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Cedar River Water & Sewer District

18421 SE Petrovitsky Road
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VOLUME IV

Standard Specifications for Sewer System Extensions



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STANDARD SPECIFICATIONS FOR SEWAGE WORKS CONSTRUCTION

1. SEWER MATERIALS

1.a GENERAL

All contractor supplied materials shall be new and undamaged. All reference specifications herein shall be of the latest revision.

1.b CONCRETE

1. Component Materials

a. Aggregate

- 1) Standard: ASTM Specification C-33
- 2) Description: Clean, hard, durable sand and gravel or crushed stone with no adherent coatings and containing no loam, clay, organic impurities, or other deleterious matter.
- 3) Grading:

a) Coarse aggregate:

Passing 1-1/2" screen -100%
Passing 3/4" screen -not less than 40% or more than 70%
Passing 1/4" screen -not more than 8%

b) Fine aggregate:

Passing No. 4 sieve -100%
Passing No. 16 sieve -not less than 45% or more than 80%
Passing No. 50 sieve -not less than 5% or more than 30%
Passing No. 100 sieve -not more than 8%

b. Water used in concrete shall be clean and free from oils, acids, alkali, and organic matter.

c. Admixtures shall not be used without the prior written approval of the District.

d. Reinforcing Steel Bars

- 1) Standard: ASTM Specification A-615
- 2) Description: New billet steel Grade 60, deformed bars, free from corrosion

e. Reinforcing Wire Fabric

- 1) Standard: ASTM Specification A-185

f. Cement

- 1) Standard: ASTM C-150 or ASTM C-175 (air-entraining)
- 2) Description: Portland Cement

2. Storage

a. Aggregate

Concrete aggregate shall not be stored or piled in direct contact with the ground. The aggregate shall be stored so as to avoid inclusion of dust, mud, and other foreign materials.

b. Reinforcing Steel

Reinforcing steel shall be stored so as to protect its shape and to prevent corrosion. At no time shall the steel be placed directly on the ground.

c. Cement

Cement shall be stored above the ground surface in a suitable, dry, weatherproof structure. No cement shall be used which has become caked or lumpy.

3. Miscellaneous Concrete Structures

Concrete for encasement, blocking, channeling and other sewer structures shall be Class 3000LS as specified in the latest WSDOT Standard Specifications, Section 6-02.3.

1.c GRAVITY SEWER PIPE

1. Polyvinyl Chloride (PVC) Pipe (standard installations)

- a. Standard: ASTM Designation D3034 or SDR35
- b. Type of Joint: Rubber gaskets per ASTM Designation D1869

2. Ductile Iron Pipe

- a. Ductile Iron pipe shall be used for sewer main construction in the following areas.
 1. Depth of main from finish grade is 5' or less
 2. Depth of main 18' or greater from finish grade
- b. The pipe shall be class 52 or greater conforming to the following standards.
 1. All ductile iron pipes shall be provided with a petroleum asphalt coating in conformance with AWWA C-110
 2. The lining shall be a Sewper Coat as manufactured by LaFarge Calcium Aluminates or approved equal. A seal coat shall be applied to the lining.
 3. Before lining the inside of the socket, including a portion of the gasket cavity and a portion of the pipe barrel, shall be coated with a minimum of 8mils of epoxy. Before lining, the exterior and interior of the spigot end, including the spigot face, shall be coated with a minimum of 8mils of epoxy.
 4. Lining Thickness:
0.125" for 6" through 12", 0.1875 for 14" through 24"

5. Surfaces of all field cut pipe shall be coated per manufactures specifications
- c. Type of Joint: Rubber gaskets per ANSI A21.11 or as specified in the Special Provisions/Contract Drawings

1.d SEWER PRESSURE MAINS

Sewer pressure pipe and fittings shall conform to the requirements for Water Works pipe and fittings established by the latest AWWA Specification for type and class of material specified in the Special Provisions of the approved drawings.

1.e MANHOLES

1. General

Standard manholes shall be constructed of precast concrete units, conforming to ASTM C478 all in accordance with the standard plans and these specifications.

2. Precast Manholes

a. Manhole Sections

Standard precast sections shall consist of circular sections in standard nominal inside diameters of 48", 54", and 72". Heights of 48" and 54" sections shall be multiples of 12", at the option of the manufacturer. Heights of 72" sections shall be as required to fit site conditions. Reinforcement for standard sections shall be as designed by the manufacturer. Joints shall be flexible gaskets unless otherwise provided in the special conditions, and shall conform to ASTM C478, paragraph 7. Joints shall not leak.

All manhole section joints shall be mortared on the outside of the manhole creating a water tight seal in addition to the flexible gasket

No more than two (2) lift holes shall be cast into each section. Holes shall be located so as to not damage reinforcing or expose it to corrosion. Lift holes shall be plugged outside and inside after installation. The inside of the manhole wall shall be smooth and not leak.

Steps shall be installed in each section so that sections placed together in any combination will provide a continuous vertical ladder with rungs equally spaced at 12". Steps shall project uniformly from the inside wall of the manhole as per the standard drawings, and shall be cast or firmly grouted in place so as to insure complete water tightness. The Special Provisions shall specify when it is the intention that the manholes be installed without fixed steps.

b. Base Sections

Base sections shall conform to the requirements for precast manhole sections in paragraph 1 above, except that the reinforced base slab shall be made an integral part of the unit, and openings for pipe shall be provided to meet job requirements as indicated on the plans. The base slab shall be not less than 6" in thickness and shall

be cast monolithically with the wall section, or otherwise constructed in such manner as to achieve a completely watertight structure.

Reinforcement of the base slab shall consist of No. 4 (1/2") steel bars on twelve (12) inch centers, both directions (90°). The steel shall be placed not less than 2" nor more than 4" from the top, and shall extend into the wall of the manhole section and be tied to the longitudinal steel.

Openings may be precast or core drilled in the field as recommended for NPC Kor-N-Seal or NPC Contour Seal Boot sized for pipe diameter as shown on the approved project plans.

c. Cones

Standard precast cones shall provide reduction from 54" to 36", from 54" to 24"; from 48" to 36", and from 48" to 24", inside diameters. Cones 54" to 36" and 48" to 36" shall not be less than 24" in height; others not less than 17" in height. Tongue and groove jointing shall be provided for fitting to adjoining sections, excepting, however, that the top surface of cones 54" to 24", and 48" to 24" shall be flat and at least 6" wide, radially, to receive adjustment rings

Wall thickness shall be 4" nominal, and reinforcing shall conform to the requirements specified for standard sections of manholes. Steps shall be provided as specified for standard precast section, and an additional step shall be provided in the 54" to 24", and the 48" to 24" cones opposite the ladder steps and about midway in elevation, as shown on the standard drawings. No more than two lift holes shall be cast into each cone, and they shall be located so they will not damage reinforcing or expose it to corrosion. Lift holes shall be plugged outside and inside after installation and shall not leak. The inside of the manhole wall shall be smooth.

d. Flat Slab Covers

Standard flat slab covers shall be a minimum of 8" thick and shall conform to the outer dimension of the 72", 54" or 48" standard sections upon which they are to be placed. The 24" diameter opening shall be eccentrically located as shown on the standard plans so as to provide at least 6" minimum radial distance from edge of 24" opening to outer edge of slab, but not more than 2½" offset distance from edge of the 24" opening to the inside face of the standard section below. Reinforcing shall be as shown on the standard plans.

e. Flat Slab Reducing Sections

Reduction from 72" standard section 54" or 48" shall be made by means of a flat slab reducing section as shown on the standard plans. The section shall be a minimum of 8" thick and shall conform to the outer dimension of the 72" section upon which it is to be placed. The 54" or 48" opening shall be located as shown on the plans or noted in the Special Provisions. Reinforcing shall be as shown on the standard plans.

f. Permissible Variation in Precast Section Dimensions

Variations in the inside diameters of standard sections or in the diameters of the openings in cones and slabs, shall not exceed 1½% of the nominal dimensions. Wall thicknesses of sections and cones shall not be less than 94% of the nominal dimensions specified in paragraphs D1.e.2.a. and D1.e.2.c. above. Outside dimensions of flat slab covers and reducing sections shall not be less than the nominal outside diameters of the standard sections to which they are to be joined. Thickness of precast slabs shall not be less than the nominal dimensions called for. Thickness variation in any slab shall be no more than ½". Permissible eccentricity of standard sections and cones shall be such that when sections are placed together with steps in alignment, the maximum offset between sections will not exceed ¾". The planes of the ends of cones and sections shall be perpendicular to their longitudinal axis within ¾" measured across any diameter. Variation in the steps spacing shall not exceed 1½".

Reinforcement in standard sections and cones shall be placed within 1 " of the center of the walls. Bar reinforcement in slabs shall conform to the standard drawings and shall not vary more than the dimensional tolerances shown on the drawings.

g. **Workmanship and Finish**

Cones and sections shall be substantially free from fractures, large or deep cracks, and surface roughness. Slabs shall be sound and free from gravel pockets. All manhole elements shall be capable of producing a watertight structure when assembled and jointed.

3. Steps

Polypropylene Steps (Required)

Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. Polypropylene shall conform to ASTM D-4101. Reinforcing steel shall be ½" in diameter grade 60 meeting ASTM A-615. Lane Model P14938 for manhole interiors and Lane Model P14850 for manhole necks or approved equal.

4. Ladders

Except as otherwise provided in the Special Provisions/Contract Drawings, base sections of manholes more than three (3) feet in height shall be provided with a polypropylene ladder manufactured by Lane International or equal, The maximum distance between top of landing and first rung shall be no more than 1 foot. The first ladder rung shall be installed 2 feet down from the top of the casting. Ladder shall meet all ASTM C-487 load requirements

5. Mortar

a. **Jointing**

Mortar for jointing precast manhole sections or masonry manhole units shall be one part Portland cement to not less than one part nor more than two parts plaster sand, mixed with the least amount of clean water necessary to provide a workable mortar.

All manhole section joints shall be mortared on the outside of the manhole creating a water tight seal in addition to the flexible gasket

b. Plaster-Coating

Mortar for plaster-coating masonry unit manholes shall be proportioned according to either of the two alternates tabulated below:

	Alternate 1	Alternate 2
Parts by volume Portland cement	1	1
Parts by volume masonry cement	1 (Type II)	0
Parts by volume hydrated lime	0	$\frac{1}{4}$
Plaster and measured in damp loose condition	Not less than 2 $\frac{1}{4}$ and not more than the sum of volumes of cement and lime	

6. Manhole Channels

Manhole channel material shall conform to Section D1.b.3.

7. Cast Iron Frames and Covers

- a. Standard: Type: Olympic Foundry Inc. Model No. MH41 D/T or approved equal
 Frame: ASTM A48, Class 30 (casting)
 Cover: Ductile Iron ASTM-A-536, CL 80-55-06

b. Description:

Cast iron frames and covers shall conform to the standard details for 24" opening manhole frame and cover (6" depth, 296 pounds minimum weight). All covers shall be lock down type as shown in Sewer Construction Standard Plan No. 18. The manufacturer, upon request of the District, shall certify that the assembly will resist an uplift pressure on the lid equal to 20 feet head. The "pick hole" in the cover shall be affixed with a 5/8x3" galvanized carriage bolt nut and washer. During installation the threads on the end of the "pick hole" bolt shall be altered in such a manner that the nut will not spin off the bolt.

c. Finish:

Castings shall be free of porosity, shrink cavities, or cracks, or any defects which would impair serviceability. Repair of defects by welding or by the use of "smooth-on" or similar material will not be permitted.

Normally, castings shall not be coated. However, when coating is called for in the Special Provisions, a bituminous coating as specified on the approved plans shall be applied as shown on the approved plans. The District shall have the right to require inspection and approval of all castings prior to coating.

Manhole rings and covers shall be machine finished or ground on seating surfaces so as to assure non-rocking fit in any position and inter-changeability. 1/8" clearance between cover and ring is required.

- d. Markings: Covers shall have the word "SEWER" in 3 inch raised letters.
- e. Installation Lid and Ring Assemblies shall be installed so that one ring bolt down tab is centered over access ladder.

8. Manhole Alternate

At the option of the District, the manhole base, interior walls and pipe to manhole connections shall be GU Manhole Liner System as manufactured by GU Manhole Liner Ltd., Aldergrove B.C. The GU manhole base liner shall be of one piece construction, and of unlayered homogenous Fiberglass Reinforced Plastic (F.R.P.) with: 1) full flow channels with side wall to the crown of the pipe; 2) watertight gasketed bells to suit specific pipe types and grade alignment; 3) inner surface of the bench to have anti-skid surface and 4) the outer surface of the liner shall be sand coated and have steel spirals bonded to the F.R.P.

9. Manhole Casting Adjustment Rings

Rings shall be constructed of concrete or in lieu of concrete, injection molded-recycled HDPE as manufactured by Ladtech, Inc. or approved equal and installed per manufacturer's specifications. The contractor shall utilize flat and sloping units to match the required slope and/or grade of the structure. No bricks or rocks allowed.

10. Cast Iron Frame & Cover Riser Ring

Shall only be used if called out on Approved Plans or Project Specifications.

- a. Type: Olympic Foundry Inc. Model Number: as appropriate for amount of grade change. Submittals shall be approved by District before materials are ordered.
Minimum Standards; Cast Iron ASTM A 48, CL 30
Rating: H-20

1.f GRANULAR MATERIAL

1. Foundation Material for Pipe, Manholes and other appurtances

Foundation material to be used shall be a type and gradation of angular material to provide a solid compact base for the installation of bedding, pipe, manholes and appurtances as directed by the District. All foundation material shall be clean, free from organic matter, dirt and debris and of size and gradation such that desired compaction can be readily attained.

No foundation material shall be used unless it has been accepted by the District. Samples of the material shall be submitted to the District by the Contractor a sufficient time in advance of intended use to enable its inspection and possible testing.

Since trench conditions vary, foundation material requirements may change. Foundation requirements for two general trench bottom conditions are described as follows:

a. Condition One

Where silty soil or fine sandy soil is encountered that will flow in a stream of water, the foundation material shall be a gravel-sand mixture, that when tested in accordance with ASTM D-422, shall conform to the following gradation requirements:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
3/4"	100
3/8"	70 - 100
#4	55 - 100
#10	35 - 95
#20	20 - 80
#40	10 - 55
#100	0

This foundation material shall be used only in a dry trench bottom, free from quick and/or running sand.

b. Condition Two

Where clay, peat or other soft materials are encountered that may be saturated with water but do not break down into fine particles and flow such as does silt or sand, the foundation material shall be a granular ballast material, that when tested in accordance with ASTM D-422, shall conform to the following gradation requirements:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
2 1/2"	100
2"	65 - 100
1"	50 - 85
#4	26 - 44
#40	16 max.
#200	9.0 max.
Dust Ratio:	2/3 max.
Sand Equivalent	35 min.

The foundation thus stabilized shall be leveled to provide a uniform pipe foundation by using well-graded gravel

Select material shall be hauled to the site as needed but shall not be stocked at the site in amounts in excess of anticipated daily needs.

3. Bedding Material

Bedding material used shall consist of clean, granular, well graded sand and gravel uniform in quality and substantially free from wood, roots, bark, and other extraneous material, that when tested in accordance with ASTM D-422, shall conform to the following

gradation requirements:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
3/4"	100
1/2"	80 - 100
1"	50 - 85
#4	46 - 66
#40	8-24
#200	10.0 max.
% Fracture:	75 min.
Sand Equivalent	40 min.
Generic name per WSDOT Standard Specifications is 5/8" Minus (Crushed Surfacing Top Course).	

4. Import and Native Backfill Material

Import and native backfill material shall be 100% 3" diameter or less, and may be bank run which has been passed through a 3" screen with a binder content of not more than 20% and consistent grading from fine to coarse. The material shall be substantially free from peat, wood, roots, bark or other extraneous material.

1.g LUMBER

Lumber for timbering and sheeting shall be of good quality, reasonably straight grained, and free from weakening knots and other defects. Rough sawed, unplanned lumber will be acceptable unless otherwise specified.

1.h GATED DEVELOPMENTS

Developers shall deliver to District 3 remote gate entry devices providing District staff 24 hour 7 days per week access to all gated projects.

SECTION 2. SEWER CONSTRUCTION

2.a GENERAL

Except as otherwise noted herein, all work shall be accomplished according to the recommendations of the manufacturer of the material or equipment used.

2.b CLEARING AND GRUBBING

Clearing and grubbing work shall be performed within the confines of the area indicated on the plans, or in the Special Provisions and as staked out in the field. The Contractor shall dispose of all resulting debris at a facility approved for the disposal or reclamation of the debris. No debris or garbage shall be left lying in the cleared area. Clearing limit staking shall be preserved. Areas outside of the clearing limits shall not be disturbed in any manner.

All Temporary Erosion Controls shall be installed and maintained throughout the duration of the project as specified in the approved plans or the governmental agency having control.

2.c. LOCATION, STAKING, BOUNDARIES

1. The Developer shall be responsible for surveying and construction staking. Developer shall furnish all property boundary surveys that may be deemed necessary by Engineer including the following on-site surveying:
 - a. Road centerline on 100'centers on tangents and 50'centers in curve plus P.C.s, P.T.s and intersections.
 - b. Front lot corners or off-sets to front corners (at a specific and consistent distance) and alignment stakes.
 - c. Benchmarks approximately every 500 feet.
2. A duly licensed surveyor will provide construction staking for location of the various parts of the Work and give such lines and grades as necessary for the proper construction of the Work; provided, that both sides of easements shall be staked in a manner so that clear visibility is maintained between stakes with a minimum of one stake per 100 feet and the proposed pipe line alignment shall be staked according to the same minimum requirement. All easements shall be cleared and graded to the proper subgrade prior to staking of the pipeline alignment. In the event of questions or discrepancies in survey control points, the Engineer shall evaluate the control points and require substantiation when it determines necessary. If District consents, Engineer may perform the staking at Developer's request. Engineer may review all survey and staking work performed by Developer's surveyor.
3. Developer shall provide 24 hours advance notice in writing to the District requesting that the construction staking be inspected.
4. Working operations may be suspended by the Engineer without liability to District or Engineer for such brief and reasonable time, as may be required, for the giving of lines and grades, and the taking of measurements.
5. Construction shall not proceed until such time as the construction staking has been completed and inspected by District.
6. Any restaking, for whatever reason, as well as additional staking which the District may desire, will be performed promptly at no cost to the District.
7. The District may, but is not required, to evaluate the effectiveness of survey controls and require it to be strengthened if it is found to be inadequate in District's sole judgment. All control staking shall remain in place throughout the duration of the project. Any control staking that is moved or disturbed shall be reinstalled prior to completion of the work at no cost to the District.
8. Prior to acceptance of the work, District may, use a locating device to inspect the alignments and locations of all pipe and other facilities installed.

9. Upon written request from Developer, the Engineer may, in writing, relieve Developer from performing such portions of the foregoing requirements relating to staking which Engineer deems burdensome and unnecessary.

2.d. STAKES AND MARKS TO BE PRESERVED

All stakes, benchmarks, and reference points shall be carefully preserved. In the case of their destruction, such stakes and marks will be replaced by the Engineer

All stakes, benchmarks, reference points, and official monuments, owned by others, shall be carefully preserved or replaced. In the event any such markers are disturbed, as a result of operations, they shall be replaced at no cost to the District. Replacement markers shall be of a type and quality equal to that originally existing and satisfactory to the Engineer. Replaced markers shall be located so as to clear existing utilities or any other interference and placed in a manner consistent with recognized engineering and surveying practice.

2.e EXCAVATION

1. Normal Conditions

At the end of each day's operation there shall be no trench left open. Backfilling (D2.j) shall follow behind sewer system installation as closely as safety permits. .

All excavations shall be free of all wood, debris or rocks larger than 3" in diameter.

The maximum permissible trench width from the bottom of the trench to the crown of the pipe shall be as follows:

- 24" diameter and smaller - diameter plus 24"
- 27" diameter and larger - diameter plus 36"

In all cases, trenches must be of sufficient width to permit proper jointing of the pipe and backfilling of material along the sides of the pipe. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner. Trenches wider than the maximum specified may result in a greater load of over-burden than the pipe is designed for and, consequently, if the maximum trench width is exceeded by the Contractor without the written authorization of the District and Engineer, the Contractor will be required at his/her own expense to provide pipe of higher strength classification, or to provide a higher class of bedding (D.2f), as may be deemed necessary by the District or engineer.

2. Special Conditions

a. Pavement Cutting:

- 1) Concrete –pavement shall be removed and replaced in accordance with the specifications of the agency having jurisdiction. Or in the case of no other agency having jurisdiction then the pavement shall be removed to a width of 18" greater than the top width of the trench. The concrete shall be cut on a straight line with dowels inserted as shown on plan details

- 2) Asphalt - pavement shall be removed in accordance with the specifications of the agency having jurisdiction. Or in the case of no other agency having jurisdiction then the pavement shall be removed to a width of 18" greater than the top width of the trench or as shown on the approved plans. Pavement shall be cut ahead of the trenching equipment to prevent excessive tearing up of the surface and to eliminate ragged edges.

b. Rock Excavation:

All ledge rock that requires systematic drilling and blasting for its removal, and boulders exceeding one-half cubic yard in volume, shall be removed to provide a minimum clearance of one foot (1-ft.) under the pipe.

Hard clay or hardpan will not be classified as solid rock excavation.

c. Dewatering:

Pipe trenches shall be kept free from water, at all times, the bottom stable and backfill dry enough to achieve proper compaction. Water removal and disbursement shall be accomplished using current accepted best management practices and be compliant with all governmental agencies having jurisdiction.

Before trenching operations begin, the Contractor shall have available on site in working condition sufficient pumping equipment and/or other machinery to insure that the provisions of the above paragraph can be maintained.

d. Shoring

The Contractor shall provide and install shoring as necessary to control trench width and protect workmen, the work, and existing structures, utilities, and other properties in accordance with Title 296 WAC.

e. Tunneling:

Shall be done in accordance with the approved plans and or special provisions.

f. Highway Crossing:

The Contractor shall use the method shown on the approved plans. Right of Way restoration shall be completed to a condition acceptable to the governmental agency having jurisdiction.

Normally, highway crossings require the placing of a steel casing by jacking or tunneling and inserting the sewer pipe within this casing. See approved plans or special provisions for details.

g. Over-Excavation:

Over-excavation for purposes of these specifications will be deemed to include the

loosening of subgrade material below the grade of the pipe or appurtenance, as well as the physical removal of material below the grade of the pipe or appurtenance. In the event of over-excavation, the Contractor shall provide, at this own expense, suitably compacted foundation and bedding material (D2.f), in place, to the required grade.

If the over-excavation consists of the loosening of the parent material below grade, the Contractor shall remove the loose material, at his/her own expense, and backfill with suitable foundation and bedding material as noted above. The suitability of such foundation and bedding material shall be approved by the District inspector and/or engineer.

2.f FOUNDATION AND BEDDING

1. General

Proper preparation of foundation, placement of foundation material where required, and placement of bedding material shall precede the installation of all sewer pipe. This shall include necessary leveling of the native trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade. The entire length of pipe shall rest firmly on well compacted material.

2. Foundation

When, after excavating to the foundation level, the material remaining in the trench bottom is determined to be unsuitable by the District, excavation shall be continued to such additional depth and width as required by the District. Where over-excavation has been necessary, foundation material (D1.f) shall be placed and compacted to form a suitable base for the placement of the required thickness of bedding material. In no case shall coarse aggregate contain any pieces larger than three (3) inches, measured along the line of greater dimension. Excavation for manholes and other structures connected to pipelines shall be sufficient to provide a minimum of 12-inches between their surfaces and the sides of the excavation.

3. Bedding

Bedding procedures are described as follows:

Bedding shall consist of the leveling of the bottom of the trench or the top of the foundation material to such elevations compiling with the alignment and grade provided on the approved plans, and the furnishing and placing of bedding materials (D1.f.2, D1.f.3) under the pipe. There shall be no load concentration at joint collars or bells. Upon verification of final grade of pipe, bedding shall then be added and compacted to secure pipe and to a thickness of (6) inches over the crown of pipe for the width of the trench. Minimum thickness of the layer of bedding material required under any portion of the pipe shall be four (4) inches for all pipe sizes of 27 inches diameter and smaller, and six (6) inches for all pipe sizes of 30 inches diameter and larger.

The District and or Engineer shall have the authority to change bedding classifications

and the limits thereof as he/she may deem necessary during the progress of the construction

2.g INSTALLATION OF PIPE AND FITTINGS

1. Gravity Sewer Pipe

a. Alignment and Grade

Alignment and grade control hubs will be provided by the Engineer.

The Contractor shall constantly check line and grade and in the event they do not meet specified limits described hereinafter, the Work shall be immediately stopped, the District and Engineer notified, and the cause remedied before proceeding with the Work.

The pipes shall be placed in the trench that after the sewer is completed the interior surface thereof conforms accurately to grade and alignment furnished by the Engineer. Adjustment shall be made by scraping or filling in under the body of the pipe, and not by blocking or wedging. Full solid bearing must be provided along the entire length of the pipe. "Filling" shall be accomplished in accordance with the requirements of bedding materials.

The variance from established line and grade shall not be greater than one thirty-second ($1/32$) of an inch per inch of pipe diameter and not to exceed one-half ($1/2$) inch unless:

- 1) such variation results in a level or reverse sloping invert; and/or
- 2) variation in invert elevation between adjoining ends of pipe do not exceed one sixty-fourth ($1/64$) of an inch per inch of pipe diameter, or one-half ($1/2$) inch maximum due to non-concentricity of joining surface and pipe interior surfaces.
- 3) Prior to the installation of pipe in an easement survey controls will be accurately established and installed for guidance. Pipe shall be installed in the center of the easement. All easement survey controls shall remain in place until final inspection. Easement edges and center line shall be staked.

b. Pipe Installation

Installation of sewer pipe shall be accomplished to line and grade in the trench only after the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surface. The sewer pipe, unless otherwise approved by the District, shall be installed upgrade from a designated starting point with the bell end forward or upgrade. When pipe installation is not in progress, the forward end of the pipe shall be kept tightly closed with an approved temporary plug.

Pipe installation shall be done in accordance with the specifications and instructions of the manufacturer of the kind of pipe used, subject to the approval of the District. Tools

designed especially for installing each particular type and kind of pipe shall be used. All pipe ends shall be square with the longitudinal axis of the pipe and shall be reamed and otherwise smoothed so that good connections can be made. All operations for any special type of pipe, joint, or connection shall be carefully done in accordance with the manufacturer's instructions.

All pipes shall be installed in a straight alignment. Direction changes to be made at manhole locations only.

Dissimilar pipes shall be connected using Romac (or approved equal) adaptor couplings specifically sized for the types of pipes to be coupled.

All pipe connections to manholes shall be NPC Kor-N-Seal or NPC Contour Seal Boot installed as recommended by the manufacturer or equal approved by District prior to purchase of material.

c. Tees

Tees shall be placed at the positions shown upon the plans, or as directed by the District. If the side sewer stub is not immediately connected, the open end shall be securely plugged with a PVC cap constructed of materials compatible with the Tee. It shall be sealed watertight and be suitably blocked to prevent its being blown out or moved by a head of water in the sewer or pressure testing of the system. The blocking shall be easily removable without damage to the tee or cap. Unless otherwise directed by the District, tees are to be set at a 2% minimum slope for regular side sewers, and at an inclination of 45 degrees above horizontal for riser side sewers.

d. Bedding

A minimum of 4" shall be placed and compacted under each length of pipe prior to installation of the pipe. As soon as each length of pipe has been properly placed and jointed, the space between the pipe and the sides of the trench shall be carefully filled with bedding to 6" over the pipe crown. Sufficient filling, ramming, and tamping shall be done to hold the pipe solidly in position. The joint shall then be checked for line and grade before the next succeeding joint is placed.

e. Encasement

Concrete pipe encasement shall be placed in wood forms unless specific permission is given to use trench sides for forms. Encasement shall be rectangular in cross section, and the minimum thickness of concrete in any direction, measured from the outside face of the pipe, shall conform to the following table, unless otherwise detailed on the plans:

Pipe Diameter	Min. Thickness
8" or smaller	4"
10" to 15"	6"
16" to 36"	8"

Over 36"

As detailed

Encasement shall be placed in two courses. The base course shall be accurately screeded to grade so that pipe will be at specified grade when the bells are resting on the concrete. Pipe shall be firmly braced laterally and vertically by means of suitable struts and wedges so as to prevent lateral displacement or flotation during

2. Pressure Sewer Pipe

a. Alignment and Grade

Alignment shall be within 0.5 feet of the specified alignment. Pressure sewer pipe shall be installed at a continuous uphill grade from the pump station or gravity interceptor unless specified otherwise in the Special Provisions.

b. Pipe Installation

Pipe installation shall be done in accordance with the specifications and instructions of the manufacturer of the kind of pipe used, subject to the approval of the District. Tools designed especially for installing each particular type and kind of pipe shall be used. All pipe ends shall be square with the longitudinal axis of the pipe and shall be reamed and otherwise smoothed so that good connections can be made. All operations for any special type of pipe, joint, or connection shall be carefully done in accordance with the manufacturer's instructions.

All pipe connections to manholes shall be NPC Kor-N-Seal or NPC Contour Seal Boot installed as recommended by the manufacturer, or equal as approved by the District.

c. Blocking or Bracing

Bracing of the pipe and fittings shall be made as shown on the approved plans. Concrete shall be placed back of all fittings having unbalanced thrust. Blocking of the pipe and fittings indicated on the Plans shall be placed so as to secure bearing on undisturbed earth. Blocking shall bear against fittings only and shall be clear of joints so as to permit taking up or dismantling joint. Precast blocking shall not be used without prior written approval from the District. Blocking shall not be covered up without approval of the District.

d. Bedding

A minimum of 4" for all pipe sizes of 27 inches diameter and smaller shall be placed and compacted under each length of pipe prior to installation of the pipe. As soon as each length of pipe has been properly placed and jointed, the space between the pipe and the sides of the trench shall be carefully filled with bedding to 6" over the pipe crown. Sufficient filling, ramming, and tamping shall be done to hold the pipe solidly in position.

e. Tracer Wire

Tracer wire shall be laid from the sewer pump station, spiraled around pipe, and be

terminate at manhole where pressure pipe ends as directed by District Inspector. Wire shall be 10 gauge copper solid strand, outer insulation shall be blue.

3. Side Sewers

Side sewer stubs shall be constructed in accordance with Cedar River Water & Sewer District "Specifications and Regulations for Side Sewer Permitting, Design, Construction and Use". Side sewer stubs connected to a manhole shall match crown of the incoming main line pipe.

2.h INSTALLATION OF MANHOLES

Excavation and bedding for manholes shall be similar to the specifications for pipe (D2.e and D2.f).

1. Base Section

The base section shall be set on a suitable firm foundation, with the channels at the proper grade. The base shall be clean and free of foreign materials.

2. Precast Manholes

All manholes for sanitary sewer construction shall be precast sectional manholes, unless otherwise specified in the Special Provisions. They shall be carefully installed so that the units shall not be cracked; the cylinder walls shall be vertical, and the entire structure watertight.

3. Channels

Channels shall be made to conform accurately to the sewer grade, poured monolithically and shall be brought together smoothly with well-rounded junctions. Channel sides shall be carried up vertically to 75% of the various pipe diameters. Channels shall provide a 0.1-ft or 1/10th fall across the manhole. The concrete shelf between the channels shall be smoothly finished and warped evenly and sloped at 2% minimum to drain. Concrete shall conform to section D1.b.3. Side sewer stubs connected to a manhole shall match crowns of the incoming main line pipe. Channels shall accommodate the installation of mechanical plugs in all incoming and outgoing pipes.

4. Ladder Rungs

Ladder rungs shall be installed as detailed in section D1.e.3. and the standard details.

5. Covers

Manhole cover rings shall be carefully set to the proposed finish road grade unless otherwise specifically directed by the District and shall be firmly set in a full bed of mortar. If the Contractor is responsible for road restoration and does not establish the finish grade exactly as called for, the contractor shall readjust the manhole rings so that the covers are flush with the finished road grade unless otherwise specifically directed by the District.

6. Drop Manholes (Inside)

Drop manholes are not allowed unless pre-approved at time of design.

2.i CONNECTION TO EXISTING SYSTEM

All connections of the sewer extension to the existing sewer system shall be into an existing manhole. While such connections are being made, the existing sewer line shall be maintained in service and the work of making the connection shall be performed in such a manner that no refuse or concrete or other extraneous matter gains access to the existing sewer. In addition, the outlet of the manhole shall be screened during these operations and the manhole shall be cleaned at the conclusion of the work. As soon as the first pipe selection leading from the manhole is placed, the new pipe shall be tightly plugged and shall remain plugged until the new line is accepted. The District shall lock in place all pipe connection plugs. They shall stay in place and be removed by District staff upon approved request.

2.j BACKFILLING

1. Above Embedment

Backfilling of sewer trenches and around manholes above the embedment shall be accomplished by placing earth in the trench in layers not over twenty four inches (24") deep and mechanically tamping each layer up to the top of the trench.

At locations where paved streets, driveways, or sidewalk will be constructed or reconstructed over the trench, or where the trench is greater than four (4) feet deep, or where provided for in the Special Provisions or directed by the District, the backfill shall be mechanically compacted to 95% of maximum density. Throughout the length of any pipe run, backfill at depths over 4 feet shall be compacted to 90% maximum density by mechanical compaction. The top 4 feet of the trench line shall then be mechanically compacted to 95%. All densities shall be determined by testing specified in Section 2-03.3 (14) D of current WSDOT Standard Specifications. Contractor shall provide weekly reports to the District verifying the required compaction, prepared by a civil engineer registered in the State of Washington, with experience and knowledge in engineering geology. A minimum of two compaction tests shall be taken for each 200 linear feet of main line trench, and as designated by the District Inspector at each side of the sewer connection; one at subgrade and one at 50% of trench depth.

In any trench in which 95% density cannot be achieved with existing backfill, the top 4 feet shall be replaced with gravel base as specified in the WSDOT 2008 compacted to 95%. Imported materials required to properly complete backfilling shall be hauled in and placed.

Restoration of roadway shall be in conformance with the standards set by the governmental agency having jurisdiction.

2. Removal of Timbering

Temporary timbering shall be removed

3. Holding Backfill on Steep Slopes

Where, in the opinion of the District or Engineer, there is a danger of backfill being washed away due to steepness of the slope in the direction of the trench, material shall be held in place as follows:

Backfilling to eighteen (18) inches below the top of trench. Then, at intervals, as specified by the Engineer, two (2) 2" x 6" posts at least four (4) feet long, shall be driven into the backfill, one on either side of the pipe, at about right angles to the slope of the ground, and broadside facing in the direction of the trench. These posts shall be supported on the downhill side by 2" x 4" stakes at least three (3) feet long, driven at an angle of 45 degrees, about twelve (12) inches into undisturbed ground in the trench sides. Tops of posts and stakes shall be driven approximately flush with the ground surface. Three (3) 2" x 6" crosspieces, cut to fit tightly between the trench sides, shall then be laid against the uphill sides of the posts, to form an 18-inch bulkhead, and then crosspieces and stakes shall then be securely spiked to the posts. Backfilling shall then be completed as previously described.

2.k PAVEMENT RESTORATION

1. Bituminous Paving

Bituminous paving within jurisdiction of King County shall be 1-1/2" Hot Mix Asphalt (HMA). Bituminous paving within other municipalities shall be to the standards of the controlling agency.

Method of construction shall be subject to approval by the Inspector and acceptable to the controlling governmental agency. Batch Plant monitoring may be required at Contractor/ Developer expense.

On private property, restoration shall be as shown on the approved plans.

2. Temporary restoration

Temporary restoration shall be done to the standards of the municipality having jurisdiction in the work area. It may consist of "Cold Mix Asphalt, Hot Mix Asphalt or Sheeting at no extra cost to the District.

2.l CLEANUP/INSPECTION

1. General

Final inspection, testing and video examination shall not take place until the roadway(s) have asphalt treated base or the first paving lift placed, all manholes have been channeled and all backfilling and compaction has been completed.

2. Sewer Cleaning

Prior to video inspection (D2.l.3) acceptance and final manhole-to-manhole inspection by the District of the sewer extension, all parts of the system shall be completely water jetted

clean. All accumulated construction debris; rocks, gravel, and other foreign material shall be removed from the sewer extension at or near the closest downstream manhole. If necessary, the use of mechanical rodding equipment to remove accumulated mud, silt, and sand deposits shall be employed.

Upon the District's final manhole-to-manhole inspection of the sewer system, if foreign matter and other construction debris are still prevalent in the system, the portions affected shall be cleaned as required.

In addition to the above requirements for cleaning the system for inspection and acceptance, all parts of the system shall be water jetted after installation of final lift of asphalt and the completion of raising all lids and rings. The District Inspector must be given 48 hours advance notice of the jetting.

3. Video Examination of Sewer Mains & Side Sewers

- a. Closed Circuit TV(CCTV) examination of all sewer mains & side sewer stubs constructed under this agreement shall be conducted by a firm experienced in such inspections and acceptable to the District. Sewer main shall be flushed clean and poured with water containing a biodegradable commercial dye (florescent red or green) intended for such inspection prior to CCTV examination. Each section of pipe inspected using this method shall have the flows plugged off and bypassed. A 1" ball marked with the District standard of .750" shall be pulled before the camera to observe "ponding." Camera shall travel against the flow with the 1" ball gauge riding on the pipe invert to determine ponding depth. A representative of the District shall be present before starting the video examination of the mains. The method and procedures shall be submitted to the District for approval prior to CCTV examination. The quality of the image shall be clear enough to easily see defects in the pipe, ponding, jointing and side sewer connections. A color DVD recording shall be supplied to the District, for examination by the District prior to acceptance of the system.
- b. Sections of sewer main ponding exceeding the District's standard of .750" shall be excavated with the District Inspector on site. The affected pipe reinstalled at the correct grade and alignment maintaining the specified bedding. The affected pipe shall then be re-examined to determine if it complies with the standards in item "a" above. Upon completing a successful repair the site shall be restored to its original condition or better.

4. Mandrel Test

At the option of the District, a mandrel test of all or a portion of the sewer mains may be required. The mandrel testing device shall be a rigid cylindrical plug, tapered on each end and equal to 95% of the inside diameter (I.D.) of the pipe. It shall be designed so it will not pass if a joint, pipe has been deflected beyond 5% of its diameter, or if a side sewer stub connection is protruding into the main. If a main fails the mandrel test, it shall be re-excavated and repaired/replaced.

5. Site Cleanup

- a. Final cleanup work shall be completed as closely behind the construction work as it is physically possible to do so.

- b. All excess material, rocks, logs, debris, etc., shall be disposed of by the Contractor at an approved reclamation facility. No debris shall be disposed of by dumping on private property.
- c. Drainage ditches affected by the construction operation shall be left in as good as, or better, operational condition than what existed prior to beginning work.
- d. Upon completion of all cleanup work, the entire site shall have a neat and workmanlike appearance.

SECTION 3. SEWER TESTING

3.a GENERAL

All sanitary sewer pipe and appurtenances shall be cleaned, and shall be tested for leakage after backfill has been completed and the roadway(s) have asphalt treated base or the first pavement lift placed. The test shall be made between two (2) manholes. Side sewer stubs from manholes shall also be tested. The Contractor shall furnish all labor, tools, equipment, (the pressure test gauge shall be supplied by District) and materials necessary to make the tests and to perform any work incidental thereto.

Preliminary tests shall be conducted to assure that the section to be tested is in an acceptable condition before requesting the District to witness the test.

The District/Engineer at all times shall have access to the Work and to the locations where the Work is in preparation. Proper facilities shall be maintained at all times for such access.

Inspection and testing shall be in accordance with Control of Work Section of the Contract Documents.

3.b GRAVITY SEWERS

1. General

All gravity sanitary sewer pipe and appurtenances shall be tested by one of three methods: air test, exfiltration test, or infiltration test. Of the three methods the air test method is preferred by the District. The District shall have final determination of the type of test that will be performed for acceptance of the new system.

2. Air Test

- a. All materials and personnel for conducting the test shall be furnished at no cost to the District. The equipment and personnel shall be subject to the approval of the District. The District will provide the gauge for the final air test.

The acceptance air test shall be made only after backfilling has been completed and the roadway(s) have asphalt treated base or the first pavement lift placed.

All wyes, tees, or end of side sewer stubs shall be plugged with flexible-joint caps or acceptable alternate, and securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable.

The pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two (2) minutes shall be allowed for temperature stabilization before proceeding further.

b. Acceptance

The requirement of this specification shall be considered satisfied if the time required in seconds for the pressure to decrease from 3.5 to 2.5 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe is not less than value taken from the following table for appropriate diameter and length:

Diameter (Inches)	Length (Feet)						
	100	150	200	250	300	350	400
8	70	105	141	176	211	227	227
10	110	165	220	275	283	283	283
12	158	238	317	340	340	340	340
15	248	371	425	425	425	425	425
18	356	510	510	510	510	510	510
21	485	595	595	595	595	595	595
24	634	680	680	680	680	680	680
27	765	765	765	765	765	765	765
30	850	850	850	850	850	850	850

If the pipe installation fails to meet these requirements, the source or sources of leakage shall be determined at no cost to the District. Contractor shall present a proposal on method of repair or replacement of all defective materials or workmanship to District. The District shall make the final decision regarding the method of repair or replacement of all defective materials or workmanship.

3. Exfiltration Test

a. Procedure

The Contractor may, for their own purposes, desire to make an exfiltration test prior to complete backfilling. However, the acceptance test shall be made after backfilling has been completed and the roadway(s) have asphalt treated base or the first pavement lift placed.

Each section of sewer shall be tested by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers and filling the pipe and manhole with water to a point six (6) feet above the crown of the open sewer in the upper manhole, or if ground water is present, six (6) feet above the sections' average adjacent ground water level, whichever is higher as determined by the District. The

length of pipe tested shall be limited so that the pressure on the invert of the lower end of the section tested shall not exceed sixteen (16) feet of water column.

The line shall be filled at least one (1) hour prior to testing and shall be tested at least one (1) hour maintaining the head specified by measured additions of water. The sum of these additions shall be the leakage for the test period.

b. Acceptance

Allowable exfiltration leakage shall be no greater than 200 gallons per day per inch of diameter per mile of sewer pipe with a minimum test pressure of six (6) feet of water column above the crown at the upper end of the pipe. For each increase in pressure of two (2) feet above a basic six (6) feet of water column measured above the crown at the lower end of the test section, the allowable leakage shall be increased ten (10) feet.

The following table shows the amount of exfiltration at six (6) foot water column or infiltration allowable in gallons per hour per 100 feet of pipe:

Size pipe	8	10	12	15	18	21	24	27	30
Exfiltration/Infiltration	1.3	1.6	1.9	2.4	2.9	3.4	3.8	4.3	4.8

4. Infiltration Test

The infiltration test shall be used only when there is sufficient ground water to assure that the water table will be above the pipe after backfilling. The Contractor may, for their own purposes, desire to make an infiltration test prior to complete backfilling. However, the acceptance test shall be made after backfilling has been completed as specified.

The upper end of the section of the pipe to be tested shall be temporarily plugged so as to prevent inflow. All blank tees and ends of side sewers shall be tightly plugged. A suitable device for directing flow into a measuring can shall be introduced into the trench, if necessary, so that the pipe is submerged in water or saturated earth along its entire length, and this condition shall be maintained for at least two (2) hours, or until the flow has become constant. Flow shall then be measured by timing the filling of a container of known volume.

Allowable infiltration leakage shall be no greater than 200 gallons per day per inch of diameter per mile of sewer pipe, but with no allowance for external hydrostatic head. The table in paragraph 3b above also pertains to infiltration.

3.c PRESSURE SEWERS

1. Procedure

Sewer force mains or other pipe designated as pressure pipe shall be subjected to a hydrostatic test fifty (50) percent greater than the operating pressure specified. The section to be tested shall be filled with water, then pumped to the required pressure and allowed to stand for fifteen (15) minutes. The section shall then be pumped up to test

pressure and the amount of water required shall then be measured by pumping from a container. Gauges used shall be supplied by District.

2. Acceptance

The quantity of water lost from the main during the 15 minute test period shall not exceed the quantities shown in the following table:

Pipe Diameter (inches)	6	8	10	12
Water loss (gallons/1000 feet)	1.13	1.50	1.88	2.25

3.d SIDE SEWERS

Side sewers shall also be tested for their entire length from the public sewer in the street to the connection with the building plumbing. The method of testing side sewers shall be determined by the District but in no case shall it be less thorough than filling the pipe with water before backfill and visually inspecting the exterior for leakage.

SECTION 4. INSTALLATION OF PIPE BURSTING

4.a SUBMITTALS

The Contractor shall submit documentation provided by the Pipe Bursting System Manufacturer that the Contractor is qualified to properly install pipe using their system. The documentation shall consist of evidence of Contractor training, testing and/or certification of being trained to install pipe using the Manufacturer's system. The name, address and phone number of the manufacturer's representative who issued certification to the contractor performing pipe bursting shall also be submitted to the Engineer. The Contractor shall hold the District and Engineer harmless in any legal action resulting from patent infringements.

The above documentation of Contractor's training shall be hand carried, mailed or faxed to the Engineer and District within 14 calendar days after the Notice to Proceed date.

An itemized list detailing the installation procedures to be used shall be submitted. This shall include estimated times for each task, the number of required excavations, and any other items unique to each process.

Polyethylene pipe joining shall be performed by personnel trained in the use of thermal butt-fusion equipment and recommended methods for new pipe connections. In addition, where electrofusion is necessary to join any new pipe and fittings, it shall be performed by personnel trained in this pipe joining method. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Training shall be performed by a qualified representative.

Any nationally recognized standards for pipe bursting shall be submitted.

All related ASTM standards or any nationally recognized standards for HDPE pipe shall be submitted.

Detailed description and physical properties of any lubricants to be used for pipe bursting shall be submitted for the District and Engineer's approval.

4.b PIPE BURSTING INSTALLATION OF NEW PIPE

Pipe bursting shall be in accordance with the following requirements:

1. Cleaning and Inspection

The sewer line shall be cleaned and televised prior to pipe bursting installation. Cleaning and video inspection shall be approved by the Engineer before beginning the pipe bursting installation work. **Cleaning and video inspection shall be scheduled and coordinated with the District and Engineer to avoid impacts to daily operations.** The Contractor shall remove all debris, roots and other materials from the host pipe. All roots shall be cut flush with the wall of the host pipe. All such debris resulting from cleaning operations shall be removed from the site and disposed in accordance with applicable laws and regulations. **Precautions shall be taken to ensure that the cleaning operations will not cause any damage or flooding to public and/or private property.**

The Contractor shall conduct a television inspection of the sewer pipe before pipe bursting to assure that the pipe is clean, and existing pipe conditions are acceptable for installing the new pipe. Video inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit color television. The interior of the pipe shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the new pipe, and it shall be noted so that the condition(s) can be corrected. A remote-reading footage counter shall record the footages so that they can be seen while viewing the video. A videotape or DVD and suitable log shall be kept and submitted to the Engineer.

The Contractor shall clear the line of any obstructions or collapsed pipe that will prevent proper installation of the new pipe. The Contractor shall perform point repairs at any location(s) where the pipe is collapsed or obstructions cannot be cleared by conventional cleaning methods.

2. Bypassing

- a. If bypassing of sewage flows is required around the sections of pipe designated for rehabilitation, the bypass shall be made in accordance with D.4.c. of the specifications.
- d. Public advisory services shall be required to notify all parties whose service laterals or side sewers will be affected and all connected residents to advise minimum water usage. The Contractor shall provide written notification of work activities to all local users 14 calendar days before interruption of service and provide interim sewer service. This notification shall include a description of the project, the method of construction, and the approximate date and duration that disruption of sewer service will occur. The notification shall also note the potential inconvenience from noise and lights. The Contractor shall maintain a notification log which will include the date and time of the notification, the contact person's name, and if no contact was made, a

notation that the information was left at the resident's door. The notification shall be submitted to the Owner for approval at least 14 calendar days prior to being mailed to affected parties.

- e. If authorized by the Owner, in-person verbal notification shall be acceptable in lieu of the above written notifications.

3. Insertion and Reception Pits

Insertion and reception pits shall be excavated to allow for the launch and termination of the new pipe with the pipe bursting equipment.

4. Pipe Joining

- a. The polyethylene pipe shall be assembled and joined at the site using the thermal butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted. Where necessary, polyethylene pipe fittings shall be joined to polyethylene pipe using the electrofusion method.
- b. All equipment and procedures used in both thermal butt-fusion and electrofusion shall be used in strict compliance with the manufacturer's recommendations. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.
- c. The butt-fused joint shall be properly aligned and shall have uniform roll-back beads resulting from the use of proper temperature and pressure. Inside joints shall be debaded and the joint surfaces shall be smooth. The fused joint shall be watertight and shall have tensile strength equal to that of the pipe. All joints shall be subject to acceptance by the Engineer and/or his representative prior to insertion. All defective joints shall be cut out and replaced at no cost to the District. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer and/or his representative shall be discarded and not used.

5. Pipe Bursting

- a. The pipe bursting method shall at least consist of a bursting head, which will be pulled through the existing pipe to break it into fragments and form a tunnel for the new pipe. The maximum outside diameter of the bursting head shall be greater than the maximum inside diameter of the existing sewer pipe, and shall form a tunnel with a maximum diameter no larger than the maximum outside diameter of the new pipe plus one inch.
- b. The new pipe shall be installed to match the alignment and invert of the existing pipe with some lowering allowance due to varied diameters of the new and existing pipe.

- c. The Equipment used to perform the work shall be located away from buildings as much as possible, so as to lessen the noise impact. Provide silencers or other devices to reduce machine noise as required to meet requirements.
- d. The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect the pipe from damage during installation. Lubrication may be used as recommended by the manufacturer. Under no circumstances will the pipe be stressed beyond its yield point.

4.c PIPE BURSTING BYPASSING SEWAGE

The Contractor, as necessary, shall provide for the flow of sewage around the section or sections of pipe designated for pipe bursting repair. Plugging the line at an existing upstream manhole or cleanout and pumping the flow into a downstream manhole or adjacent system shall make the bypass. The pump(s) and bypass line(s) shall be of adequate capacity to accommodate the sewage flow. A detail of the bypass plan shall be submitted to the Owner for approval.

4.d. PIPE BURSTING REFERENCED DOCUMENTS

This Technical Provision references American Society for Testing and Materials (ASTM) standards which are made part hereof by such reference, and shall be the latest edition and revision thereof.

4.e. PIPE BURSTING GENERAL

Basic procedure for the sewer rehabilitation shall include excavation of insertion and reception pits, sewer flow control and bypassing, cleaning, pre- and post-rehabilitation television inspection, pipe joining, pipe bursting installation, testing, reconstruction, and restoration.

Prior to ordering sewer rehabilitation materials, the Contractor shall be responsible for inspecting and confirming the inside dimension, alignment, pipe material, and condition of the existing sewer pipe segments to be pipe bursted.

The Contractor shall be responsible for performing all pipe bursting and related work, including video inspection, excavations and cleaning in accordance with applicable Federal, State, and City safety regulations, including current OSHA safety standards.

The Contractor shall be responsible for odor and noise mitigation on this Project in accordance with applicable Federal, State, and City regulations. The Contractor shall monitor the surrounding area and minimize any odors and noise that may occur due to his work activities.

The Contractor shall test all materials for compliance with the Contract Documents prior to delivery to the Project.

4.f. HIGH DENSITY POLYETHYLENE PIPE (HDPE) MATERIALS

Polyethylene Plastic Pipe shall be high density polyethylene pipe and meet the applicable requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) based on outside diameter, ASTM D1248, ASTM D3550.

- a. Sizes of the insertions to be used shall be such to renew the sewer to its original or greater flow capacity.
- b. All pipe shall be made of virgin material. No rework except that obtained from the manufacturer's own production of the same formulation shall be used.
- c. The liner material shall be manufactured from a High Density High Molecular weight polyethylene compound which conforms to ASTM D- 1248 and meets the requirements for Type III, Class C, Grade P-34, Category 5, and has a PPI rating of PE 3408.
- d. The body of the pipe produced from this resin shall have a minimum cell classification of 345444C under ASTM D-3350. A higher cell classification limit which gives a desirable higher primary property, per ASTM D-3350 may also be accepted by the Engineer at no extra cost to the owner. The value for the Hydrostatic Design basis shall not be less than 1600 PSI (11.03 MPA) per ASTM D-2837.
- e. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.
- f. Dimension Ratios: The minimum wall thickness of the polyethylene pipe shall be per plans.

4.g. HDPE PIPE DELIVERY, STORAGE, AND HANDLING

- a. Transport, handle, and store pipe and fittings as recommended by manufacturer.
- b. If new pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor's expense, before proceeding further.
- c. Deliver, store and handle other materials as required to prevent damage.

4.h. PIPE BURSTING DESIGN SUBMITTALS

Provide sufficient detail to allow the Engineer to judge whether or not the proposed materials, equipment, and procedures will meet the Contract requirements.

The design submittals shall be sent to the Engineer within 14 days following the Pipe Bursting Preliminary Investigation of Host Sewer Pipe. Design submittals shall include the following:

- a. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe. Include manufacturer's recommendation for handling, storage, and repair of pipe damaged.

- b. Method of construction including written description of the entire construction procedure to install pipe.

4.i. PIPE BURSTING PRELIMINARY INVESTIGATION OF HOST SEWER PIPE

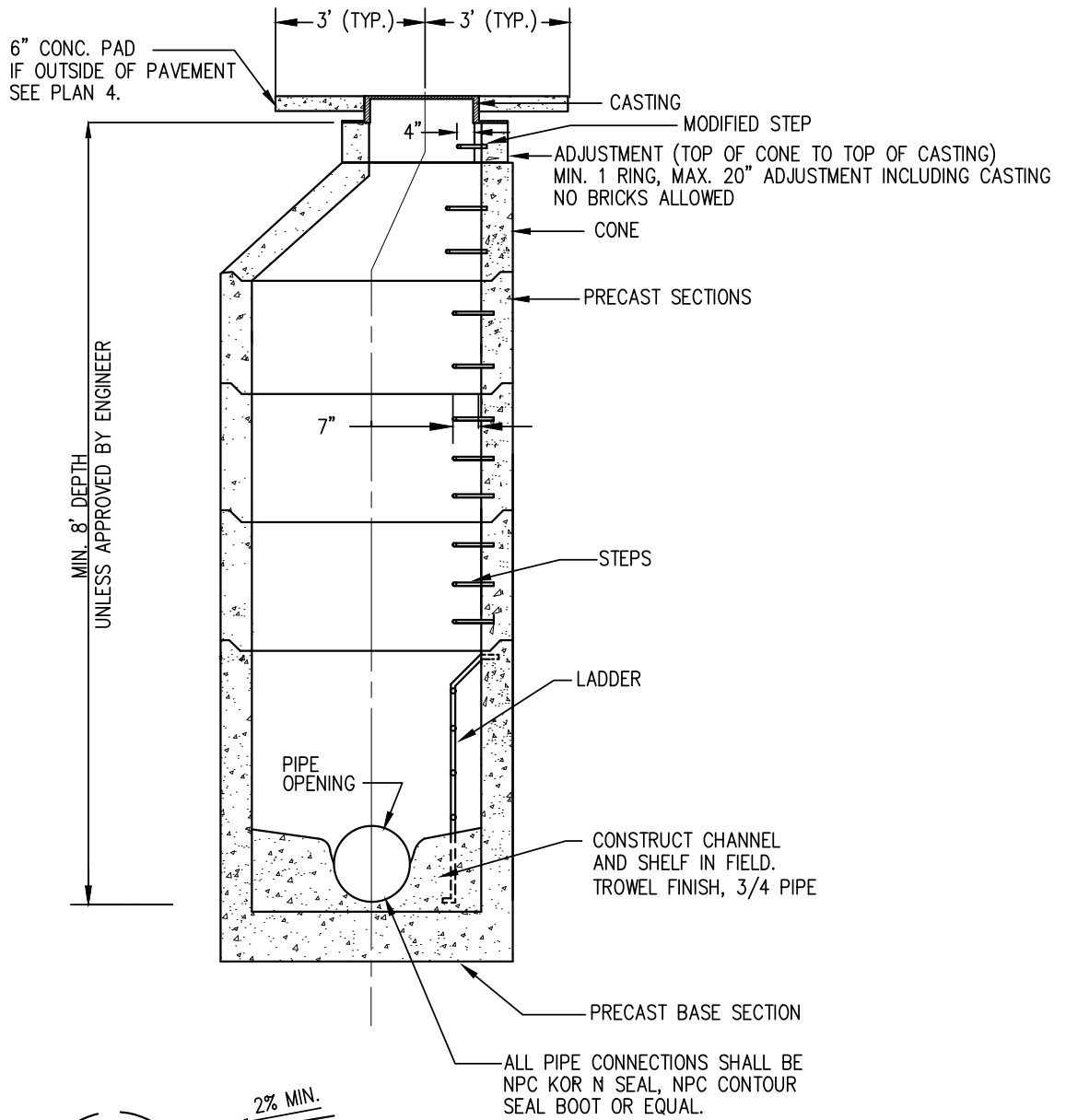
Prior to ordering rehabilitation materials, the Contractor shall be responsible for inspecting and confirming the inside diameter, pipe material, and alignment of the host sewer pipe. All host sewer pipe shall be inspected using video equipment. The Contractor shall use the data and information collected from this inspection to prepare for proper pipe bursting installation. If unknown physical conditions in the work area are encountered during the investigation that materially differ from those ordinarily encountered, the Contractor shall notify the Engineer. The Contractor shall provide a copy of all inspection videotapes, notes and photographs to the Engineer.

4.j. PIPE BURSTING INSPECTION AND ACCEPTANCE

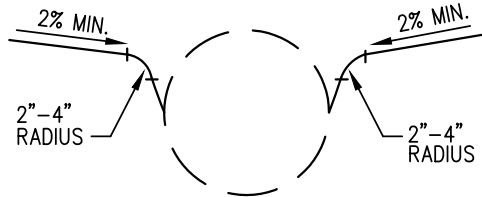
The finished installation shall be inspected by the Contractor by closed-circuit television camera in the presence of the Owner, unless otherwise directed by the Owner. Variations from true line and grade will only be acceptable if proven by the Contractor that the variations existed under the original conditions of the existing sewer lines. Variations caused by the Contractor's installation shall be repaired at the Contractor's expense. The pipe bursting work will be deemed unacceptable if infiltration of groundwater is detected.

5 SEWER CONSTRUCTION STANDARD PLANS

PLAN 1	48"/54" DIAMETER MANHOLE
PLAN 2	72" REDUCED TO 48"
PLAN 3	48"/54"/72" DIAMETER SHALLOW SECTION
PLAN 4	STANDARD FLAT SLABS AND REDUCING SLABS
PLAN 5	MANHOLE BASE
PLAN 6	MANHOLE LADDER AND STEPS
PLAN 7	CLEANOUT (LAMPHOLE)
PLAN 8	NOT USED
PLAN 9	TEE AND RISER
PLAN 10	HILL HOLDER
PLAN 11	PIPE ANCHOR
PLAN 12	PARALLEL CONSTRUCTION
PLAN 13	FAT & GREASE INTERCEPTOR
PLAN 14	OIL SEPARATOR
PLAN 15	INSIDE DROP MANHOLE
PLAN 16	GRAVEL ACCESS ROAD
PLAN 17	ABANDONED PIPE PLUG
PLAN 18	LOCKING MANHOLE FRAME & COVER
PLAN 19	SIDE SEWER & CLEANOUT



NOTE: SEE D1.e 11 FOR MANHOLE



**TYPICAL
CHANNEL DETAIL**

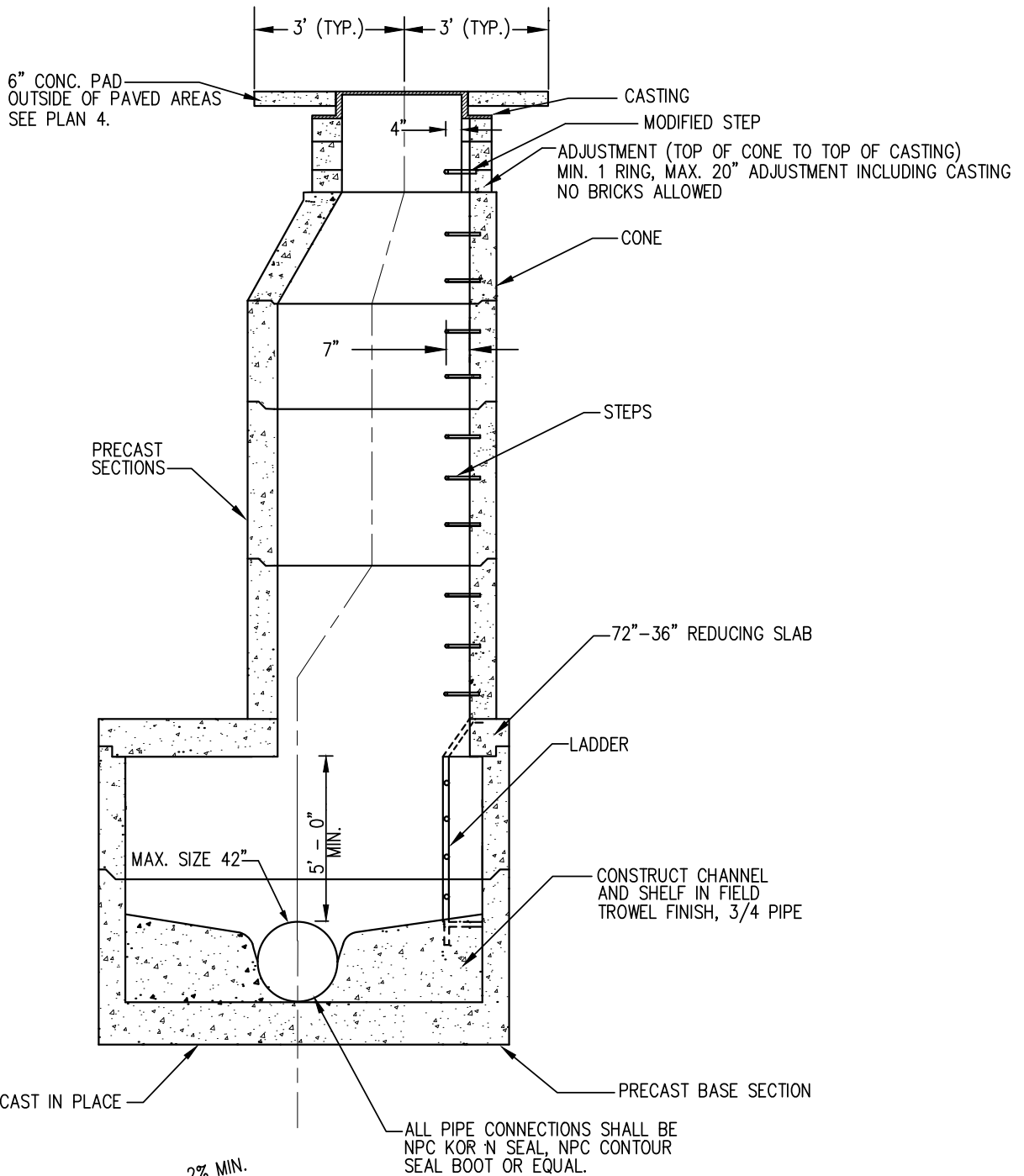
REVISED 3/26/2020



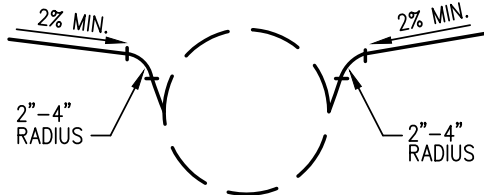
**48"/54" DIAMETER MANHOLE
(PRECAST UNITS)
Sewer Construction Standard Plan No. 01**



CEDARRIVER
WATER & SEWER DISTRICT



NOTE: SEE D1.e 11 FOR MANHOLE



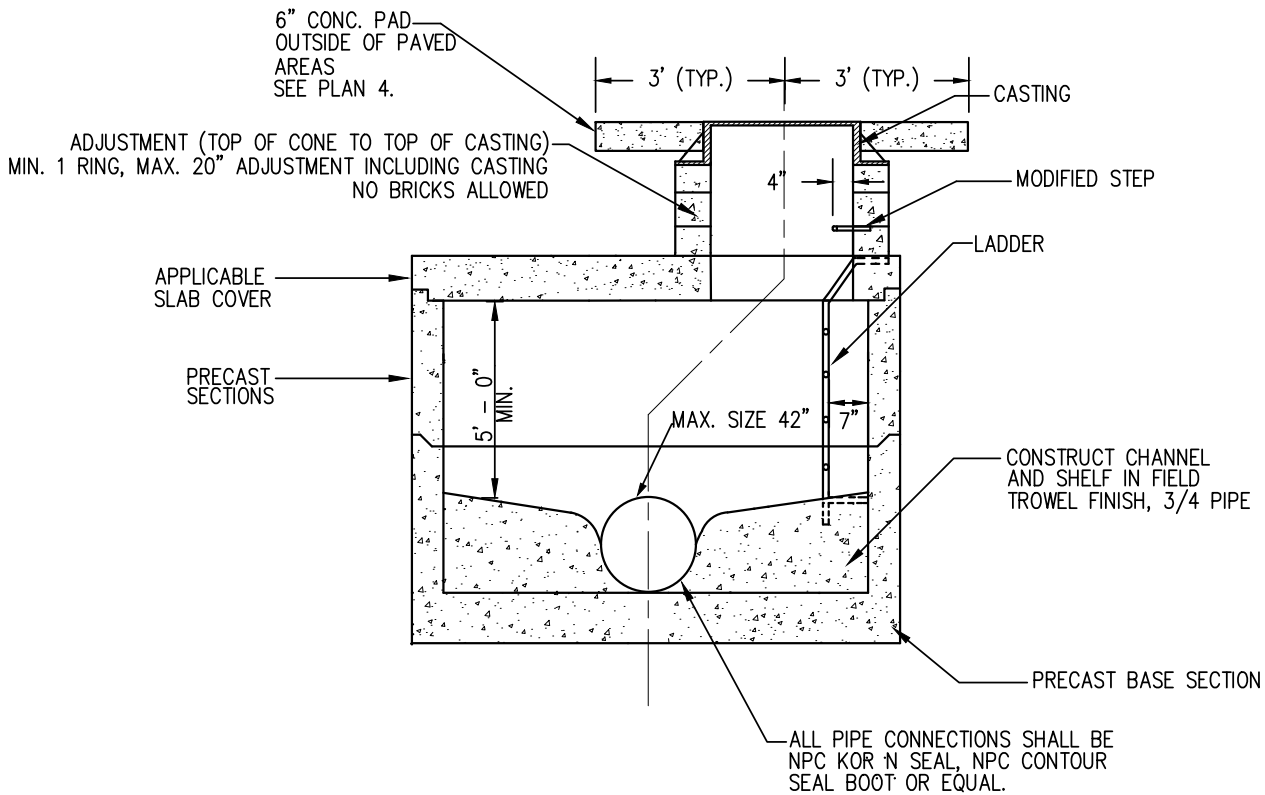
**TYPICAL
CHANNEL DETAIL**

REVISED 3/26/2020

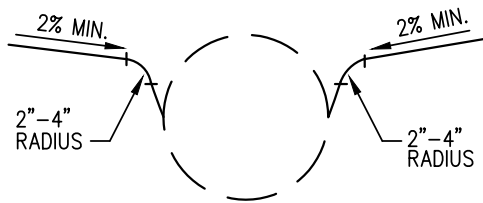


**72" DIAMETER REDUCED TO 48"
(PRECAST UNITS)
Sewer Construction Standard Plan No. 02**





NOTE: SEE D1.e 11 FOR MANHOLE



**TYPICAL
CHANNEL DETAIL**

REVISED 3/26/2020

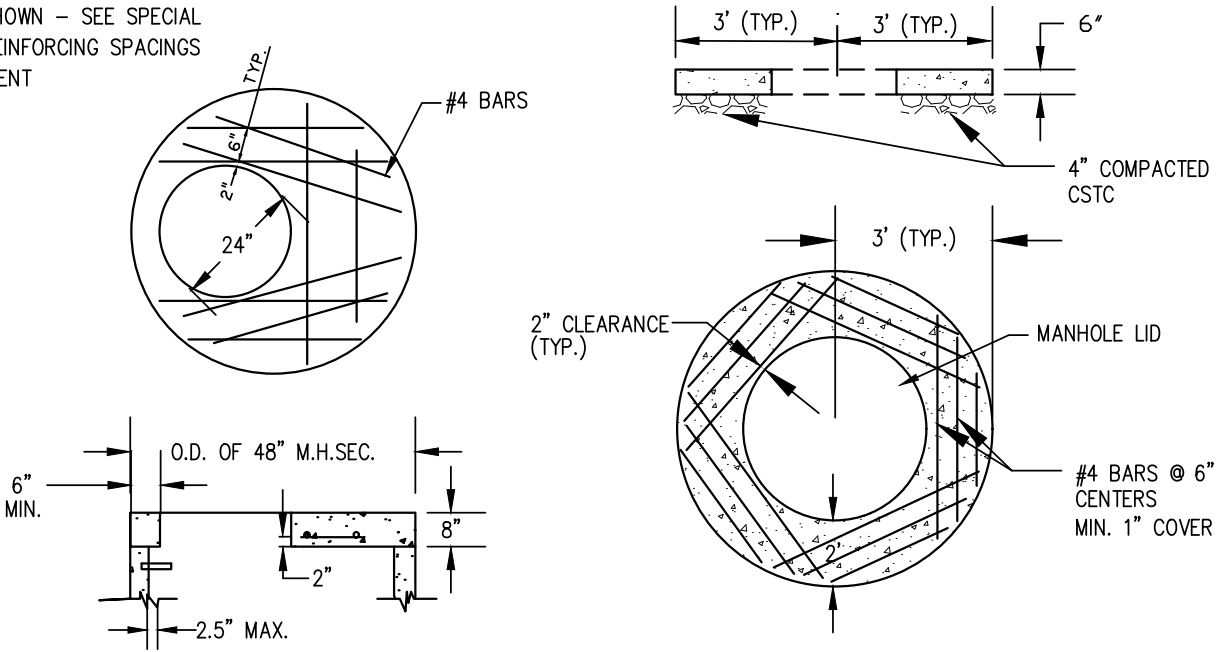


**48"/54"/72" DIAMETER SHALLOW
MANHOLE (PRECAST UNITS)
Sewer Construction Standard Plan No. 03**



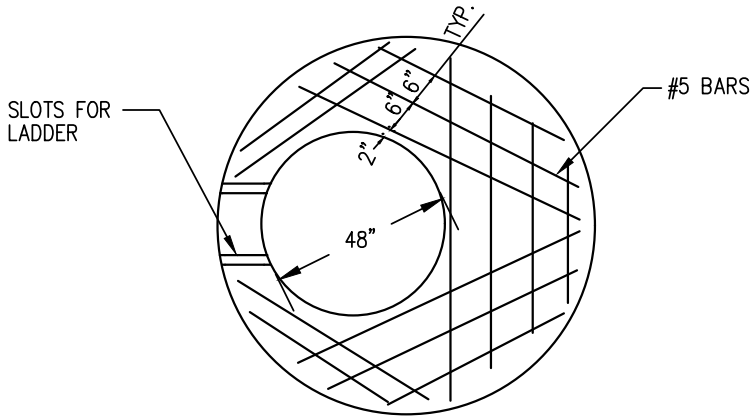
NOTE:

WHERE PLANS CALL FOR OPENINGS OTHER THAN SHOWN - SEE SPECIAL DETAILS FOR REINFORCING SPACINGS AND ARRANGEMENT

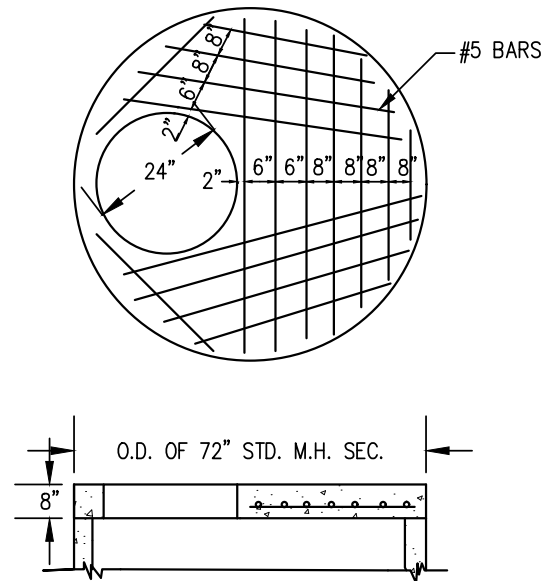


STANDARD FLAT SLAB FOR 48" M.H. SEC.

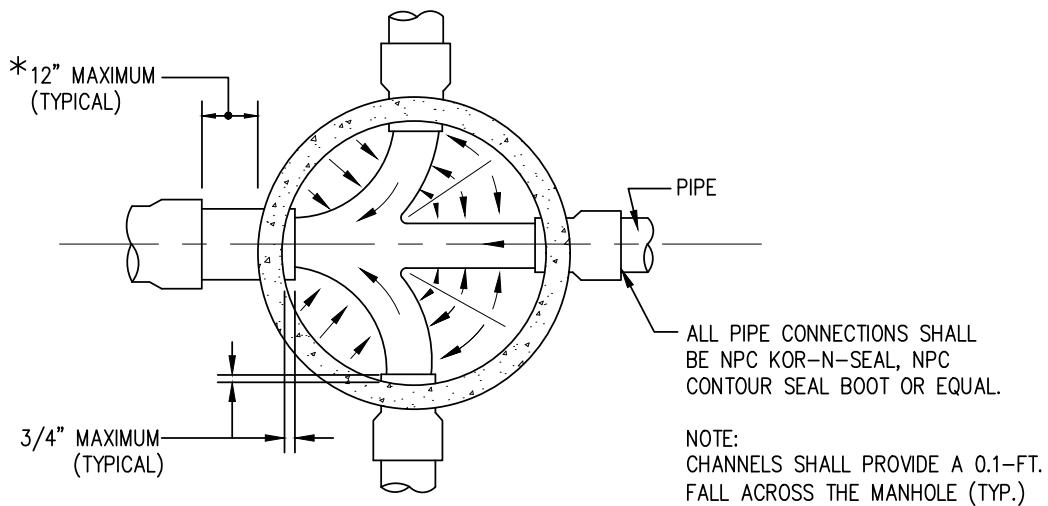
6" THICK CONCRETE PAD INSTALLATION FOR MANHOLE CASTING OUTSIDE PAVED AREA



72" / 54" / 48" REDUCING SLAB

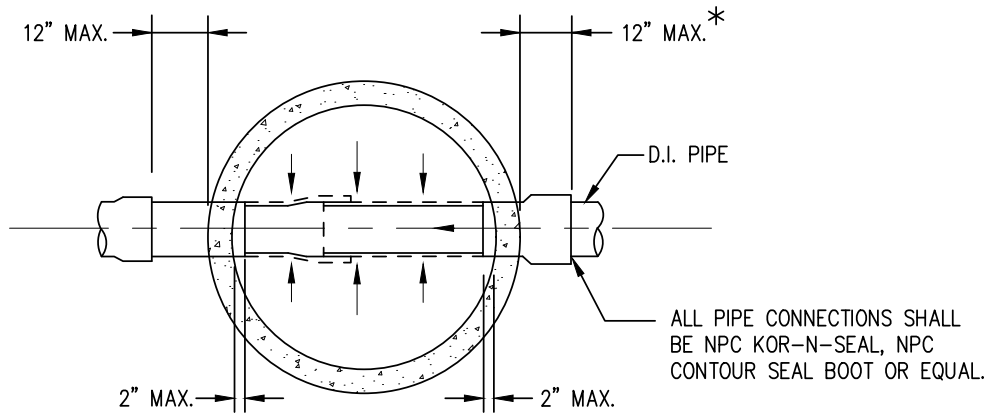


STANDARD FLAT SLAB FOR 72" MH SECTION

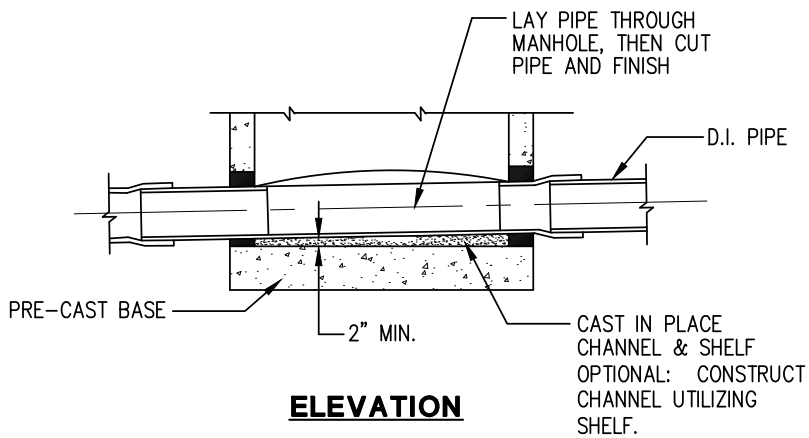


PLAN

BRANCHING SEWERS



PLAN



ELEVATION

STRAIGHT THROUGH FLOW

* FOR PVC PIPE, JOINTS SHALL BE PLACED A MIN. OF 10 FEET FROM THE MANHOLE WALL.

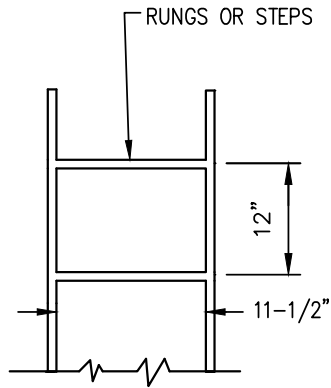
REVISED 5/11/2011



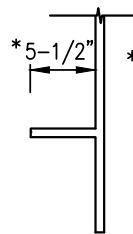
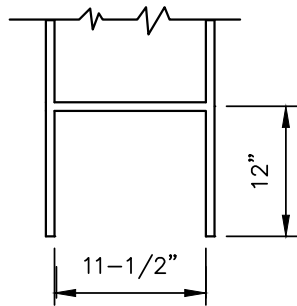
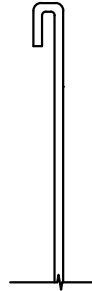
MANHOLE BASE
Sewer Construction Standard Plan No. 05



RUNGS TO BE THE SAME AS STEPS
-DEFORMED OR NON-SKID
ALL PARTS TO BE 1" DIA. MIN.
OR EQUIVALENT SECTION



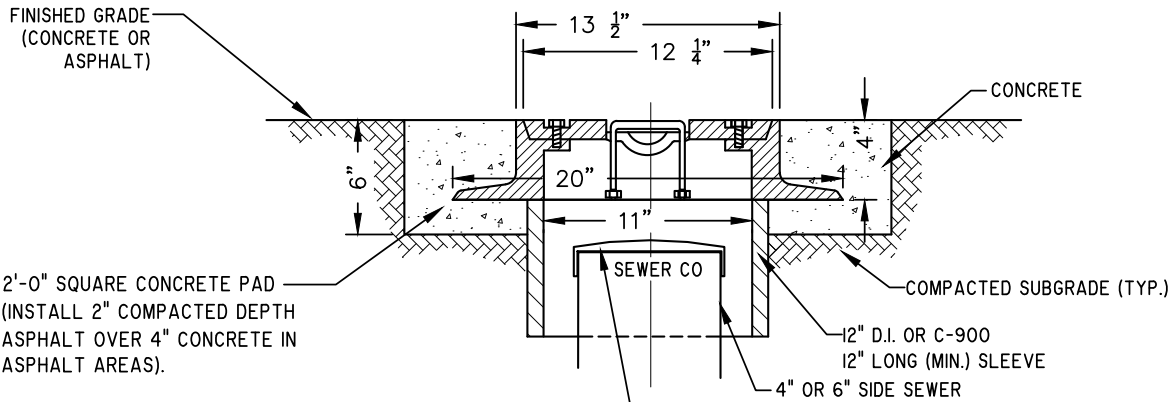
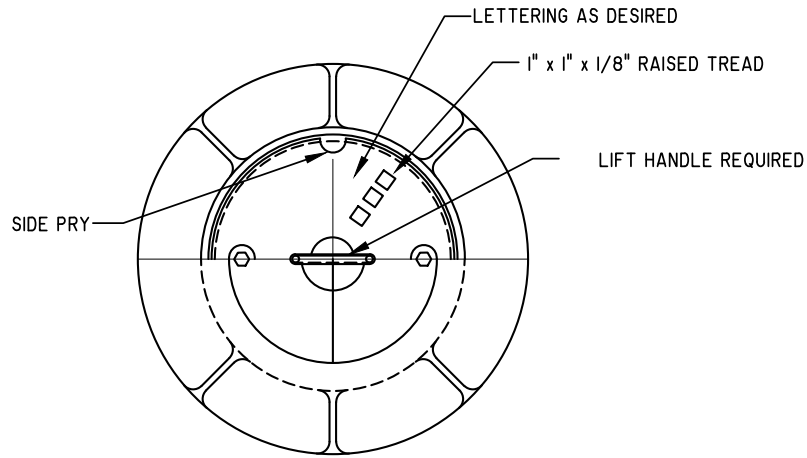
**STANDARD POLY
LADDER**



* LARGER DIM. WHEN
LADDER USED WITH
REDUCING SLAB

NOTE:
POLYPROPYLENE MANHOLE STEPS
SHALL BE LANE MODEL P-14938 OR APPROVED
EQUAL.

MANHOLE STEP



NOTES:

1. LAMPHOLE COVER & FRAME TO BE PROVIDED FOR CLEANOUTS IN PAVED AREAS (RIGHTS-OF-WAY AND DRIVEWAYS), AND IN ALL COMMERCIAL INSTALLATIONS (INCLUDING MULTIFAMILY).
 2. 11" x 4" LOCKING FLANGE DOWN FRAME & COVER (H20 RATING). PART NO. MH5D/T WITH 5/8" x 1/2" STAINLESS STEEL SOCKET HEAD CAP SCREW (2 PLCS)
 3. MATERIAL: CAST IRON, ASTM A-48, CL 30
 4. MACHINE SURFACE ON FRAME AND COVER
 5. CONCRETE SHALL BE CLASS 3000
- PVC GASKETED CAP OR SCREW-ON PLUG WITH 2" SQUARE OPERATING NUT. TOP OF CAP OR PLUG TO BE NO MORE THAN 2" BELOW LOOP HANDLE AND SHALL NOT TO INTERFERE WITH LID HANDLE OPERATION.



CLEANOUT (LAMPHOLE)
Sewer Construction Standard Plan No. 07



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 WATER & SEWER DISTRICT

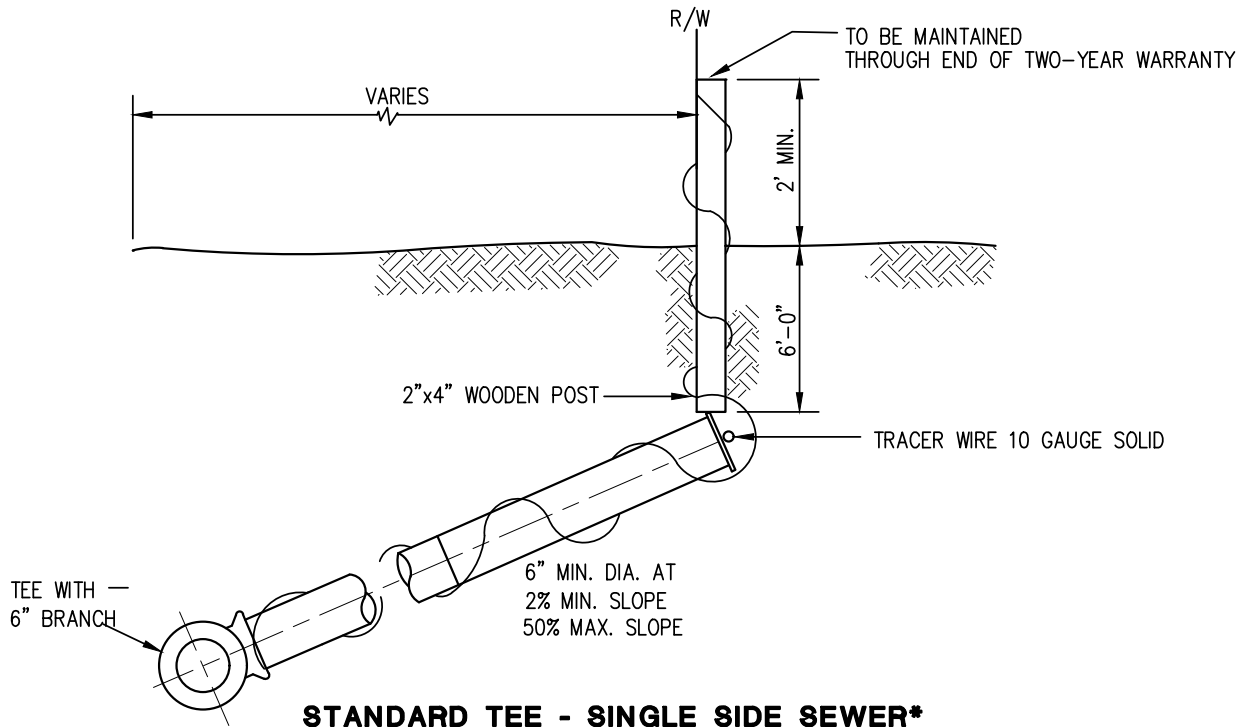
REVISED 5/11/2011



NOT USED - INTENTIONALLY BLANK
Sewer Construction Standard Plan No. 08

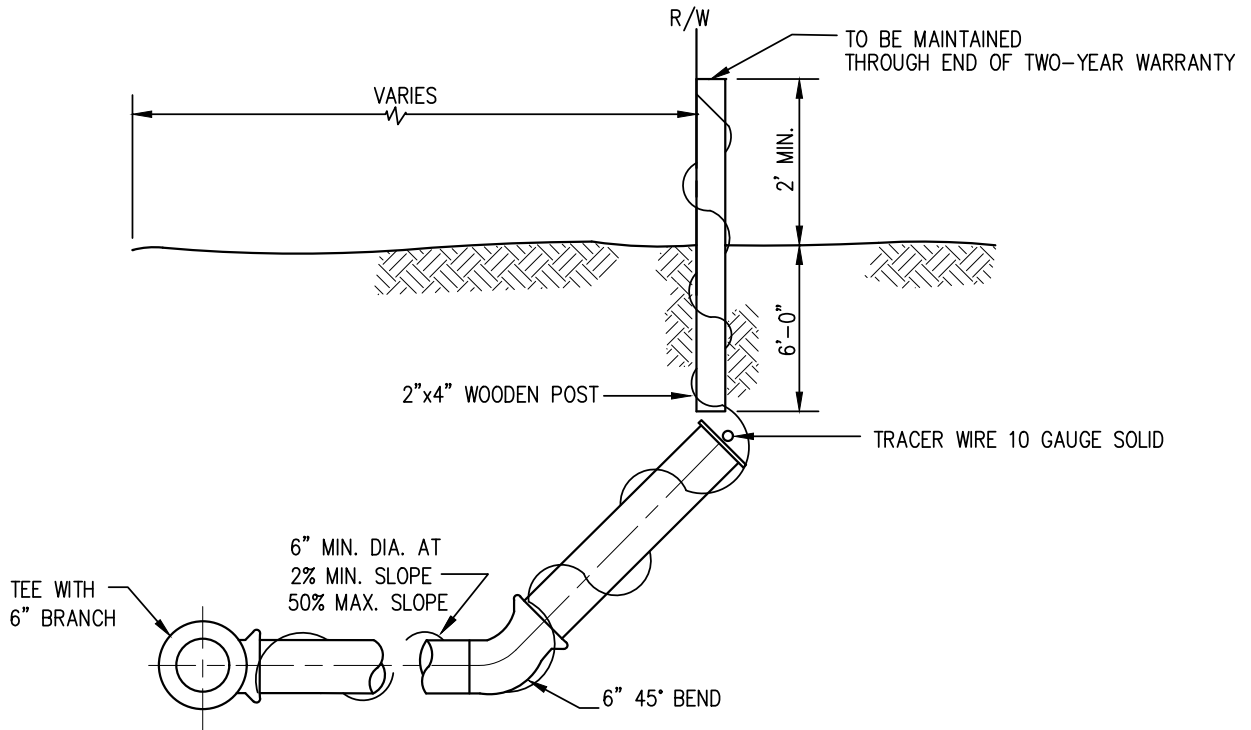


CEDARRIVER
WATER & SEWER DISTRICT



STANDARD TEE - SINGLE SIDE SEWER*

* ALL SIDE SEWERS SHALL BE SINGLE SERVICE LINES, LOCATED AT THE CENTER OF THE LOT, UNLESS APPROVED BY THE DISTRICT.



OPTIONAL TEE (AT DISTRICT'S DISCRETION) - SINGLE SIDE SEWER*

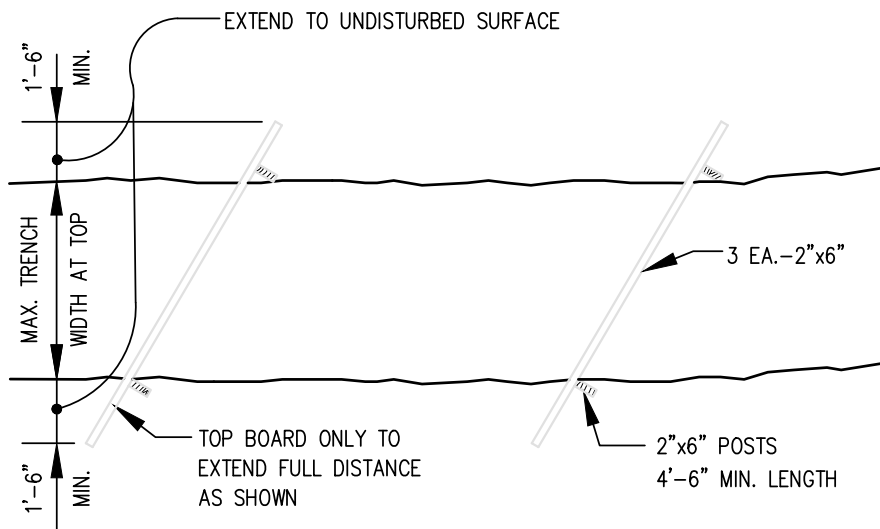
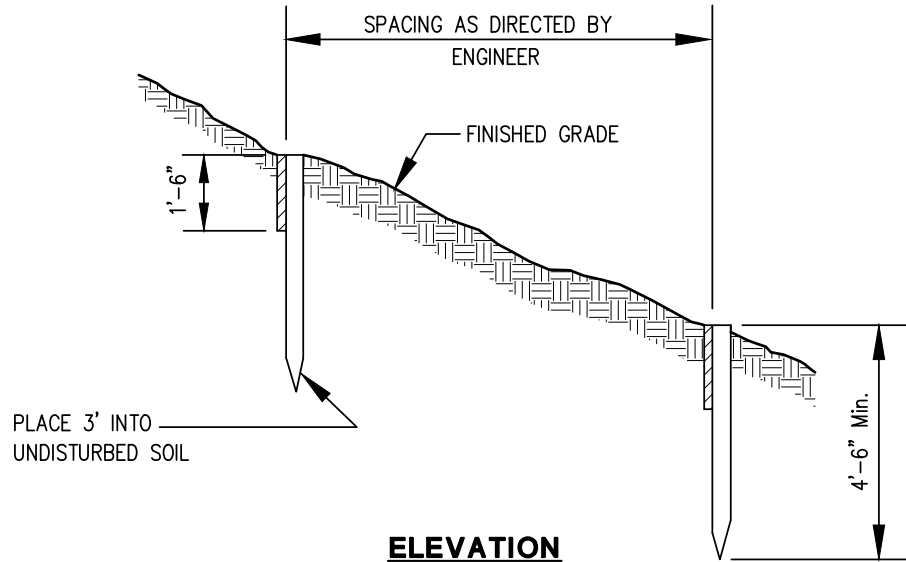
* ALL SIDE SEWERS SHALL BE SINGLE SERVICE LINES, LOCATED AT THE CENTER OF THE LOT, UNLESS APPROVED BY THE DISTRICT.

REVISED 3/26/2020



TEE & RISER
Sewer Construction Standard Plan No. 09





NOTES:

1. TIMBER BAFFLES TO BE INSTALLED WHERE DIRECTED BY THE ENGINEER OR DISTRICT INSPECTOR
2. ANY PORTION OF THE SITE THAT HAS BEEN DISTURBED SHALL BE SEEDED OR HYDROSEEDED WITH FRESH, CLEAN, PURE, LIVE, DROUGHT TOLERANT FESCUE BLEND SEED. THE TOPSOIL LAYER SHALL CONSIST OF A MINIMUM OF (6)-INCHES OF EARTHEN MATERIAL THAT IS CAPABLE OF SUSTAINING PLANT GROWTH. THE AREA SHALL BE WATERED AS NECESSARY UNTIL GRASS IS ESTABLISHED. APPLY MULCH CONSISTING OF STRAW OR GRASS HAY THAT IS FREE OF NOXIOUS WEEDS DURING WET SEASON AND AS WEATHER DICTATES.

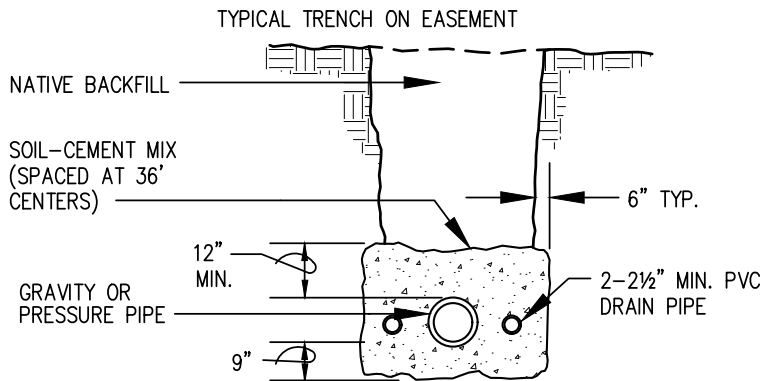
REVISED 5/11/2011



HILL HOLDER
Sewer Construction Standard Plan No. 10

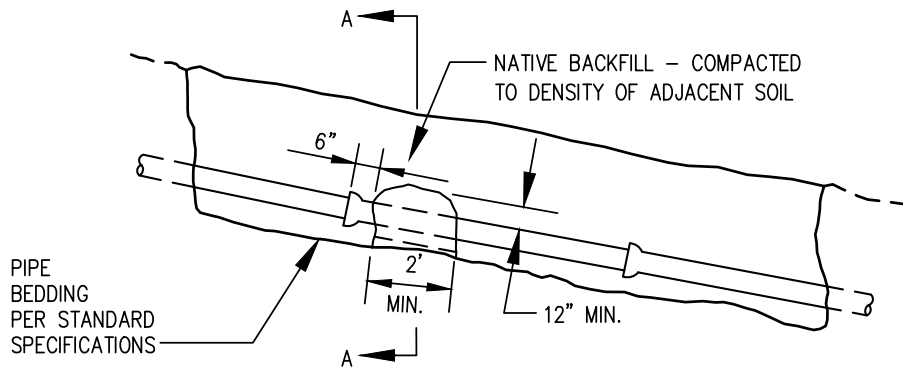


CEDARRIVER
 WATER & SEWER DISTRICT



SECTION A-A

SOIL CEMENT BLOCKS PLACED OVER AND AROUND PIPE. TAMPED INTO PLACE BEFORE PLACING BACKFILL. USE 10 PERCENT CEMENT WITH 90 PERCENT NATIVE SOIL AND WATER TO SUIT TO FORM A DRY MIX THAT WILL HOLD ITS SHAPE WHEN MOLDED INTO A BALL. OMIT SOIL CEMENT BLOCKS ON SLOPES LESS THAN 15 PERCENT UNLESS OTHERWISE SHOWN ON PLAN.



REVISED 5/11/2011



PIPE ANCHOR
Sewer Construction Standard Plan No. 11



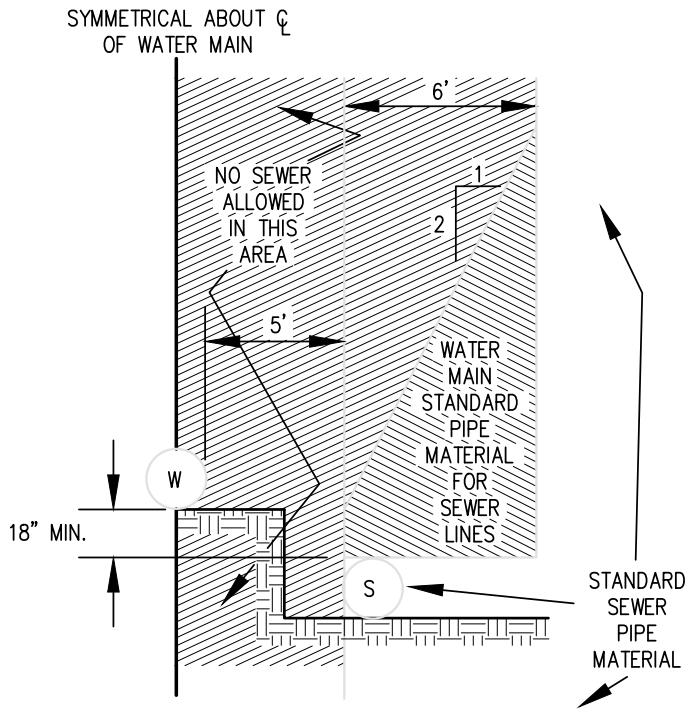
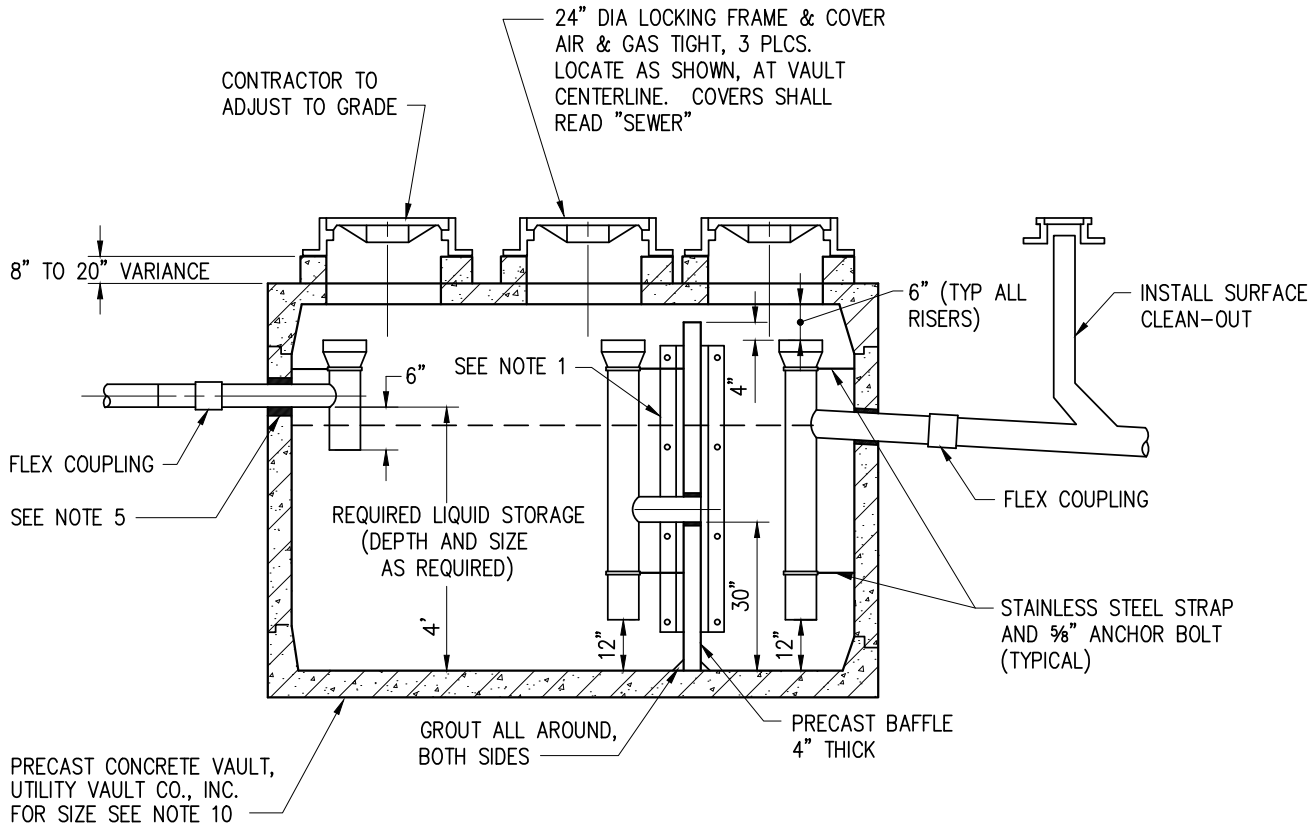


Table 1
WATER MAIN STANDARD PIPE MATERIAL

TYPE OF PIPE	AWWA (ASTM) STANDARD		
	PIPE	JOINT	FITTINGS
Ductile Iron	C 151 & C104	C 111	C 153

NOTE:

FOR PERPENDICULAR CONSTRUCTION, MAINTAIN 18" SEPARATION OR CONSTRUCT WATERLINE PASSING OVER SEWER LINE AND USE WATER MAIN STANDARDS SET FORTH ABOVE FOR THE SEWER WITH MINIMUM 18 FEET LENGTH CENTERED OVER CROSSING.



Notes:

1. If vault is not slotted to accept precast concrete baffle then precast concrete baffle shall be held in place by (2) 3" x 3" x 3/8" angle (4ft. long) attached to vault wall with (4 ea.) 1/2" bolts and nuts (with washers) spaced 14" o.c. angle and fasteners shall be stainless steel, or galvanized and asphalt coated. Baffle shall have 2' minimum clearance between top of baffle and underside of vault top.
2. All pipe penetrations shall be core drilled using core and seal boots.
3. Install riser rings and frame and cover using vault section mastic or non-shrink grout.
4. Locate interceptor within 20' of drive for access by maintenance vehicle.
5. Connections to concrete walls with p.v.c. pipe require Kor-n-Seal connector or a.c. x p.v.c. brant adapter. Seal all pipe connections with with non-shrink grout. Stainless steel hardware will be used on all vertical pipe connections.
6. Line-sized p.v.c pipe shall be used throughout.
7. Gray-water only. Black-water shall be carried by separate side sewer or connect downstream of vault.
8. Clean-out required 3' max. downstream of interceptor.
9. Schedule District inspection and approval before filling with clean water prior to start up of system.
10. Size will be per Uniform Plumbing Code Appendix H (750 gallon min.).

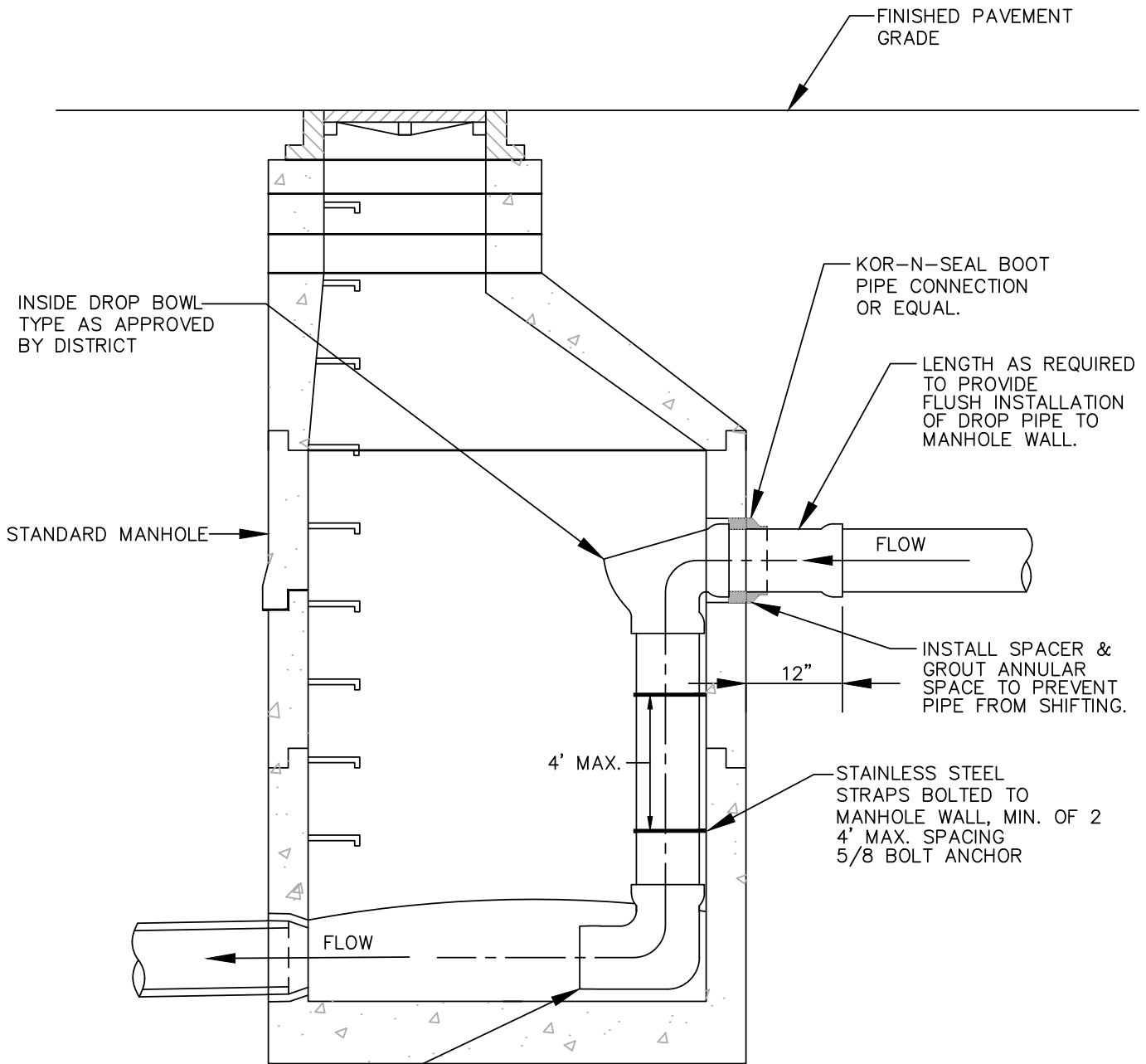
OIL WATER SERPARTOR SIZING AND
DESIGN ON A CASE BY CASE BASIS
AS NEEDED.



TYPICAL OIL SEPARATOR
(600 GALLON MINIMUM)
Sewer Construction Standard Plan No. 14



CEDARRIVER
WATER & SEWER DISTRICT



PLAIN END 90° BEND
W/GASKETED JOINT. MATCH
FLOW LINE OF MANHOLE.

NOTES:

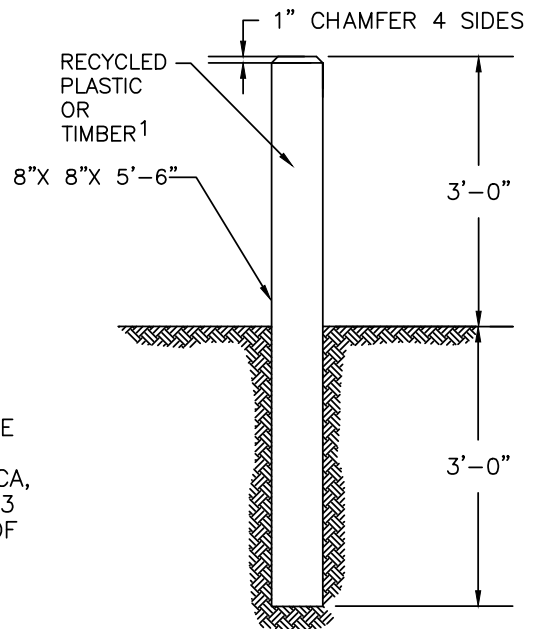
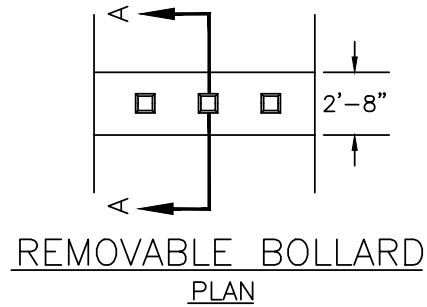
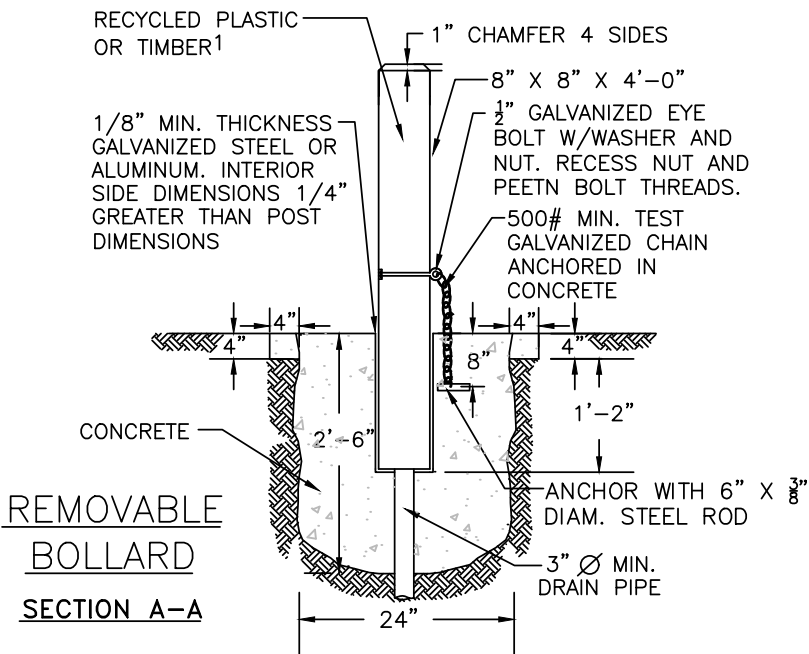
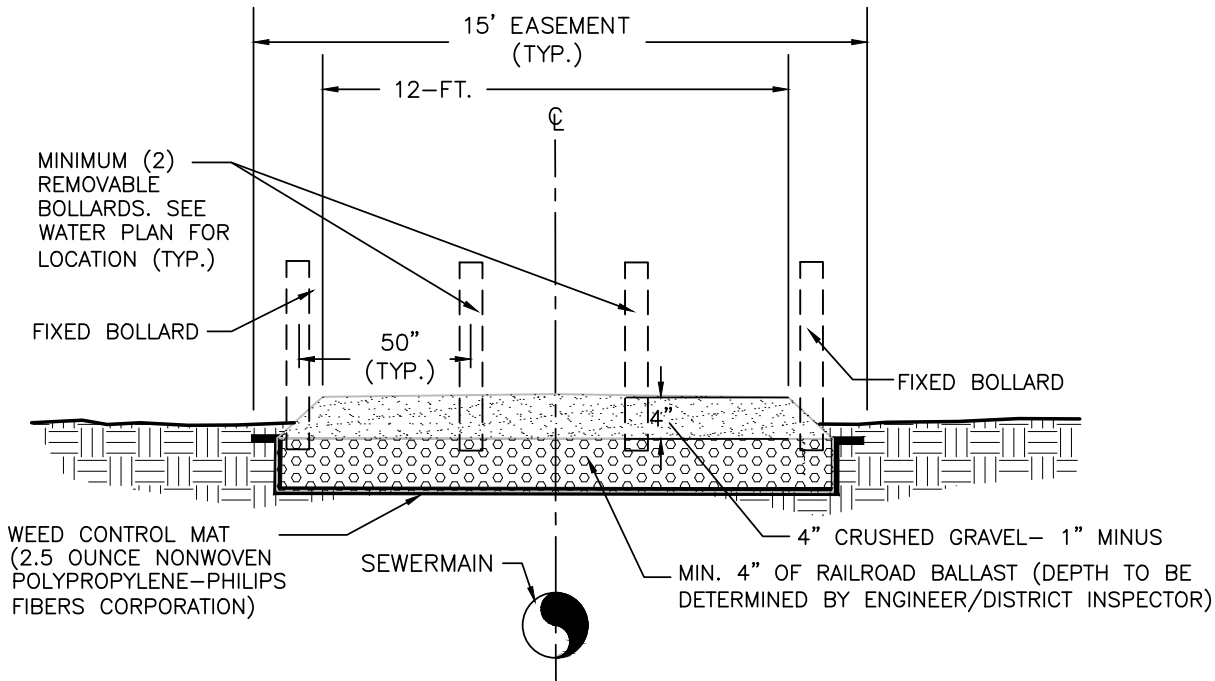
1. DROP TEE TO BE INSTALLED MINIMUM 3' BELOW CONE SECTION.
2. **INSIDE DROP MANHOLE SHALL BE INSTALLED ONLY WHERE APPROVED BY DISTRICT.**
3. CORE DRILL OPENINGS FOR NEW PIPE.
4. RECHANNEL BASE WITH 3000 PSI CONCRETE. HEIGHT OF CHANNELS SHALL BE NO LESS THAN 3/4 OF PIPE DIAMETERS.

REVISED 5/11/2011



INSIDE DROP MANHOLE
Sewer Construction Standard Plan No. 15





NOTES:

1. RECYCLED PLASTIC BOLLARD SHALL BE WHITE. TIMBER SHALL BE DOUGLAS FIR, DENSE CONSTRUCTION GRADE, AND SHALL BE PRESSURE TREATED WITH A WATERBORNE PRESERVATIVE (ACA, CCA, ACZA) IN ACCORDANCE WITH THE REQUIREMENTS OF SEC. 9-09.3 (4) OF THE WSDOT/APWA STANDARD SPECIFICATIONS. TOP 5" OF TIMBER SHALL BE PAINTED WHITE.
2. STEEL TUBE SHALL CONFORM TO ASTM A53 GRADE A.
3. NUTS, BOLTS, & WASHERS SHALL CONFORM TO ASTM A307.
4. ALL STEEL PARTS SHALL BE GALVANIZED.
5. CONCRETE SHALL BE CLASS 3000.

EXISTING GROUND

POUR CONCRETE AROUND PIPE TO PLUG

EXISTING PIPE TO BE ABANDONED

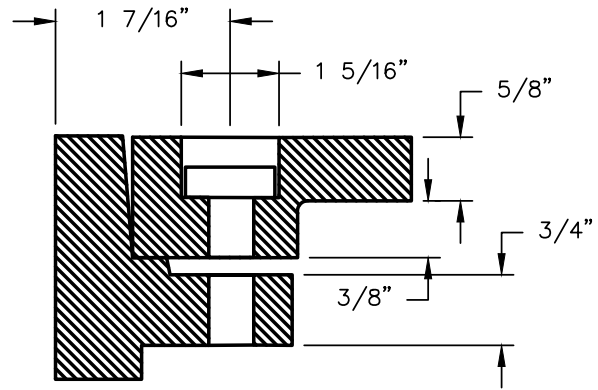
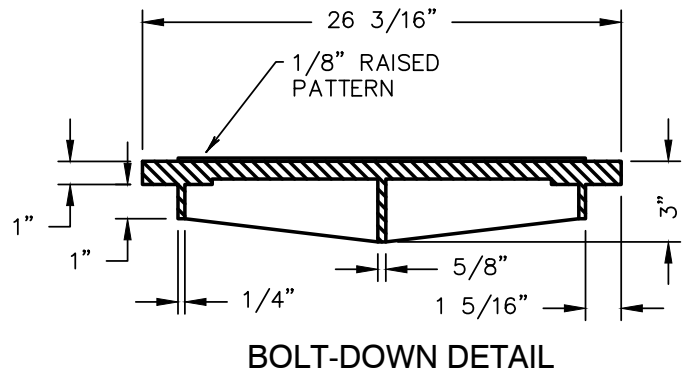
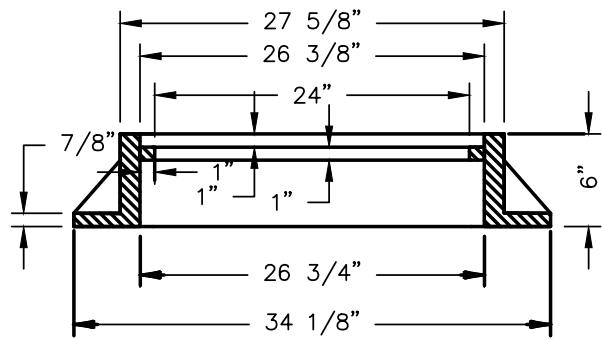
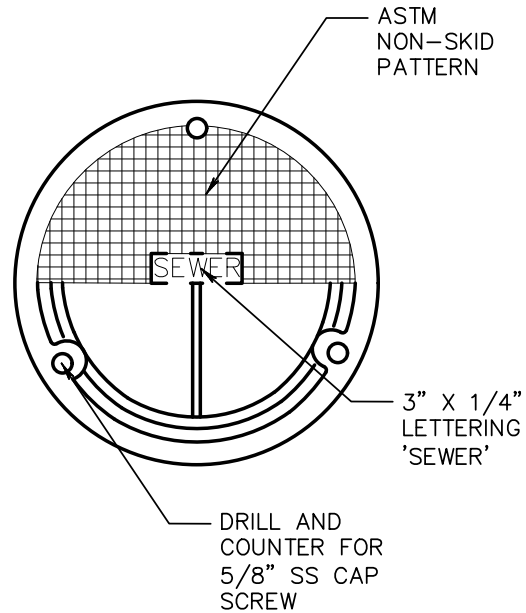
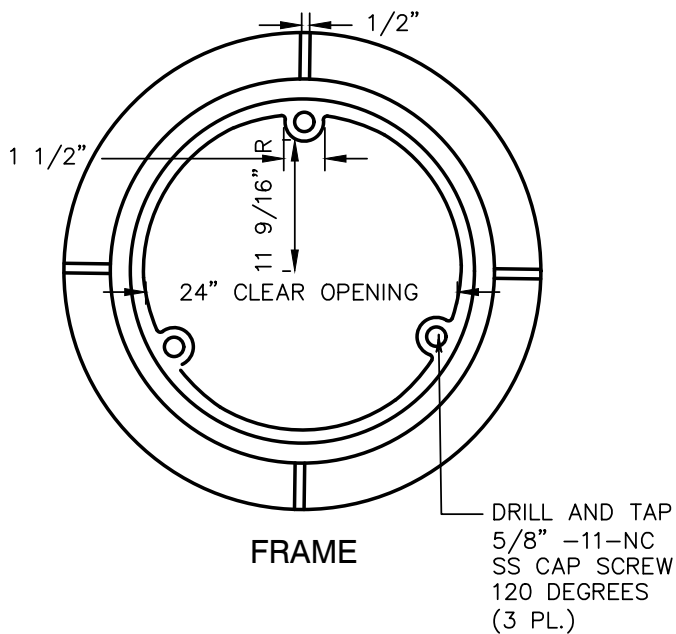
POUR CONCRETE INSIDE PIPE TO BE ABANDONED

ELEVATION



ABANDONED PIPE PLUG
Sewer Construction Standard Plan No. 17





NOTES:

1. MATERIAL;
FRAME: CAST IRON ASTM A48, CL 30
COVER: DUCTILE IRON ASTM A-536, CL 80-55-06
2. WSDOT STD. PLAN B28
3. APPROXIMATE WEIGHT: RING - 168 LBS., COVER - 118 LBS
4. RATING: H-20
5. PART NO. MH41 D/T

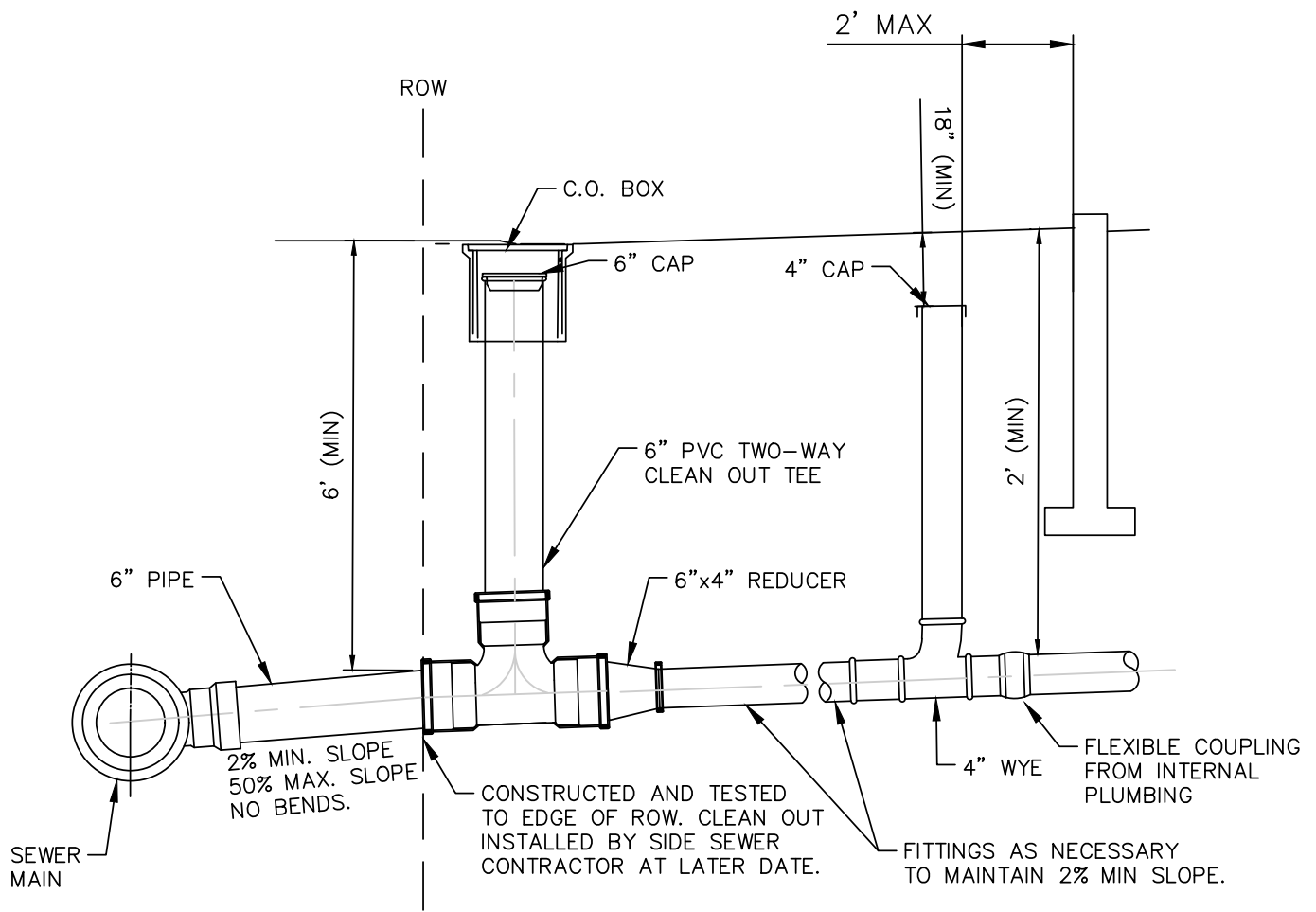
REVISED 5/11/2011



LOCKING MANHOLE FRAME & COVER
Sewer Construction Standard Plan No. 18



CEDARRIVER
WATER & SEWER DISTRICT



NOTES:

1. SIDE SEWER BEDDING MIN. 4" BELOW PIPE TO MIN. 6' ABOVE PIPE USING 5/8" MINUS CRUSHED ROCK.

CROSS SECTION VIEW

N.T.S.



SIDE SEWER & CLEANOUT
Sewer Construction Standard Plan No. 19

