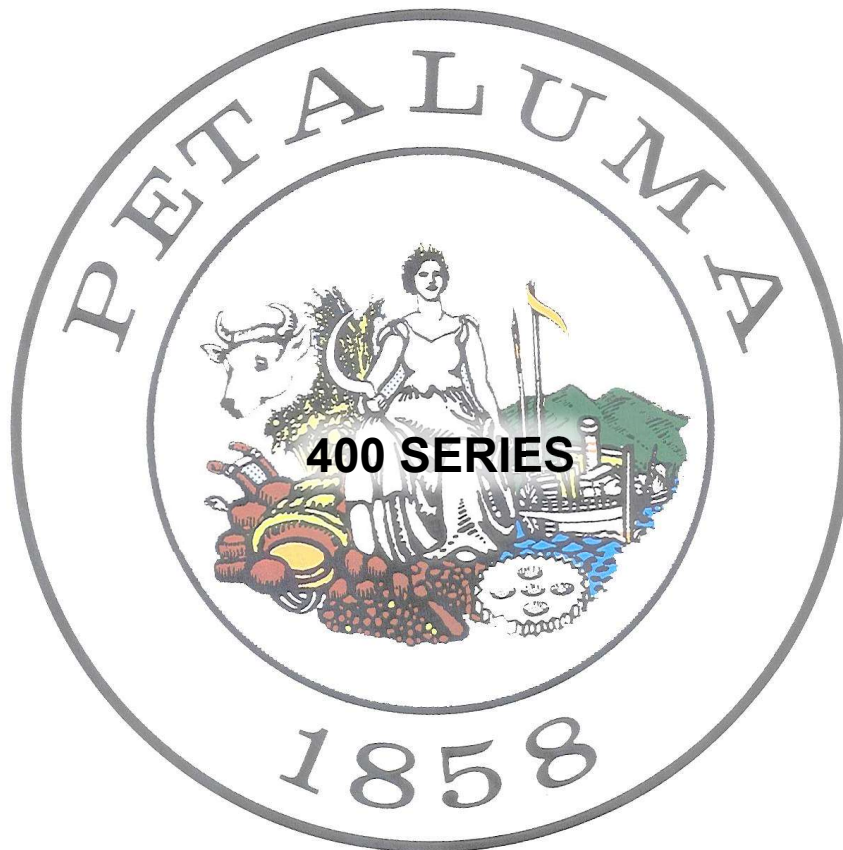


Storm Drain System

- Design and Construction Guidelines
- Construction Standards
- Approved Materials



City of Petaluma - Sonoma County - California
Public Works & Utilities
202 North McDowell Boulevard
Petaluma, CA 94954

APPROVED BY:

Jeff Stutsman, City Engineer

1/19/2023

Date

Storm Drain System
CONSTRUCTION STANDARDS
January 2023

Storm Drain System Construction Standards

Standards List

<u>Std. No.</u>	<u>Title</u>	<u>Date Approved</u>
	DETAIL SPECIFICATION.....	JAN 2023
400.1	STANDARD TRENCH DETAILS.....	JAN 2023
401.1	PRECAST CONCRETE MANHOLE.....	JAN 2023
402.1	STORM DRAIN MANHOLE OVER CIP PIPE, 1.0' TO 2.5' OF COVER	JAN 2023
403.1	STORM DRAIN MANHOLE OVER CIP PIPE, 2.5' TO 4.5' OF COVER	JAN 2023
404.1	STORM DRAIN MANHOLE OVER CIP PIPE, 4.5' OR GREATER COVER	JAN 2023
405.1	CIP REDUCER SLAB.....	JAN 2023
406.1	TYPE "OS" DRAINAGE INLET OVER CAST-IN-PLACE PIPE.....	JAN 2023
407.1	STANDARD PRECAST CONCRETE CURB INLET	JAN 2023
408.1	TYPE "B" CIP DRAINAGE INLET	JAN 2023
409.1	TYPE "24" DRAINAGE INLET GRATE	JAN 2023
410.1	CIP CONCRETE DRAINAGE INLET NOTES.....	JAN 2023
412.1	TEMPORARY REDWOOD DRAIN BOX	JAN 2023
413.1	PRECAST DRAINAGE INLET COVER.....	JAN 2023
414.1	SIDEWALK UNDERDRAIN	JAN 2023
415.1	STANDARD DRAINAGE INLET GALLERY	JAN 2023
416.1	TYPE "G1" DRAINAGE INLET	JAN 2023
417.1	LOOSE ROCK RIPRAP DRAIN OUTLET	JAN 2023
420.1	DEFLECTION MANDREL FOR PVC STORM DRAIN PIPE.....	JAN 2023

Storm Drain Installation Detail Specifications

Storm Drain System Design and Construction Guidelines

A. DESCRIPTION

The work shall include the furnishing of all material, labor, tools, implements, and equipment necessary to construct the storm drains, drop inlets, and manholes, complete and ready to operate; all construction to be in accordance with the details shown on the plans and with these specifications.

B. MATERIALS

1. Portland Cement Concrete

- a. Portland Cement Concrete (PCC) shall conform to the requirements of Section 90 of the Caltrans Specifications¹ and as herein specified. The concrete shall be Class "A" containing (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the requirements for one- and one-half inch (1-1/2") maximum. The consistency of the fresh concrete shall be such that the slump does not exceed four (4) inches as determined by the Test Method No. California 519A.
- b. Portland cement shall conform to ASTM C150/C150M-22², Type II, and shall be delivered in the original package with the brand name of the manufacturer plainly marked thereon.
- c. Reinforcing steel shall meet the requirements of the Caltrans Specifications, section 52-1.02B, "Bar Reinforcement".

2. Pipe

Storm Drain mains shall be of reinforced concrete, cast in place concrete, ductile iron, polyvinyl chloride, or high-density polyethylene pipe. Corrugated metal pipe may be used above ground only, and only when approved by City Engineer.

- a. Reinforced Concrete Culvert Pipe (RCP) shall conform to Caltrans Specifications section 65-2.
- b. Cast in Place (CIP) Concrete Pipe shall conform to Caltrans Specifications section 65-2.
- c. Corrugated Metal Pipe (CMP), when allowed, shall conform to Caltrans Specifications sections 66-1.02E, "Corrugated Steel Pipe", or 66-102F, "Corrugated Aluminum Pipe."
- d. Ductile Iron Pipe (DI) shall conform to ASTM standard A716-18(2022).
- e. Polyvinyl Chloride Pipe (PVC) shall of thickness no less than SDR 26 or C900. For private drains, SDR 35 may be allowed at City's discretion.
- f. High Density Polyethylene (HDPE) pipe shall be in the N-12 form factor, which is classified as Type S, meaning smooth on the inside but is corrugated outside.

¹ Throughout this document, the term "Caltrans Specifications" refers to Caltrans Standard Specifications, 2018 edition.

² C150/C150M-22 "Standard Specification for Portland Cement", www.astm.org, last updated July 26, 2022.

- g. Select Backfill Material shall be Class 2 Aggregate Base, 3/4" maximum gradation. Select backfill material shall have a size and a gradation falling within the following limits:

<u>Sieve Size</u>	<u>% Passing Sieve</u>
1"	100
3/4"	90 to 100
No. 4	35 to 60
No. 30	10 to 30
No. 200	2 to 9

The material shall compact to a relative compaction of ninety (90) percent. The relative compaction is that determined by the Test Method No. California 216 Materials and Research Department, California Division of Highways. The material shall have a minimum sand equivalent value of twenty-five (25) as determined by the test method currently in use by the California Division of Highways.

The in-place density and moisture of soils and aggregates may be determined using nuclear methods and the area concept as per Test Method No. California 231 with the following conditions. The test maximum density shall be determined as specified in Part II of test Method No. California 216. A minimum of one in-place density test using the sand volume method as prescribed in Part I of Test Method No California 216 shall be taken to standardize the nuclear gauge for each type of soil or aggregate. After correlation is assured and the equipment standardized, then the nuclear gauge may be used as directed by the Engineer.

- h. Optional backfill material may be Controlled Density Fill (CDF) Mix No. 1500 (95% relative compaction). CDF shall be a mixture of Portland cement, sand, and 1" maximum coarse aggregate, air entraining agent and water, batched by a ready-mixed concrete plant and delivered to the job site by means of transit mixing trucks. CDF may also contain Class F Pozzolan (Fly Ash). CDF shall be free of asphaltic material.

Cement shall meet the standards as set forth in ASTM C150/C150M-22, type II Cement. Fly ash shall meet the standards as set forth in ASTM C-618, for Class F Pozzolans. The fly ash shall not inhibit entrainment of air. Sand shall meet the standards as set forth in ASTM C33.

Mix proportions shall be determined by the producer of the control density fill to produce a flowable fill mixture which will not segregate. Each yard shall contain not less than 50 pounds of Portland cement and not less than a total of 100 pounds of cementitious material. The contractor shall supply a mix design two weeks prior to any use of control density fill. CDF shall have a compressive strength of 75-200 PSI at 28 days and a minimum slump of 6".

The consistency of CDF shall be such that all trench voids are filled with minimum rodding or vibrating, but not so wet as to cause excessive shrinkage.

3. Storm Drain Manhole Materials

- a. Precast manhole sections shall conform with the plans and with ASTM C478-68 as amended to date. Manhole cones shall be the concentric type unless otherwise shown on the plans or required by the Technical Specifications. Manholes shall be constructed without steps. A minimum of nine inches (9") and a maximum of twenty-four inches (24") total depth of three-inch (3") and six-inch (6") grade rings, as shown on the standard drawings, shall be required on all manholes unless otherwise required by the Technical Specifications or contract plans.
- b. Casting for manhole ring, cover, and other purposes, shall conform accurately to the form and dimensions shown on the detailed drawings. Castings must have workmanlike finish, free from blow and sand holes or defects of any kind and shall be made from a superior quality of tough even-grained gray iron and shall possess a tensile strength of not less than twenty thousand (20,000) pounds per square inch.
- c. Before leaving the foundry, they shall be thoroughly cleaned and coated by dipping in asphalt applied at a temperature of three hundred degrees Fahrenheit (300°F) in such a manner as to provide a firm, durable, tenacious coating.
- d. Portland Cement shall conform to ASTM designation ASTM C150/C150M-22, Type II.
- e. Portland Cement Concrete for manhole bases shall conform to the requirements of Section 90, "Concrete," of the Standard Specifications current revision and as herein specified.
- f. The concrete shall be class "A" containing six (6) sacks of Portland Cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the requirements for one and one-half (1 ½") inch maximum. The consistency of the fresh concrete shall be such that the slump does not exceed four inches (4") as determined by Test Method No, California 519A or 520. The test method used shall be determined by the Engineer.
- g. All mortar used in the construction of manholes shall consists of one (1) part Portland Cement and two (2) parts sand, and shall conform to Section 51-1.02F, "Mortar," of the Standard Specifications and as herein specified.

4. Storm Drain Trench Excavation

- a. Alignment shall be in accordance with the provisions of the City Standard.
- b. Any existing pavement over the trench shall be cut, removed, and hauled away from the job. Pavement shall be cut as specified in City Standard Details 219.1 through 219.3. All storm drains shall be laid in open trench as indicated on the plans or as directed by the Engineer. Minimum width of trench shall be half the pipe outside diameter wider than the pipe on each side.
- c. Whenever the maximum allowable trench width is exceeded for any reason, the Contractor shall, at his expense, embed or cradle the pipe in concrete in a manner satisfactory to the Engineer.

- d. The trench shall be excavated a minimum of four (4 ") inches below the grade of the bottom of the pipe and sufficient "Select Backfill Material" shall be placed in the trench and tamped to bring the trench bottom up to the grade of the bottom of the pipe. The relative compaction of the tamped material shall not be less than ninety (90%) percent as determined by Test Method No. California 216. It is the intention of these requirements to provide firm, uniform bearing for the pipe.
- e. At street crossings or where existing driveways occur on a street, the Contractor shall make provisions for trench crossings at these points, either by means of backfill or temporary bridges, as the Engineer may direct. Free access must be provided to all fire hydrants, water gate valves and private drives. Means shall be provided whereby all storm and wastewater can flow uninterrupted in the gutters or drainage channels.
- f. All trench excavation shall be properly braced and supported with shoring equipment, as set forth in the rules, orders and regulations of the State of California Division of Occupational Safety and Health (Cal/OSHA). Failure to comply with any of these rules, orders and regulations shall be sufficient cause for the Engineer to immediately suspend all work. Compensation for losses incurred by the Contractor by such an emergency suspension shall not be allowed. The Contractor shall backfill the ditch in a manner such that the removal of the shoring will not disturb the initial backfill.
- g. The Contractor shall keep the streets sufficiently watered and swept of all loose material produced by the excavating operations in order that traffic and construction does not raise an objectionable amount of dust. When directed by the Engineer, the Contractor shall apply a suitable dust palliative to control dust.
- h. The Contractor shall furnish, install, and operate all necessary equipment to keep trenches reasonably free from water. All water removed from trenches or flushed from pipes shall be disposed of in a manner that will cause no injury to public or private property or cause no nuisance or menace to the public. Under no circumstances will the laying of pipe or the placing of concrete in water be permitted.

5. Storm Drain Pipe Laying

- a. No pipe shall be laid until PW&U inspects and approves the condition of the bottom of the trench.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell and spigot pipe pointing in the direction of flow. Each piece shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line. As the work progresses, the interior of the storm drain shall be cleaned of all dirt and debris of every description. Pipe shall not be laid when the condition of the trench or the weather is unsuitable. At times when work is not in progress, open ends of pipe and fittings shall be closed.
- c. Unless otherwise indicated on the drawings or directed by PW&U, pipe shall be placed on prepared subgrade of imported material at least four inches (4") deep below the barrel of the pipe. The imported material shall be Class 2 Aggregate

Base, as specified in Section B.2.g. of these specifications, and thoroughly compacted to obtain a final density of at least ninety percent (90%) of maximum at optimum moisture as determined by Test Method No. California 216.

- d. When additional gravel or crushed rock is required to stabilize a soft, wet, or spongy foundation caused by the operations of the Contractor in order to stabilize a trench bottom, such gravel or crushed rock shall be furnished at the Contractor's expense.

PW&U shall approve the suitability of the trench bottom based on the recommendations of the soil engineer as to the amount of gravel required to stabilize a soft foundation. The contractor shall remove any soft material and replace it with gravel or crushed rock when ordered to do so by the Engineer. Such gravel or crushed rock shall be of a size and gradation falling within the following limits:

<u>Sieve Size</u>	<u>% Passing Sieve</u>
1-1/2"	100
1"	95-100
1/2"	0-30
No. 4	0-4

6. Excavation, Backfill, and Resurfacing

- a. All excavation, backfill, and resurfacing required for installation of storm drains shall be as shown on City Standard Trench Details.
- b. Excess material from excavation shall become the property of the contractor and shall be disposed of to the satisfaction of PW&U and in accordance with all applicable waste-disposal regulations.
- c. The contractor shall not excavate within six feet (6') of any City Valve, tie-down, thrust block, or fire hydrant without prior approval of PW&U.

7. Flushing and Cleaning Storm Drain Lines

- a. Two hydro flushings are required, with each flushing followed by a video inspection. The first hydro flushing occurs at finished rock grade of street section. The second is to be performed at the conclusion of final paving and iron raising. Debris flushed from the system must be captured and removed from the lowest manhole prior to entering an active storm drain system maintained by the City. Care shall be exercised to remove all debris from each manhole.
- b. All new storm drain mains shall be video inspected. Pipe joint separations, low or high spots, cracked or chipped pipe, deflection, improper lateral connections, infiltration, and all other pipe material and/or installation defects identified shall be corrected by the Contractor.

The second video inspection shall be conducted after all new work, including backfill and pipe testing, is completed and all street structural section aggregate subbase is in place and compacted but prior to placement of aggregate base and AC paving.

The Contractor shall hire an independent inspection service to perform a video inspection of all newly constructed storm drains. All video files of the inspection shall be produced and delivered to the Engineer in digital (.wmv) format. With each file shall be submitted a digital log of the inspection, created in Microsoft Word file format.

The following conditions shall exist prior to the second video inspection.

- i. All storm drain lines shall be installed, backfilled, and compacted.
- ii. All structures shall be in place, all channeling complete and all pipelines accessible from structures.
- iii. All other underground facilities, utility piping and conduit within two feet of the storm drain main, shall be installed.
- iv. All compaction required shall be completed.
- v. Pipelines to be tested shall be flushed.
- vi. The final water test shall have been completed.
- vii. Immediately before the video inspection, hydro flush all lines.

When the above work has been completed, the Contractor shall notify the Engineer 48 hours in advance of the date for video inspection. During this inspection, the Contractor or his authorized representative shall be present to observe the video in real time as it is provided by the camera.

The following video observations shall be considered defects in the construction of the storm drain pipelines and will require corrections prior to acceptance.

- i. Off grade – 1" or more deviation from grade
- ii. Joint separations – more than 3/4"
- iii. Offset joints
- iv. Chips in pipe ends – none more than 1/4" deep
- v. Cracked or damaged pipe or evidence of the presence of any external objects bearing upon the pipe (rocks, roots, etc.)
- vi. Infiltration
- vii. Debris or other foreign objects
- viii. Other obvious deficiencies when compared to Approved Plans and Specifications, and these Standards and Standard Drawings

The Contractor shall be notified in writing of any deficiencies revealed by the video inspection that will require repair, following which the Contractor shall excavate and make the necessary repairs and request a video re-inspection. Video re-inspection shall be at the Contractor's expense.

The City Engineer shall be given one-week written notice by the Contractor for video inspection.

C. TRAFFIC CONTROL

1. Traffic control shall conform with Section 12 of the State of California 2018 Standard Specifications, shall meet the current edition of the Manual of Uniform Traffic Control Devices (MUTCD CA), and shall be approved by the City of Petaluma.

All costs including flagging shall be the responsibility of the Contractor. The Contractor shall provide safe passage for vehicular, bicycle and pedestrian traffic through the work at all times.

2. Access to public and private buildings, businesses, and driveways shall be maintained by the Contractor. The Contractor shall provide approved metal "bridge" or temporary backfill for access when and where required within one-half (1/2) hour after request by the City Inspector, except that emergency vehicles and personnel shall be provided immediate access at all times.
3. The contractor shall notify the property owner at least five (5) calendar days prior to any activity that will impact access to their property.

PLEASE REFER TO CITY STANDARDS
SERIES 200 STREETS,
DETAILS 219.1, 219.2 & 219.3



CITY OF PETALUMA
PUBLIC WORKS & UTILITIES
UTILITIES DIVISION

202 N. McDOWELL BLVD. TEL. 707-778-4546
PETALUMA, CALIFORNIA 94954 FAX. 707-778-4508

**STANDARD TRENCH
DETAILS**

DATE: JANUARY 2023

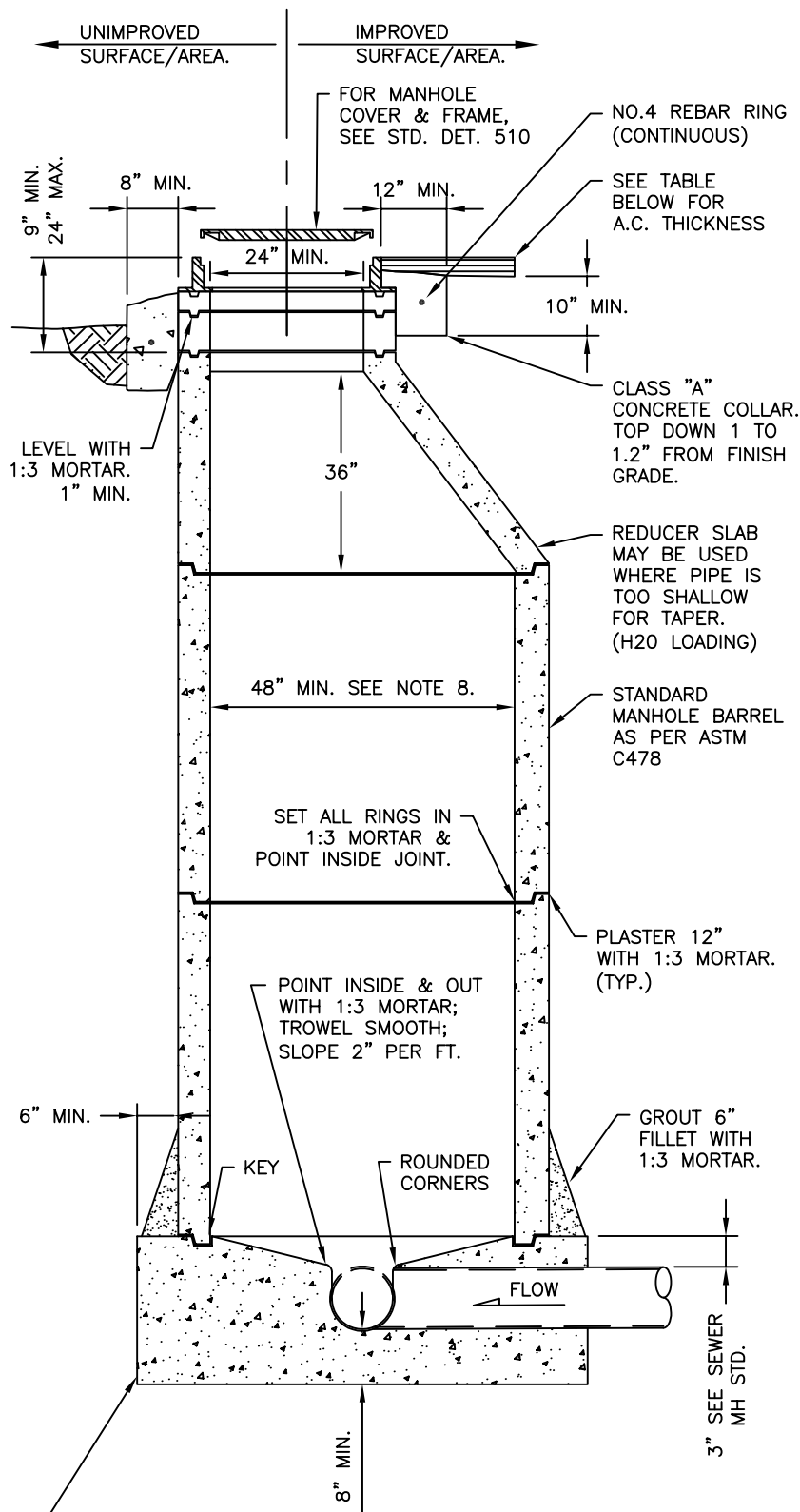
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APPROVED BY:

Jeffrey A. Stutsman, P.E. City Engineer C79843

REV'D BY: ETL

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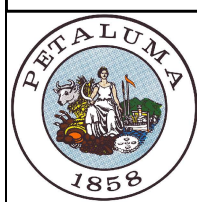


NOTES:

1. WHEN MANHOLES ARE INSTALLED IN UNIMPROVED AREAS, THE TOP OF THE COVER SHALL BE A MIN. OF 1-FOOT ABOVE ADJACENT FINISHED GRADE.
2. MINIMUM OF ONE 3" AND ONE 6" GRADE ADJUSTMENT RINGS. MAXIMUM HEIGHT OF GRADE ADJUSTMENT RINGS IS 24". ALTERNATIVELY, CONTRACTOR MAY CAST GRADE RINGS IN PLACE,
3. SET ALL BARREL SECTIONS AND TAPER SECTIONS IN APPROVED GASKET/SEALER. "RAM-NEK" OR APPROVED EQUAL. TYPICAL JOINT USES ONE (1) "RAM-NEK" SEAL OR TWO (2) SEALS IN HIGH WATER TABLE AREAS.
4. CONE SECTION (TAPER) MAY BE EITHER CONCENTRIC OR ECCENTRIC FOR UNLESS OTHERWISE SPECIFIED BY THE CITY ENGINEER.
5. CONSTRUCT ALL FLOW CHANNELS OF PIPE WHERE POSSIBLE AFTER LOW RING SECTION IS SET, BREAK OUT TOP HALF OF PIPE FLUSH WITH INSIDE FACE OF MANHOLE WALL AND CONSTRUCT SHELF AND U-SHAPED CHANNEL. MAKE ELEVATION CHANGES GRADUALLY AND DIRECTIONAL CHANGES WITH SMOOTHED CURVES.
6. POURED-IN-PLACE BASE SHALL BE POURED FULL THICKNESS TO UNDISTURBED SIDES OF EXCAVATION OR SHALL BE FORMED. PRECAST BASES MAY BE USED ONLY WITH DIRECT APPROVAL OF THE CITY ENGINEER, AND SHALL BE PLACED ON 12" SUB-BASE OF 3/4" DRAIN ROCK INSTALLED AGAINST UNDISTURBED EARTH.
7. THE GRADE RING, CONCENTRIC CONE, VERTICAL WALL SECTION, AND BASE SHALL HAVE MINIMUM WALL THICKNESS OF 5" AND SHALL BE PRECAST CONCRETE CONFORMING TO ASTM SPECIFICATION C478. THE BASE SHALL BE CAST IN PLACE UNLESS OTHERWISE APPROVED BY CITY ENGINEER.
8. 48" I.D. MANHOLE TO BE USED FOR MAINS LESS THAN 18" ON CENTER AND LESS THAN 8- FEET DEEP FROM FINISHED GRADE. LARGER I.D. REQUIRED FOR GREATER DEPTH.
9. MANHOLE REDUCER SLAB MAY BE USED WHERE PIPE IS TOO SHALLOW FOR TAPER SECTION.
10. MANHOLE TAPER SHALL BE IN DIRECTION OF FLOW.

6'-0" MINIMUM DIAMETER CLASS "A" PCC BASE SHALL BE POURED FULL THICKNESS TO UNDISTURBED SIDES OF EXCAVATION OR SHALL BE FORMED.

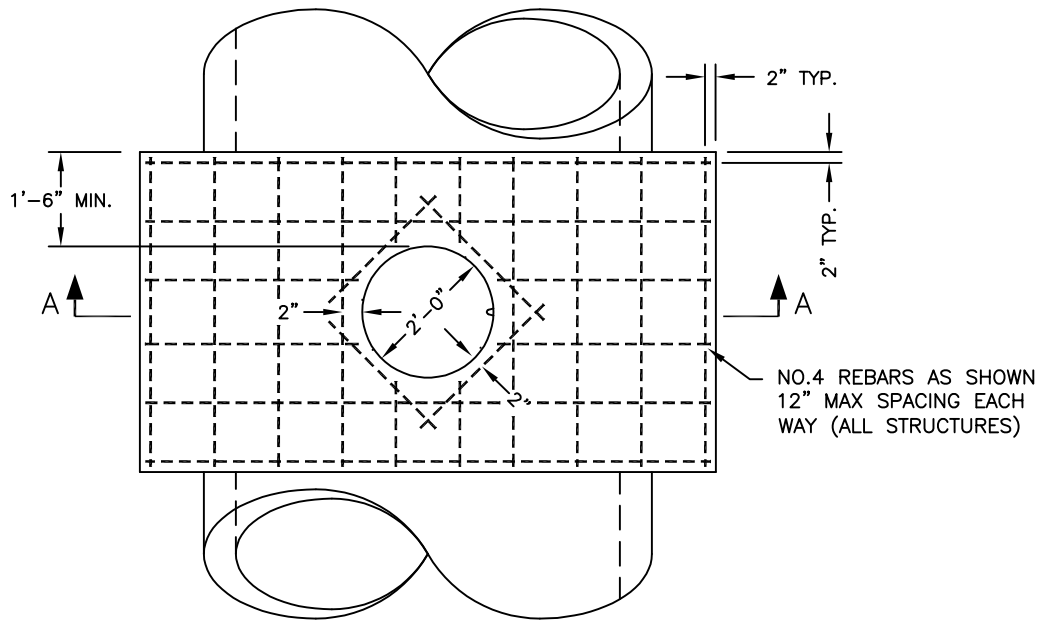
A.C. THICKNESS TABLE		LIFTS
ARTERIAL	6" MIN.	3
COLLECTOR	5" MIN.	2
RESIDENTIAL	4" MIN.	2



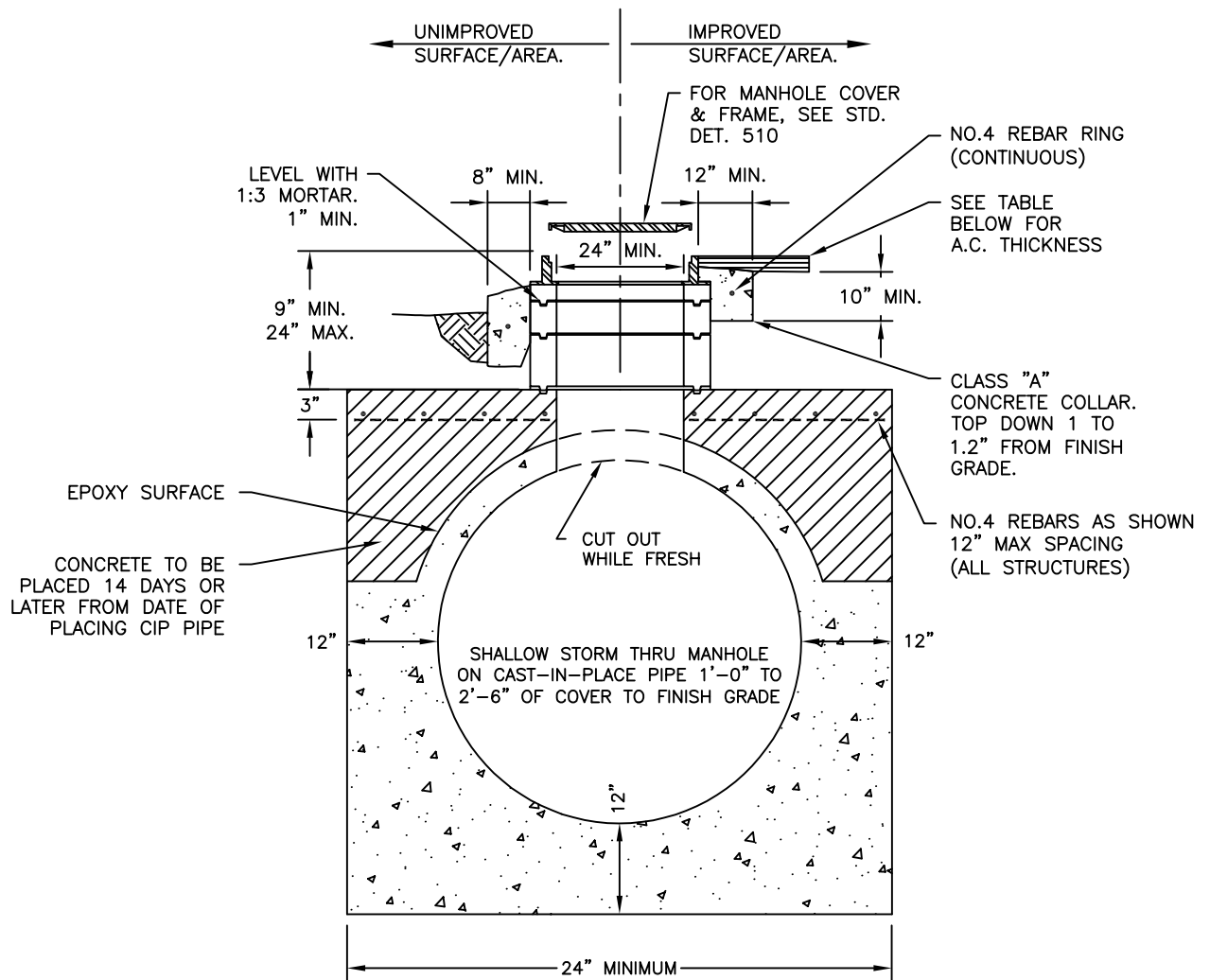
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**STANDARD PRECAST
 CONCRETE MANHOLE
 STORM DRAIN**

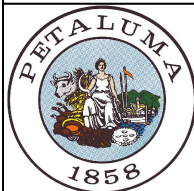
DATE: JANUARY 2023 SCALE: N.T.S.
 APPROVED BY:
Jeff A. Stutsman
 Jeffrey A. Stutsman, P.E. City Engineer C79843
 DRAWN BY: ETL NO 401.1



PLAN VIEW



SECTION A-A



CITY OF PETALUMA
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STANDARD
STORM DRAIN MANHOLE
OVER CIP PIPE
1.0' TO 2.5' OF COVER

DATE: JANUARY 2023

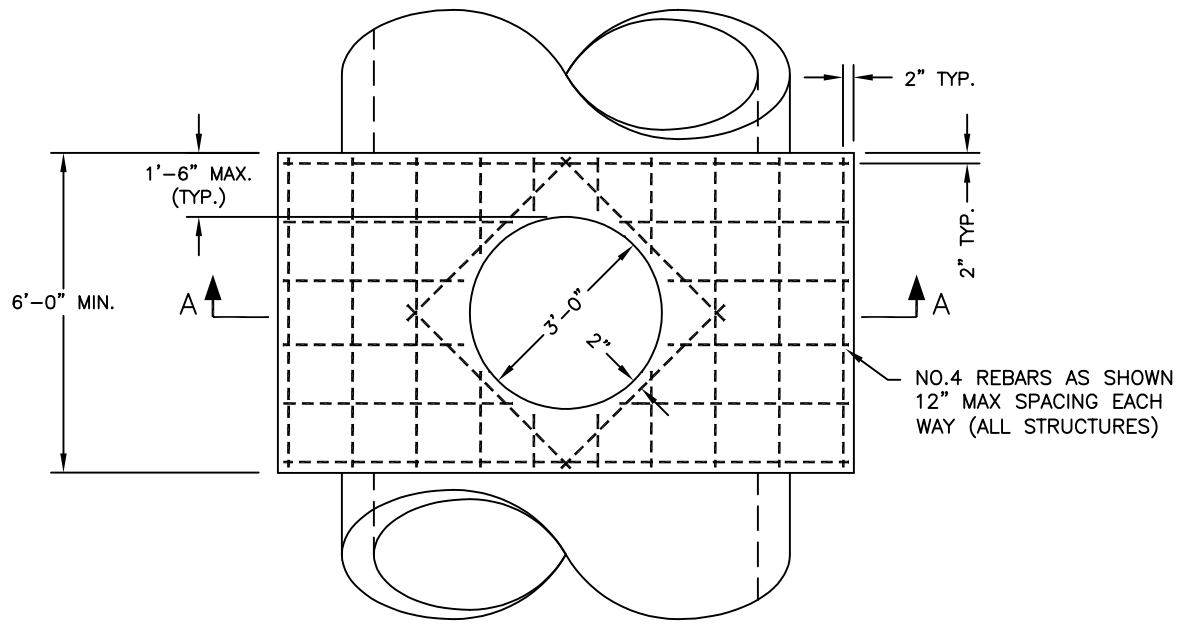
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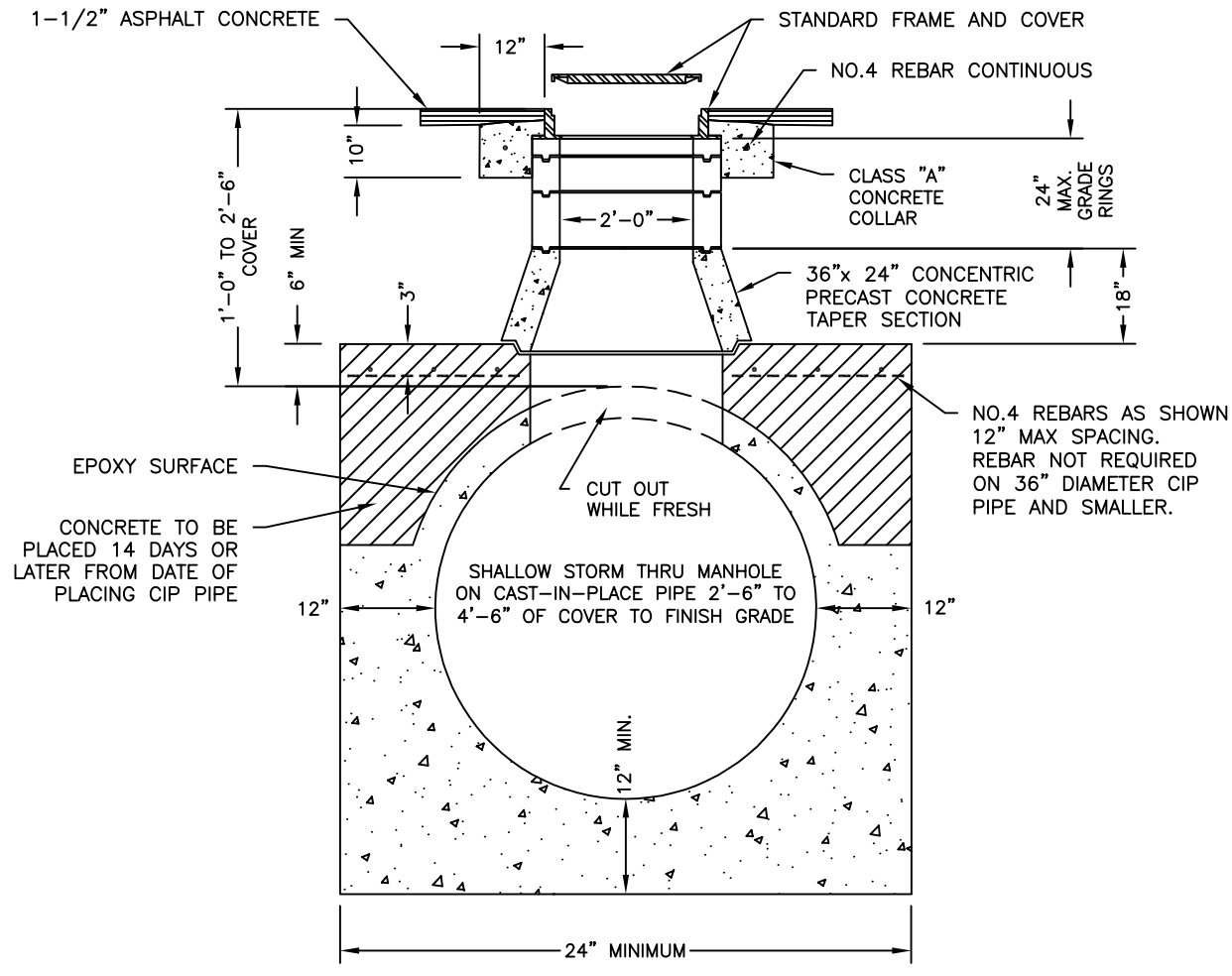
Jeffrey A. Stutsman, P.E. City Engineer C79843

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NO. 402.1



PLAN VIEW



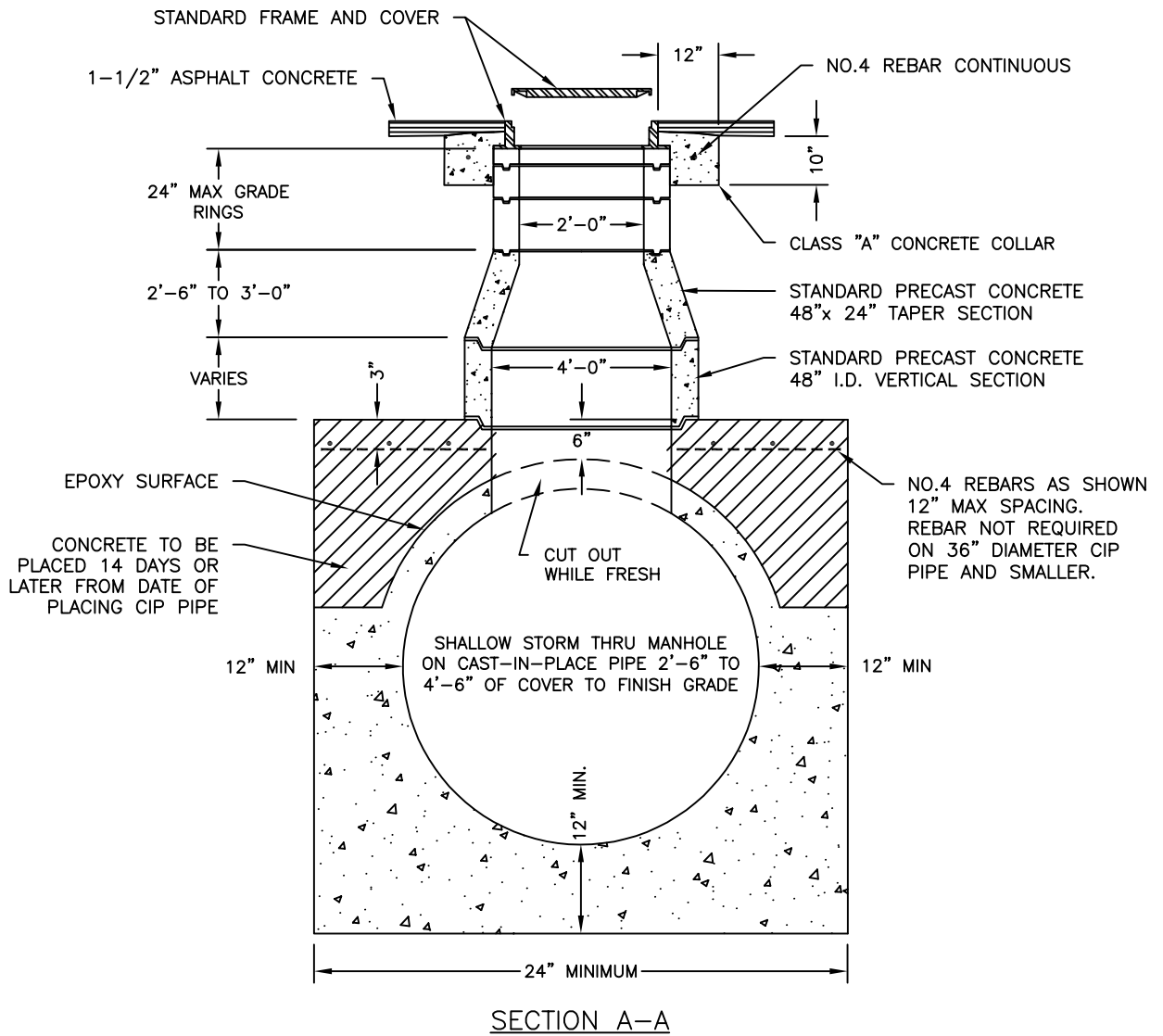
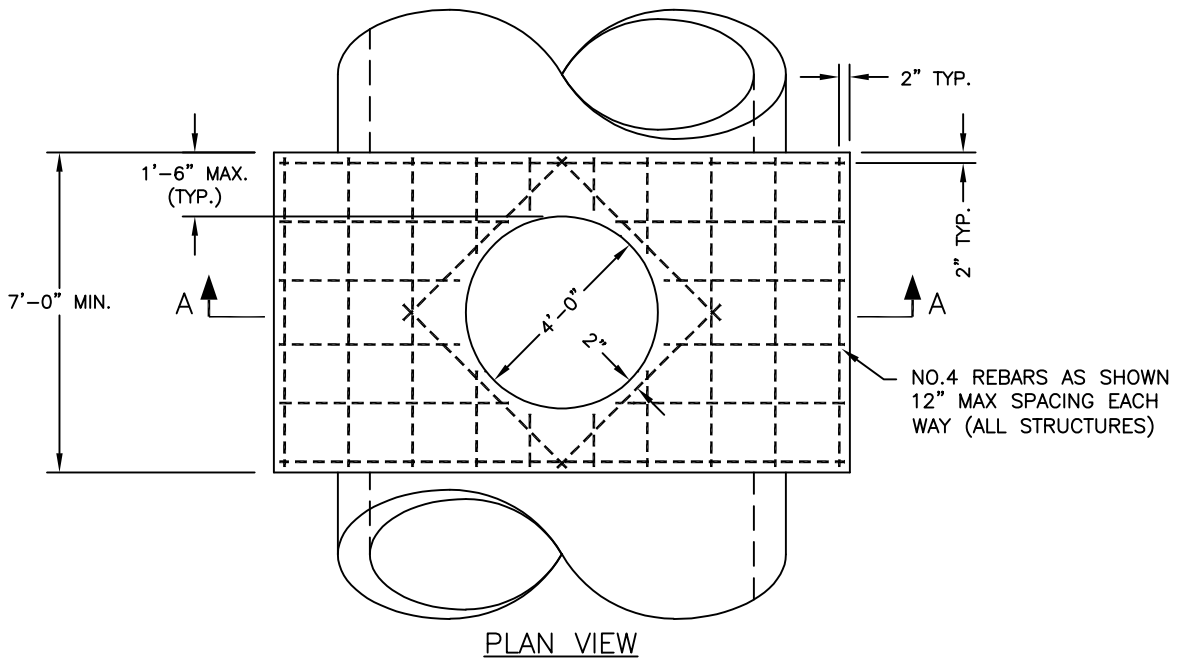
SECTION A-A



CITY OF PETALUMA
PUBLIC WORKS & UTILITIES
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STANDARD
STORM DRAIN MANHOLE
OVER CIP PIPE
2.5' TO 4.5' OF COVER

DATE: JANUARY 2023	SCALE: N.T.S.
APPROVED BY: <i>Jeff Stutsman</i> Jeffrey A. Stutsman, P.E. City Engineer C79843	
DRAWN BY: ETL	NO. 403.1



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STANDARD
STORM DRAIN MANHOLE
OVER CAST-IN-PLACE PIPE
4.5' OR GREATER COVER

DATE: JANUARY 2023

SCALE: N.T.S.

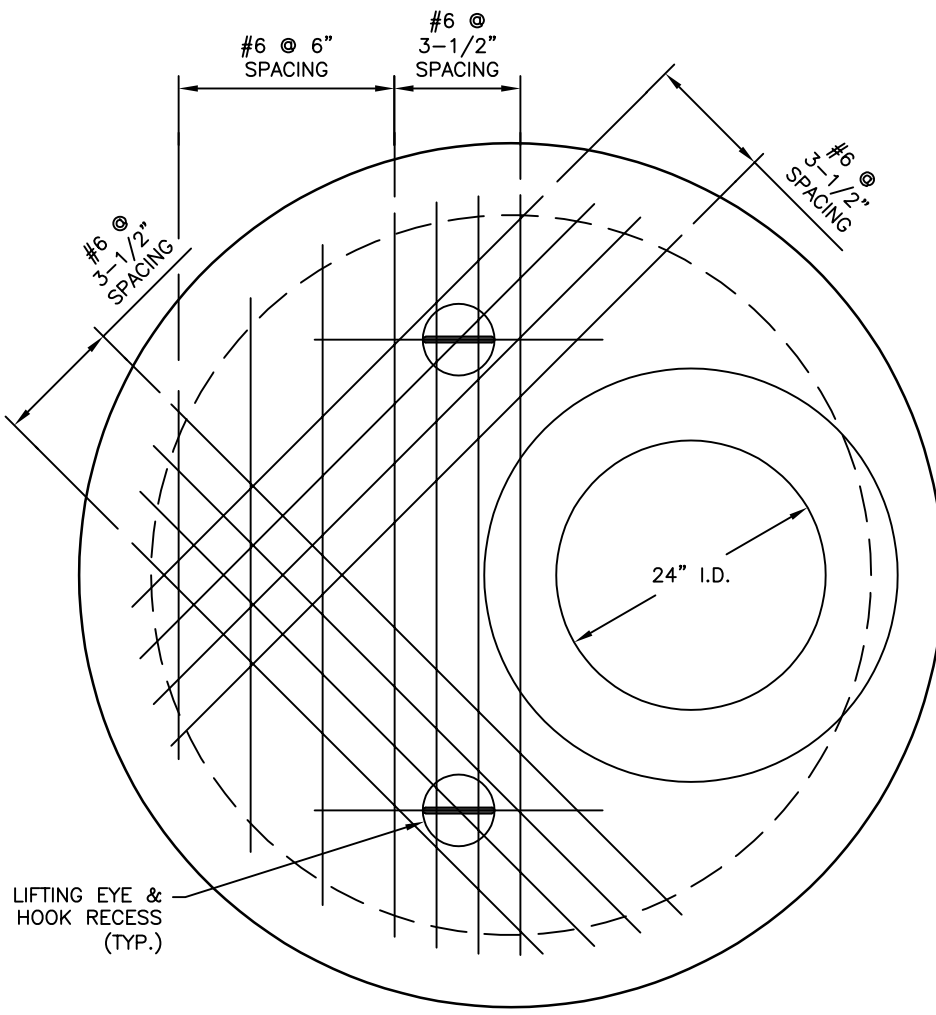
APPROVED BY:

Jeff Stutsman

Jeffrey A. Stutsman, P.E. City Engineer C79843

DRAWN BY: ETL

NO. 404.1



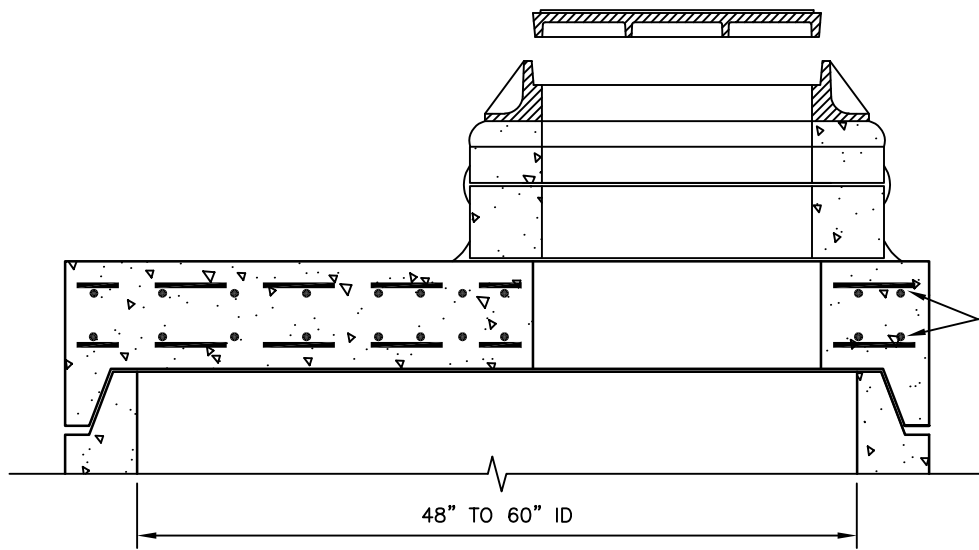
PLAN VIEW

NOTES:

1. WHEN MANHOLES ARE INSTALLED IN UNIMPROVED AREAS, THE TOP OF THE COVER SHALL BE A MINIMUM OF 1-FOOT ABOVE ADJACENT FINISHED GRADE.
2. MINIMUM OF ONE 3" AND ONE 6" GRADE ADJUSTMENT RINGS. MAXIMUM HEIGHT OF GRADE ADJUSTMENT RINGS - 24". ALTERNATIVELY, CONTRACTOR MAY CAST GRADE RINGS IN PLACE.
3. SET ALL BARREL SECTIONS AND TAPER SECTIONS IN APPROVED GASKET/SEALER. "RAM-NEK" OR APPROVED EQUAL. TYPICAL JOINT USES ONE (1) 3/4" x 2 1/2" "RAM-NEK" SEAL OR TWO (2) SEALS IN HIGH WATER TABLE AREAS.
4. CONE SECTION (TAPER) MAY BE EITHER CONCENTRIC OR ECCENTRIC UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.
5. LARGER DIAMETER BARRELS MAY BE REQUIRED UNDER SPECIAL CIRCUMSTANCES.
6. SET ALL RINGS IN 1:3 MORTAR BED. WET BOTH TONGUE AND GROOVE BEFORE APPLYING MORTAR AND SETTING RING. WIPE INSIDE OF JOINTS SMOOTH AND PLASTER OUTSIDE OF JOINT WITH ONE-HALF INCH (1/2") LAYER OF MORTAR.
7. CONSTRUCT ALL FLOW CHANNELS OF PIPE WHERE POSSIBLE AFTER LOW RING SECTION IS SET, BREAK OUT TOP HALF OF PIPE FLUSH WITH INSIDE FACE OF MANHOLE WALL AND CONSTRUCT SHELF AND U-SHAPED CHANNEL. MAKE ELEVATION CHANGES GRADUALLY AND DIRECTIONAL CHANGES WITH SMOOTHED CURVES.

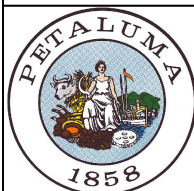
LIFTING EYE & HOOK RECESS (TYP.)

24" I.D.



#4 REBAR, 4 HOOPS AROUND OPENING

SECTION VIEW



CITY OF PETALUMA
PUBLIC WORKS & UTILITIES
 UTILITIES DIVISION

202 N. McDOWELL BLVD. TEL. 707-778-4546
 PETALUMA, CALIFORNIA 94954 FAX. 707-778-4508

**STANDARD CIP
 REDUCER SLAB
 STORM DRAIN**

DATE: JANUARY 2023

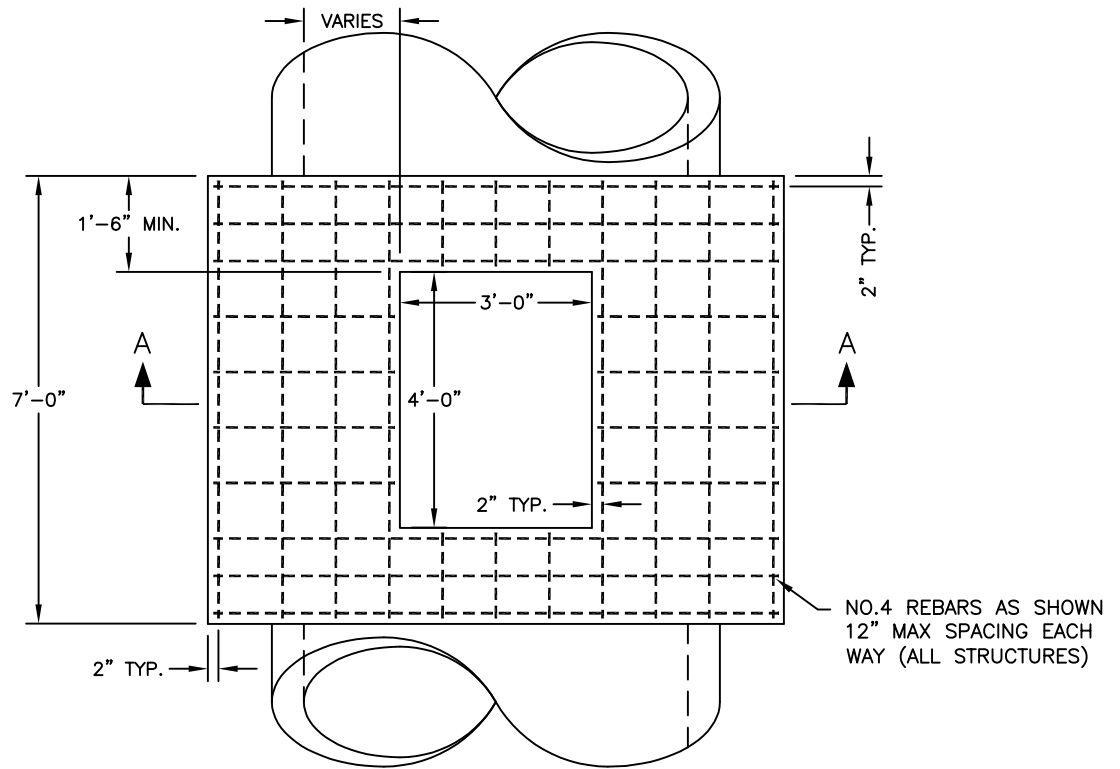
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APPROVED BY:

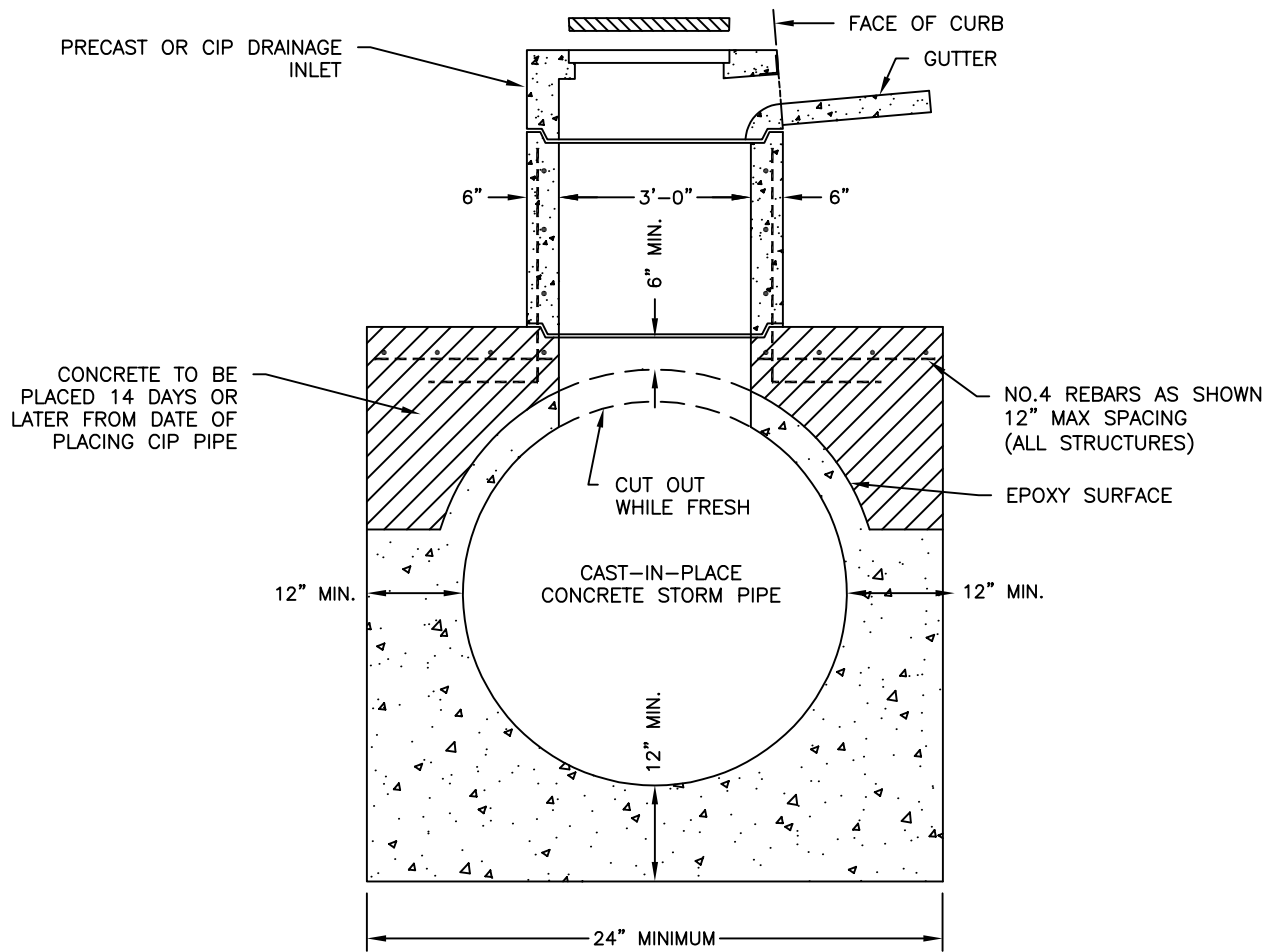
Jeffrey A. Stutsman, P.E. City Engineer C79843

DRAWN BY: ETL

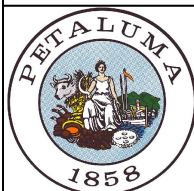
NO. 405.1



PLAN VIEW



SECTION A-A



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 UTILITIES DIVISION

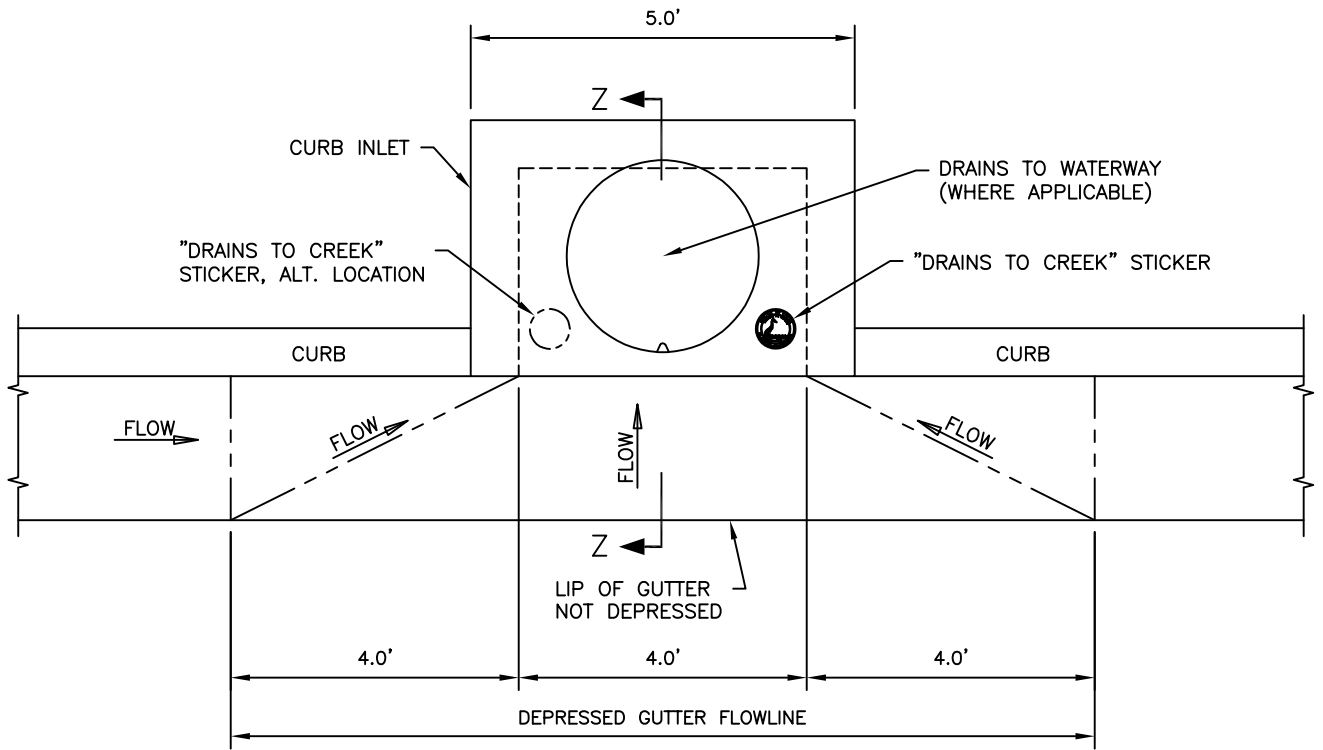
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STANDARD TYPE "OS"
DRAINAGE INLET OVER
CAST-IN-PLACE PIPE
STORM DRAIN

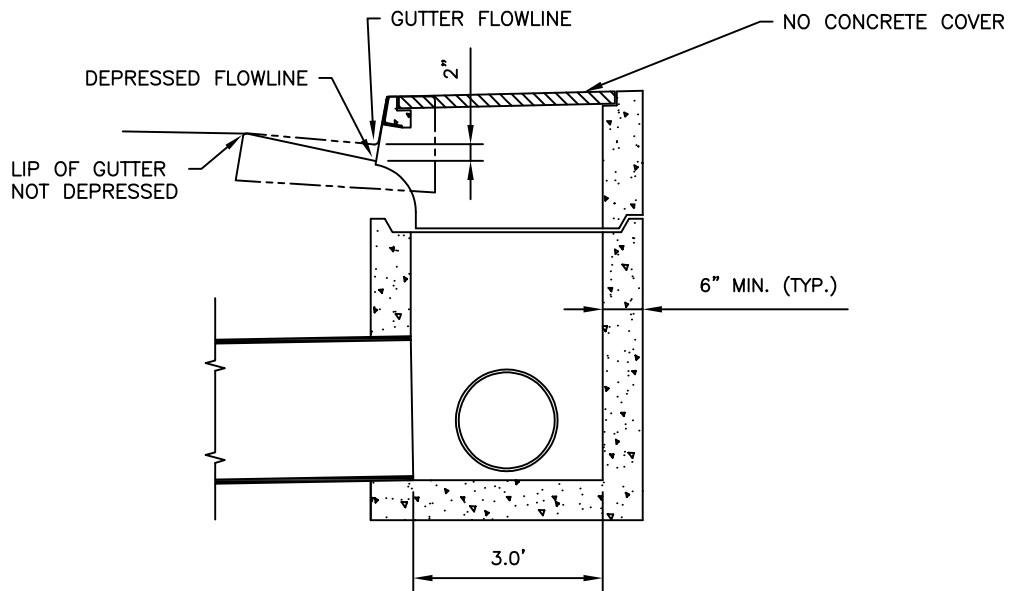
DATE: JANUARY 2023 SCALE: N.T.S.

APPROVED BY:
Jeff Stutsman
 Jeffrey A. Stutsman, P.E. City Engineer C79843

DRAWN BY: ETL NO. 406.1



TYPE "A" CATCH BASIN, PLAN VIEW



Z-Z, TYPE "A" CATCH BASIN, SECTION VIEW



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**STANDARD PRECAST
 CONCRETE CURB INLET
 STORM DRAIN**

DATE: JANUARY 2023

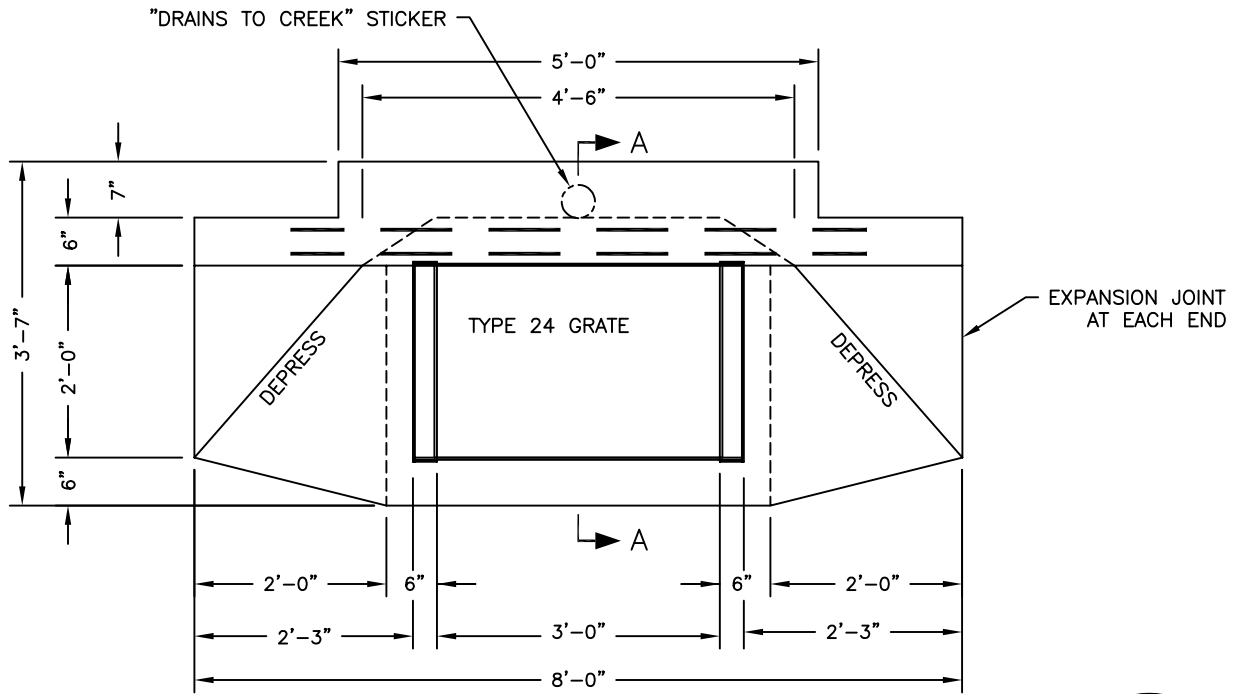
SCALE: N.T.S.

APPROVED BY:

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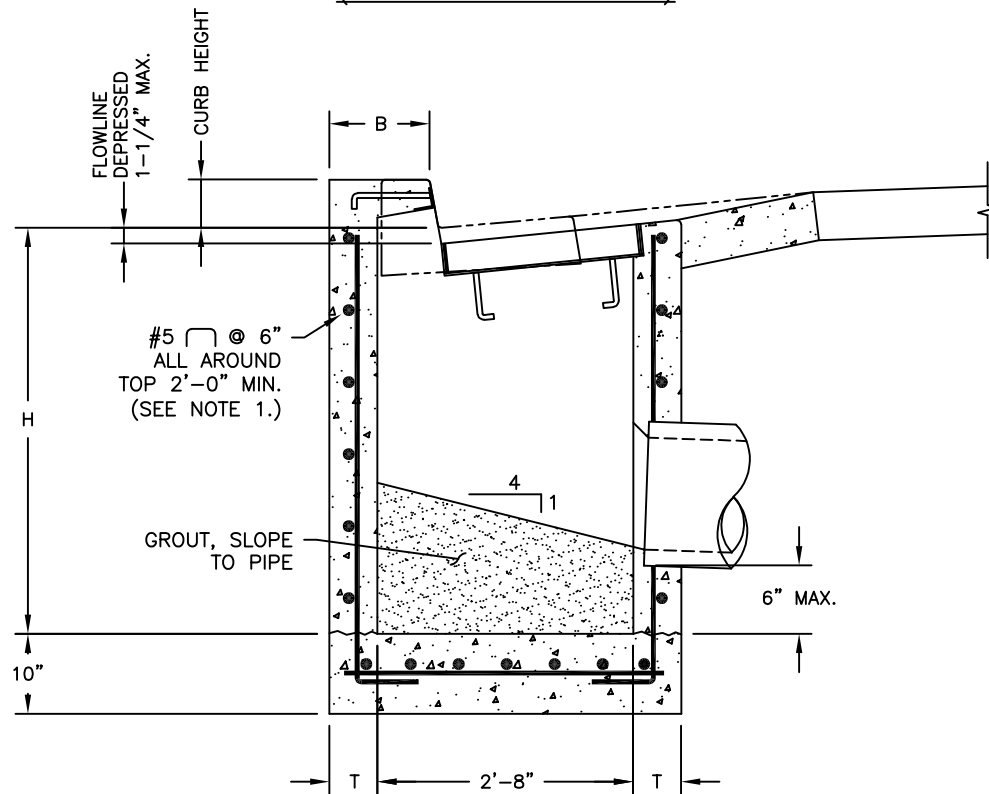
NO. 407.1



TYPE "B" INLET PLAN VIEW
(REF. CALTRANS D78A)



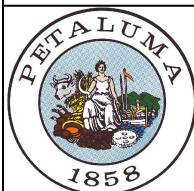
STICKER



A-A TYPE "B" CURB INLET
(REF. CALTRANS D72E)

NOTES:

1. SEE STANDARD 410.1 FOR TABLE OF VARIABLES "B", "H" AND "T", AND FOR SIZES AND SPACING OF REBARS.
2. FOR CIP DETAILS REFER TO CALTRANS STANDARD PLANS 2018, SHEET D72E TYPE GO,
3. FOR PRECAST DETAILS REFER TO CALTRANS STANDARD PLANS 2018, SHEET D73E TYPE GO.



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STANDARD TYPE "B"
CIP DRAINAGE INLET
STORM DRAIN

DATE: JANUARY 2023

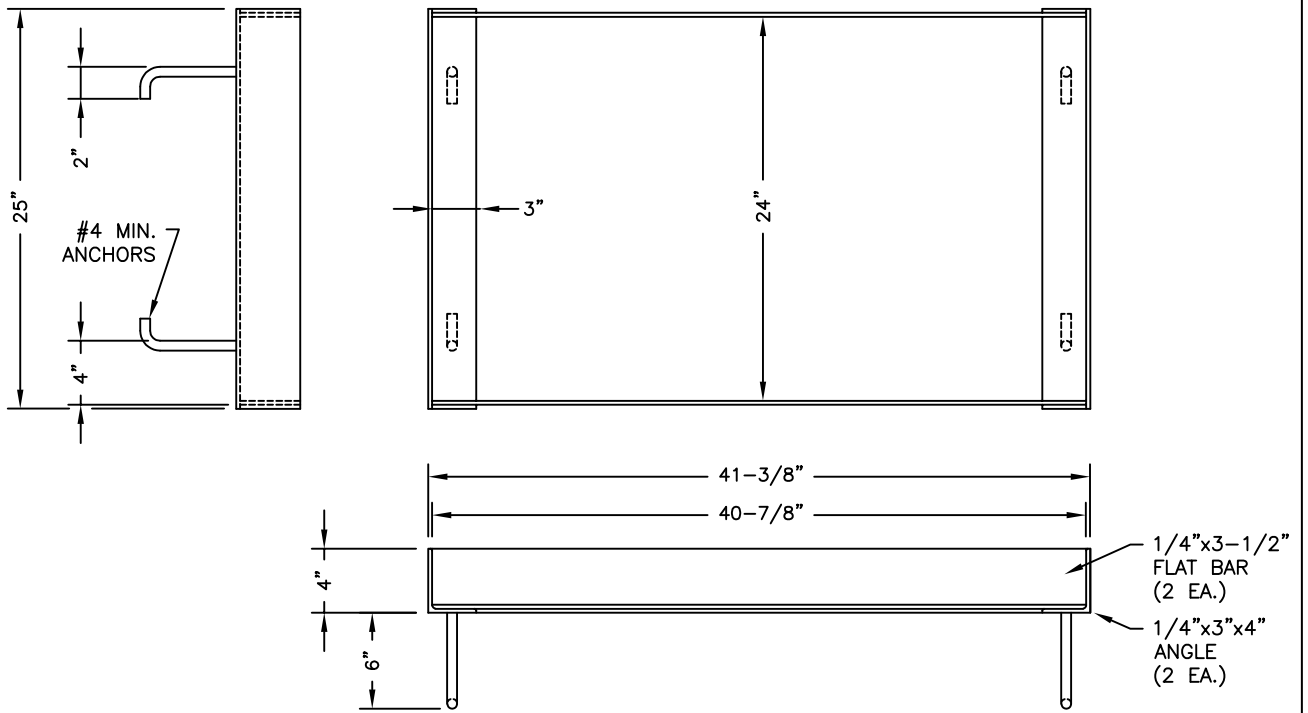
SCALE: N.T.S.

APPROVED BY:

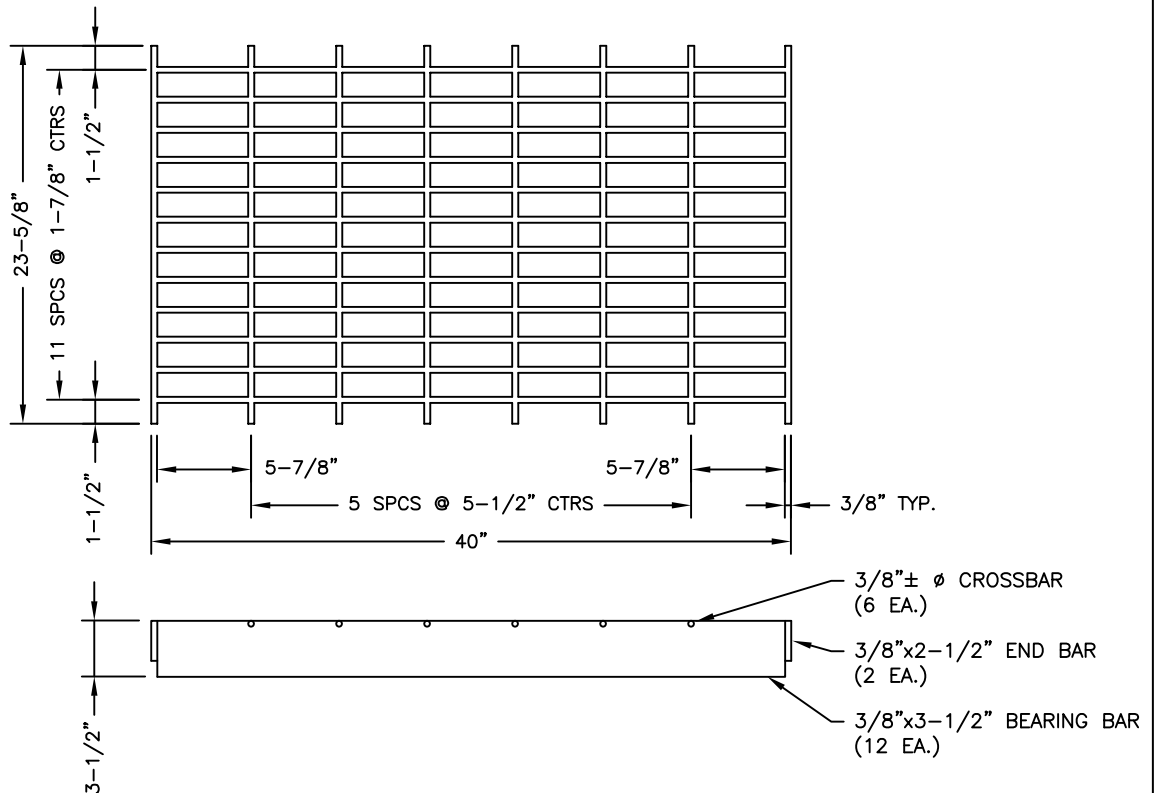
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REV'D BY: ETL

NO. 408.1



TYPE "24" GRATE FRAME
(REF. CALTRANS D77A)



NOTE:
THIS GRATE IS NOT APPROVED FOR BICYCLE TRAFFIC. THE GRATE TYPES SHOWN ON CALTRANS STANDARD PLAN D77B MUST BE USED IF BICYCLE TRAFFIC CAN BE EXPECTED.

TYPE "24-12" WELDED STEEL GRATE
(REF. CALTRANS D77A)



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STANDARD TYPE "24"
DRAINAGE INLET
GRATE DETAIL

DATE: JANUARY 2023

SCALE: N.T.S.

APPROVED BY:

Jeffrey A. Stutsman, P.E. City Engineer C79843

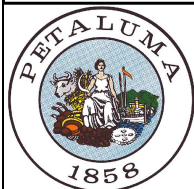
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NO. 409.1

DRAINAGE INLET NOTES

1. ALL CONCRETE SHALL BE CLASS "A" (6-SACK MIX) UNLESS OTHERWISE NOTED.
2. BASE SHALL BE POURED IN PLACE AGAINST UNDISTURBED EARTH. SIDES MAY BE FORMED OR POURED IN PLACE AGAINST UNDISTURBED EARTH.
3. WHERE CONDUITS ARE ENCOUNTERED LARGER IN DIAMETER THAN THE WALL THICKNESS THROUGH WHICH THEY PASS, THE THICKNESS OF THE WALLS ABUTTING THE PIPE SHALL BE INCREASED TO EQUAL THE OUTSIDE DIAMETER OF THE PIPE.
4. EXPANSION JOINTS SHALL BE PLACED THROUGH CURB AND SIDEWALK AT BOTH SIDES OF DRAINAGE INLETS AND SHALL BE LIMIT OF PAYMENT FOR CURB AND GUTTER. UNIT PRICES FOR DRAINAGE STRUCTURES SHALL INCLUDE CURB, GUTTER AND SIDEWALK POURED WITH DRAINAGE STRUCTURE.
5. NO CONCRETE SHALL BE PLACED PRIOR TO FORM AND STEEL APPROVAL BY THE CITY ENGINEER.
6. SEE STANDARD DRAWING FOR TYPE 24 DRAINAGE INLET GRATE FRAME DETAIL 403.1 (REF. CALTRANS D77A).
7. WALL THICKNESS AND REINFORCING SHALL BE DETERMINED FROM THE TABLE BELOW.
8. PLACE 3/4" WEEP HOLES AS REQUIRED BY THE CITY ENGINEER.
9. EQUIVALENT PRECAST STRUCTURES MAY BE SUBSTITUTED AS APPROVED BY THE CITY ENGINEER.

CIP DRAINAGE INLET VARIABLES (REF. D72E, TABLE A & D72G, TABLE C)		
	SHALLOW OPTION ↓	DEEP OPTION ↓
"H" (HEIGHT OF INLET BODY)	$H \leq 8 \text{ FT}$	$8 \text{ FT} < H \leq 20 \text{ FT}$
"T" (WALL THICKNESS)	6"	11"
"B" (T+ 6-1/2")	12-1/2"	17-1/2"
WALL REBAR (HORIZONTAL)	#4 @ 9"	#4 @ 6"
WALL REBAR (VERTICAL)	#4 @ 6"	#6 @ 4-1/2"
BASE REBAR (EACH WAY)	#6 @ 4"	#6 @ 4"



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**STANDARD
CIP CONCRETE
DRAINAGE INLET NOTES
STORM DRAIN**

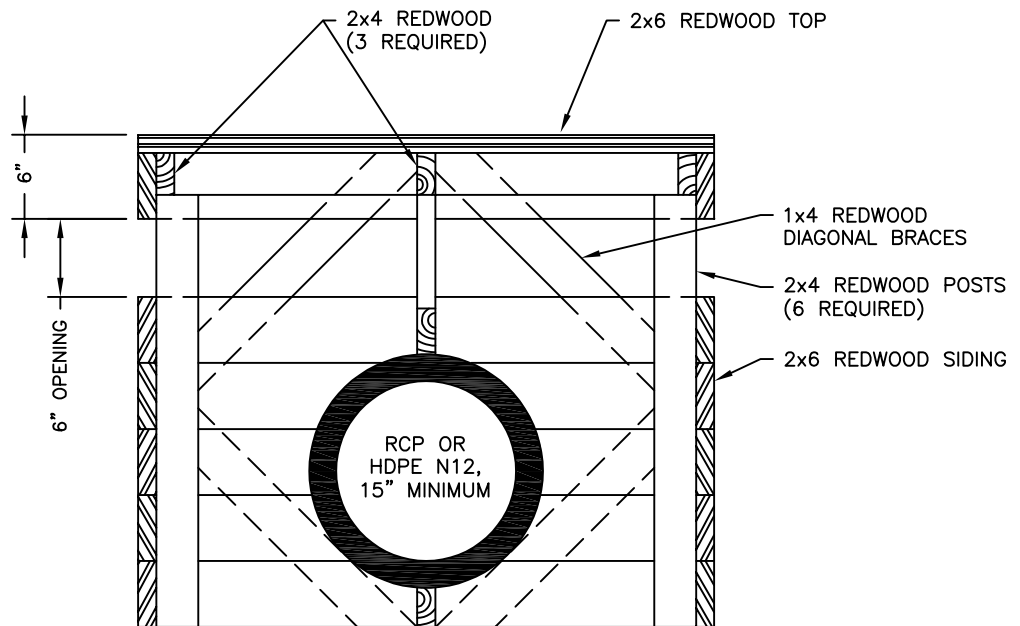
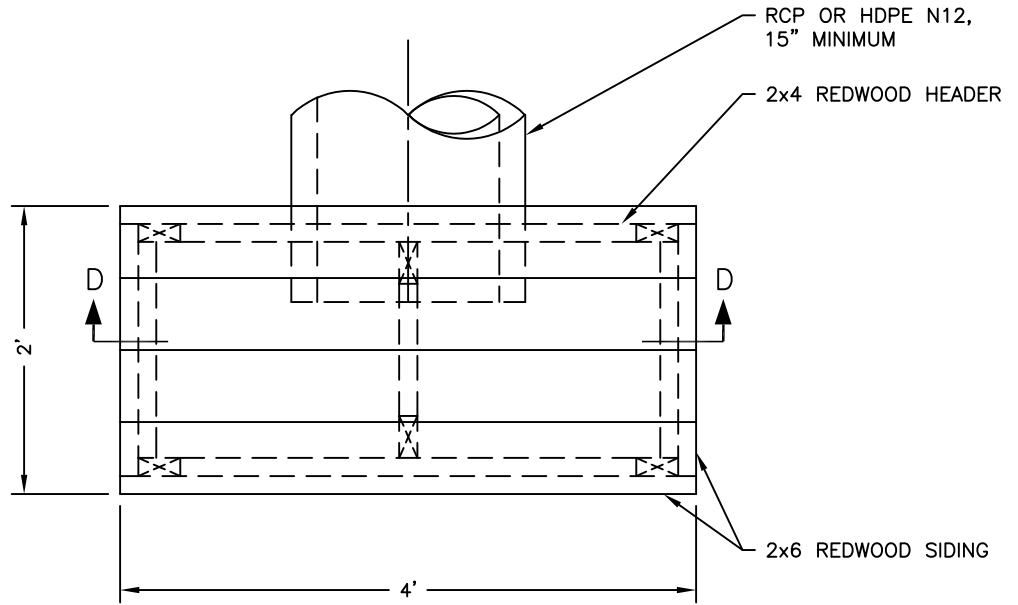
DATE: JANUARY 2023 SCALE: N.T.S.

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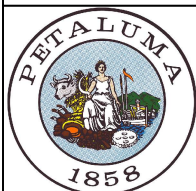
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SECTION D-D

NOTE:

1. REDWOOD MATERIAL SHALL BE CONSTRUCTION GRADE OR BETTER.



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**STANDARD TEMPORARY
 REDWOOD DRAIN BOX
 STORM DRAIN**

DATE: JANUARY 2023

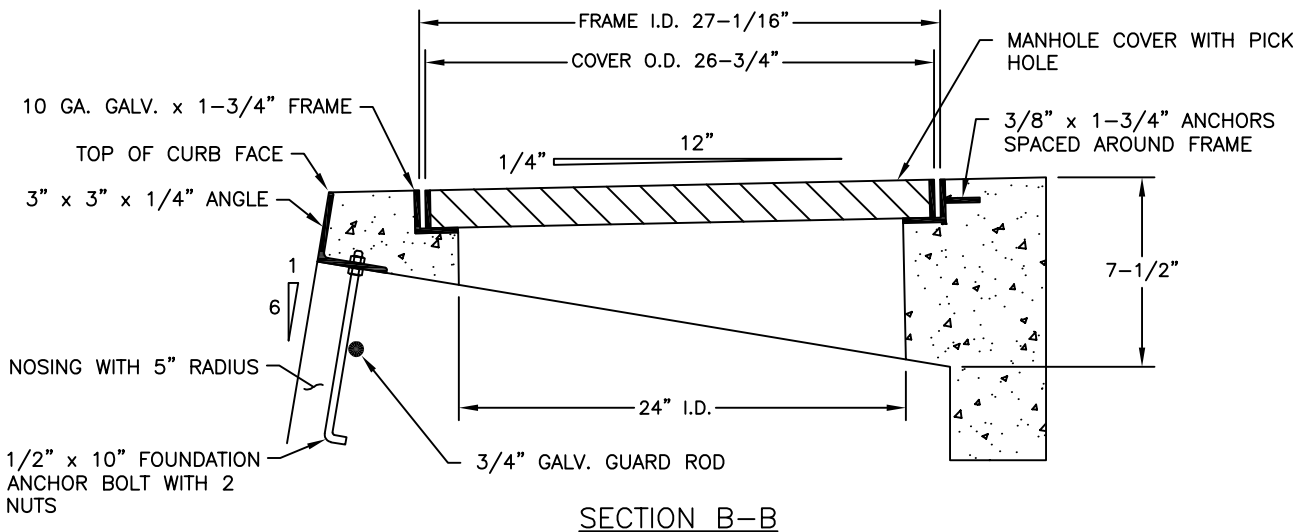
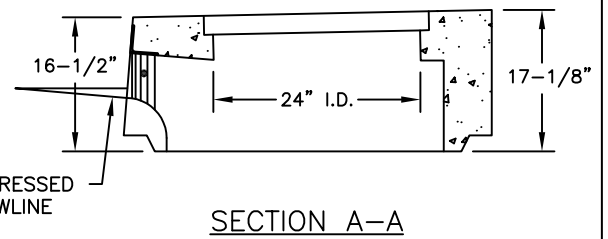
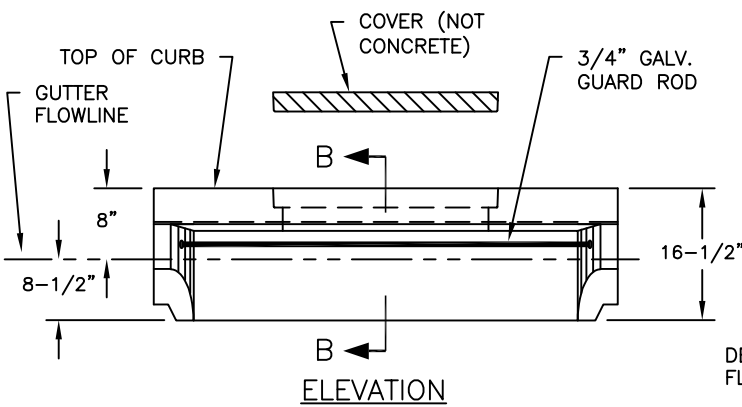
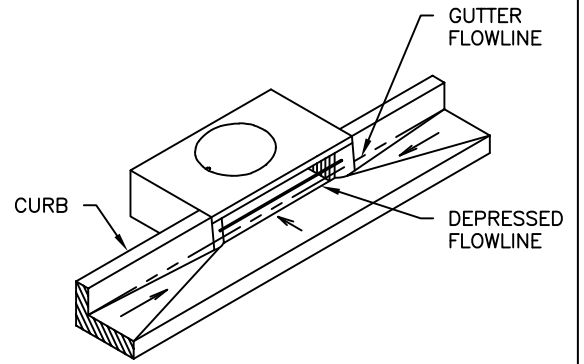
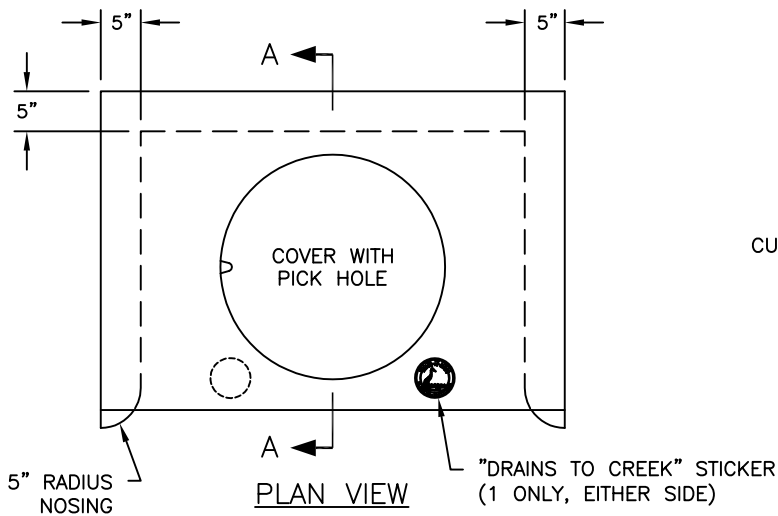
SCALE: N.T.S.

APPROVED BY:

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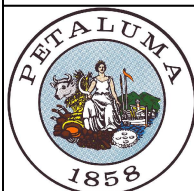
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NO. 412.1



NOTES:

1. THE CONTRACTOR MAY AT HIS OPTION USE A FIBERGLASS LINER AND CAST THE DRAINAGE INLET TOP IN PLACE.



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**STANDARD PRECAST
 DRAINAGE INLET COVER
 STORM DRAIN**

DATE: JANUARY 2023

SCALE: N.T.S.

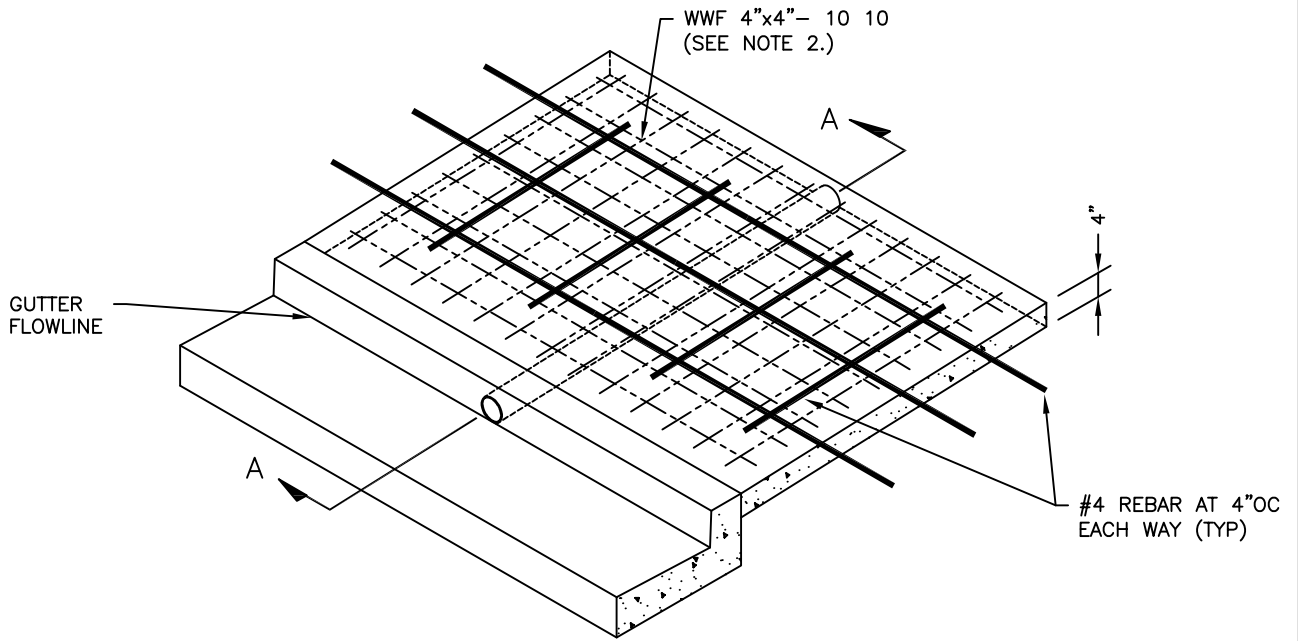
APPROVED BY:

Jeff Stutsman

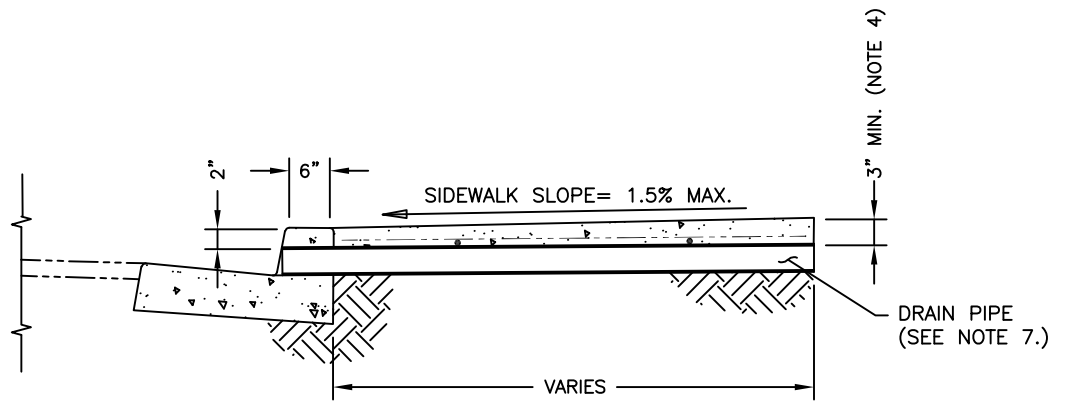
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NO. 413.1



CURB OPENING DETAIL



SECTION A-A CURB OPENING

NOTES:

1. REBAR IS PLACED UNDER WWF MESH TO REINFORCE CONCRETE WHICH COVERS THE DRAIN PIPE.
2. WIRE MESH SHALL BE 4'-0" WIDE (MINIMUM). LENGTH SHALL EQUAL SIDEWALK WIDTH MINUS 4". EXTEND 24" MIN. EACH SIDE OF PIPE.
3. MIN 2" CONCRETE ABOVE TOP OF WWF AND REBAR.
4. SCORE CONCRETE OVER CENTERLINE OF PIPE.
5. ON-SITE DRAINAGE AND LOCATION OF CURB OUTLETS SHALL BE BY OWNER TO THE SATISFACTION OF THE CITY ENGINEER.
6. DRAIN PIPE SHALL BE INSTALLED SO THAT TOP OF PIPE IS 3" MINIMUM BELOW FINISH GRADE AT BACK OF SIDEWALK.
7. SIDEWALK DRAIN TO BE 3" SCHEDULE 40 HEAVY WALL RIGID POLYVINYL CHLORIDE PIPE OR APPROVED EQUAL.



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STANDARD
SIDEWALK UNDERDRAIN
STORM DRAIN

DATE: JANUARY 2023

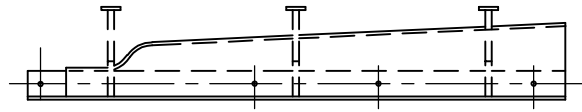
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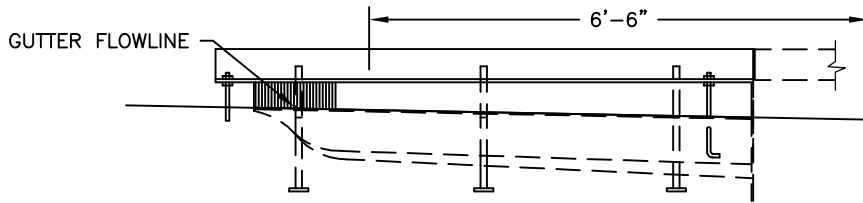
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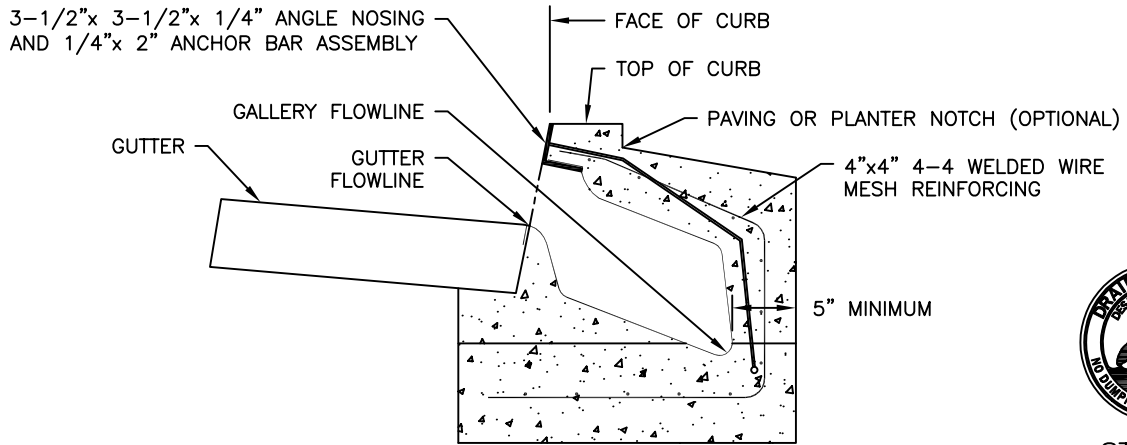
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GALLERY PLAN VIEW



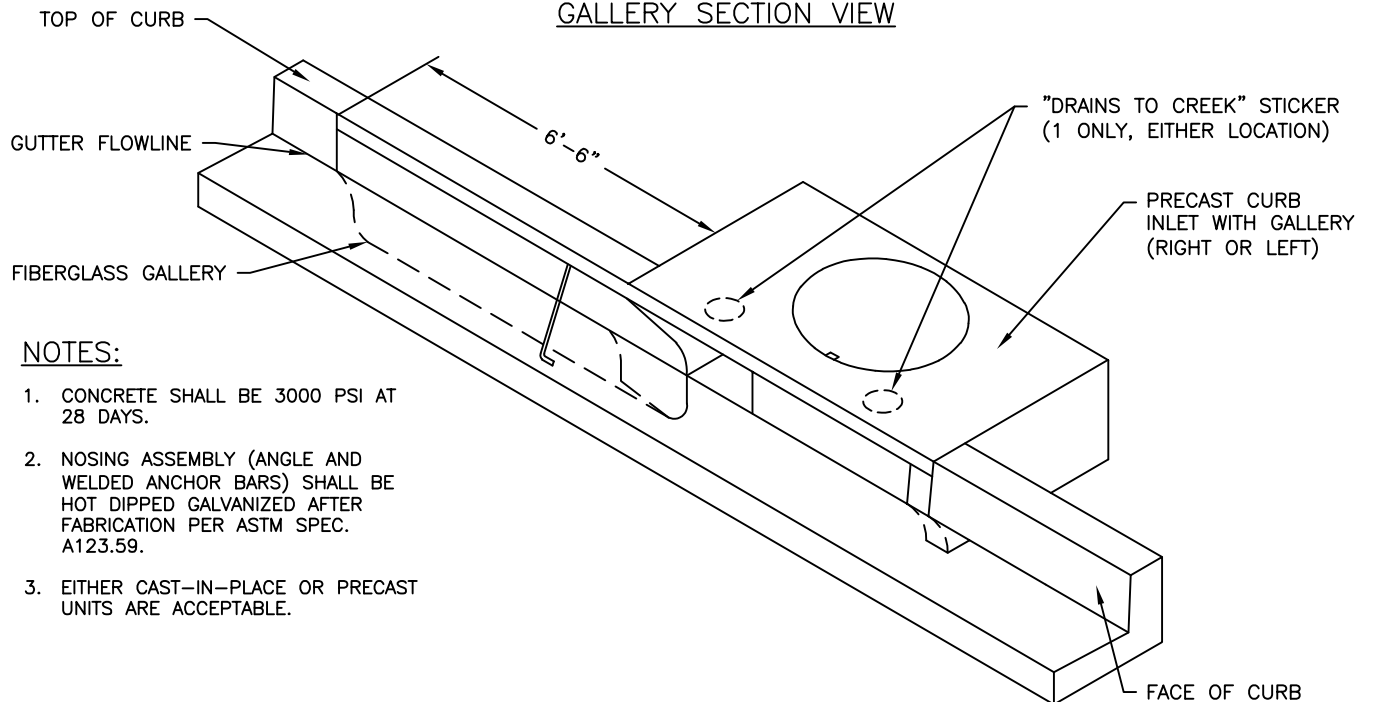
GALLERY FRONT VIEW



GALLERY SECTION VIEW

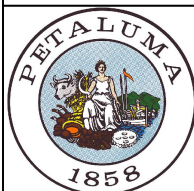


STICKER



NOTES:

1. CONCRETE SHALL BE 3000 PSI AT 28 DAYS.
2. NOSING ASSEMBLY (ANGLE AND WELDED ANCHOR BARS) SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION PER ASTM SPEC. A123.59.
3. EITHER CAST-IN-PLACE OR PRECAST UNITS ARE ACCEPTABLE.



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STANDARD DRAINAGE
INLET GALLERY
STORM DRAIN

DATE: JANUARY 2023

SCALE: N.T.S.

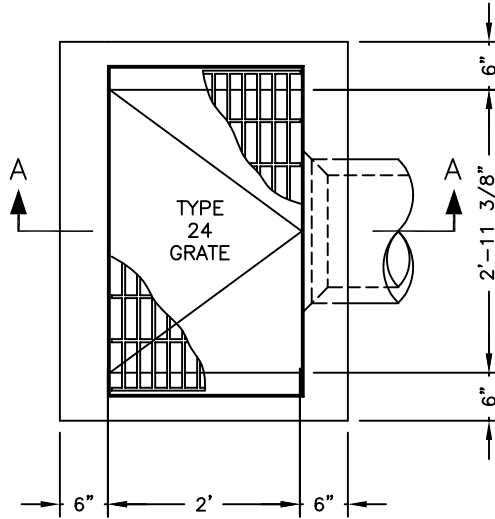
APPROVED BY:

Jeff Stutsman

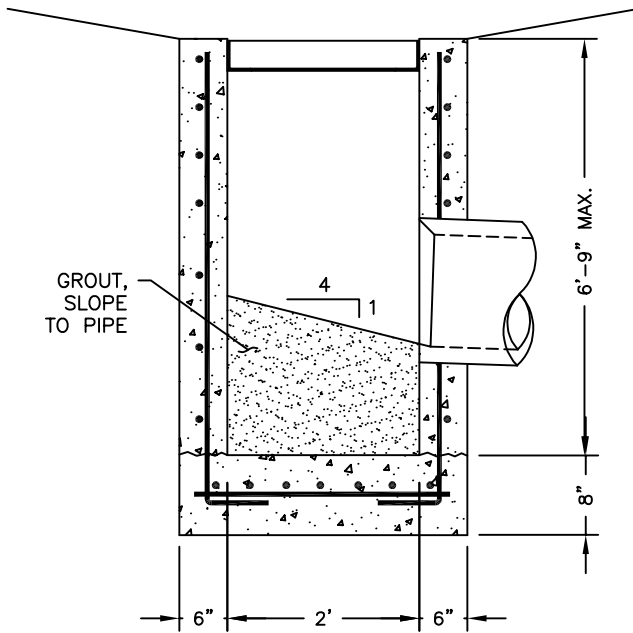
Jeffrey A. Stutsman, P.E. City Engineer C79843

DRAWN BY: ETL

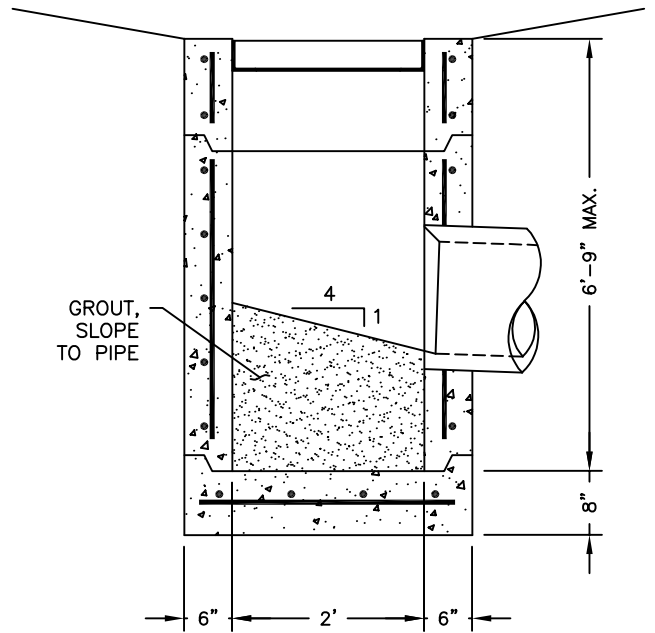
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DRAINAGE INLET PLAN VIEW
(REF CALTRANS TYPE G1)



A-A CIP DRAINAGE INLET SECTION



A-A PRECAST DRAINAGE INLET SECTION

NOTES:

1. REFER TO CALTRANS D72B AND D73B FOR TYPE G1 DETAILS.



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STANDARD TYPE "G1"
DRAINAGE INLET
STORM DRAIN

DATE: JANUARY 2023

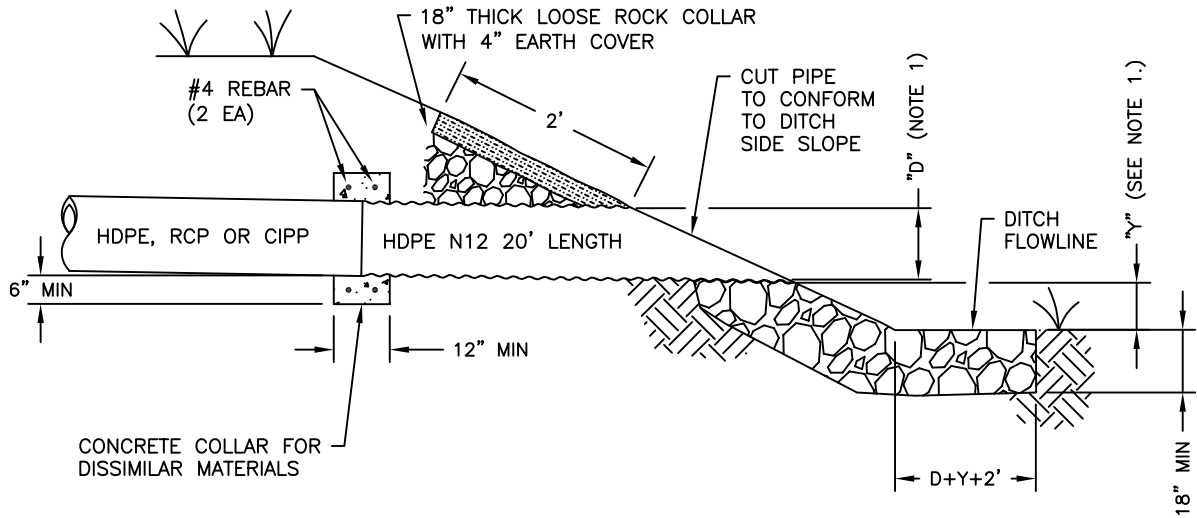
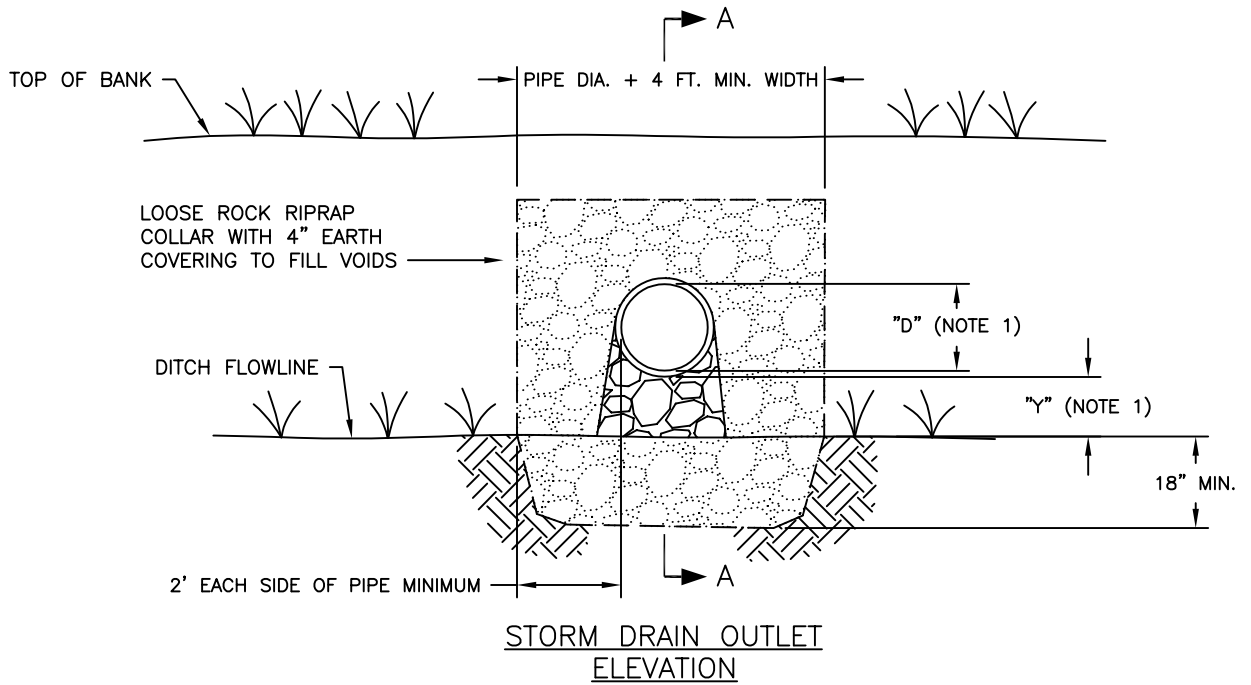
SCALE: N.T.S.

APPROVED BY:

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DRAWN BY: ETL

NO. 416.1



SECTION A-A

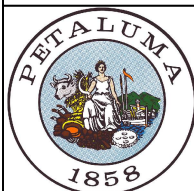
NOTES:

1. WHEN "D" (NOMINAL DIAMETER OF PIPE) IS LESS THAN 24", "Y"=2'. WHEN "D" IS GREATER THAN OR EQUAL TO 24", "Y"=1'.
2. RCP SHALL CONFORM WITH SECTION 3102.4 OF THE STANDARD SPECIFICATIONS.
3. HDPE PIPE SHALL CONFORM WITH SECTION 3103.44 OF THE STANDARD SPECIFICATIONS FOR TYPE S PIPE.

ROCK SLOPE PROTECTION

MATERIALS:

ROCKS SHALL BE ANGULAR AND WELL GRADED FROM AN AVERAGE DIAMETER OF FOUR (4) INCHES TO AN AVERAGE DIAMETER OF FIFTEEN (15) INCHES WITH APPROXIMATELY 50% BY WEIGHT SMALLER THAN NINE (INCHES) IN AVERAGE DIAMETER. NOT MORE THAN 10% OF THE ROCK RIPRAP BY WEIGHT SHALL BE LESS THAN FOUR (4) INCHES AVERAGE DIAMETER. NOT MORE THAN 10% OF THE ROCK RIPRAP BY WEIGHT SHALL BE GREATER THAN FIFTEEN (15) INCHES IN AVERAGE DIAMETER AND NONE SHALL EXCEED AN AVERAGE DIAMETER OF TWENTY (20) INCHES.




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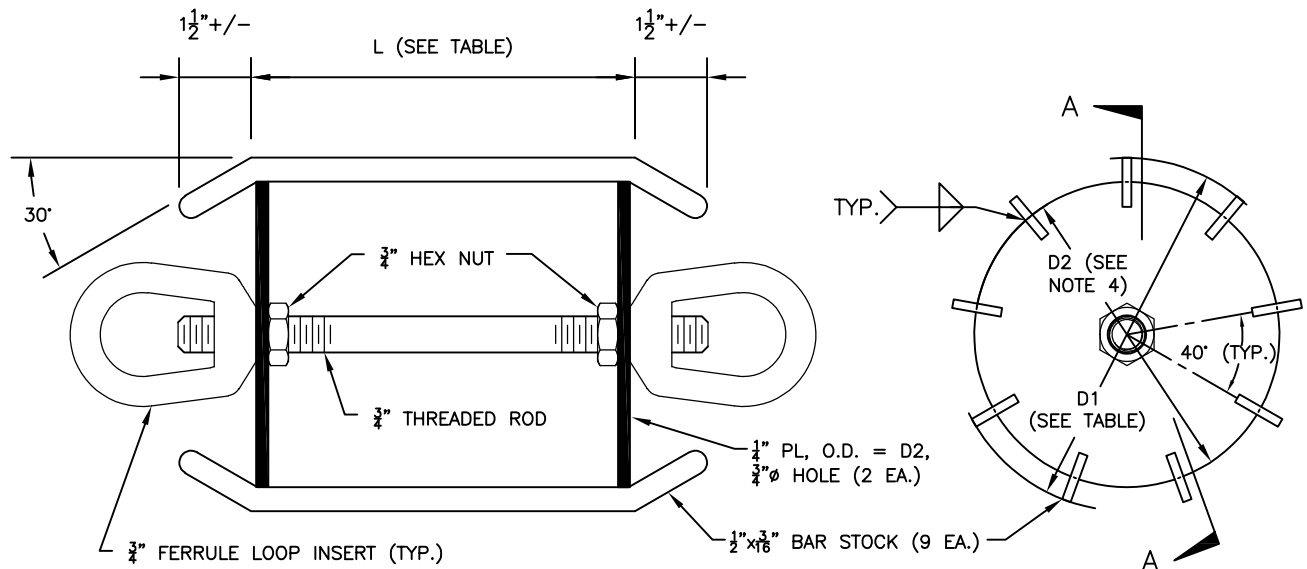
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STANDARD LOOSE ROCK
RIPRAP DRAIN OUTLET
STORM DRAIN

DATE: JANUARY 2023 SCALE: N.T.S.

APPROVED BY:

 Jeffrey A. Stutsman, P.E. City Engineer C79843

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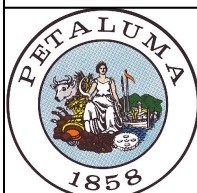
SECTION A-A

		MANDREL DIAMETER (D1) SEE NOTE 4	
		5% DEFLECTION	
NOM. PIPE DIA.	L	SDR 35	SDR 26
6	6"	5.619	5.503
8	8"	7.524	7.366
10	10"	9.405	9.207
12	12"	11.191	10.961
15	15"	13.849	13.559
>15	*	*	*

* REQUEST MANDREL DIMENSIONS FROM CITY.

NOTES:

1. MARK ALL MATERIALS WITH ASTM SPECIFICATION NUMBER, SDR NUMBER, AND DEFLECTION.
2. PLATE DIAMETER SHALL BE 1" LESS THAN THE MANDREL DIAMETER.
3. THE 1/2" BAR STOCK ON EDGE PROVIDES CLEARANCE TO PASS SMALL AMOUNTS OF SOIL WHICH MAY BE IN PIPE.
4. MANDREL DIAMETER HAS BEEN CALCULATED BASED ON SECTION 306-1.2.12 OF THE "GREENBOOK" STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND/OR DIMENSIONS GIVEN IN TABLE 1 OF ASTM STANDARD D3034-21.
5. ALTERNATIVE DESIGNS THAT MATCH THE DEFLECTION DIMENSIONS SHOWN MY BE SUBMITTED FOR REVIEW.



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**DEFLECTION MANDREL
 FOR PVC STORM DRAIN
 PIPE**

DATE: JANUARY 2023 SCALE: N.T.S.

APPROVED BY:

Jeff Stutsman
 Jeff Stutsman, P.E.

DRAWN BY: ETL

NO. 420.1