div> <div>1. LOCATE STOP BARS 10' BACK OF THE EXTENDED FOG LINE, EDGE OF PAVEMENT, OR CURB FACE. VERIFY SIGHT DISTANCE. 2. LOCATE CROSSWALKS AS PER ADA RAMP LOCATIONS OR 5' BACK OF EXTENDED FOGLINE, EDGE OF PAVEMENT OR CURB FACE. 3. REMOVAL OF EXISTING STRIPING IS TO BE DETERMINED IN THE FIELD. STRIPING SHALL BE REMOVED AS DIRECTED BY THE CITY ENGINEER OF RECORD. 4. ALL THERMOPLASTIC PAVEMENT MARKING MATERIAL SHALL BE INSTALLED AS PER SECTION 00850 OF THE OREGON STANDARD SPECIFICATIONS FOR HWY. CONSTRUCTION. 5. ALL PAVEMENT MARKING SHALL CONFORM TO THE MOST CURRENT ODOT SPECIFICATION. COPIES OF THE MATERIALS SPECIFICATIONS ARE AVAILABLE FROM: ENGINEER OF MATERIALS AND RESEARCH HWY. MATERIALS LABORATORY 600 AIRPORT ROAD S.E. SALEM, OR 97310 (503) 986-3100 6. THE ENGINEER MUST OBTAIN AUTHORIZATION FOR PLACEMENT OF "RAILROAD CROSSING" MARKINGS PRIOR TO PLAN APPROVAL. AUTHORIZATION SHALL BE OBTAINED FROM THE ODOT RAIL DIVISION AND THE CITY ENGINEER OF RECORD. 7. FOR SCHOOL ZONE STENCILS, USE ODOT DETAIL, "SCHOOL & X-MG". AS NEEDED, IN 120 mil. WHITE THERMOPLASTIC PAVEMENT MARKING MATERIAL. VERIFY LOCATIONS & STENCILS WITH CITY TRAFFIC ENGINEERING. WHEN BOTH ARE USED, SPACING IS 32 FEET. 8. ALL PAVEMENT MARKINGS SHALL BE THERMOPLASTIC WITHIN THE URBAN GROWTH BOUNDARY. 9. FOR DIAGONAL MARKERS, USE "PERMARK IN-LANE RUMBLE BARS" BY FLINT TRADING INC., OR EQUIVALENT. X SUBSCRIPT FOR PAVEMENT MARKING. DENOTES COLOR. (Y) YELLOW OR (W) WHITE. * LANE MARKING DIMENSION LOCATION AT ½ OF STRIPING UNLESS NOTED OTHERWISE.</div>
<div>(E)</div>	<div>(F)</div>	<div>(G)</div>	<div>(H)</div>	
<div>(I)</div>	<div>(J)</div>	<div>(K)</div>	<div>(L)</div>	
<div>(M)</div>	<div>(N)</div>	<div>(O)</div> <div>X</div>	<div>(P)</div>	
<div>(R)</div>	<div>(S)</div>	<div>(T)</div>	<div>(U)</div>	
<div>(V)</div>				

NOTES:

1. LOCATE STOP BARS 10' BACK OF THE EXTENDED FOG LINE.
EDGE OF PAVEMENT, OR CURB FACE. VERIFY SIGHT DISTANCE.
2. LOCATE CROSSWALKS AS PER ADA RAMP LOCATION OR
5' BACK OF EXTENDED FOGLINE, EDGE OF PAVEMENT OR
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3. REMOVAL OF EXISTING STRIPING IS TO BE DETERMINED
IN THE FIELD. STRIPING SHALL BE REMOVED AS DIRECTED
BY THE CITY ENGINEER OF RECORD.
4. ALL THERMOPLASTIC PAVEMENT MARKING MATERIAL SHALL
BE INSTALLED AS PER SECTION 00850 OF THE OREGON
STANDARD SPECIFICATIONS FOR HWY. CONSTRUCTION.
5. ALL PAVEMENT MARKING SHALL CONFORM TO THE MOST
CURRENT ODOT SPECIFICATION. COPIES OF THE MATERIALS
SPECIFICATIONS ARE AVAILABLE FROM:

ENGINEER OF MATERIALS AND RESEARCH
HWY. MATERIALS LABORATORY
600 AIRPORT ROAD S.E.
SALEM, OR 97310
(503) 986-3100
6. THE ENGINEER MUST OBTAIN AUTHORIZATION FOR
PLACEMENT OF "RAILROAD CROSSING" MARKINGS PRIOR TO
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RECORD.
7. FOR SCHOOL ZONE STENCILS, USE ODOT DETAIL "SCHOOL" &
X-JNG". AS NEEDED, IN 120 ml WHITE THERMOPLASTIC
PAVEMENT MARKING MATERIAL. VERIFY LOCATIONS &
STENCILS WITH CITY TRAFFIC ENGINEERING. WHEN BOTH
ARE USED, SPACING IS 32 FEET.
8. ALL PAVEMENT MARKINGS SHALL BE THERMOPLASTIC WITHIN
THE URBAN GROWTH BOUNDARY.
9. FOR DIAGONAL MARKERS, USE "PREMARK IN-LANE RUMBLE
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- X SUBSCRIPT FOR PAVEMENT MARKING.
DENOTES COLOR, (Y) YELLOW OR
(W) WHITE.
- * LANE MARKING DIMENSION LOCATION
AT & OF STRIPING UNLESS NOTED
OTHERWISE.
- (C)
-
- The diagram illustrates lane markings for a two-lane road. It shows a centerline with a width of 30 feet between the edges of the lanes. Each lane is 10 feet wide. The distance from the edge of the pavement to the first stop bar is 10 feet. The distance between stop bars is 15 feet. The distance from the stop bar to the edge of the pavement is 4 inches. The diagram also shows a crosswalk with a width of 10 feet (minimum). The distance from the edge of the pavement to the crosswalk is 24 inches. The distance between crosswalks is 3 feet minimum to 5 feet maximum (adjust spacing to miss wheel tracks). The diagram indicates that the type of reflectors used varies along the road.
- TRAFFIC FLOW
- TRAFFIC FLOW
- LANE LINE - 4" WHITE LINE WITH 4" WHITE MONO-DIRECTIONAL TYPE REFLECTORS.

PERMANENT SIGNING LEGEND

GENERAL SIGNING NOTES:

1) Contractor Shall Supply And Install All Signs, And Is Responsible For Staking Sign Locations And Obtaining Utility Locates For Staked Sign Locations. Signs Shall Be Located Per Typical Sign Location Or As Shown On Plans. **IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE RECORDED STREET NAMES WITH THE COUNTY SURVEY OFFICE AT (503)842-3423 BEFORE ORDERING AND INSTALLING STREET NAME SIGNS.**

2) All Signing Shall Conform To The Manual On Uniform Traffic Control Devices.

3) Street Name Signs Shall Be: (Verify RECORDED Street Names Before Ordering And Installing)

A) FOR LOCAL STREET, COLLECTOR STREET AND NEIGHBORHOOD ROUTE INTERSECTIONS: Six (6) Inch 0.080 Inch Flat Blade Aluminum Blanks, Mounted On Top Of Post With Special Brackets.

Lettering: Four (4) Inch Upper Case Series C
Pre-fixes And Suffixes: Three (3) Inch Uppercase Series C
Superscript For Numerical Street Names: Two (2) Inch Uppercase Series C
Layout Per "Typical Street Name Sign Layout" Two (2) Sided

B) FOR ARTERIAL STREET INTERSECTIONS: Nine (9) Inch 0.080 Inch Flat Blade Aluminum Blanks, Mounted Directly To Post With Rivets For Street Name Sign Facing The Arterial Traffic Approach. For Sign Facing Local Street, Collector Street Or Neighborgood Route Approach Use 3) A) Above. See Diagram*.

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Superscript For Numerical Street Names: Three (3) Inch Uppercase Series C
Layout Per "Typical Street Name Sign Layout" One (1) Sided, Two (2) Signs Per Street Name.

C) FOR SIGNALIZED INTERSECTIONS: Twelve (12) Inch 0.125 Inch Flat Blade Aluminum Blanks, Mounted To Mast Arm Or Strain Pole For Span Wire Signal Systems.

Lettering: Eight (8) Inch Upper Case Series C
Pre-fixes And Suffixes: Five (5) Inch Uppercase Series C
Superscript For Numerical Street Names: Four (4) Inch Uppercase Series C
Layout Per "Typical Street Name Sign Layout" One (1) Sided WITH BORDER

Material For All Street Name Signs Per "Signing Materials"

Width Of Sign Per Below Tables For Six (6) And Nine (9) Inch Blanks.

Suffix Abbreviations Per "Common Abbreviations"

6 INCH BLANKS (TWO SIDED)		9 INCH BLANKS (ONE SIDED)	
# Of Characters (Not Includ. Prefixes And Suffixes)	Blank Width	# Of Characters (Not Includ. Prefixes And Suffixes)	Blank Width
Up To 6	24 Inch	Up To 6	38 Inch
7 To 9	30 Inch	7 To 9	48 Inch
10 To 11	36 Inch	10 To 11	55 Inch
12 To 13	42 Inch	12 To 13	61 Inch
Over 13	48 Inch	14 To 15	68 Inch

For Mast Arm Street Name Sign Letter Spacing Use ODOT's Standards

COMMON ABBREVIATIONS

AVE = Avenue	LN = Lane	RD = Road
BLVD = Boulevard	LP = Loop	ST = Street
CIR = Circle	PKWY = Parkway	TER = Terrace
CT = Court	PL = Place	WY = Way
DR = Drive		

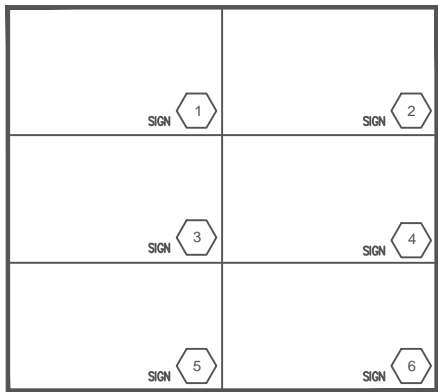
4) Posts

A Minimum Of 2" X 2" X 10 Foot (min.) Galvanized "Unistrut Telespar" 12 Gauge Perforated Posts Or Approved Equivalent Shall Be Used.

A 2" X 2" X 12 Foot (min.) Galvanized "Unistrut Telespar" 12 Gauge Perforated Posts Or Approved Equivalent Shall Be Used When A Combination Of Signs Is More Than 36 Inches In Height. Sign Combination And Minimum Sign Mounting Height Shall Determine Post Length.

Sign Post And Anchor Assembly Shall Be Installed Per "Typical Sign Installation"

No Other Type Of Post Shall Be Used Unless Prior Approval Of The City Engineer Of Record Is Obtained.



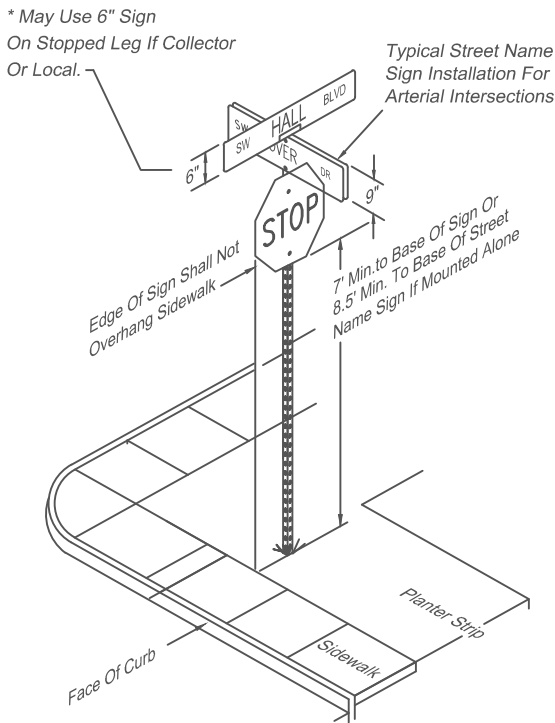
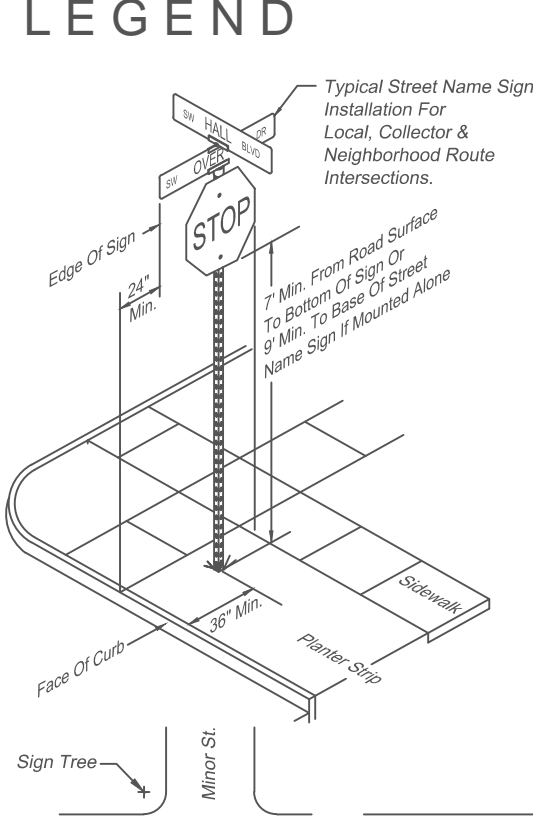
PERMANENT SIGNING LEGEND	
	Install New Sign
	Install New Sign (N) On New (M) Support
	Remove Existing Sign (N)
	Remove Existing Sign (N) And (M) Support
	Reinstall Sign (N) On New (M) Support
	Maintain And Protect Existing Sign (N) And Support
	Reinstall Existing Sign On Existing Support

N = Sign Number
M = Materials, Options Are:
S = Steel "Telespar"



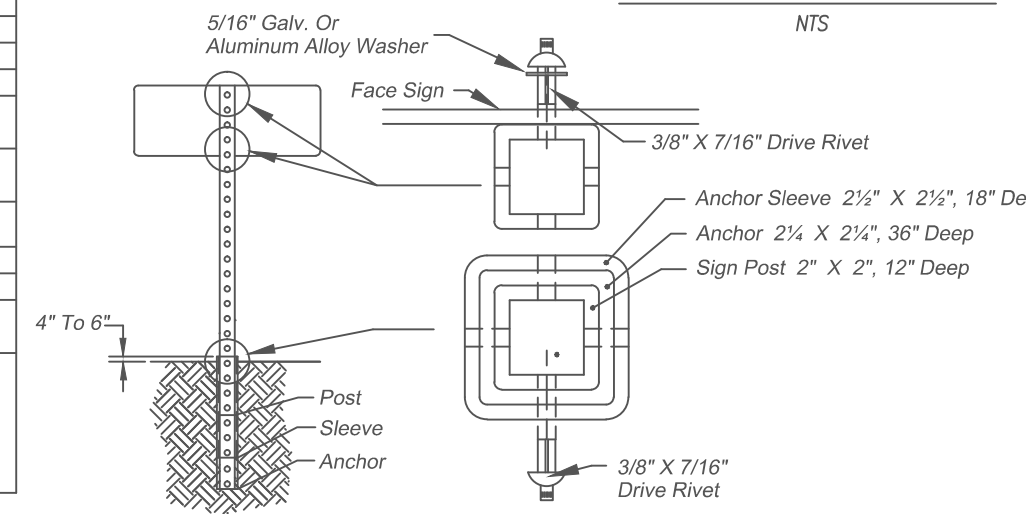
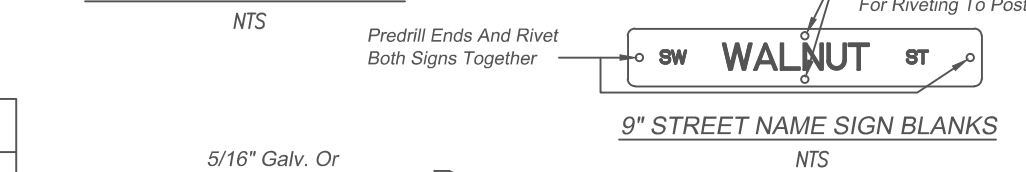
Signs Shown With Broken Borders Are Existing.

SIGNING MATERIALS	
Stop & Yield Signs	Retro-reflective Sheeting ASTM Type III
School Advance And Crossing Signs	Fluorescent Yellow/Green Retro-reflective Sheeting ASTM Type IX
Street Name Signs (Post Mounted)	Retro-reflective Sheeting ASTM Type III
Overhead Guide Signs	Background: Retro-reflective Sheeting ASTM Type III Legend: ASTM Type IX
All Other Post Mounted Signs	Background: Retro-reflective Sheeting ASTM Type III
TYPICAL SIGN SIZES	
Stop Sign - 30"x30"	
Yield Sign - 30"x30"x30"	
Speed Signs - 24"x30" On Local Streets And Neighborhood Route 30"x36" On Collector And Arterial Roads. (The Word 'Limit' Shall Only Be Used On School Speed 20 Signs)	
No Parking Signs: 12"x18" City Standard With A R7-201 12"x6" 'Tow Away Zone' On Local & Neighborhood Route Road; 18"x24" City Standard On Collectors and Arterials. Signs At Both Ends Of The Zone Shall Have Single Arrows Pointing In The Appropriate Direction With Double Arrows In Between. "NO PARKING" SIGNS SHALL BE 45° TO APPROACHING TRAFFIC	



TYPICAL SIGN LOCATIONS

TYPICAL SIGN LOCATIONS



NOTE:
Anchor Assemblies Shall Not Be In Concrete Unless PVC Sleeve Is Provided Per County Detail.



PERMANENT SIGNING LEGEND

DRAWING NO. 6510-ST

REVISED 10-2014

PERMANENT SIGNING LEGEND

GENERAL SIGNING NOTES:

1) Contractor Shall Supply And Install All Signs, And Is Responsible For Staking Sign Locations And Obtaining Utility Locates For Staked Sign Locations. Signs Shall Be Located Per Typical Sign Location Or As Shown On Plans. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE RECORDED STREET NAMES WITH THE COUNTY SURVEY OFFICE AT (503)842-3423 BEFORE ORDERING AND INSTALLING STREET NAME SIGNS.

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Lettering: Eight (8) Inch Upper Case Series C
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Material For All Street Name Signs Per "Signing Materials"

Width Of Sign Per Below Tables For Six (6) And Nine (9) Inch Blanks.

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For Mast Arm Street Name Sign Letter Spacing Use ODOT's Standards

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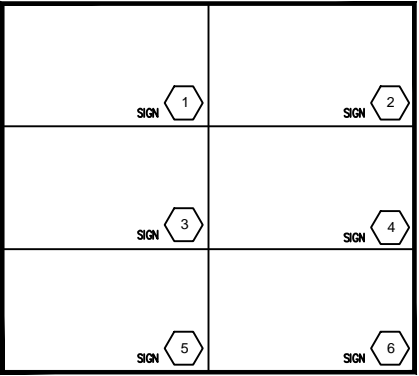
4) Posts

A Minimum Of 2" X 2" X 10 Foot (min.) Galvanized "Unistrut Telespar" 12 Gauge Perforated Posts Or Approved Equivalent Shall Be Used.

A 2" X 2" X 12 Foot (min.) Galvanized "Unistrut Telespar" 12 Gauge Perforated Posts Or Approved Equivalent Shall Be Used When A Combination Of Signs Is More Than 36 Inches In Height. Sign Combination And Minimum Sign Mounting Height Shall Determine Post Length.

Sign Post And Anchor Assembly Shall Be Installed Per "Typical Sign Installation"

No Other Type Of Post Shall Be Used Unless Prior Approval Of The City Engineer Of Record Is Obtained.



PERMANENT SIGNING LEGEND

N	Install New Sign
N M	Install New Sign (N) On New (M) Support
RXN	Remove Existing Sign (N)
RXN M	Remove Existing Sign (N) And (M) Support
RI-N M	Reinstall Sign (N) On New (M) Support
EXN	Maintain And Protect Existing Sign (N) And Support
RI-N	Reinstall Existing Sign On Existing Support

N = Sign Number
M = Materials, Options Are:
S = Steel "Telespar"

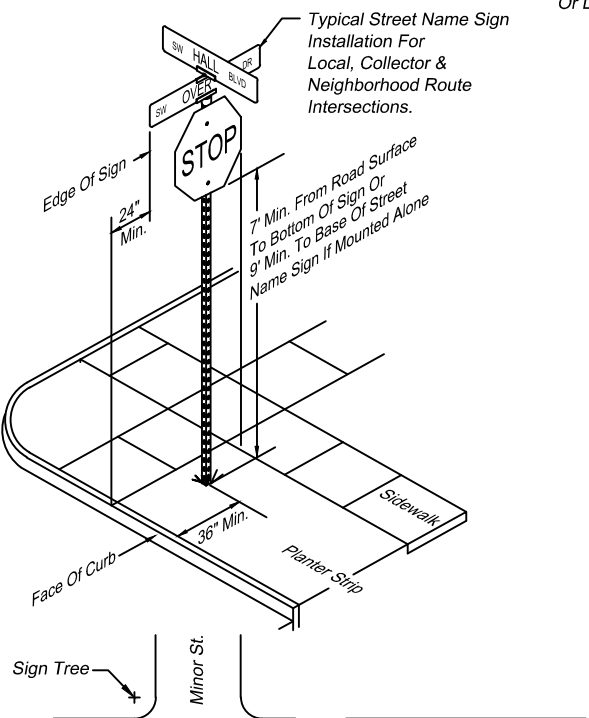
Signs Shown With Broken Borders Are Existing.

SIGNING MATERIALS

Stop & Yield Signs	Retro-reflective Sheeting ASTM Type III
School Advance And Crossing Signs	Fluorescent Yellow/Green Retro-reflective Sheeting ASTM Type IX
Street Name Signs (Post Mounted)	Retro-reflective Sheeting ASTM Type III
Overhead Guide Signs	Background: Retro-reflective Sheeting ASTM Type III Legend: ASTM Type IX
All Other Post Mounted Signs	Background: Retro-reflective Sheeting ASTM Type III

TYPICAL SIGN SIZES

Stop Sign - 30"x30"
Yield Sign - 30"x30"x30"
Speed Signs - 24"x30" On Local Streets And Neighborhood Route 30"x36" On Collector And Arterial Roads. (The Word 'Limit' Shall Only Be Used On School Speed 20 Signs)
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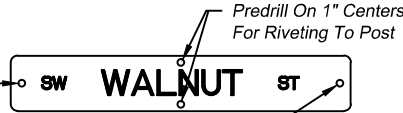


CROSS INTERSECTION TEE INTERSECTION

TYPICAL SIGN LOCATIONS

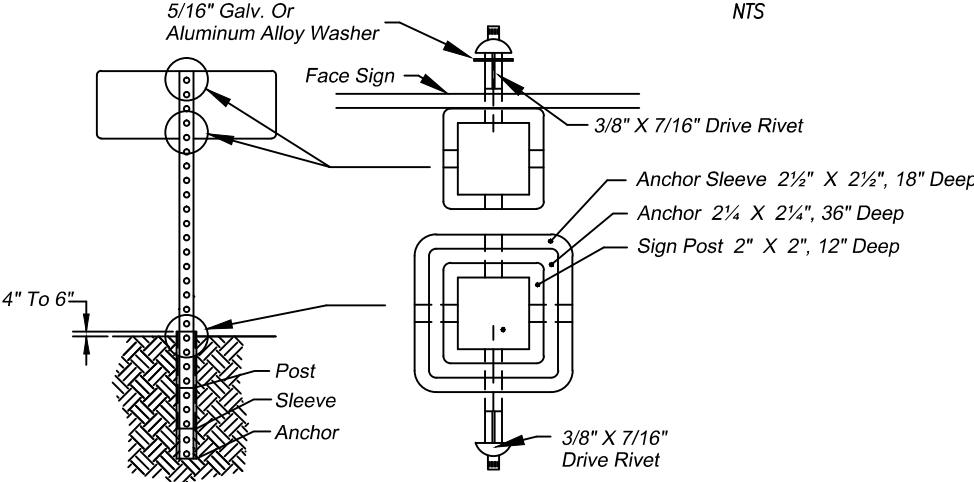
NTS

Predrill Ends And Rivet Both Signs Together



9" STREET NAME SIGN BLANKS

NTS



TYPICAL SIGN INSTALLATION

NTS

NOTE:
Anchor Assemblies Shall Not Be In Concrete Unless PVC Sleeve Is Provided Per County Detail.

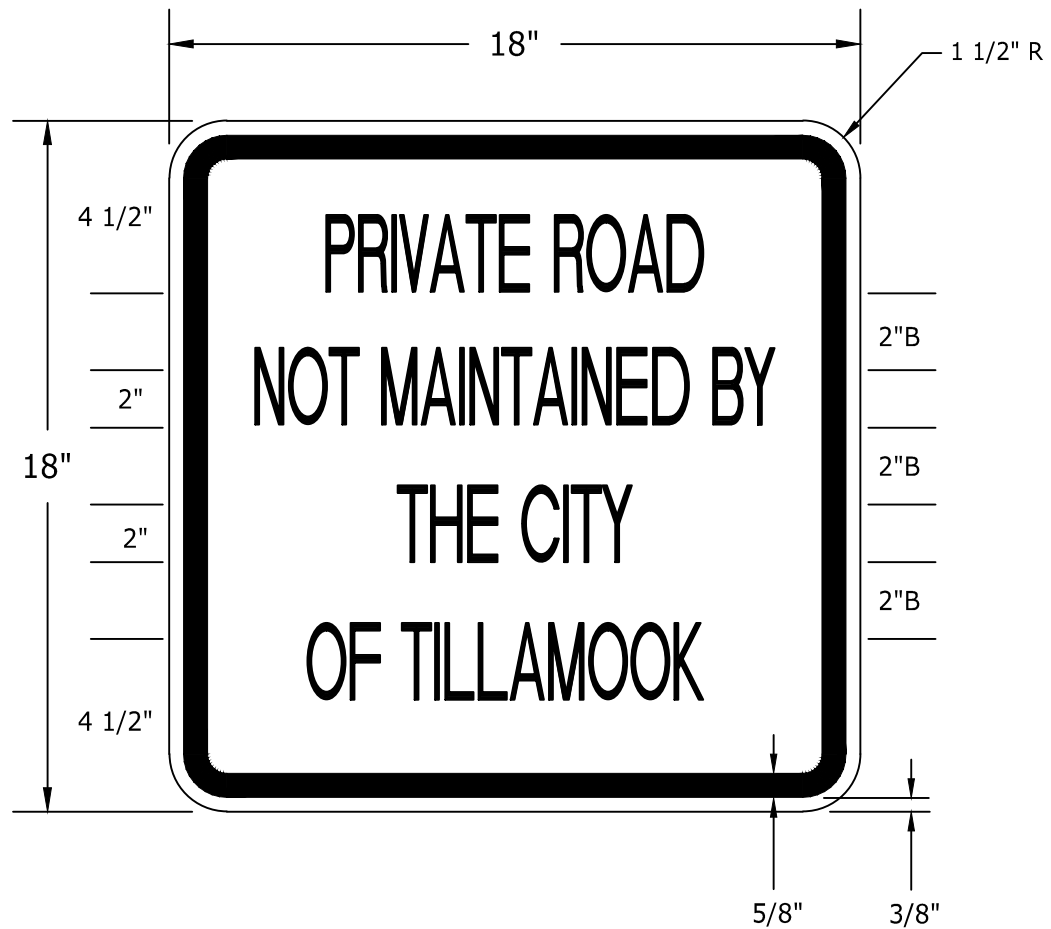


PERMANENT SIGNING LEGEND

DRAWING NO. 6510-ST

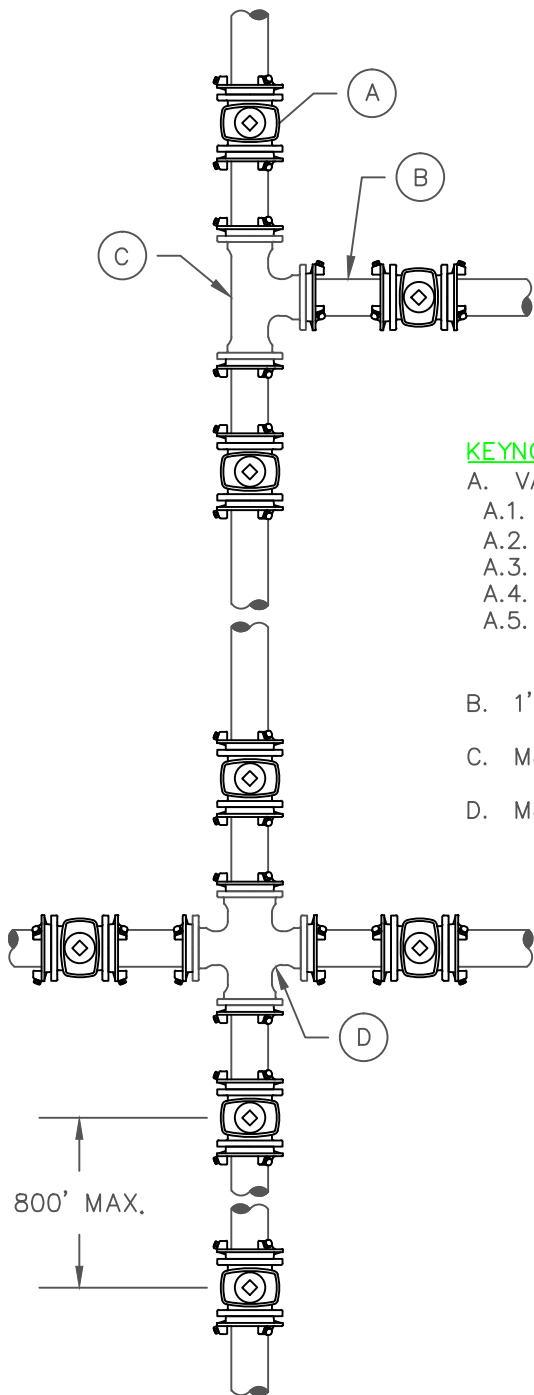
REVISED 12-2014





Note:

All Letters To Be Black On A White Type III
Relective Background.



KEYNOTES:

A. VALVE (TYPICAL).

A.1. MJ GATE VALVES 12" AND SMALLER.

A.2. MJ BUTTERFLY VALVES 14" AND LARGER.

A.3. VALVE SIZE SHALL MATCH MAINLINE SIZE.

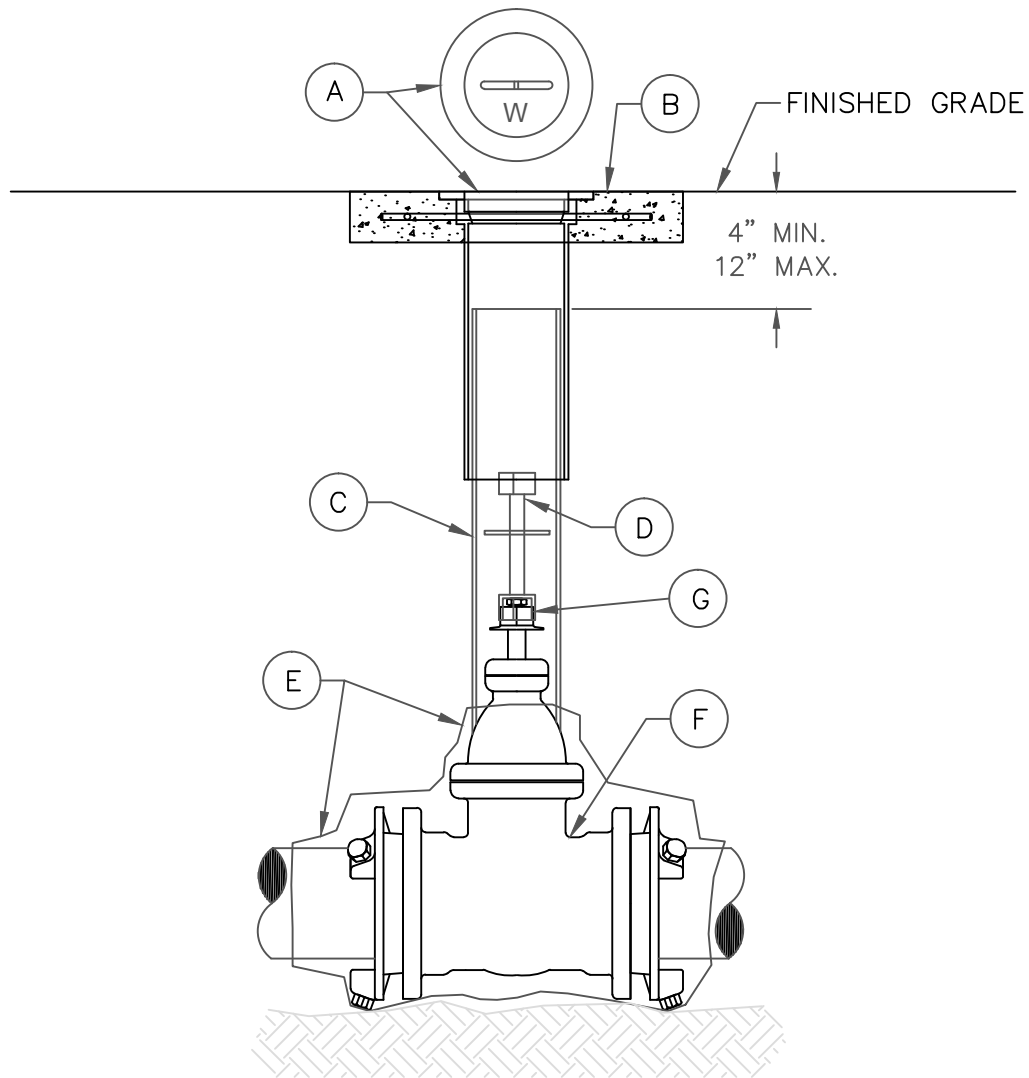
A.4. ALL MECHANICAL JOINTS SHALL BE RESTRAINED.

A.5. SEE DRAWING NO. 003-WA FOR VALVE BOX REQUIREMENTS.

B. 1'-6" DI SPOOL PE (TYPICAL).

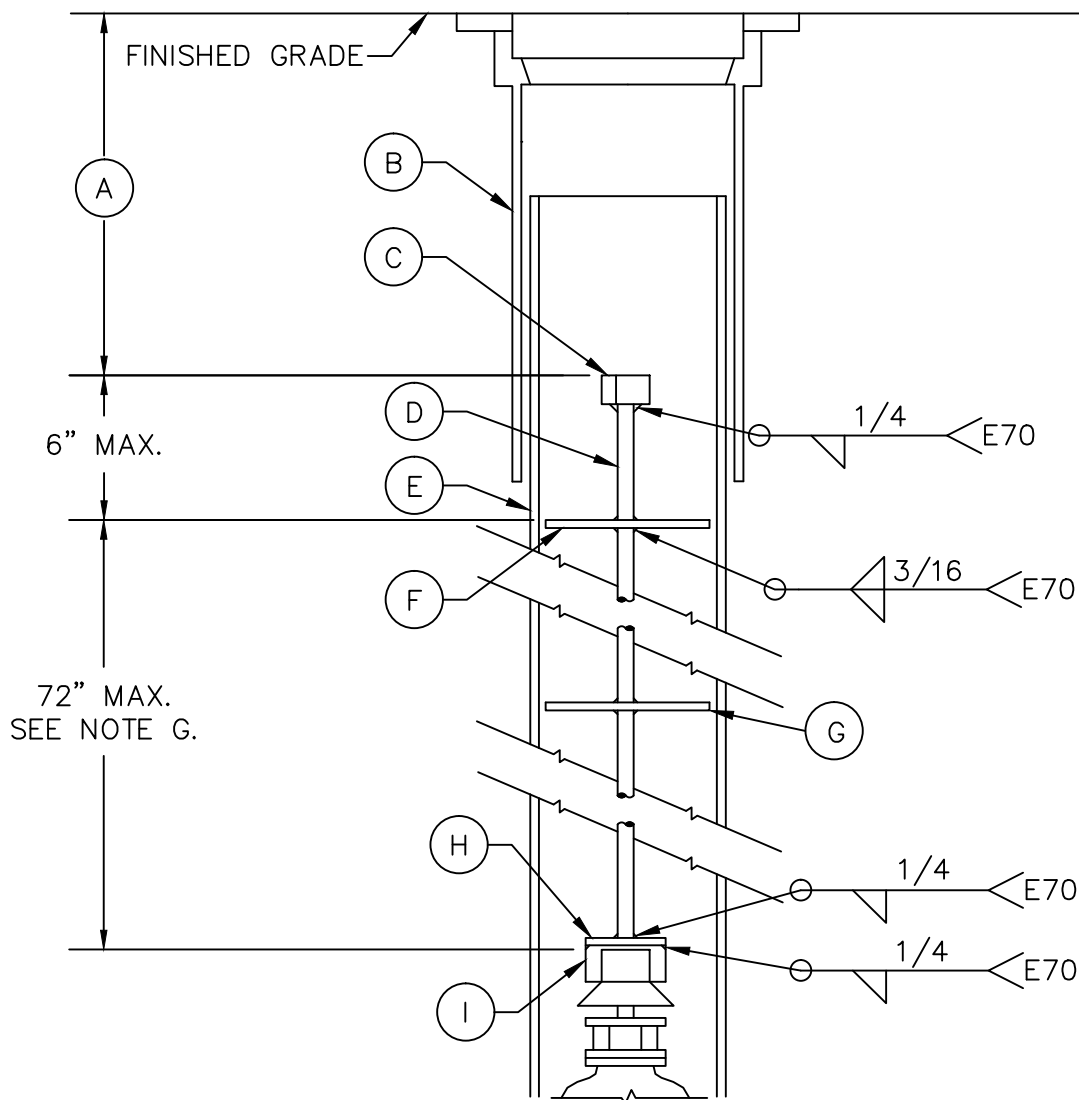
C. MJ TEE.

D. MJ CROSS.



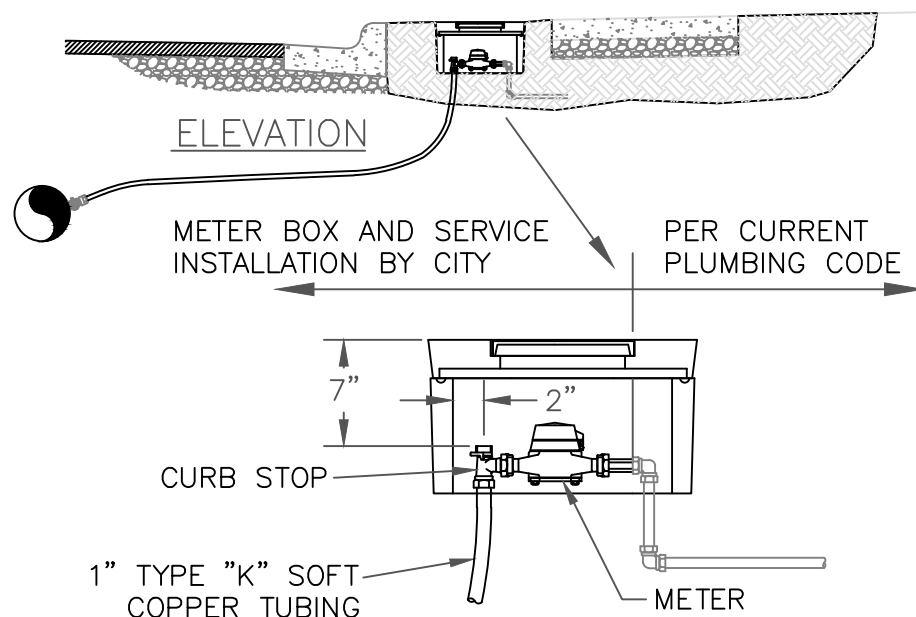
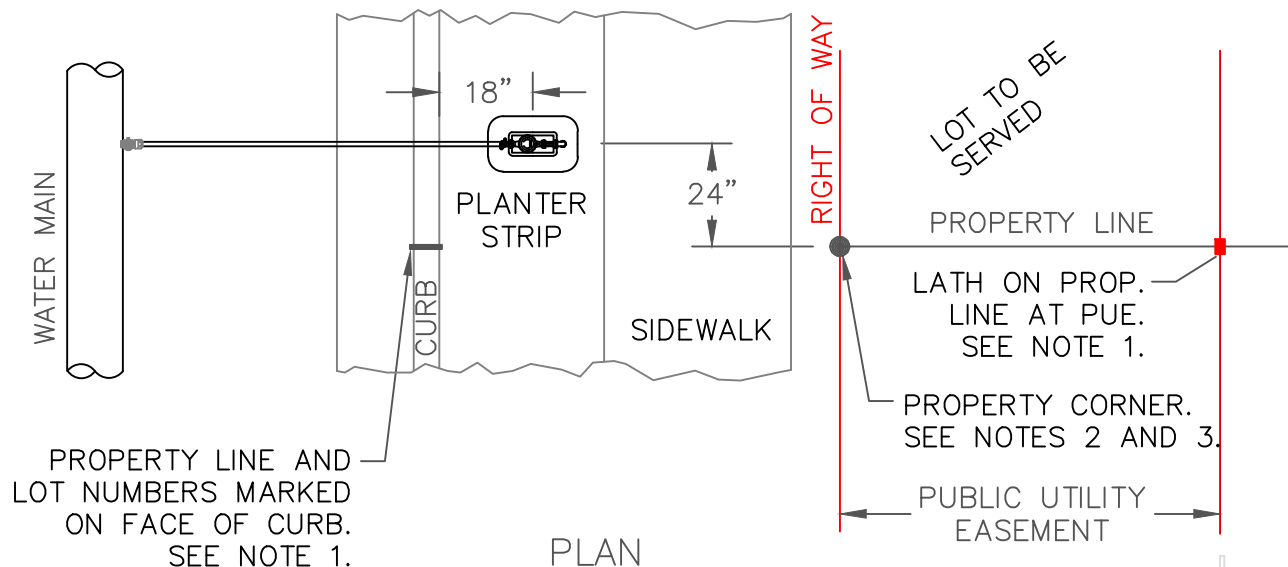
KEYNOTES:

- xi-3,13,t3; A. OLYMPIC FOUNDRY VB910 (OR APPROVED EQUAL) VALVE BOX AND COVER WITH "W" CAST IN TOP SURFACE. VALVE BOX SHALL BE PLUMB, CENTERED ON AXIS OF OPERATING NUT, AND SHALL NOT REST ON OPERATING ASSEMBLY.
- B. UNPAVED AREAS ONLY: PROVIDE 24" SQUARE BY 4" THICK CONCRETE OR AC PAVEMENT PAD WITH #4 REBAR STEEL REINFORCEMENT OVER 4" COMPACTED 1"-0" CRUSHED ROCK. REBAR SHALL BE 2" DEEP AND 3" FROM EDGE OF PAD. PAD SHALL BE CENTERED AROUND VALVE BOX
- C. 6" TYPE SDR 35 PVC, D3034 PIPE SPACER. LENGTH AS NECESSARY.
- D. OPERATOR EXTENSION REQUIRED WHEN VALVE NUT IS DEEPER THAN 48" FROM FINISHED GRADE. SEE DRAWING NO. 005-WA.
- E. WRAP VALVE WITH 3 LAYERS OF 8 MIL POLYETHYLENE PRIOR TO BACKFILLING. EXTEND PVC 6" MINIMUM BEYOND VALVE AND SECURE TO PIPE WITH POLYETHYLENE TAPE.
- F. VALVES 12" AND SMALLER SHALL BE MJ GATE VALVES. VALVES 14" AND LARGER SHALL BE MJ BUTTERFLY VALVES.
- G. 2" SQUARE OPERATING NUT.



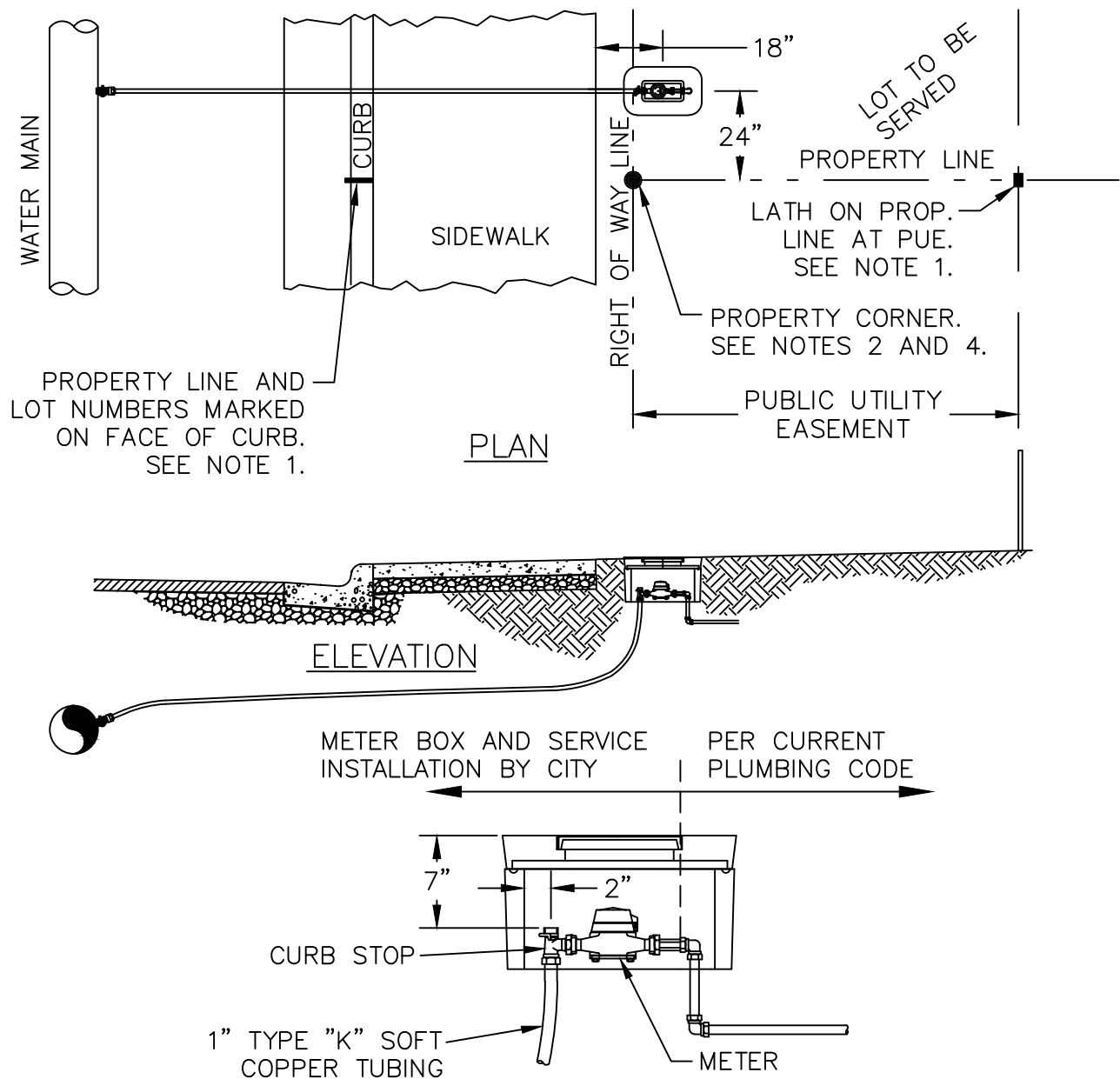
KEYNOTES:

- A. EXTEND 2" OPERATOR NUT TO BETWEEN 24" AND 36" OF FINISHED GRADE WHEN VALVE NUT IS DEEPER THAN 48" FROM FINISHED GRADE.
- B. VALVE BOX PER DETAIL No. 3.
- C. 2" SQUARE OPERATOR NUT.
- D. 1" MINIMUM SOLID STOCK A36 STEEL (ROUND OR SQUARE). VALVE OPERATOR EXTENSION SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
- E. 6" SDR 35 PVC D3034 PIPE SPACER. LENGTH AS NECESSARY.
- F. ROCK GUARD. $\frac{1}{8}$ " STEEL PLATE WELDED TO SOLID SHAFT. GUARD SHALL BE $\frac{3}{8}$ " SMALLER THAN INSIDE DIAMETER OF PIPE SPACER.
- G. SECONDARY ROCK GUARD IS REQUIRED IF DISTANCE FROM UPPER ROCK GUARD TO VALVE NUT EXCEEDS 72". INSTALL SECONDARY GUARD HALFWAY BETWEEN UPPER GUARD AND VALVE NUT.
- H. $2 \frac{1}{2}$ " X $2 \frac{1}{2}$ " X $\frac{3}{8}$ " STEEL FLAT BAR.
- I. 3" X 3" X $\frac{3}{8}$ " X 2" LONG STEEL SQUARE TUBE.



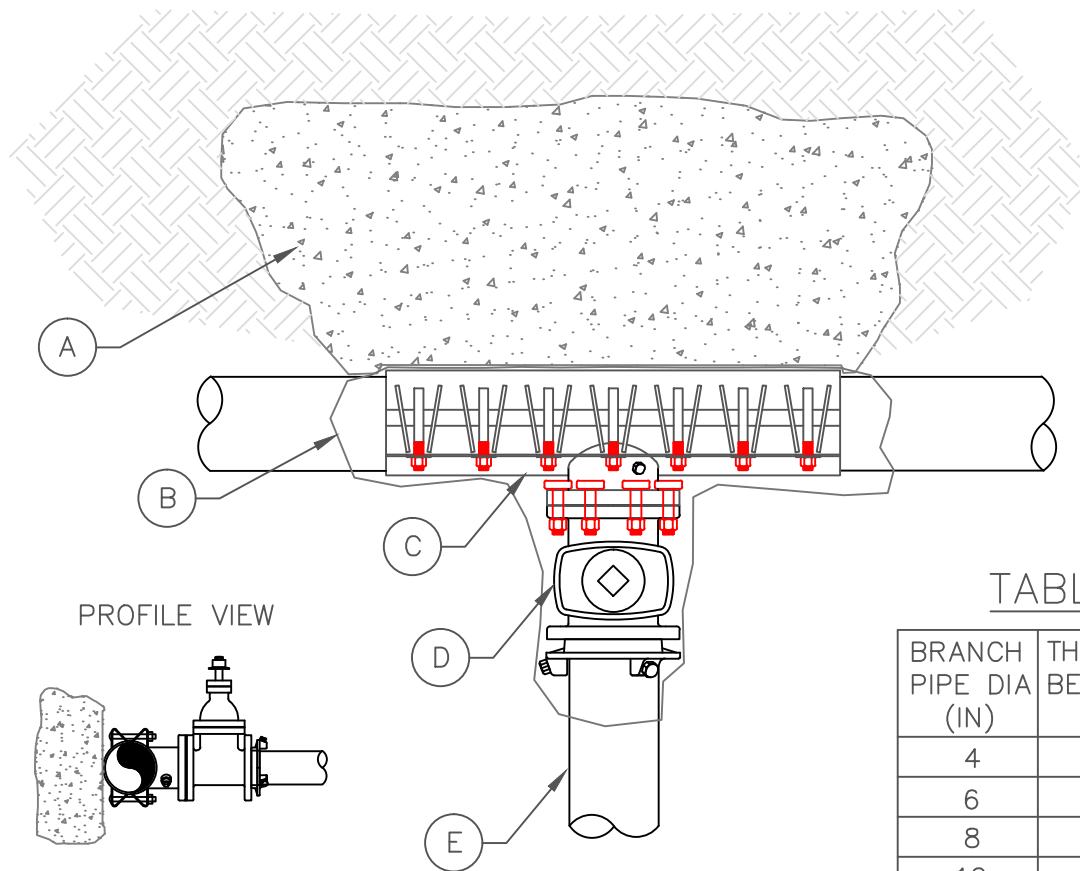
NOTES:

1. DEVELOPER'S SURVEYOR SHALL SET A LATH AT THE INTERSECTION OF THE PROPERTY LINE AND THE PUBLIC UTILITY EASEMENT. DEVELOPER'S SURVEYOR SHALL ALSO MARK THE PROPERTY LINE AND LOT NUMBERS ON THE FACE OF CURB WITH WHITE PAINT.
2. IF PROPERTY CORNER MONUMENTS HAVE NOT BEEN SET AT THE TIME OF WATER SERVICE INSTALLATION, THE DEVELOPER'S SURVEYOR SHALL SET A LATH AT THE PROPERTY CORNER LOCATION ON THE RIGHT-OF-WAY LINE.
3. ORS 92.044(7) PROHIBITS LOCATING ANY UTILITY INFRASTRUCTURE WITHIN 1 FOOT OF A SURVEY MONUMENT. DEVELOPER SHALL PAY FOR ANY RELOCATION OF SERVICES AND/OR METER BOXES FOUND TO FALL WITHIN 1 FOOT OF A SURVEY MONUMENT LOCATION.



NOTES:

1. DEVELOPER'S SURVEYOR SHALL SET A LATH AT THE INTERSECTION OF THE PROPERTY LINE AND THE PUBLIC UTILITY EASEMENT. DEVELOPER'S SURVEYOR SHALL ALSO MARK THE PROPERTY LINE AND LOT NUMBERS ON THE FACE OF CURB WITH WHITE PAINT.
2. IF PROPERTY CORNER MONUMENTS HAVE NOT BEEN SET AT THE TIME OF WATER SERVICE INSTALLATION, THE DEVELOPER'S SURVEYOR SHALL SET A LATH AT THE PROPERTY CORNER LOCATION ON THE RIGHT-OF-WAY LINE.
3. IF NO P.U.E., LOCATE METER BOX ADJACENT TO SIDEWALK.
4. ORS 92.044(7) PROHIBITS LOCATING ANY UTILITY INFRASTRUCTURE WITHIN 1 FOOT OF A SURVEY MONUMENT. DEVELOPER SHALL PAY FOR ANY RELOCATION OF SERVICES AND/OR METER BOXES FOUND TO FALL WITHIN 1 FOOT OF A SURVEY MONUMENT LOCATION.

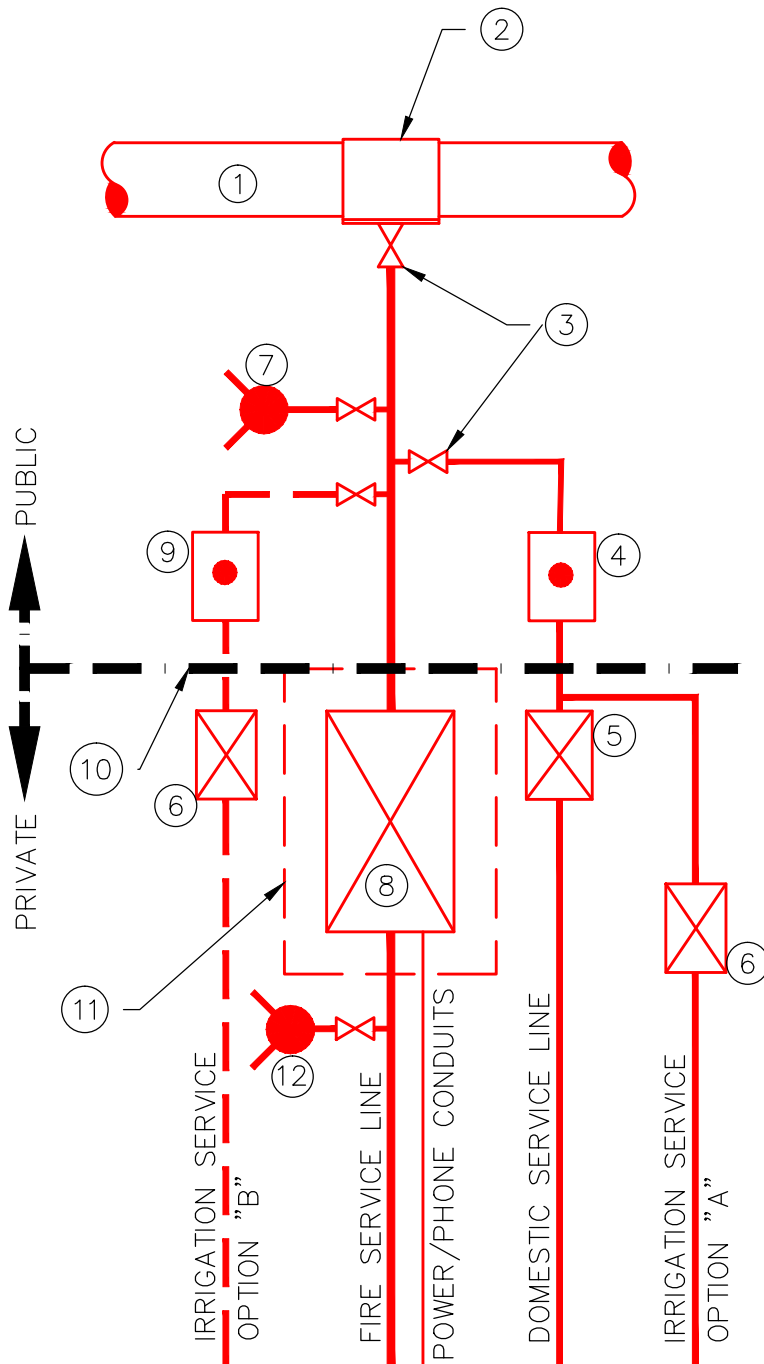


KEYNOTES:

- CONCRETE THRUST BLOCK POURED AGAINST UNDISTURBED EARTH. THRUST BLOCK SIZE SHALL BE PER TABLE 1 AND SHALL NOT BE LESS THAN ONE FOOT IN ANY DIMENSION. CONCRETE SHALL BE CLASS 3500 (6.5 SACK MIN.)
- WRAP TAPPING SADDLE AND VALVE WITH 3 LAYERS OF 8 MIL POLYTHEYLENE PRIOR TO POURING THRUST BLOCK AND BACKFILLING. EXTEND POLYETHYLENE 6" MINIMUM BEYOND SADDLE AND VALVE AND SECURE TO PIPE WITH POLYETHYLENE TAPE.
- STAINLESS STEEL TAPPING SADDLE WITH GASKET AND FLANGED CONNECTION.
- LINE-SIZE GATE VALVE (FLG X MJ).
- JOINTS ON BRANCH PIPE SHALL BE RESTRAINED PER DRAWING NO. 021-WA.

GENERAL NOTES:

- BEFORE INSTALLING TAPPING SADDLE, CONTRACTOR SHALL THOROUGHLY CLEAN PIPE TO REMOVE ALL DIRT, ROCKS, AND OTHER FOREIGN MATERIAL FROM PIPE WHERE SADDLE WILL BE INSTALLED.
- SADDLE BOLTS SHALL BE TORQUED TO MANUFACTURER'S SPECIFICATIONS.
- CONTRACTOR SHALL ENSURE THAT GASKET IS PROPERLY ALIGNED AND FREE OF FOREIGN MATERIAL PRIOR TO TIGHTENING SADDLE.
- SADDLE LOCATION AND INSTALLATION SHALL BE APPROVED BY DISTRICT INSPECTOR PRIOR TO TAPPING.
- CONTRACTOR SHALL AIR TEST SADDLE TO 40 PSI PRIOR TO TAPPING.
- CONTRACTOR SHALL FLUSH AND PRESSURE TEST VALVE PRIOR TO BACKFILLING.



KEYNOTES:

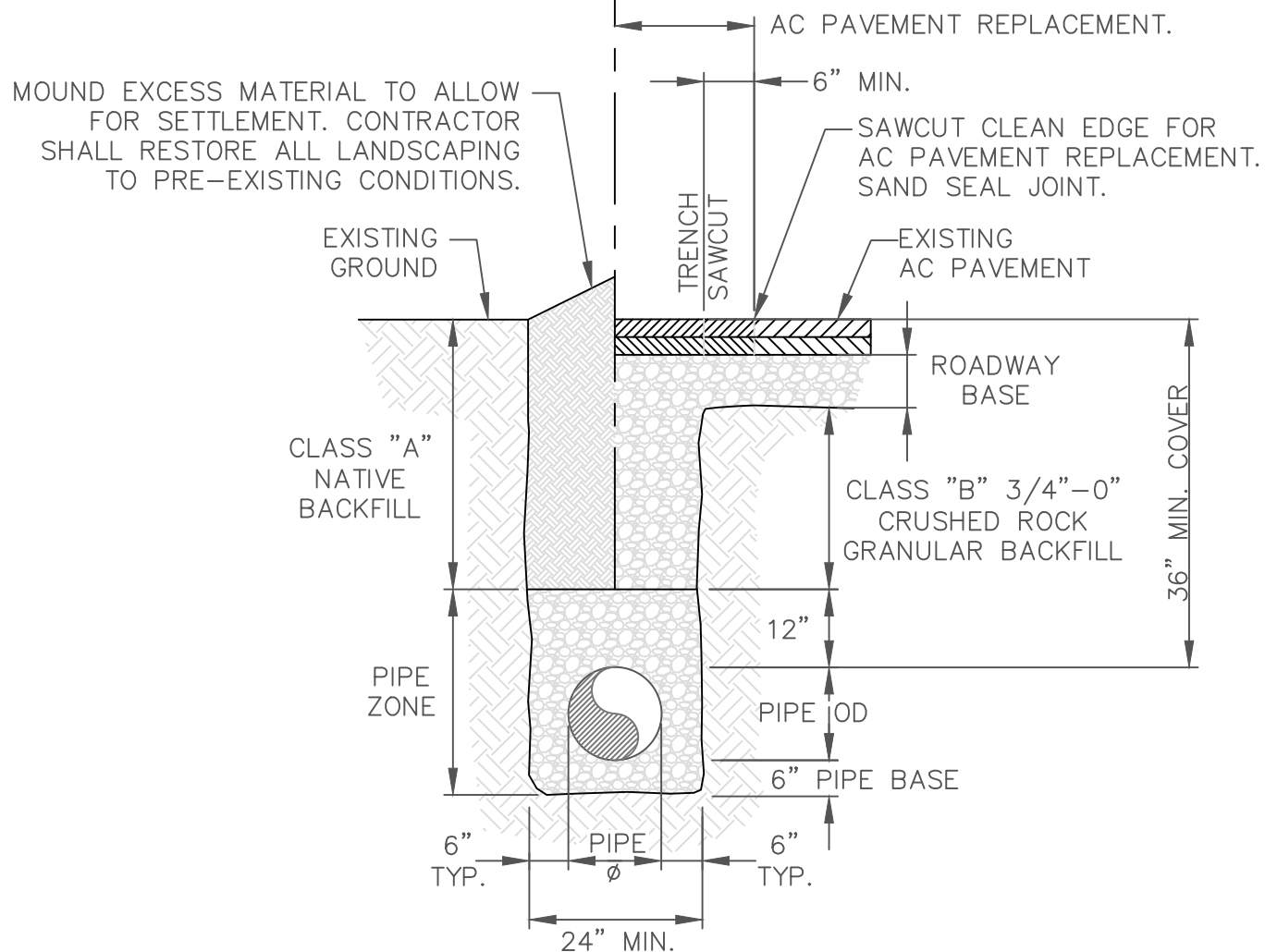
- ① EXISTING WATER MAIN.
- ② SERVICE CONNECTION WET TAP BY CITY.
- ③ GATE VALVE (TYPICAL).
- ④ DOMESTIC WATER SERVICE METER.
- ⑤ DOMESTIC SERVICE BACKFLOW PREVENTION ASSEMBLY.
- ⑥ IRRIGATION BACKFLOW PREVENTION ASSEMBLY.
- ⑦ PUBLIC FIRE HYDRANT (IF REQUIRED).
- ⑧ FIRE SERVICE BACKFLOW PREVENTION ASSEMBLY.
- ⑨ IRRIGATION METER (OPTIONAL AT ADDITIONAL SDC EXPENSE).
- ⑩ RIGHT-OF-WAY LINE.
- ⑪ PERMANENT UTILITY EASEMENT MINIMUM 5' OUTSIDE OF FIRE SERVICE VAULT.
- ⑫ PRIVATE HYDRANT OR FIRE DEPT CONNECTION (FDC) – REFER TO NOTE 3.

NOTES:

1. THE IRRIGATION SYSTEM SHALL BE CONNECTED DOWNSTREAM OF THE DOMESTIC SERVICE BACKFLOW PREVENTION ASSEMBLY (OPTION A) OR SHALL HAVE ITS OWN METER AND BACKFLOW ASSEMBLY (OPTION B).
2. DOMESTIC AND FIRE SERVICE LINES 4" AND LARGER SHALL BE DUCTILE IRON FOR A DISTANCE OF 5' MINIMUM DOWNSTREAM OF THE BACKFLOW VAULT.
3. PRIVATE FDC OR HYDRANT MUST BE LOCATED ON CUSTOMER SIDE OF BACKFLOW DEVICE.

CLASS "A" NATIVE BACKFILL

CLASS "B" GRANULAR BACKFILL



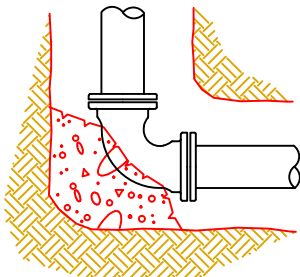
NOTES:

1. PIPE ZONE MATERIAL SHALL BE 3/4"-0" CRUSHED ROCK GRANULAR BACKFILL COMPACTED TO 95% OF AASHTO T-99.
2. CLASS "A" NATIVE BACKFILL MAY ONLY BE USED OUTSIDE OF PAVED AREAS AND REQUIRES DISTRICT APPROVAL. BACKFILL SHALL BE COMPACTED TO 90% OF AASHTO T-99 IN LIFTS NOT EXCEEDING 18" (LOOSE MEASURE).
3. CLASS "B" 3/4"-0" CRUSHED ROCK GRANULAR BACKFILL SHALL BE USED WITHIN PAVED AREAS. BACKFILL SHALL BE COMPACTED TO 95% OF AASHTO T-99.

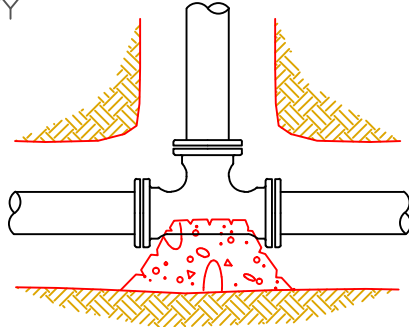
(HORIZONTAL)
BEARING AREA OF THRUST BLOCKS IN SQ FT

FITTING SIZE	TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
4	1.3	1.8	1.0	1.0	1.0
6	2.8	4.0	2.2	1.1	1.0
8	5.0	7.1	3.8	2.0	1.0
12	11.3	16.0	8.7	4.4	2.2
16	20.1	28.4	15.4	7.8	3.9
20	31.1	44.4	24.0	12.3	6.2
24	45.2	64.0	34.6	17.7	8.9

VALUES BASED ON 200 PSI
WATER PRESSURE AND 2000 PSF
SOIL BEARING CAPACITY



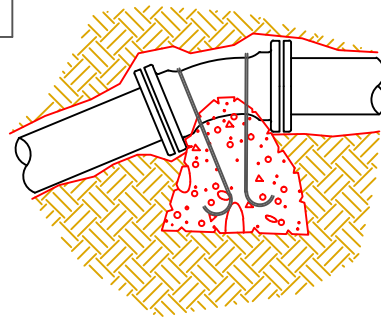
BEND



TEE

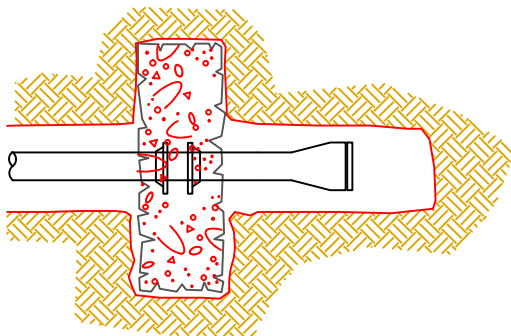
VOLUME OF THRUST BLOCK
IN CU YDS (VERTICAL)

FITTING SIZE	BEND ANGLE		
	45°	22.5°	11.25°
4	1.1	0.4	0.2
6	2.7	1.0	0.4
8	4.0	1.5	0.6
12	8.5	3.2	1.3
16	14.8	5.6	2.3



VERTICAL BEND

FITTING SIZE	ROD SIZE	EMBEDMENT
4"–12"	#6	30"
14"–16"	#8	36"



STRADDLE BLOCK

SEE DRAWING No. 200-WA

NOTES:

1. THRUST BLOCKING SHALL BE INSTALLED AT ALL TEES, BENDS AND ENDS OF PIPING (IN ADDITION TO RESTRAINED JOINTS).
2. CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
3. ALL CONCRETE TO BE CLASS 3500 (6.5 SACK MIN.)
4. INSTALL 4 LAYERS OF 3 MIL POLYETHENE SHEET AROUND FITTING. SECURE SHEET ENDS TO PREVENT INFILTRATION OF DIRT BETWEEN SHEET AND PIPE FITTING PRIOR TO POURING THRUST BLOCKING.
5. PROTECT MECHANICAL JOINT FOLLOWERS AND BOLTS FROM CONCRETE WITH TEMPORARY FORMS AND POLYETHENE SHEETING.

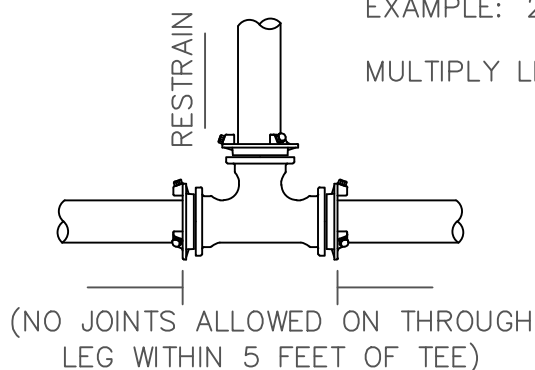
RESTRAINED LENGTH (FEET) REQUIRED FROM COMMON FITTINGS

PIPE DIA (IN)	DEAD END / TEE BRANCH	HORIZONTAL & VERTICAL BENDS				REDUCER (SEE NOTE 3)			
		90°	45°	22 1/2°	11 1/4°	4"	6"	8"	10"
4	45	45	15	10	5	-	-	-	-
6	62	62	20	10	5	25	-	-	-
8	75	75	25	10	5	42	24	-	-
10	95	95	30	10	5	62	48	27	-
12	115	115	35	10	5	79	67	49	27

THESE VALUES ARE BASED ON A TEST PRESSURE OF 150 PSI. IF TEST PRESSURE EXCEEDS 150 PSI, INCREASE RESTRAINED LENGTH VALUE BY THE RATIO OF THE ACTUAL PRESSURE TO 150 PSI.

EXAMPLE: 200 PSI TEST PRESSURE — $\frac{200 \text{ PSI}}{150 \text{ PSI}} = 1.33$

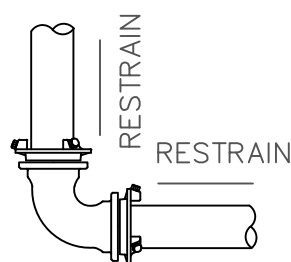
MULTIPLY LISTED VALUE FOR RESTRAINED LENGTH BY 1.33



TEE BRANCH



DEAD END



BEND

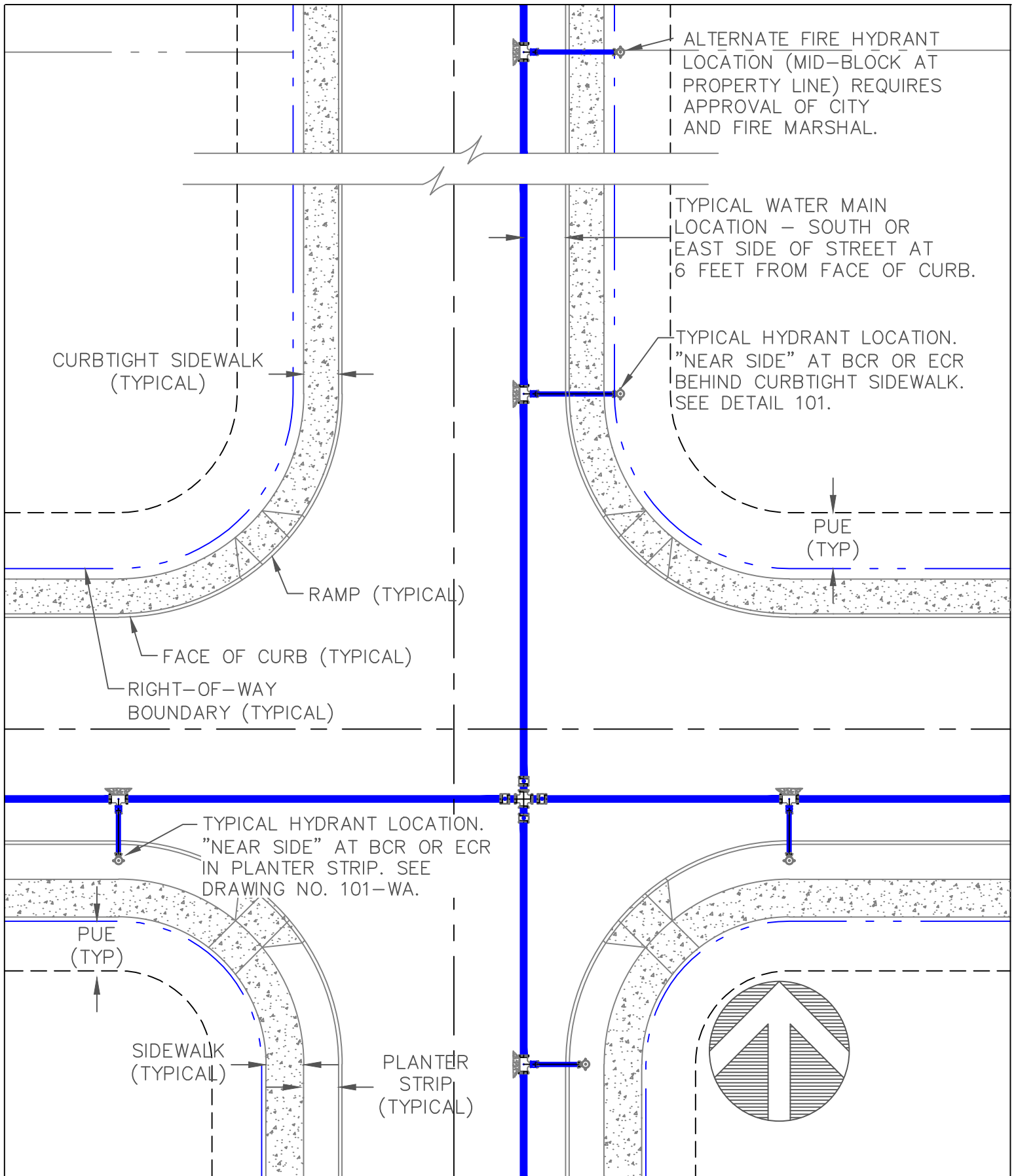


REDUCER

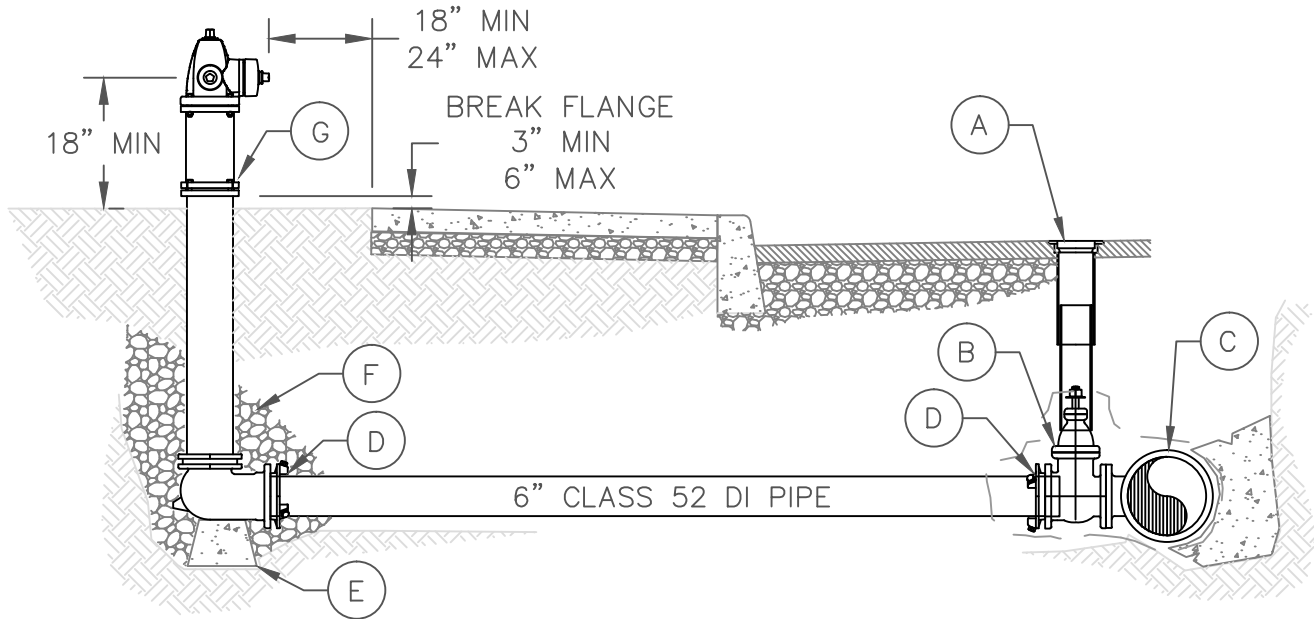
NOTES:

- ALL PIPE JOINTS WITHIN THE SPECIFIED DISTANCE FROM A DEAD END, TEE BRANCH, REDUCER (RESTRAIN LARGE DIAMETER SIDE EXCEPT AS ALLOWED IN NOTE 3), OR BEND (RESTRAIN EACH SIDE) SHALL BE RESTRAINED WITH FIELD LOK® OR FAST GRIP® GASKETS.
- RESTRAINED LENGTH VALUES ARE BASED ON THE FOLLOWING ASSUMPTIONS:
 - TEST PRESSURE: 150 PSI
 - PIPE MATERIAL: CEMENT-MORTAR LINED DUCTILE IRON WITHOUT POLY WRAP
 - PIPE COVER: 3 FEET
 - TRENCH CONDITIONS: TYPE 5 (CRUSHED ROCK IN PIPE ZONE AT 90% OF T-99)
 - SURROUNDING SOIL CLASSIFICATION: GM/SM (SAND/SILT)
 - SURROUNDING SOIL DENSITY: 90 LB/FT³
 - FACTOR OF SAFETY: 1.5
- JOINT RESTRAINT IS NOT REQUIRED ON THE LARGE DIAMETER SIDE OF REDUCER IF THE UNRESTRAINED STRAIGHT PIPE LENGTH ON THE SMALL DIAMETER SIDE OF THE REDUCER EXCEEDS THE VALUE CALCULATED AS FOLLOWS:

$$\text{SMALL PIPE STRAIGHT LENGTH} = \frac{\text{LARGE DIAMETER}}{\text{SMALL DIAMETER}} \times \text{RESTRAINED LENGTH (FROM TABLE ABOVE)}$$
- CONTACT CITY ENGINEER FOR GUIDANCE ON PIPE JOINT RESTRAINT IF PIPE DIAMETER EXCEEDS 12" AND/OR DESIGN CONDITIONS DIFFER SUBSTANTIALLY FROM THE ASSUMPTIONS LISTED ABOVE.



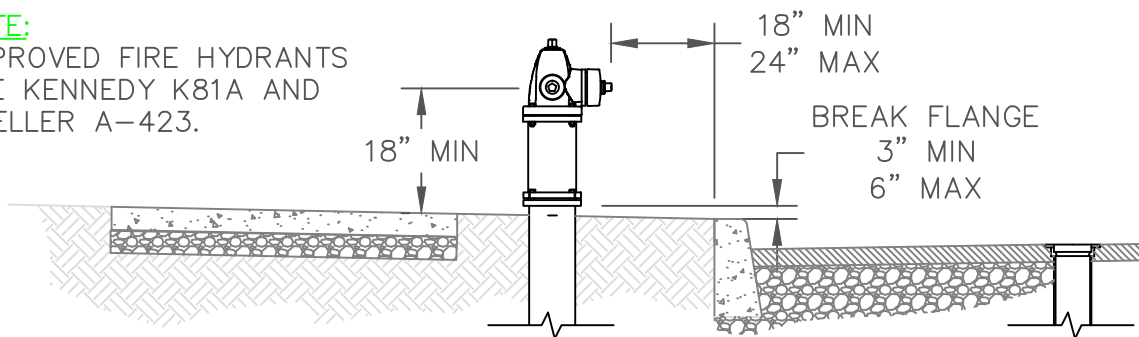
HYDRANT BEHIND CURBTIGHT SIDEWALK



HYDRANT IN PLANTER STRIP

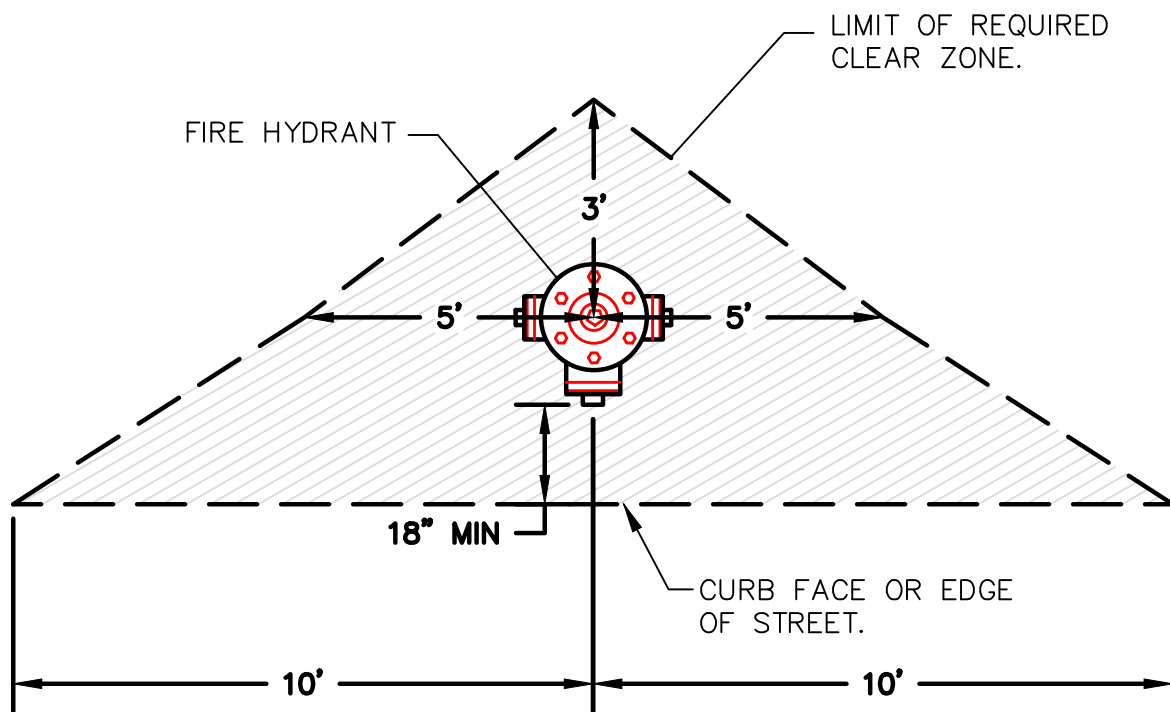
NOTE:

APPROVED FIRE HYDRANTS ARE KENNEDY K81A AND MUELLER A-423.



KEYNOTES:

- A. VALVE BOX ASSEMBLY PER DRAWING No. 003-WA.
- B. 6" GATE VALVE. WRAP TEE AND VALVE WITH 3 LAYERS OF 8 MIL POLYETHYLENE PRIOR TO BACKFILLING.
- C. TEE. NEW CONSTRUCTION TEE SHALL BE MJ X MJ. CONNECTIONS TO EXISTING MAINS SHALL BE TAPPING TEE PER DRAWING No. 008-WA. THRUST BLOCK REQUIRED ONLY FOR TAPPING TEE.
- D. MECHANICAL JOINT WITH GRIP FOLLOWER. ALL JOINTS IN HYDRANT ASSEMBLY SHALL BE FULLY RESTRAINED.
- E. 12"X12" CONCRETE PIER BLOCK ON UNDISTURBED NATIVE SOIL.
- F. DRAIN ROCK POCKET. 4 CUBIC FEET MINIMUM.
- G. MAINTAIN MINIMUM CLEAR SPACE IN ALL DIRECTIONS PER DRAWING No. 102-WA. PLACEMENT OF CONCRETE AROUND HYDRANTS IS PROHIBITED.



NOTES:

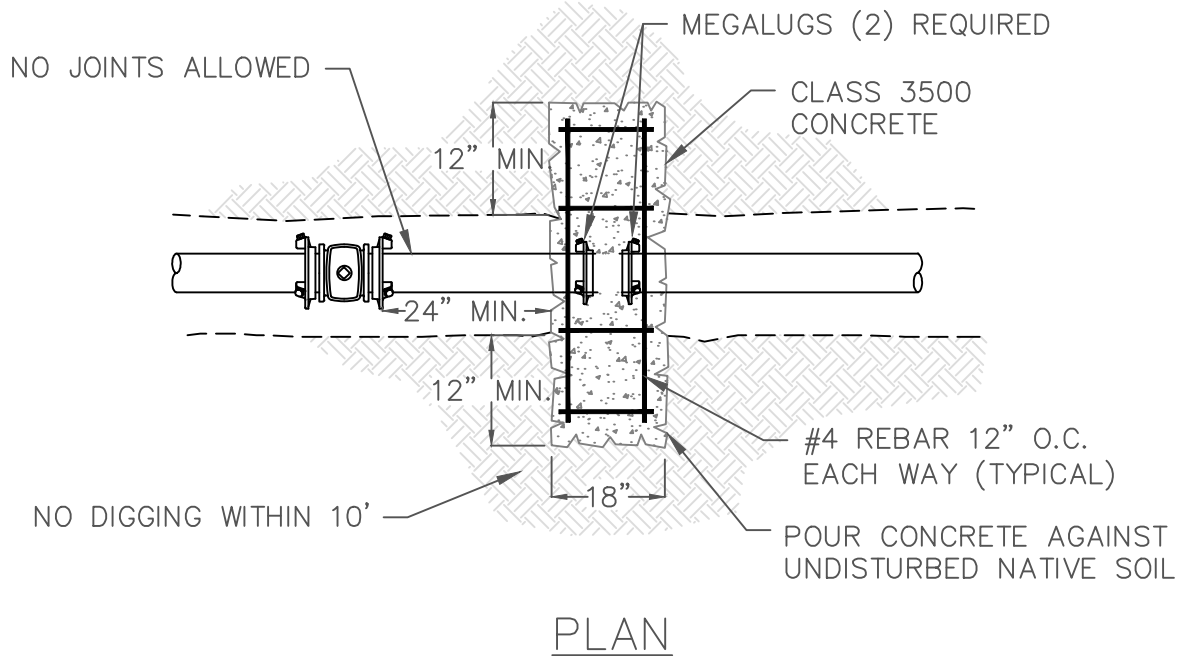
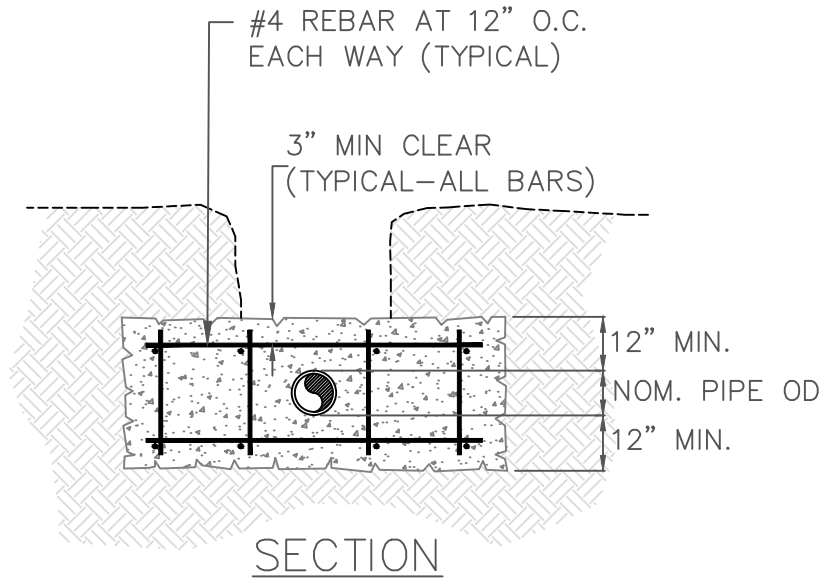
1. THE CLEAR ZONE PROHIBITS THE FOLLOWING:
 - VEHICLE PARKING
 - FENCES
 - TREES
 - LARGE BUSHES
 - RETAINING WALLS
 - ANYTHING ELSE THAT MAY INTERFERE WITH OPERATION OF THE FIRE HYDRANT.

2. THE CLEAR ZONE ALLOWS THE FOLLOWING:

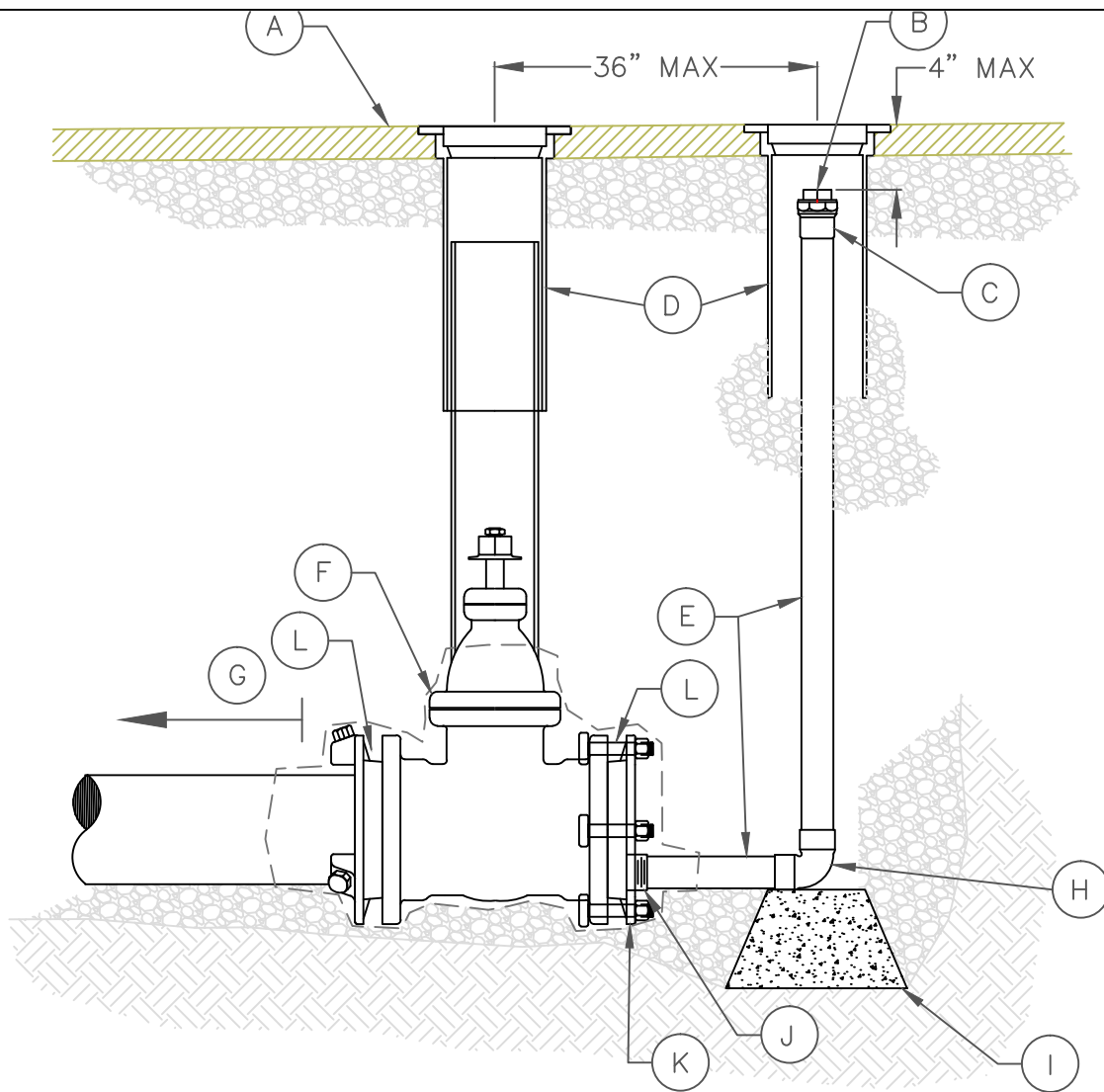
- LAWN GRASS
- MULCH
- BARK DUST
- GROUND COVER
- LOW PLANTINGS

HOWEVER, THE PROPERTY OWNERS SHOULD BE AWARE THE GROUND COVER COULD BE DAMAGED WHEN THE HYDRANT IS USED OR MAINTAINED.

3. THE CONTRACTOR SHALL NOTIFY CITY WHEN FINAL LIFT OF AC PAVEMENT IS TO BE PLACED SO A BLUE REFLECTOR BUTTON CAN BE INSTALLED FOR THE FIRE DEPARTMENT.



NOTE:
CONCRETE STRADDLE BLOCKS FOR 12" AND LARGER WATER MAINS SHALL BE DESIGNED AND STAMPED BY THE ENGINEER OF RECORD.

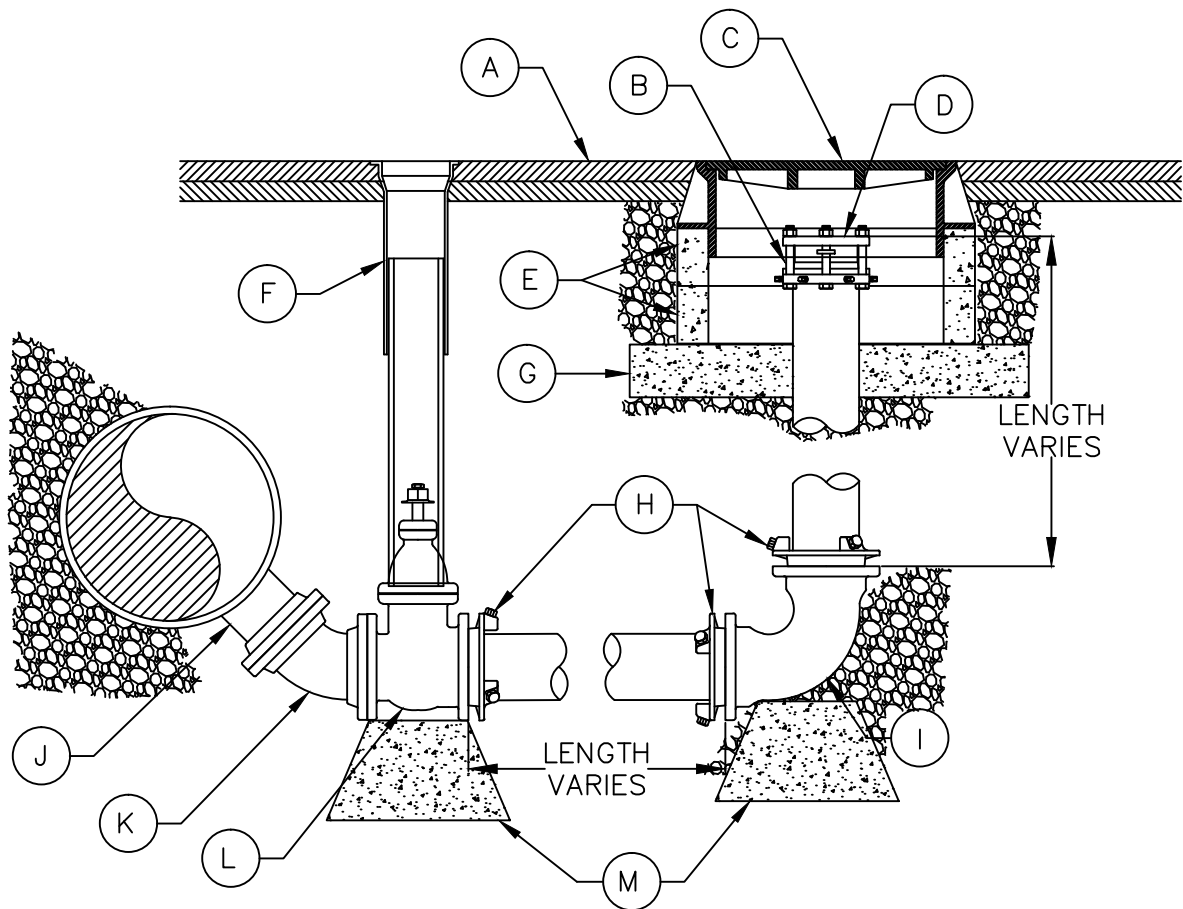


KEYNOTES:

- A. FINISHED GRADE. IF OUTSIDE THE PAVED AREA PROVIDE 24" SQUARE BY 4" THICK AC PAVEMENT OR CONCRETE PAD OVER 4" COMPACTED 1"-0" CRUSHED ROCK. PAD SHALL BE CENTERED AROUND VALVE BOX.
- B. 2" BRASS PLUG HAND-TIGHT.
- C. 2" ADAPTER. COPPER SWEAT TO FIPT.
- D. VALVE BOX ASSEMBLY PER DETAIL 3 AND 5.
- E. 2" TYPE K RIGID COPPER TUBING OR THREADED BRASS PIPING.
- F. LINE SIZE GATE VALVE. WRAP VALVE WITH 3 LAYERS OF 8 MIL POLYETHYLENE.
- G. RESTRAIN JOINTS PER DRAWING NO. 021-WA.
- H. 2" ELL COPPER SLIP OR THREADED BRASS.
- I. 8"X8" CONCRETE PIER BLOCK ON NATIVE SOIL.
- J. 2" ADAPTER. COPPER SWEAT OR THREADED BRASS TO MIPT.
- K. MJ CAP WITH OFFSET 2" PLUG AT BOTTOM.
- L. FULLY RESTRAINED JOINT WITH MECHANICAL GRIP FOLLOWERS.

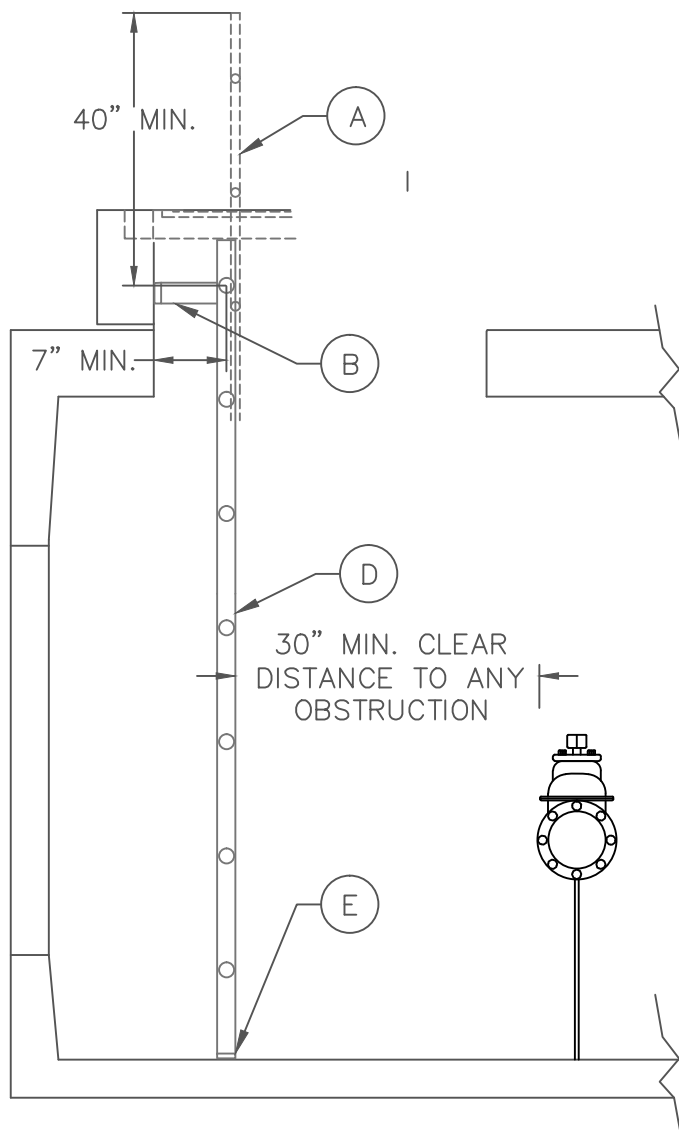
GENERAL NOTE:

1. APPLICABLE TO DEAD END MAINS, 10" AND SMALLER, WHICH WILL BE EXTENDED IN THE FUTURE. EXTEND MAIN AS CLOSE AS PRACTICABLE TO END OF STREET.

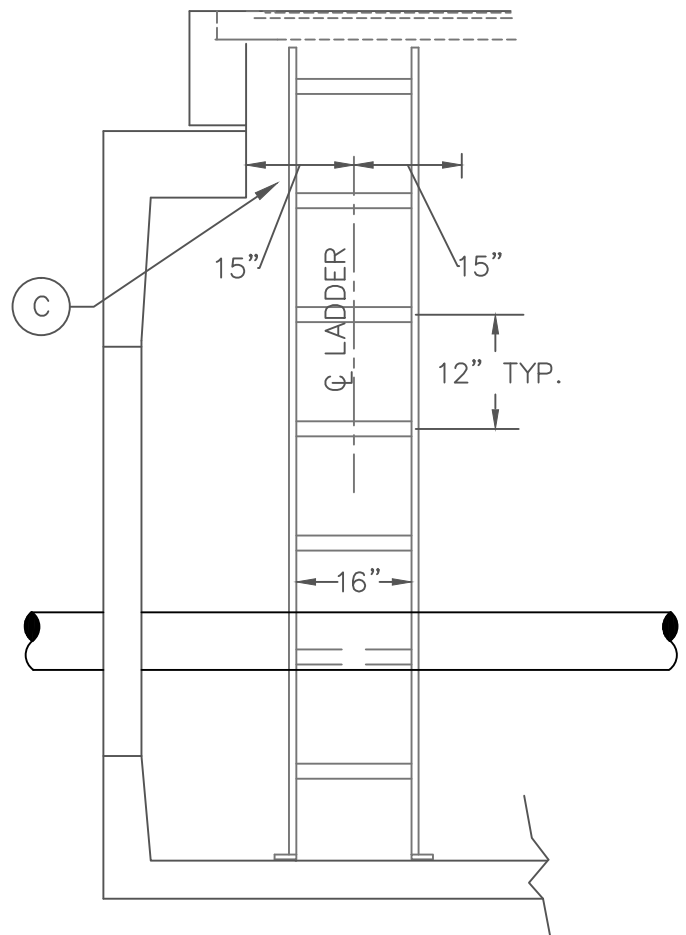


KEYNOTES:

- A. FINISHED GRADE. PROVIDE 4" THICK AC PAVEMENT OR CONCRETE PAD CENTERED AROUND VALVE BOXES AND MANHOLES IF OUTSIDE OF PAVED AREAS. PAD SHALL EXTEND A MINIMUM OF 6" BEYOND ALL SIDES OF VALVE BOXES AND MANHOLES.
- B. 6" RESTRAINED FLANGED COUPLING ADAPTER.
- C. 10"X24" STANDARD MANHOLE FRAME WITH "W" LID.
- D. 6" BLIND FLANGE.
- E. 2 EACH-6"X24" CONCRETE MANHOLE GRADE RING.
- F. VALVE BOX ASSEMBLY PER DRAWING NO. 003-WA.
- G. 6" THICK CAST-IN-PLACE CONCRETE BASE.
- H. ALL JOINTS IN BLOWOFF ASSEMBLY SHALL BE FULLY RESTRAINED WITH MECHANICAL GRIP FOLLOWERS.
- I. 6" 90° BEND. MJ X MJ.
- J. MAINLINE DIAMETER X 6" TEE ROTATED DOWN 45°. MJ X FLANGE.
- K. 45° BEND. FLANGE X FLANGE.
- L. 6" GATE VALVE. FLANGE X MJ.
- M. 12"X12" CONCRETE PIER BLOCK ON UNDISTURBED NATIVE SOIL.



SIDE VIEW



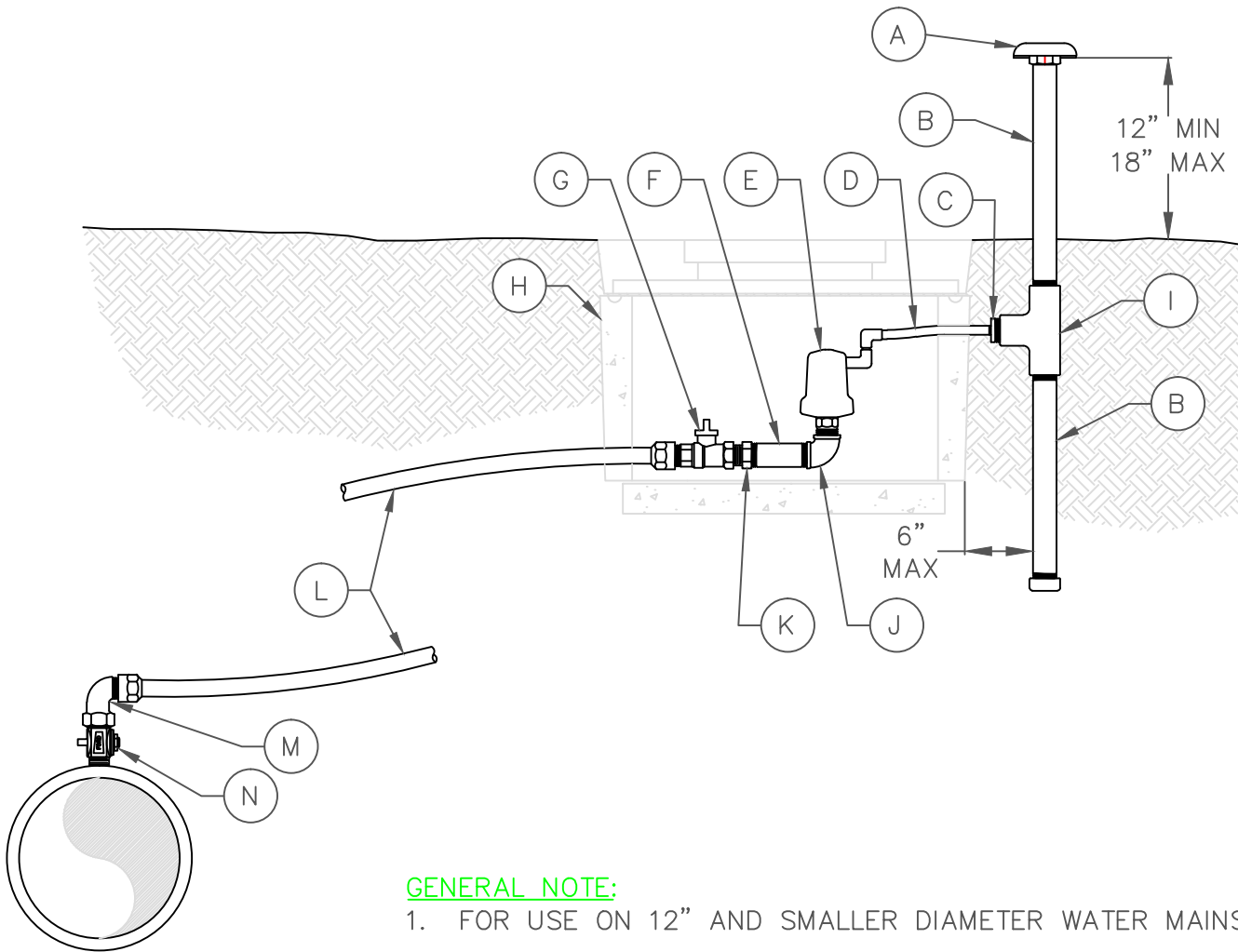
FRONT VIEW

KEYNOTES:

- A. LADDER EXTENSION SHALL BE ALUMINUM AND EXTEND 40" ABOVE THE TOP RUNG OF THE LADDER.
- B. ATTACH LADDER SUPPORT TO INSIDE FACE OF VAULT COVER OPENING WITH STAINLESS STEEL HARDWARE AS SHOWN. CENTERLINE OF RUNG MUST BE SET 7" FROM FACE OF SURFACE BEHIND RUNG.
- C. PROVIDE 15" MINIMUM LATERAL CLEARANCE ON EACH SIDE CENTERLINE OF LADDER.
- D. LADDER SHALL MEET THE REQUIREMENTS OF OSHA AND SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
- E. LADDER SHALL BE ATTACHED TO FLOOR OF VAULT WITH STAINLESS STEEL HARDWARE OF SUFFICIENT SIZE.



- ## SUMP/SUMP PUMP INSTALLATION

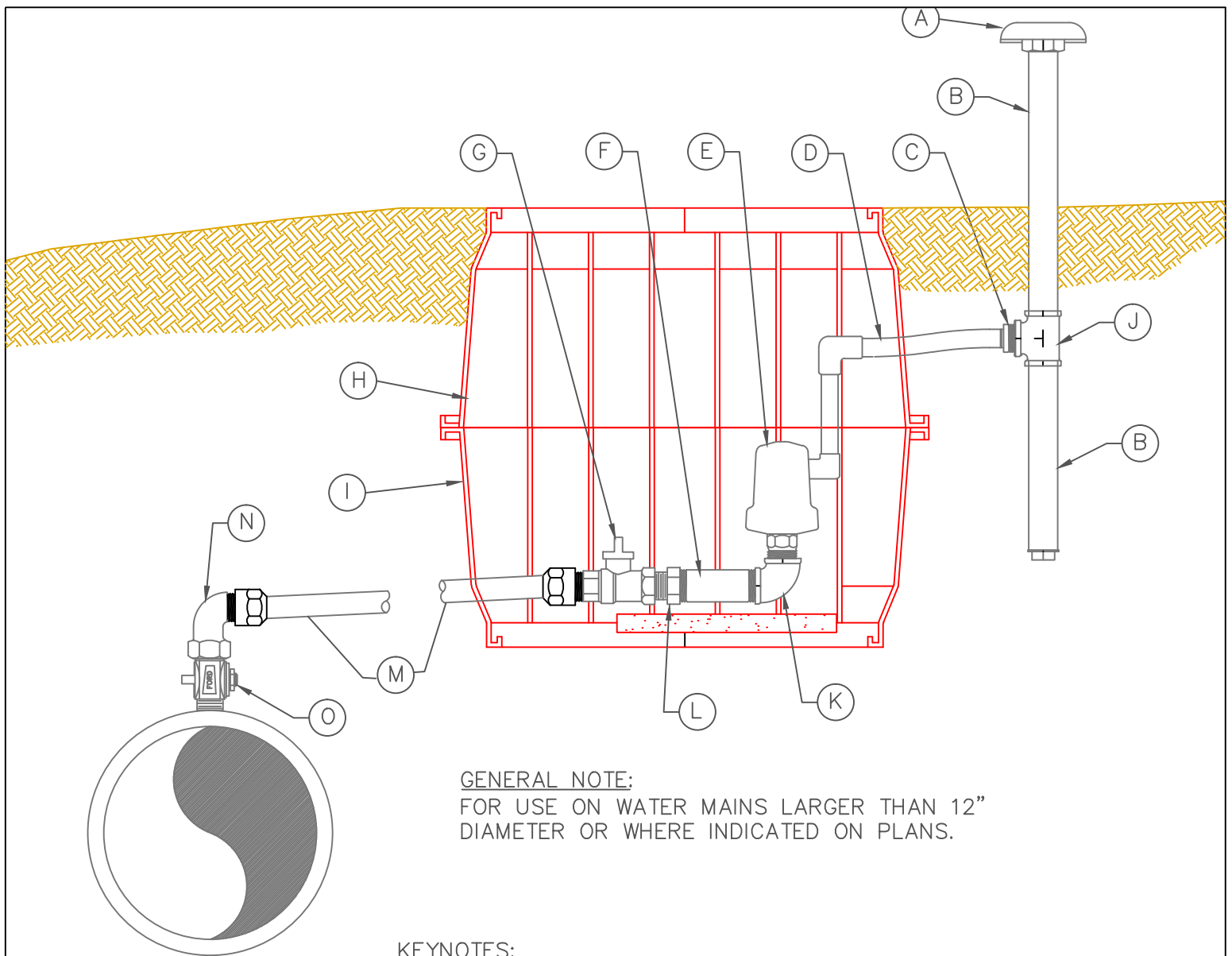


GENERAL NOTE:

1. FOR USE ON 12" AND SMALLER DIAMETER WATER MAINS.

KEYNOTES:

- 1" TANK VENT WITH MSA VENT CAP
- 1" GALVANIZED VENT PIPE
- POLYETHYLENE MALE COUPLING 1" I.P. X $\frac{3}{8}$ " BARB INSERT
- $\frac{3}{8}$ " THICK-WALL POLYETHYLENE PIPE
- 1" COMBINATION AIR VALVE. ARI MODEL D-040-C
- 1" X 6" BRASS NIPPLE
- 1" INLINE BALL VALVE
- 37 STYLE METER BOX. LOCATION SIMILAR TO WATER METERS IN DRAWING 007-WA.
- 1" GALVANIZED TEE
- 1" BRASS 90° ELL
- 1" BRASS COUPLING
- 1" DOMESTIC COPPER SOFT K-TYPE SLOPED AT 1% MINIMUM UP FROM MAIN.
- 1" OFF CORP. 90° ELL
- 1" CORP. STOP (600 STYLE)

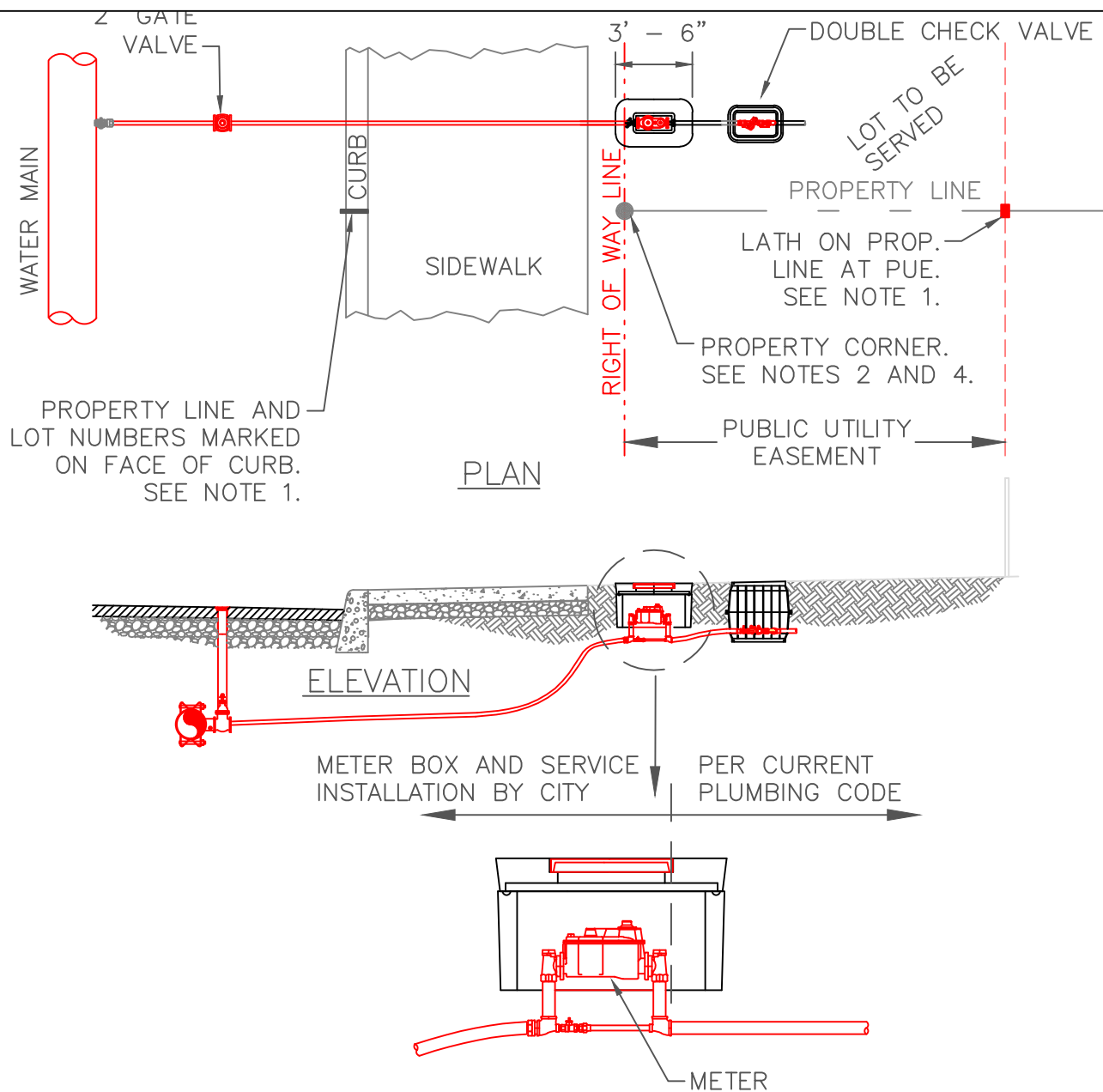


GENERAL NOTE:

FOR USE ON WATER MAINS LARGER THAN 12" DIAMETER OR WHERE INDICATED ON PLANS.

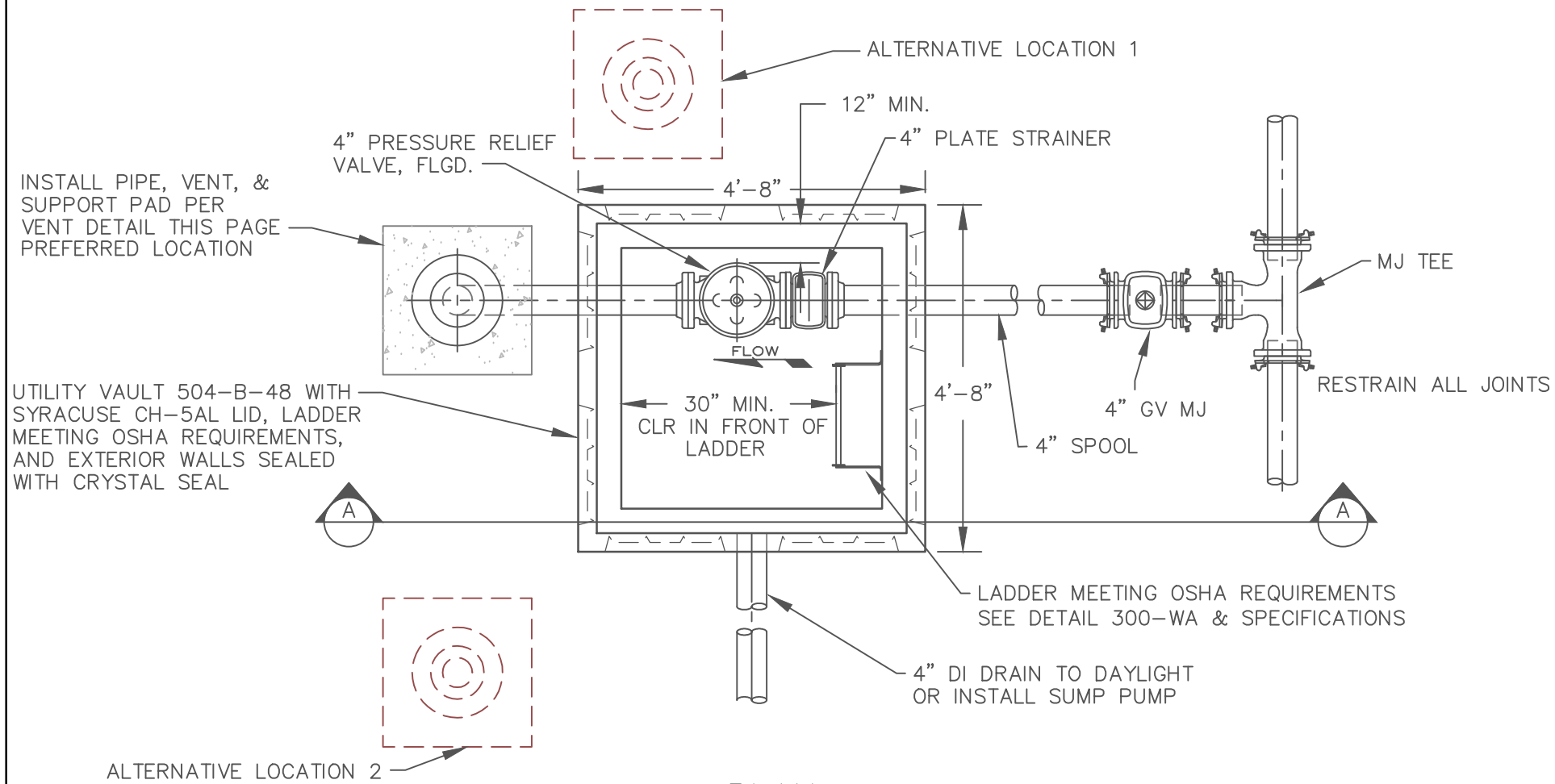
KEYNOTES:

- A. 2" TANK VENT WITH MSA VENT CAP
- B. 2" GALVANIZED VENT PIPE
- C. POLYETHYLENE MALE COUPLING 2" I.P. X 1½" BARB INSERT
- D. 2" THICK-WALL POLYETHYLENE ("FUNNY" PIPE)
- E. 2" COMBINATION AIR VALVE. ARI MODEL D-040-C OR APPROVED EQUAL.
- F. 2" X 6" BRASS NIPPLE
- G. 2" INLINE BALL VALVE
- H. CARSON BOX WITH EXTENSION PART 1730-P15L
- I. CARBON BOX EXT. PART 1730-1L
- J. 2" GALVANIZED TEE
- K. 2" BRASS 90° ELL
- L. 2" BRASS COUPLING
- M. 2" DOMESTIC COPPER SOFT K-TYPE SLOPED AT 1% MINIMUM UP FROM MAIN.
- N. 2" OFF CORP. 90° ELL
- O. 2" CORP. STOP (600 STYLE)

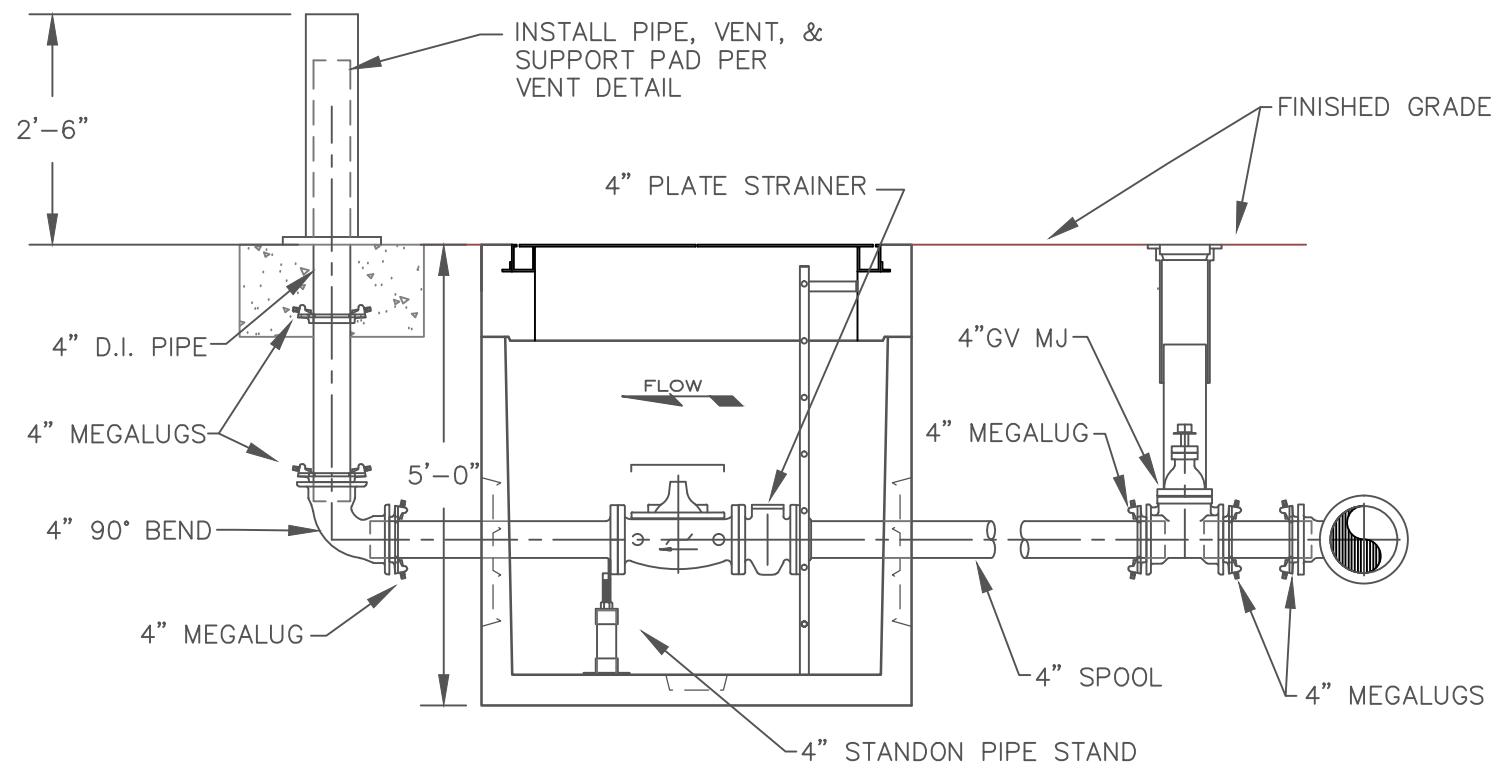


NOTES:

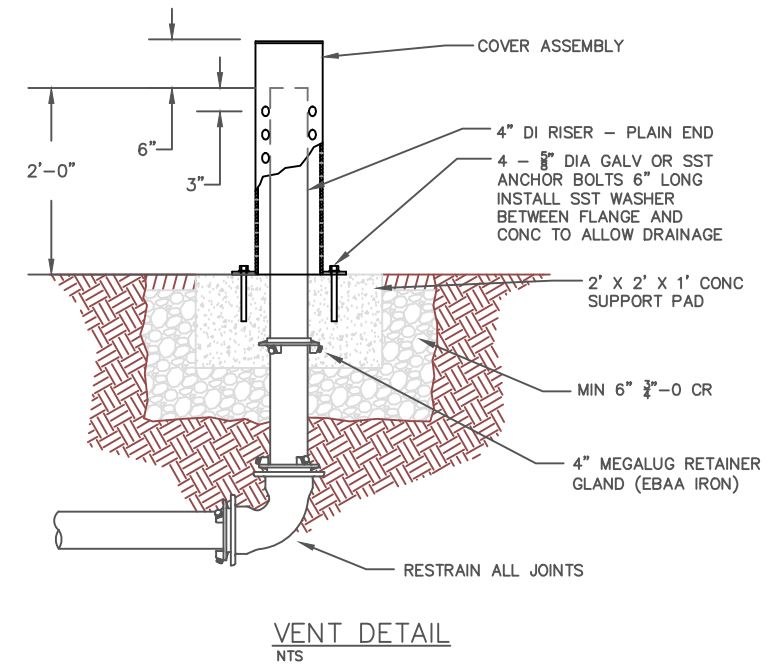
1. DEVELOPER'S SURVEYOR SHALL SET A LATH AT THE INTERSECTION OF THE PROPERTY LINE AND THE PUBLIC UTILITY EASEMENT. DEVELOPER'S SURVEYOR SHALL ALSO MARK THE PROPERTY LINE AND LOT NUMBERS ON THE FACE OF CURB WITH WHITE PAINT.
2. IF PROPERTY CORNER MONUMENTS HAVE NOT BEEN SET AT THE TIME OF WATER SERVICE INSTALLATION, THE DEVELOPER'S SURVEYOR SHALL SET A LATH AT THE PROPERTY CORNER LOCATION ON THE RIGHT-OF-WAY LINE.
3. WHERE NO P.U.E. EXISTS, LOCATE METER AND BACKFLOW DEVICE ADJACENT TO CURB.
4. ORS 92.044(7) PROHIBITS LOCATING ANY UTILITY INFRASTRUCTURE WITHIN 1 FOOT OF A SURVEY MONUMENT. DEVELOPER SHALL PAY FOR ANY RELOCATION OF SERVICES AND/OR METER BOXES FOUND TO FALL WITHIN 1 FOOT OF A SURVEY MONUMENT LOCATION.

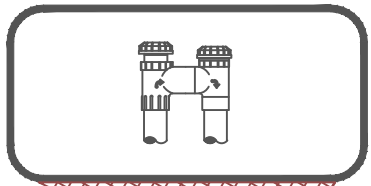


PLAN
NTS



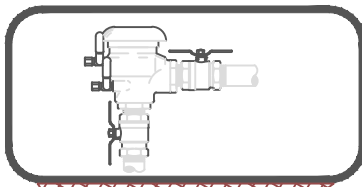
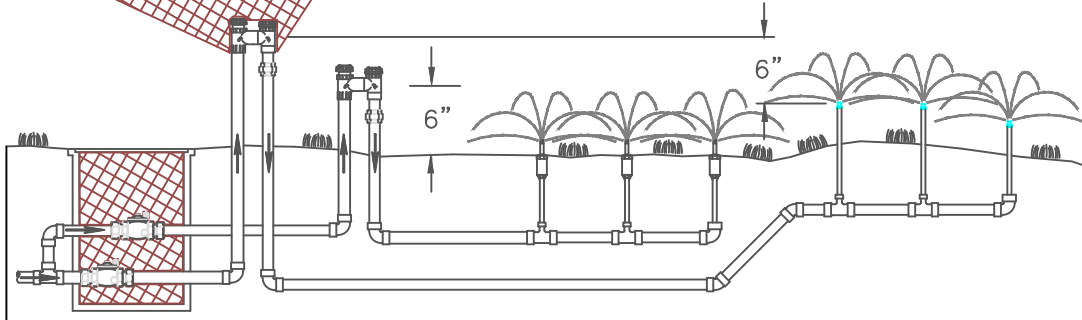
ELEVATION AA
NTS





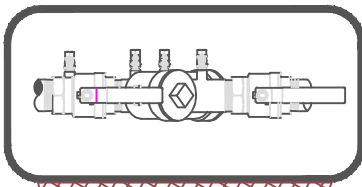
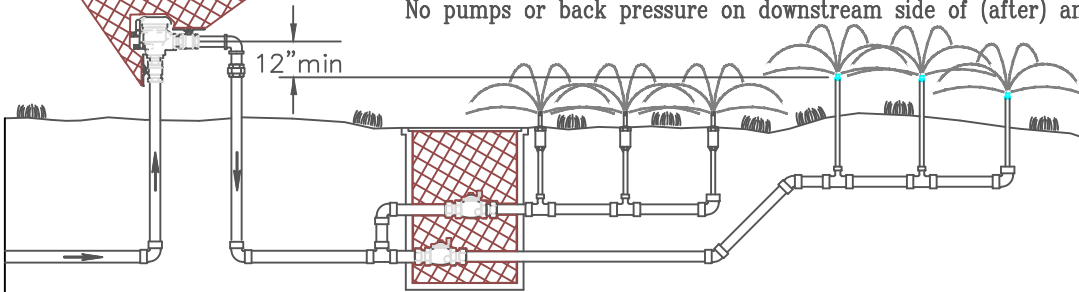
A V B... ATMOSPHERIC VACUUM BREAKER

- One AVB req'd for each irrigation zone; no control valves (on/off valves) allowed downstream of (after) an AVB.
- Each AVB must be installed a min of six inches (6") above the highest point of water in the zone it serves.
- No chemical or fertilizer may be introduced into an irrigation system equipped with AVB's.
- No pumps or back pressure on downstream side of (after) an AVB.



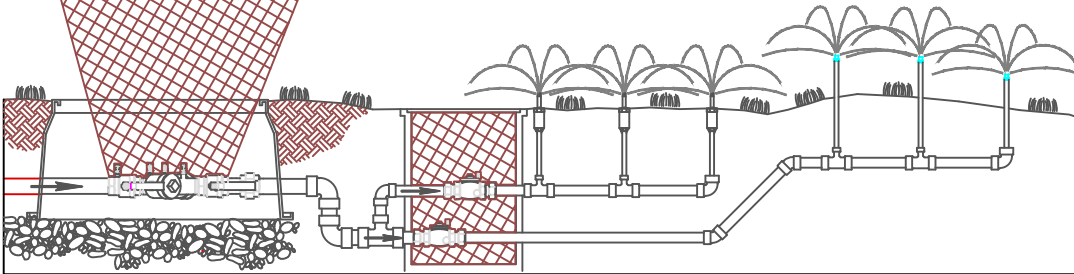
P V B... PRESSURE VACUUM BREAKER ASSEMBLY

- Only one PVB required to serve the whole system; control valves can be located downstream of (after) the PVB.
- PVB's must be installed a minimum of one foot (12") above the highest point of water they serve.
- PVB's must be tested by a State-certified Backflow Assembly Tester...when installed ...annually ... when moved or repaired.
- No chemical or fertilizer may be introduced into an irrigation system equipped with PVB's.
- No pumps or back pressure on downstream side of (after) an PVB.

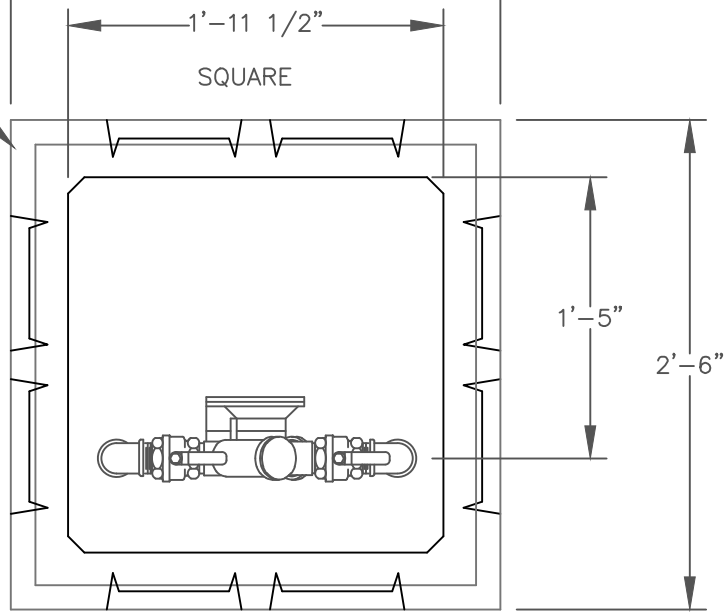


D C V A... DOUBLE CHECK VALVE ASSEMBLY

- Only one DCVA required to serve the whole system; control valves can be located downstream of the DCVA.
- DCVA must be tested by a State-certified Backflow Assembly Tester...when installed ...annually ... when moved or repaired.
- No chemical or fertilizer may be introduced into an irrigation system equipped with DCVA's.



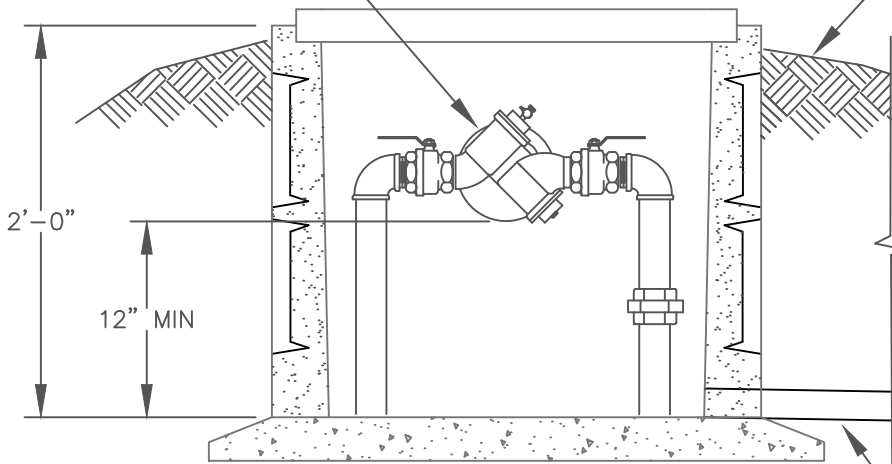
CHIEF VAULT CO.
3030-LA HANDHOLE AND
COVER OR APPROVED
EQUAL



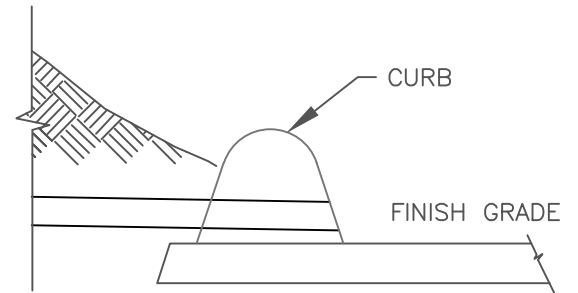
PLAN

APPROVED, REDUCED PRESSURE
BACKFLOW ASSEMBLY

SLOPE EARTH AWAY FROM
VAULT IN BERM AREA



CONCRETE PAD

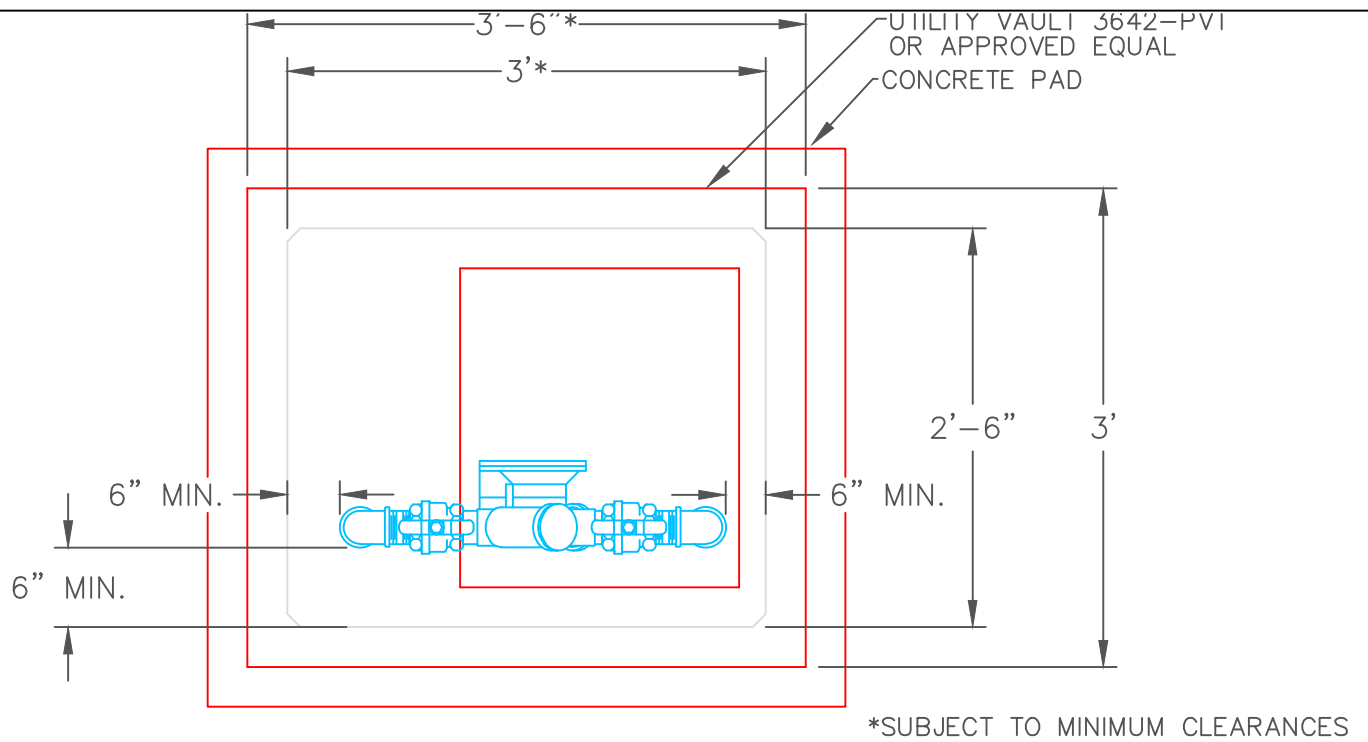


1 1/2" DRAIN TO DAYLIGHT
SLOPE 1/8" PER FOOT MIN.
AWAY FROM VAULT

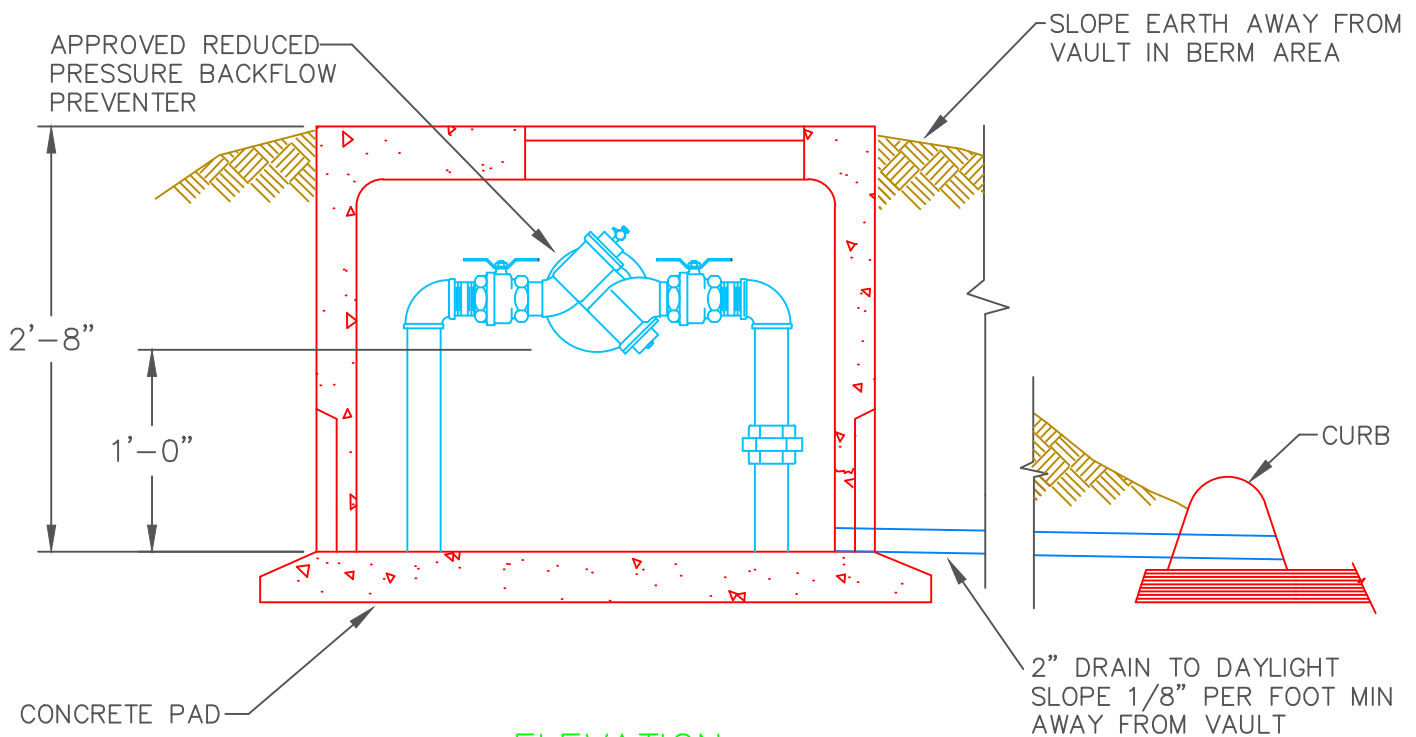
ELEVATION

NOTE:

INSTALLATION SHOWN IS ONLY A SUGGESTION. THE
DISTANCE FROM BOTTOM OF DEVICE TO VAULT FLOOR,
FREEZE PROTECTION, CLEARANCE FOR TESTING AND REPAIR
ARE THE MAJOR CONSIDERATIONS FOR INSTALLATION.



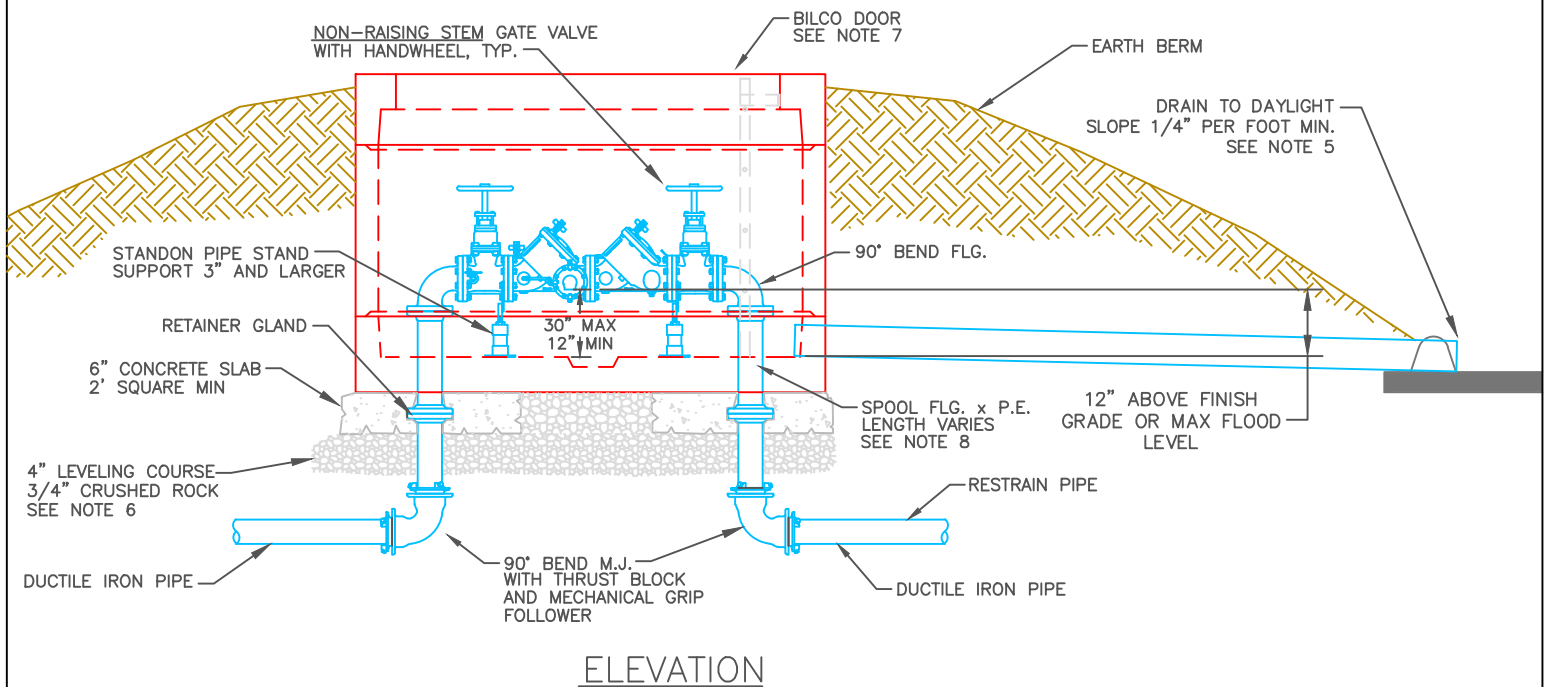
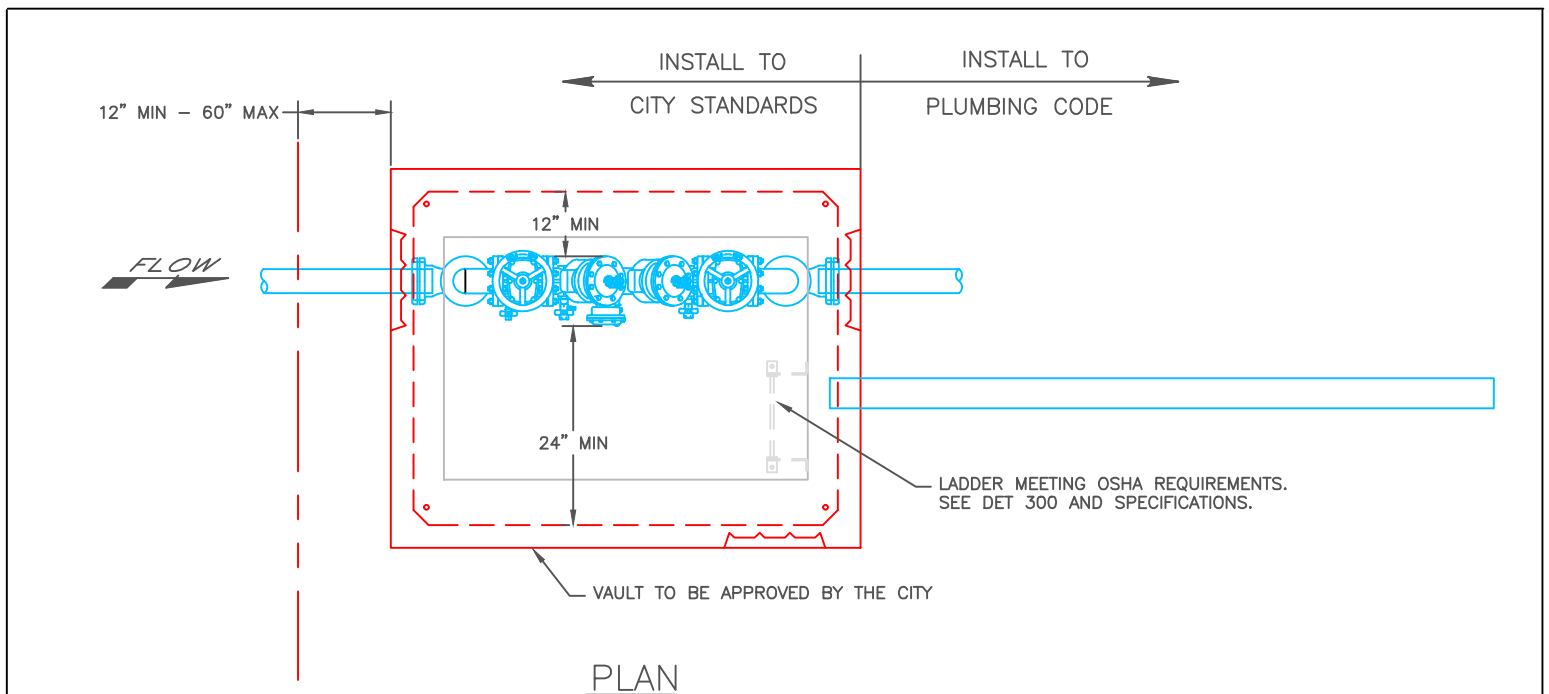
PLAN



ELEVATION

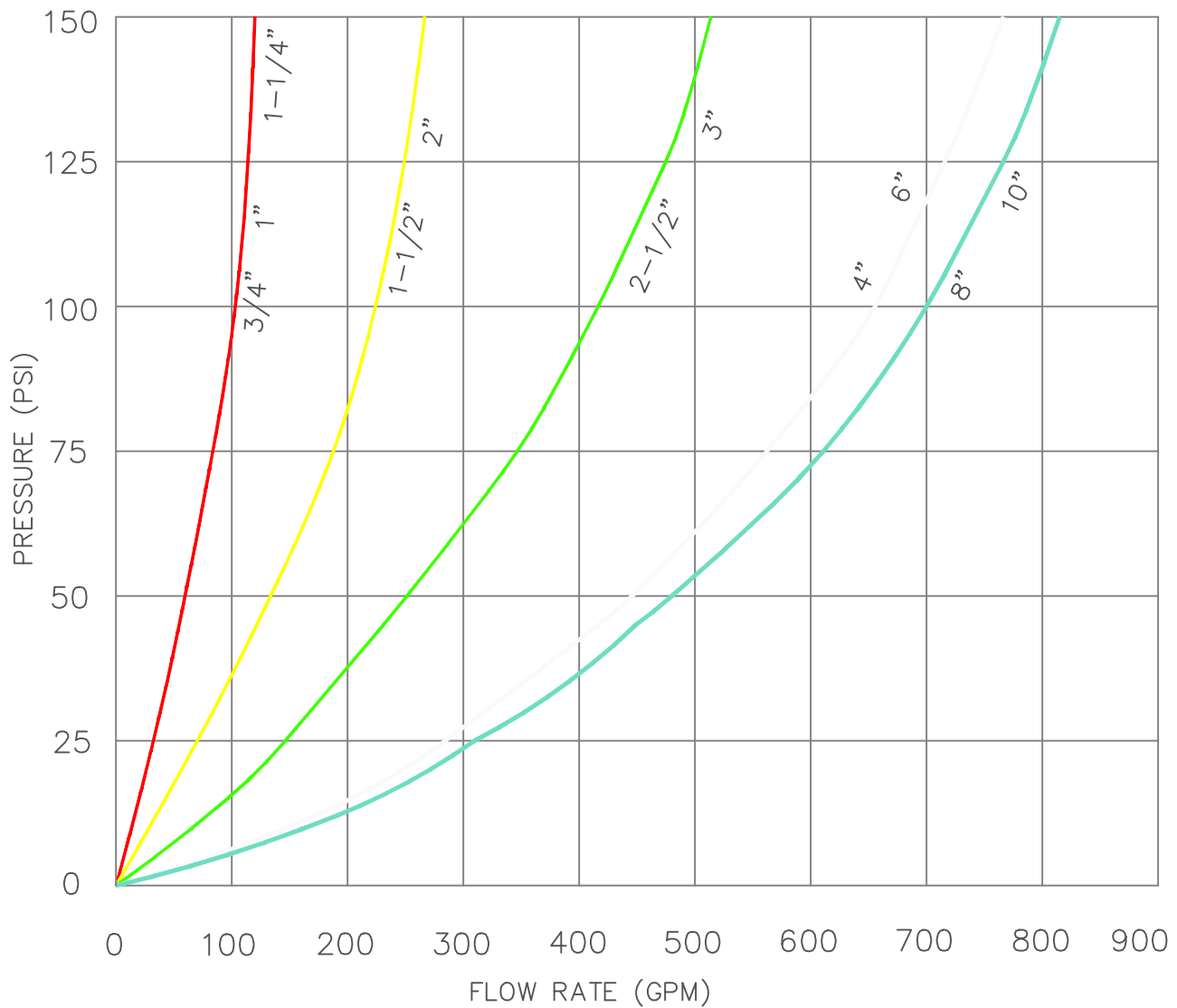
NOTE:

DISTANCE FROM BOTTOM OF DEVICE TO VAULT FLOOR, FREEZE PROTECTION, CLEARANCE FOR TESTING AND REPAIR ARE THE MAJOR CONSIDERATIONS FOR INSTALLATION. BRASS PLUGS TO BE INSTALLED IN TEST COCKS. ADEQUATE DRAINAGE ALSO REQUIRED.



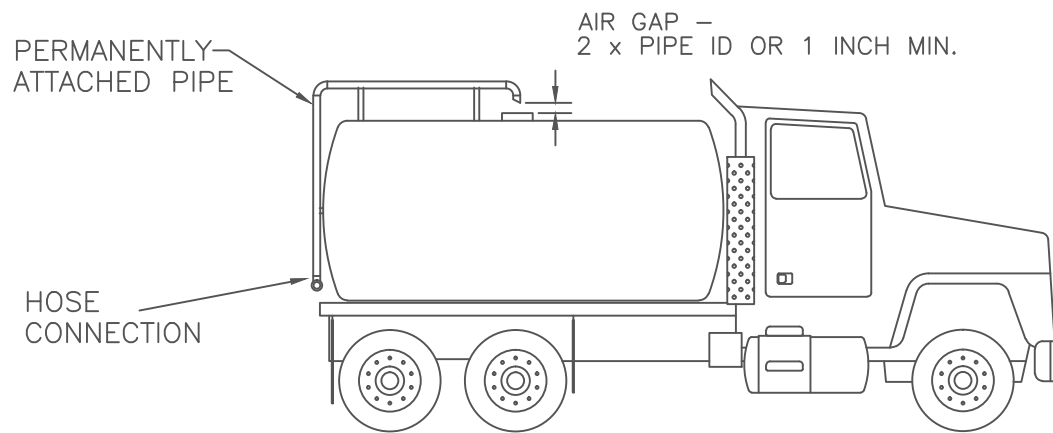
NOTES:

1. REDUCED PRESSURE BACKFLOW ASSEMBLY SHALL BE INSTALLED IN A LOCATION APPROVED BY THE CITY
2. REDUCED PRESSURE BACKFLOW ASSEMBLY SHALL BE INSTALLED HORIZONTAL AND PLUMB
3. ALL CLEARANCES APPLY TO OUTSIDE, IN-BUILDING, AND VAULT INSTALLATIONS
4. VAULT TO BE INSULATED AND/OR HAVE A HEAT SOURCE TO KEEP ENCLOSURE AT 40°F (NFPA 13-4-5.4.1.1)
5. ENCLOSURE SHALL INCLUDE A BORE SIGHTED DRAIN TO DAYLIGHT CAPABLE OF DRAINING A FULL RELIEF VALVE DISCHARGE
6. 4" 3/4"-0" COMPACTED GRAVEL LEVELING COURSE
7. A BILCO DOOR OR OTHER APPROVED ACCESS SHALL BE PROVIDED
8. ALL ASSEMBLIES 2 1/2" AND LARGER SHALL BE FLANGED
9. ALL STRUCTURES TO COMPLY WITH LOCAL BUILDING CODES
10. OPENINGS IN BOTTOM OF VAULT TO BE PRE-FORMED KNOCKOUTS



APPROXIMATE RELIEF VALVE DISCHARGE RATES FOR REDUCED PRESSURE BACKFLOW ASSEMBLIES

Care should be taken to ensure that the entire drainage system has adequate capacity to carry the continuous discharge rates shown above. Designer shall be responsible for providing adequately sized drain lines for relief valve discharge rate. For parallel assemblies, the drainage system should be designed for the discharge from both assemblies.



WITH AIR GAP

