Supplemental Details

Design Guidance

December 2020

California Department of Transportation
HQ Division of Design

For individuals with sensory disabilities, this document is available in alternate formats upon request. Please call or write to:

Caltrans Division of Design

Office of Hydraulics and Stormwater Design

P.O. Box 942874, Sacramento, CA 94274-0001

(916) 653-8896 Voice or dial 711 to use a relay service.

Table of Contents

TABLE OF CONTENTS

List of Figures

List of Tables

List of Abbreviations

AVSF	Austin Vault Sand Filter
BMP	Best Management Practice
CF	cubic foot
cfs	cubic feet per second
CRZ	Clear Recovery Zone, (AASHTO Clear Zone)
CY	cubic yard
EPA	Environmental Protection Agency
ft	foot/feet
ft/s	foot/feet per second
HQ	Headquarters
HDM	Highway Design Manual
hr	hour
H:V	Horizontal:Vertical
in	inch
in/hr	inches per hour
max	maximum
min	minimum
NPDES	National Pollutant Discharge Elimination System
nSSP	non-Standard Special Provision
OHSD	Office of Hydraulics and Stormwater Design
PS&E	Plans, Specifications and Estimate
PE	Project Engineer
PPDG	Project Planning and Design Guide – Stormwater Quality Handbook
RSP	Rock Slope Protection
RWQCB	Regional Water Quality Control Board
sec	second
SSHM	Small Storm Hydrology Method
SSP	Standard Special Provision
WQV	Water Quality Volume

Section 1

Introduction

This guidance document provides information to Caltrans Designers regarding supporting supplemental details that may be used in conjunction with Caltrans post-construction Treatment Best Management Practices (TBMPs). Supplemental details, non-Standard Special Provisions (nSSPs), and this guidance document are provided to assist the Project Engineer (PE) with the selection, sizing, and the preparation of Plans, Specifications, and Estimates (PS&E). The Headquarters (HQ) Office of Hydraulics and Stormwater Design (OHSD) should be contacted to obtain electronic copies of the figures, plans, and nSSPs referenced in this document.

1.1 Organization

The organization of this guidance document contains detailed information for each supplemental detail. Each section generally provides the following:

- An introduction to the detail
- Basis of design used to develop the detail
- Directions on how to get started using the detail
- Directions on how to select a specific detail or how to choose among several types of similar details
- Instructions for laying out the detail, including identifying the location constraints
- List of design elements that must be considered and other details that must be used in conjunction
- Guidance on how to incorporate the detail into the PS&E
- Special Designs and the suggested methodologies to be used with them

1.2 Using Supplemental Details

Conceptualized figures have been provided as a starting point in the use, location, and application of many of the supplemental details provided herein. Take caution as the figures in this document are only conceptual and site-specific design is required. An example of how the supplemental details in this guidance can be incorporated into the design of TBMPs is provided in Figures 1-1 through 1-3. Refer to the TBMP specific Design Guidance for detailed design criteria.

Figure 1-1 is a conceptualized Detention Basin, showing the use of the following supplemental details: low flow channel, overflow spillway, maintenance drain valve, water quality outlet riser, anti-seep collar, and maintenance access ramp. Figure 1-2 shows a conceptual media filter (Austin Sand Filter – Full Sedimentation

Device, Earthen Type) layout utilizing supplemental details for the maintenance access ramp, overflow spillway, water quality outlet riser, anti-seep collar, and maintenance drain valve. Figure 1-3 shows a conceptual media filter (Austin Sand Filter – Partial Sedimentation Device, Earthen Type) utilizing the supplemental details for the maintenance access ramp, overflow spillway, and maintenance drain valve.

Other supplemental details provided in this document, such as the baffle wall and the geomembrane liner, are provided for use when geometry or limiting soil or site conditions prevents standard design or layout. As used in this document, 'standard' for these supplemental details only means that the design assumption, detailing, and placements as recommended in this document are met, and not that a Caltrans Standard Plan has been established or is referenced. Likewise, special designs mean the detailing presented in this document must be changed due to the new conditions. All supplemental details must be included in the contract plans and approved by the appropriate District functional units and OHSD.

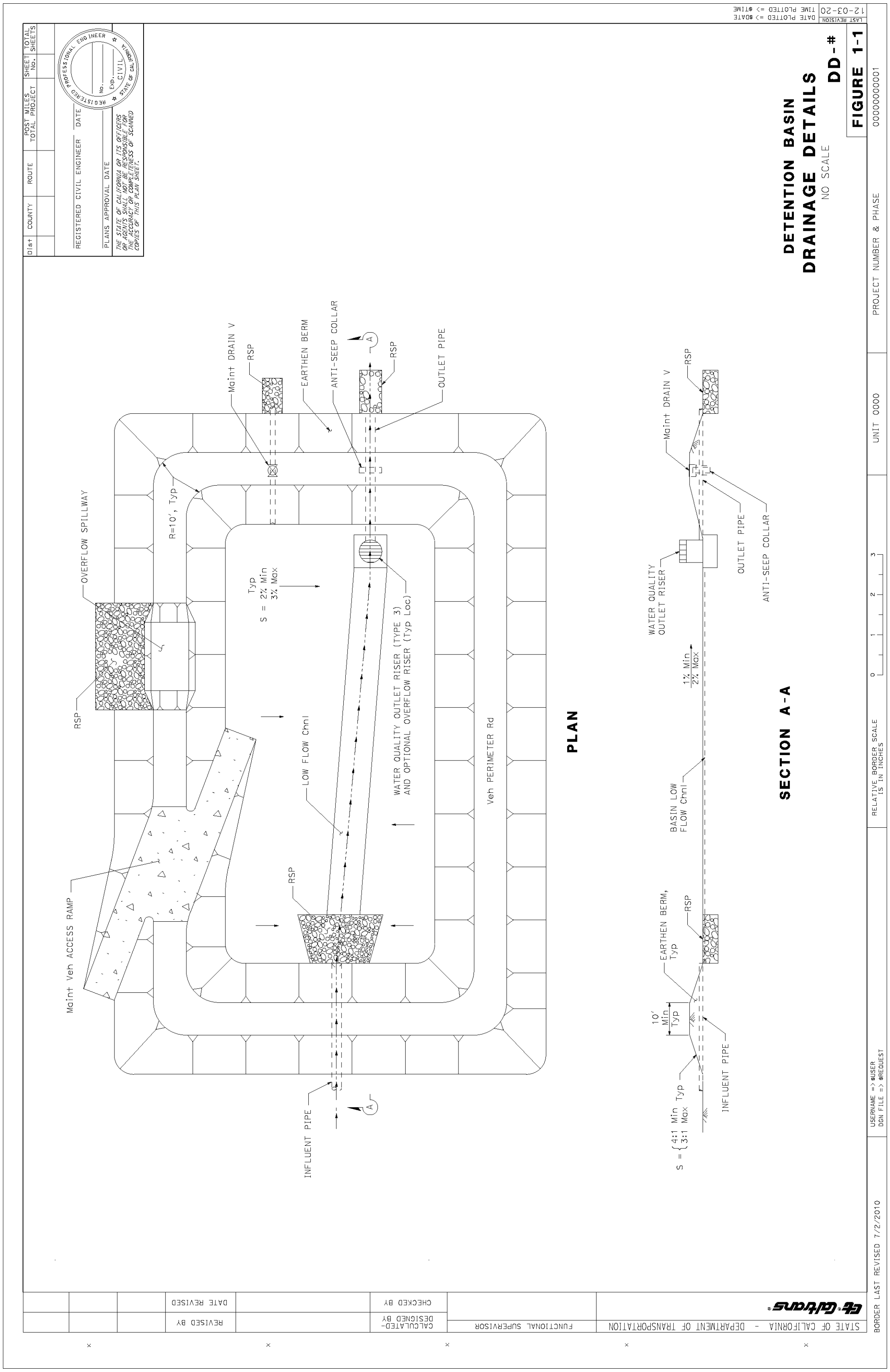


Figure 1-1. Detention Basin

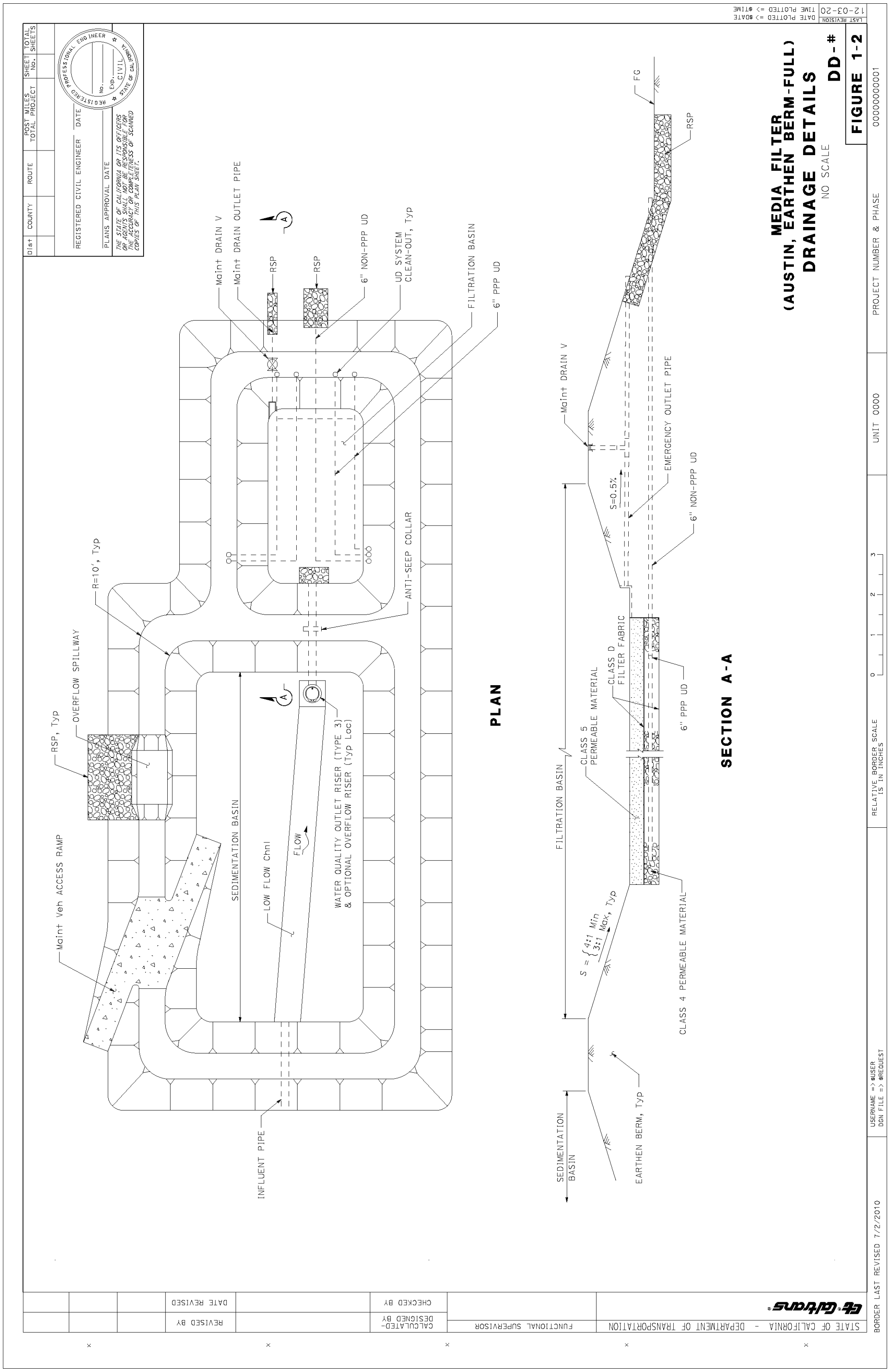


Figure 1-2. Media Filter (Austin, Earthen Berm-Full)

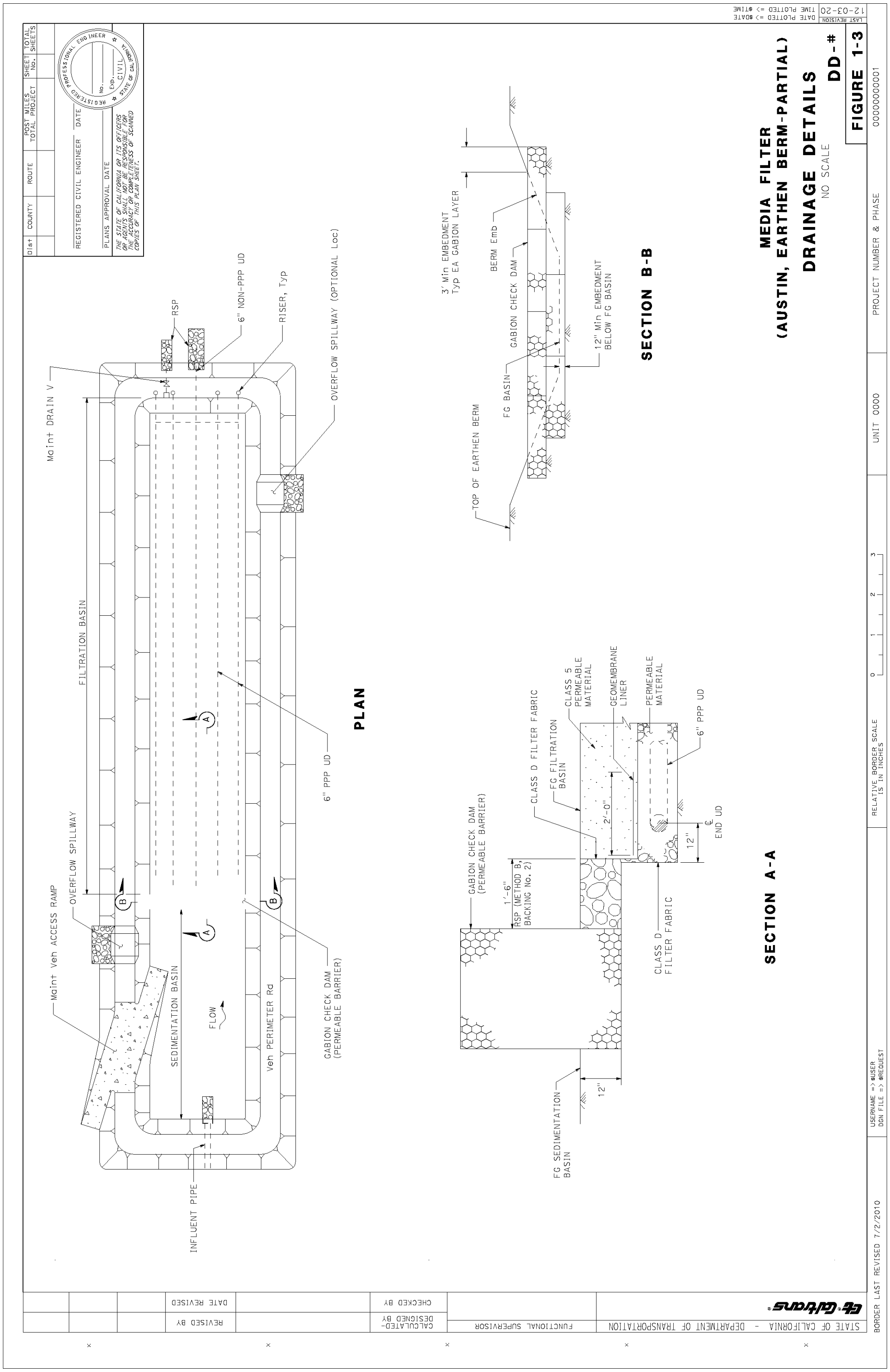


Figure 1-3. Media Filter (Austin, Earthen Berm-Partial)

This page intentionally left blank.

Section 2

Anti-Seep Collar

An anti-seep collar is a watertight device constructed around a pipe or other conduit that is buried in an embankment. Its purpose is to reduce seepage around the pipe and prevent pipe and trench failures. Figure 2-1 shows the standard detail for an anti-seep collar.

2.1 Design Basis

The standard detail for anti-seep collars was developed based on the following design criteria:

Table 2-1. Anti-Seep Collar Standard Detail Design Basis

Parameter	Preferred	Alternate
Shape	Rectangular	None
Material	Concrete	None
Parameter	Minimum	Maximum
Thickness	1 foot	
Width	trench width + 2 ft	
Height	3 x pipe diameter	
Height Above Pipe	1.5 ft min	

2.2 Getting Started

Anti-seep collars are recommended for use in berms holding stormwater, in areas with high groundwater, and when pipe slopes exceed 10%. Collars shall be installed along pipes at the recommended size and spacing.

Anti-seep collars will effectively protect pipes and embankments from failure due to loss of bedding caused by subsurface water flow.

2.3 Type/Size Selection

The selected size of the anti-seep collar is dependent upon the pipe diameter and trench size. The standard collar height is three times the pipe diameter, and the minimum width is 2 ft wider than the width of the trench. The top of the collar should extend a minimum of 1.5 ft above the top of the pipe.

When the collar is constructed around pipes on slopes, the collar faces shall be vertical, with all minimum distances maintained.

2.4 Layout

Anti-seep collars shall be placed under earthen berms, with a recommended maximum spacing of 20 ft on center and with a minimum of two collars per pipe run. A minimum of 6 inches of cover shall be maintained over the top of the collar.

2.5 Design Elements

Anti-seep collar design elements consist of pipe diameter, pipe length, and trench dimensions.

2.6 PS&E Preparation

Anti-seep collars shall be shown on the contract plans, and the quantity of "Minor Concrete (Minor Structure)" should be summarized in a Quantity Summary Table. Engineers should calculate the volume of concrete utilized in each collar; however, reinforcement need not be calculated nor summarized. The pay item to be included in the estimate shall be "Minor Concrete (Minor Structure)", with the quantity units of cubic yards, unless payment is included in the TBMP bid item.

2.7 Special Designs

The pipe is assumed to be RCP, CSP, APC, PVC or HDPE; if other materials are used, then the collar should be designed per Caltrans HDM or drainage standards. Text on the detail should be modified to reference the pipe material used. Collars are not recommended in shared trenches; however, if shared trenches are necessary, then the collar shall be designed based on the largest pipe in the trench. In corrosive soils conditions, it is recommended that the supplemental detail be modified to show an increase in concrete cover over the reinforcement to 6 inches.

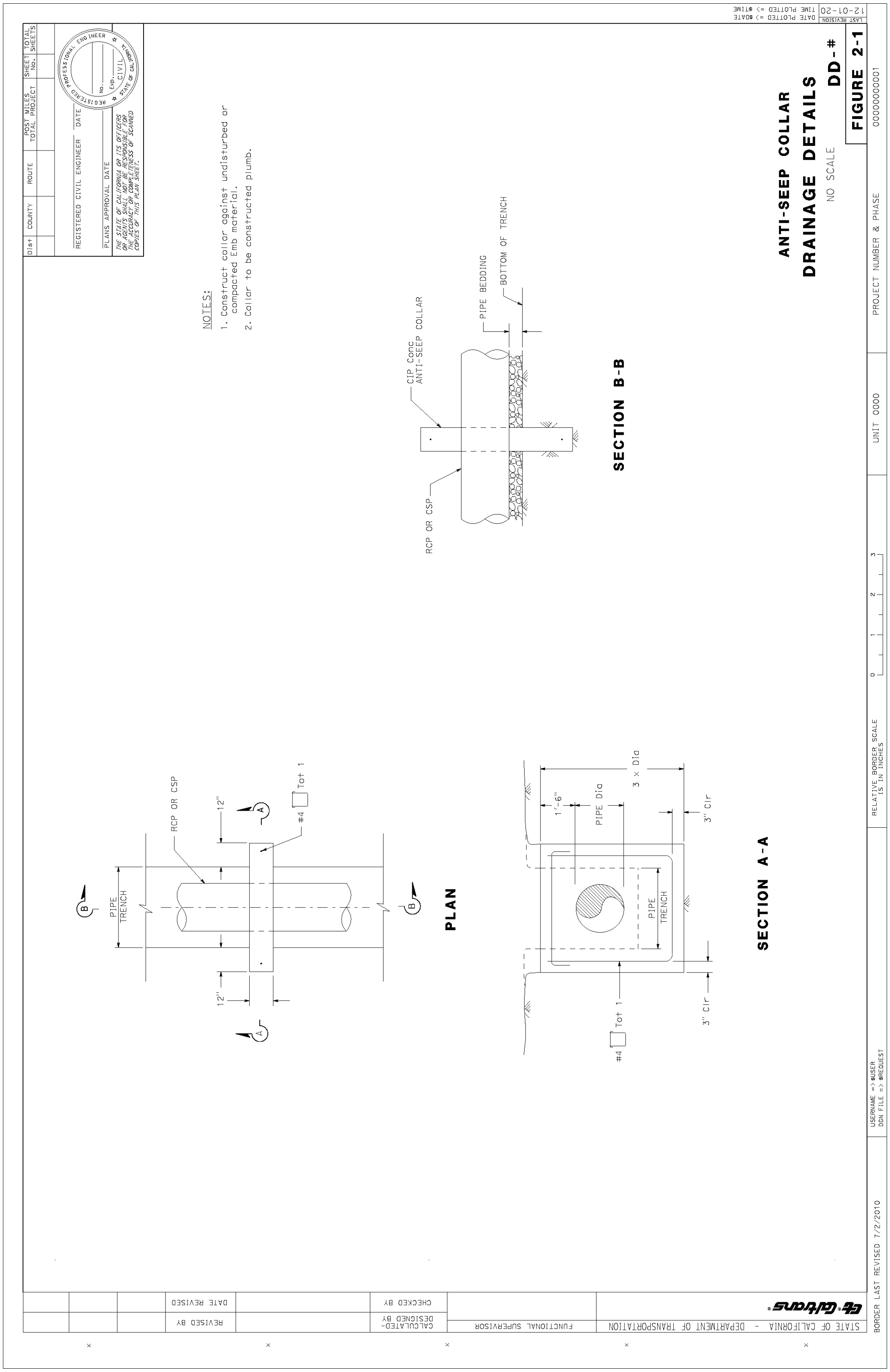


Figure 2-1. Anti-Seep Collar

This page intentionally left blank.

Section 3

Baffle Wall

Baffle walls are constructed barriers used to deflect flow in order to achieve the recommended 2:1 length-to-width ratio in detention devices where the natural basin geometry does not provide the 2:1 ratio between the inlet(s) and the outlet structure. A baffle wall increases the distance of the flow path and the residence time, eliminating the 'short circuiting' of the flow and thereby maintaining detention time. Figures 3-1 and 3-2 are standard details for baffle walls.

3.1 Design Basis

The standard details for baffle walls were developed based on the following design criteria:

Table 3-1. Baffle Wall Standard Detail Design Basis

Parameter	Preferred	Alternate
Anchor Type	Posts Set in Concrete	Removable posts with sleeves set in concrete
Post Material	Recycled Plastic Lumber	Galvanized Steel
Panel Material	Recycled Plastic Lumber	None
Spacing between panels	10'	None
Parameter	Minimum	Maximum
Spacing Between Posts	3.5 ft	8 ft
Height of Panel	16 inches	6 ft
Wind Pressure	0 psf	23 psf (80 mph)

3.2 Getting Started

Step 1: Develop Basin Layout: If the length-to-width ratio is at least 2:1 (as measured at the WQV surface elevation), and the inlet pipes and outlet pipe are at opposite ends, then a baffle wall is not needed. If a baffle wall is required, proceed to Step 2.

Step 2: Develop Wall Layout: If the basin length-to-width ratio is less than 2:1, the baffle wall(s) shall be located at a skew or perpendicular to the inlet pipe(s). Baffle walls shall be located away from the basin inlet, leaving room for a maintenance vehicle, and shall be constructed in straight lengths without bends or angle points. The length and layout of the baffle wall shall define a flow path length that is a minimum of twice the width of the basin. Openings or gaps in the baffle wall shall be provided so that stormwater is not impounded by the baffle wall, only redirected along a path parallel to the baffle wall. Sufficient distance along the flow path between the end of the baffle wall and the side berm of the basin shall be provided to allow an unobstructed flow. In general, for every independent baffle wall, one end will be constructed into the basin berm per this standard detail and one end will terminate within the bottom of the basin.

Consideration shall be given to maintenance vehicles accessing the basin such that baffle walls do not restrict vehicle access or movements. If basin geometry does not allow maintenance vehicle access and baffle walls, the engineer may consider an alternative design that allows temporary removal of baffle walls and support posts.

Step 3: Determine Wall Height: The height of the baffle wall is based on the elevation of the basin discharge relative to the inlet elevation. In general, the top of the wall should be set 1 foot above the anticipated water surface elevation during water quality events including any surcharge. This relative height shall be maintained for the entire length of the baffle wall.

Step 4: Identify Anchorage and Wall Terminal Details: After the layout and height of the wall has been determined, the engineer shall identify the end conditions associated with each wall length.

3.3 Type/Size Selection

Two types of posts are shown on the drawings. At the Contractor's option, either post material may be selected for use.

3.4 Layout

The layout of baffle walls shall conform to the steps outlined above. The engineer must consider the specific soils type and the local wind speed (80 mph max) at the project location to verify that site-specific conditions are applicable when compared with the "Design Data" and "Notes" shown on the Standard Details.

3.5 Design Elements

Mandatory design elements include the 2:1 length-to-width ratio when designing the flow path directed along the baffle wall. Additionally, wall height is limited based on site specific wind speed (80 mph maximum); heights greater than those identified in the standard details will require site-specific design. The use of recycled plastic lumber minimizes maintenance requirements associated with baffle walls.

3.6 PS&E Preparation

The layout and end conditions of the baffle wall shall be shown on the drainage plan(s). Quantities for "Baffle Wall" should be summarized in a Quantity Summary Table. The two Standard Detail sheets shall be included with the drawings, and the baffle wall nSSP shall be included in the contract special provisions. The pay item to be included in the estimate shall be "Baffle Wall", with the quantity units of square feet, unless payment is included in the TBMP bid item.

3.7 Special Designs

Special Designs include sites with poor or corrosive soils, or wind loading in excess of 23 psf (80 mph). For sites with these conditions, the engineer will need to prepare a site-specific design and modify the Standard Details as required.

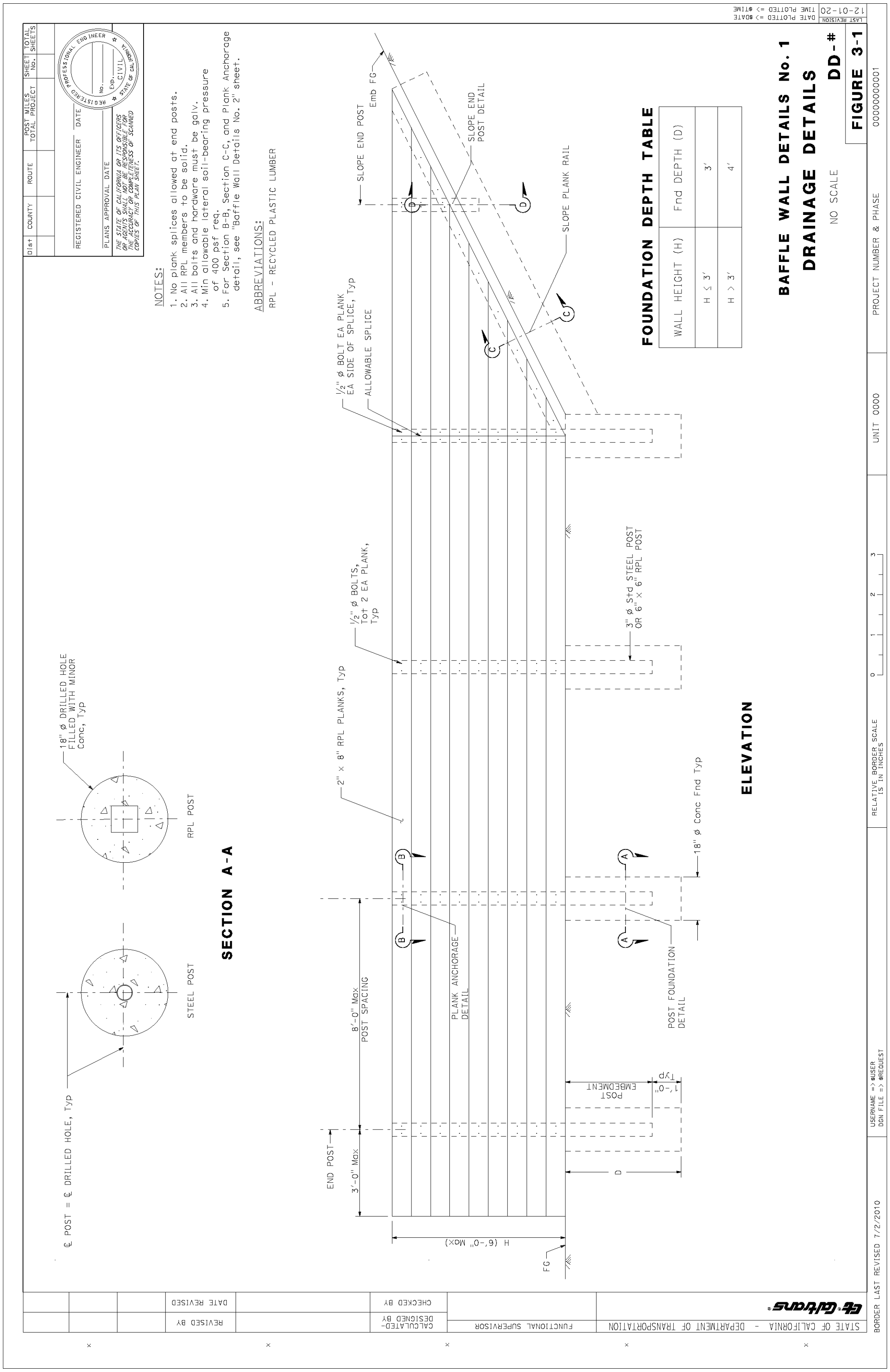


Figure 3-1. Baffle Wall Details No. 1

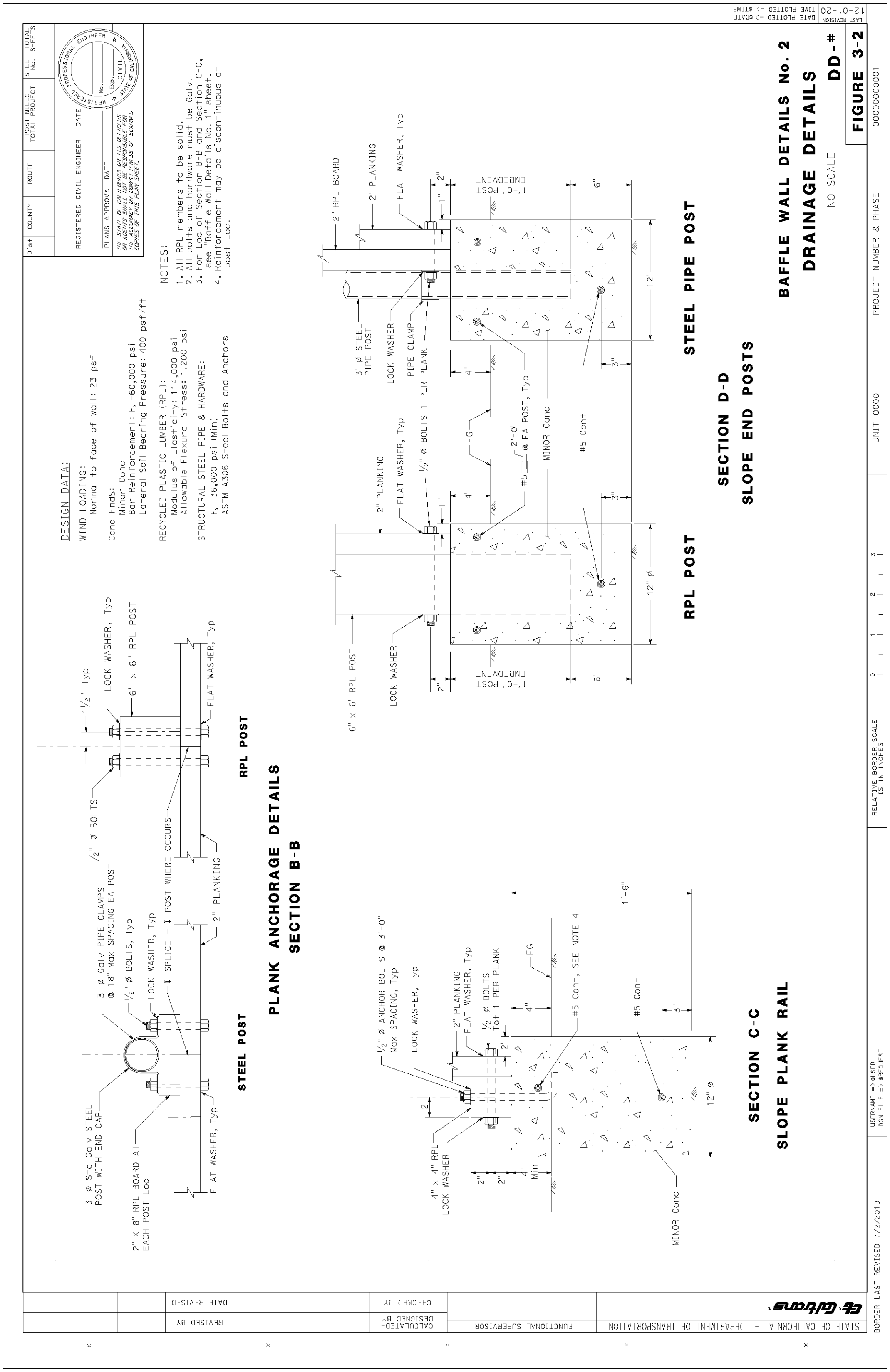


Figure 3-2. Baffle Wall Details No. 2

This page intentionally left blank.

Section 4

Maintenance Drain Valve

Maintenance drain valves are outlet mechanisms used for draining the stored water in the event that the water quality release becomes clogged or fails to drain the stored water within the specified drain time. Maintenance drain valves are utilized as a supplemental detail in Caltrans-Approved TBMPs such as Detention Basins, Austin Sand Filters, Wet Basins, and Infiltration Basins.

On the drawings, maintenance drain valves are shown along an outlet pipe in line with the plan and profile of the maintenance drain line from the detention device. Figure 4-1 shows the standard detail for a maintenance drain valve.

4.1 Design Basis

The standard detail for a maintenance drain valve was developed based on the following design criteria:

Table 4-1. Maintenance Drain Valve Standard Detail Design Basis

Parameter	Preferred	Alternate
Type of Valve	Gate Valve	None
Valve Material	Ductile Iron	None
Pipe Material	Plastic	Ductile Iron
Drain Time	None	24 hours
Valve Working Water Pressure	200 psi	None
Pipe Diameter	8 inches	None

4.2 Getting Started

When locating the maintenance drain valve, the engineer will need to determine the profile of the drain pipe in relation to grade at the drain valve and show this relationship on a profile drawing. The drain valve will be located along the drain pipe in a location where the valve box is accessible during inclement weather. Care must be taken to ensure that the discharge of the drain valve pipe is directed into a stabilized channel. The engineer is responsible for verifying that the system receiving discharge from the drain valve has sufficient capacity for this use.

A single 8-inch valve will release approximately 90% of a 15-acre-foot basin within 72-hours and will empty a 5 acre-foot basin within 30-hours (initial depth: 4 foot, final depth 0.1 foot). Using this as a basis for design, a single drain valve will be utilized for basins up to 5 acre-feet. For every 5 acre-feet increase in basin storage, an additional drain valve will be added to the basin to maintain the desired 24-hour drain time.

4.3 Type/Size Selection

The maintenance drain valve Standard Detail shows a single size and type of valve. Smaller drain valves will require site-specific design, while larger drain valves are discouraged due to operation and maintenance constraints. Maintenance drain valves of different materials require pre-approval from OHSD, with concurrence by Maintenance.

4.4 Layout

The maintenance drain valve shall be accessible from a location outside the basin to enable access to the valve operator from a non-submerged location. If there is a pipe between the basin and the drain valve, the pipe should have a slope sufficient to minimize sediment buildup at the drain valve. The valve-pipe connections should be watertight, and the valve box containing the valve operator should be capable of supporting traffic loads.

In general, the inlet condition of the maintenance drain valve pipe will consist of a standard grated inlet connected to the drain pipe or a headwall containing the drain pipe at the low point of the basin. Inlet design is site-specific and the responsibility of the engineer.

4.5 Design Elements

Design elements consist of the volume of water to be detained and providing adequate maintenance drainage capacity to drain the basin within a 24-hour period. When multiple maintenance drain valves are required, shared trenches are desirable. However, the location of the drain valve, operator, and valve box shall be sited to allow for independent operation of multiple drain valves, and outlet protection shall be designed for full-flow conditions. Consideration shall be given to utilizing the anti-seep collar on the drain pipe and other pipes exiting the Detention Basin.

4.6 PS&E Preparation

The maintenance drain valve inlet, drain pipe, valve and box location, and outlet elevations shall be called out on the plan drawings. In cases of complicated pipe routing or when other features are crossed by the drain pipe, the engineer may want to show the drain pipe and drain valve on a drainage detail profile drawing. At a minimum, the engineer shall indicate the elevation of the valve and the elevation of the valve cover.

Quantities of "maintenance drain valve" shall be summarized and shown in a Quantity Summary Table. The "maintenance drain valve" item contains valve, valve box and cover, operator, concrete and reinforcement; thus, individual quantities need not be calculated. The standard detail shall be included with the drawings, and the maintenance drain valve nSSP shall be included in the contract special provisions. The pay item to be included in the estimate shall be "maintenance drain valve", with the quantity units of EA (each). Drain pipe, inlet, and outlet are not considered a part of the "maintenance drain valve" pay item and shall be shown and measured separately, unless payment is included in the TBMP bid item.

4.7 Special Designs

Special designs include drain valves of different size or material, and pipe types other than plastic or ductile iron. To incorporate a special design, the engineer must verify the basin drain time using the special configuration and verify that operations and maintenance requirements are met. Larger drain valves will require a larger traffic rated valve box and specialized valve operator extensions. If special design will entail operational aspects different than recommended herein, obtain concurrence for placement from District Maintenance.

4.8 Design Example

Figures 4-2 and 4-3 show a sample placement depicting the use of a maintenance drain valve to drain a Detention Basin.

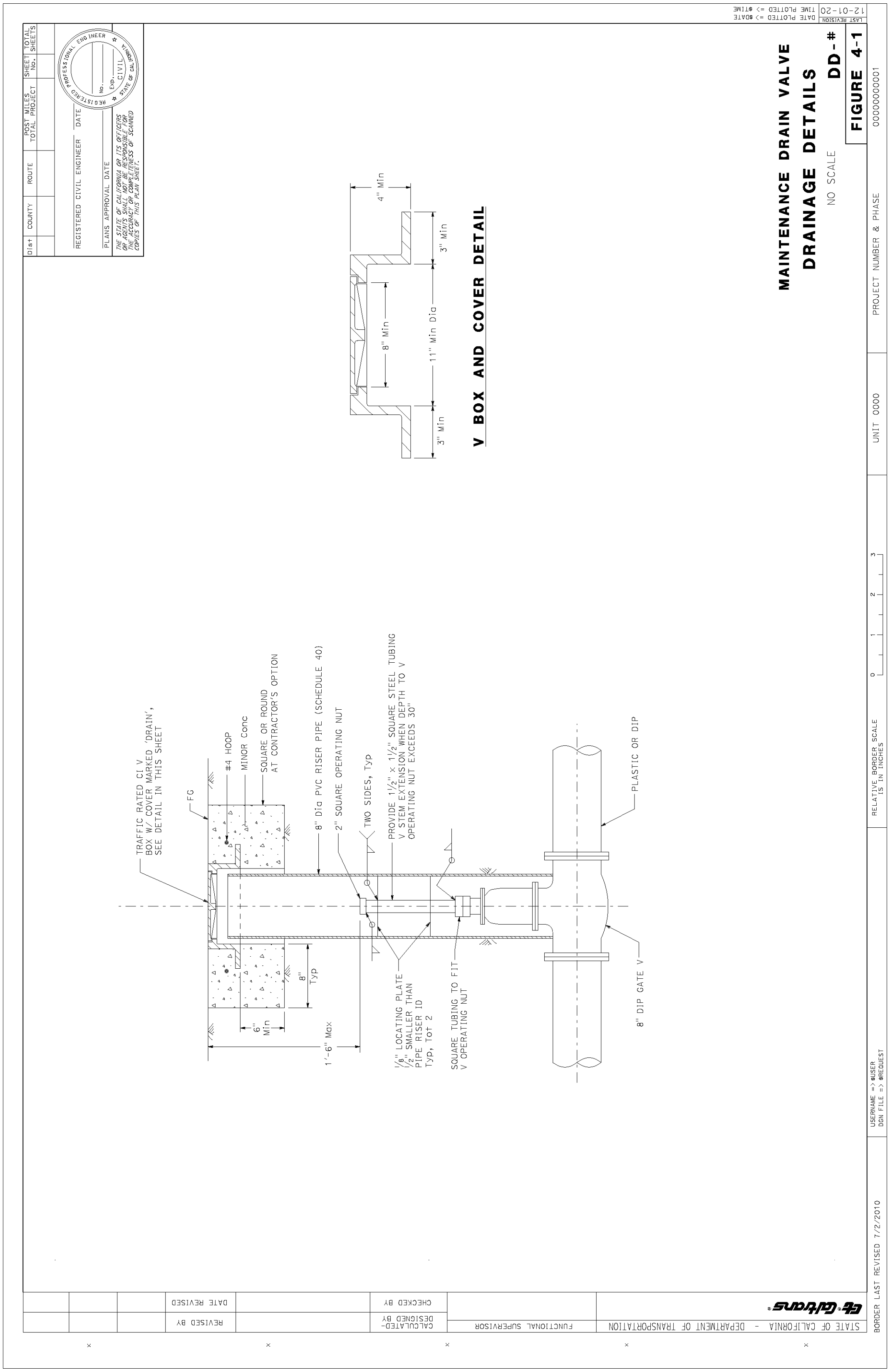


Figure 4-1. Maintenance Drain Valve

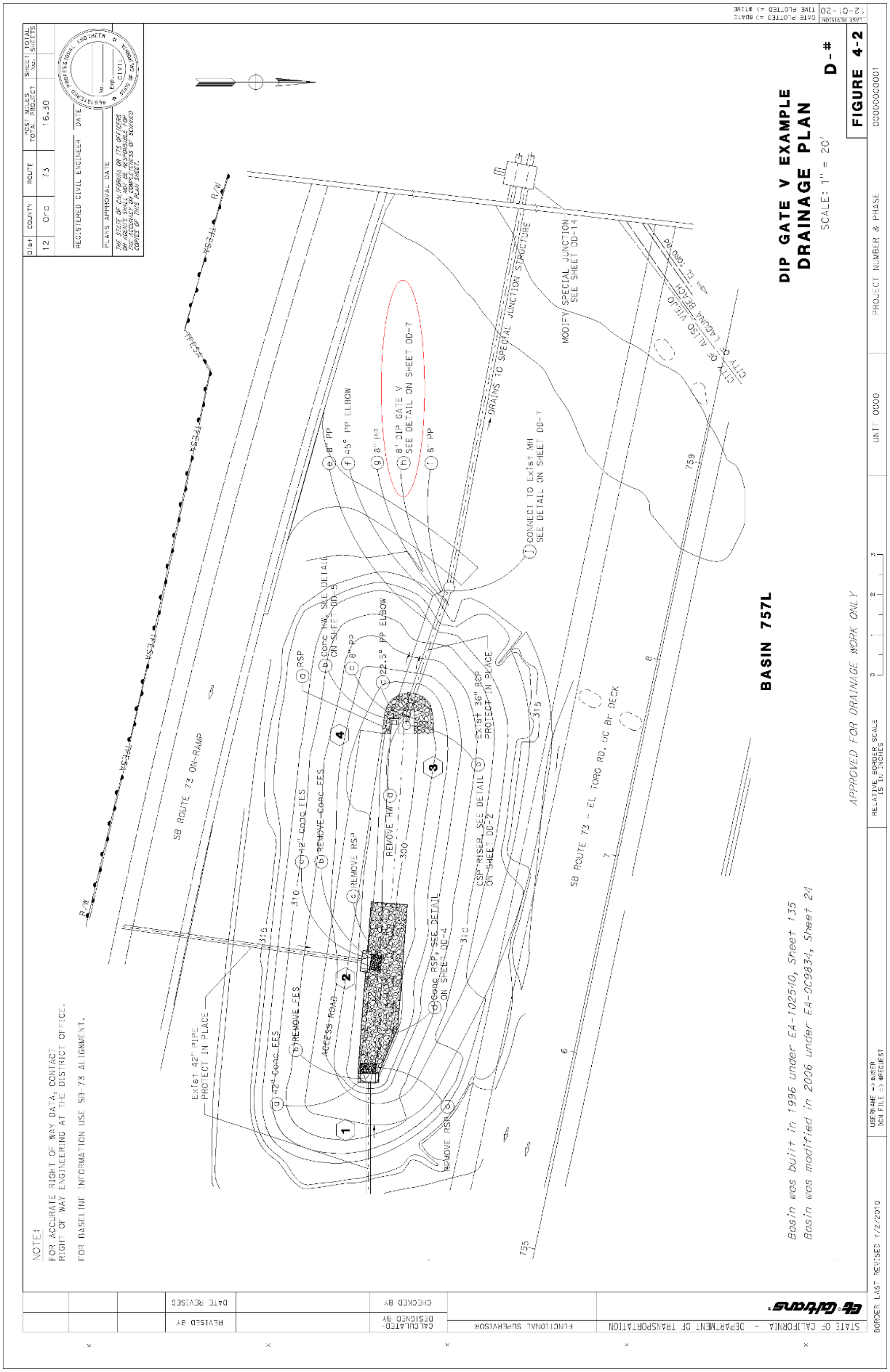


Figure 4-2. Drainage Plan

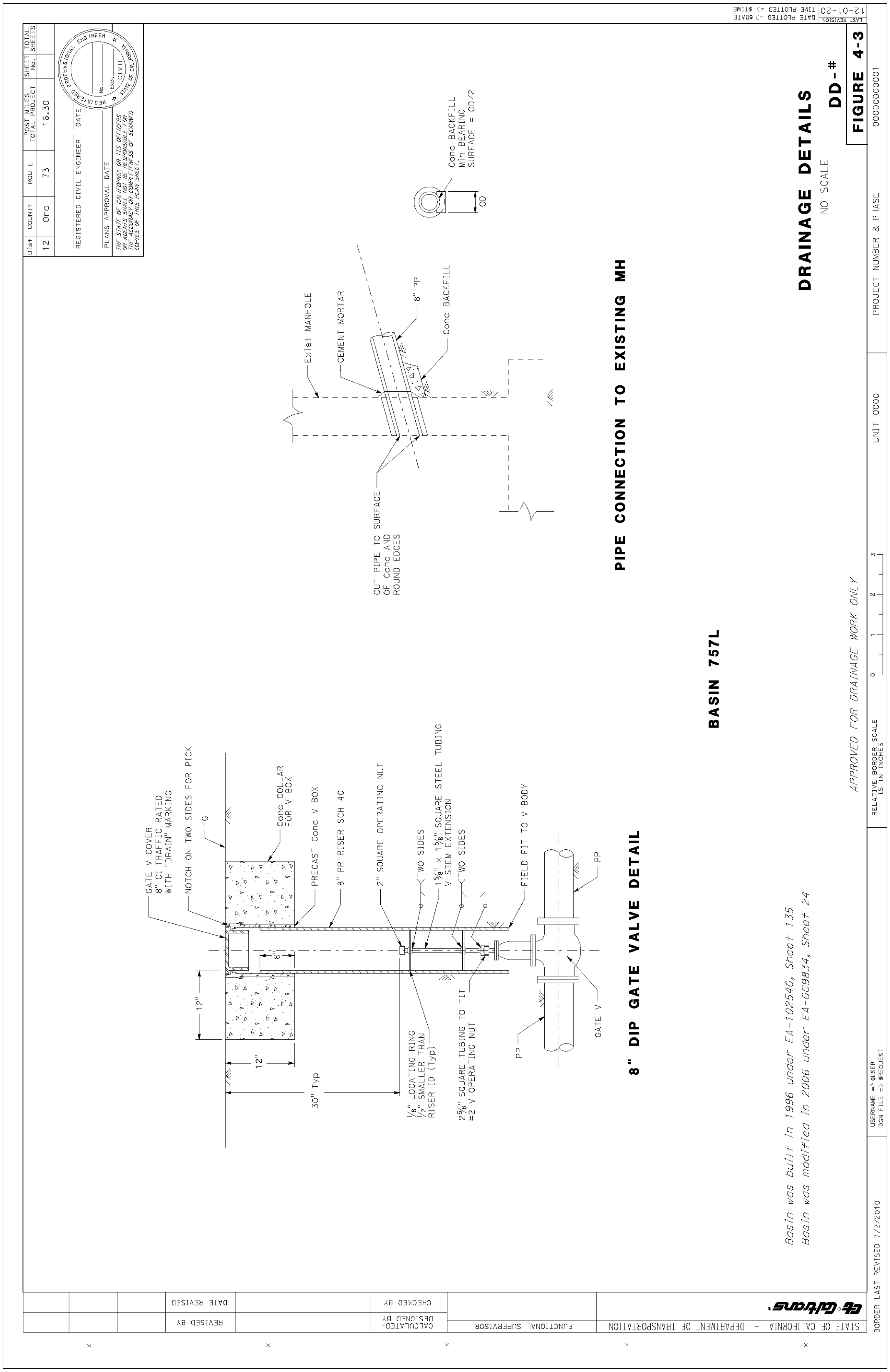


Figure 4-3. Drainage Details

Section 5

Overflow Spillway

An overflow spillway is the primary release structure used in an Infiltration Basin and a primary or additional release structure used in Detention Basins, wet basins, and Austin Sand Filters - Partial and Full Sedimentation Devices (earthen Type). Its purpose is to provide an additional level of safety should an unforeseen circumstance not contemplated by normal design assumptions arise, such as failure of the overflow riser (or the water quality outlet riser in the case of a detention device) or unexpected runoff which the overflow riser is not designed to accommodate.

An overflow spillway is also required if a basin is located adjacent to a roadway or developed property would endanger either the roadway or property upon overtopping. The spillway is constructed in the embankment of the basin to prevent basin failure and directs the overflow to a safe discharge path to protect adjacent and downstream facilities from damage. The spillway is considered uncontrolled because the spillway geometry allows variable overflow of the discharge (as opposed to flows controlled by a mechanical device).

Figure 5-2 is the standard detail for an overflow spillway, which includes a table identifying the relationship of the design flow to the dimensions of the spillway.

5.1 Design Basis

The standard detail for an overflow spillway was developed based on the following design criteria:

Table 5-1. Overflow Spillway Standard Detail Design Basis

Parameter	Preferred	Alternate
Shape	Broad-Crested Trapezoidal Weir	None
Material	Reinforced Concrete	Revetment
Parameter	**Minimum**	**Maximum**
Design Flow Rate	HDM – Topic 831	
Height	1.5 feet	2.5 ft
Breadth (length of spillway parallel to flow)	8 ft	Width of Berm
Length (perpendicular to flow)	Per Detail Table or HDM	110 ft

5.2 Getting Started

Initial design parameters that are required to design an overflow spillway include Q_{in} from the HDM Design Storm and the geometry of the basin. Given the Q_{in} and the geometry of the basin, the "Spillway Dimension Table" shown on the overflow spillway standard detail can be used to determine the length and height of the spillway that best fits the basin geometry. The table provides a choice of three sizes of spillways for each value of Q_{in}.

5.3 Type/Size Selection

Selection of the appropriate spillway size is dependent on basin geometry, the need to provide maintenance vehicle access across the spillway, and the maximum $Q_{overflow}$. In general, a shallow spillway is preferred, if possible, to allow for better maintenance access, smaller facility footprint and lower overflow velocities. Downstream facilities shall be evaluated for potential effects of flows over the spillway.

5.4 Layout

Figure 5-1 shows the relationship between the top of the basin and the overflow spillway. The calculated (per the PPDG) Q_{in} for an overflow event and height (H) in this figure, can be used with the Table in Figure 5-2 to define spillway geometry.

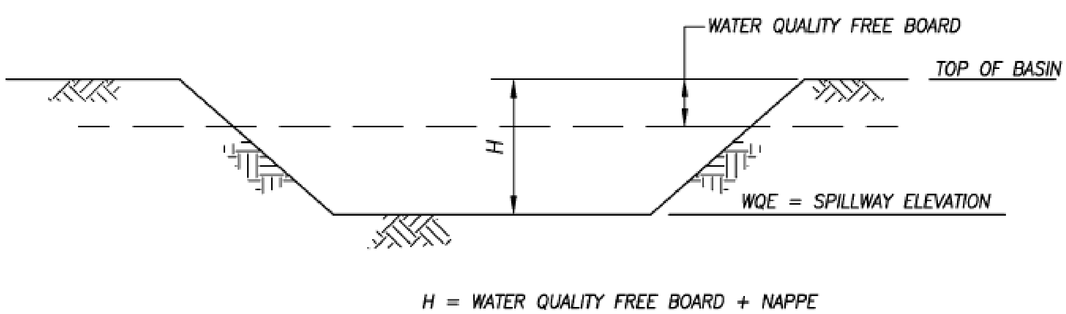


Figure 5-1. Overflow Spillway Elevation

The spillway outlet slope must be protected from erosion, and the runoff must be directed into a new or existing stormwater system.

5.5 Design Elements

Figure 5-2 shows the standard design elements of the overflow spillway. The engineer should give additional consideration to sites with poor (e.g. erodibility) or corrosive soils (provide additional concrete cover). The engineer may consider extension of the downstream spillway apron, RSP, concrete RSP or other methods to protect the downstream embankment of the basin or device. Additionally, protection of downstream receiving water facilities must be considered during the design process.

5.6 PS&E Preparation

The overflow spillway should be located on the drainage plan, with size and spillway elevation shown. A contour grading plan should also be included to provide details of final earthwork surfaces. If the basin is shown in section, it is desirable to also include the spillway in the section. The overflow spillway includes concrete, reinforcement, and earthwork. Slope protection, etc., must be considered separately. Quantities for overflow spillway shall be calculated by the engineer and shown in the Quantity Summary Table under "Minor Concrete (Minor Structure)"; reinforcement and earthwork quantities are not pay items and are included in the Minor Concrete item. The standard detail shall be included with the drawings, and the overflow spillway SSP shall be included in the contract special provisions. The pay item to be included in the estimate shall be "Minor Concrete (Minor Structure)", with the quantity units of cubic yards, unless payment is included in the TBMP bid item.

5.7 Special Designs

All TBMPs must be provided with some form of an overflow outlet to discharge water in the event the BMPs capacity is overwhelmed by a large storm event. An overflow outlet is mandatory, even if the drainage system is designed to bypass large flows through an upstream flow spitting device. If a proposed BMP would be located where no existing conveyance or drainage system exists, the engineer must install a new conveyance to a point where the discharge can tie into an existing conveyance or receiving water body.

Overflow spillways typically discharge to an open channel. In the event that an open channel is not practical, then an overflow spillway should not be installed. In lieu of the overflow spillway, the engineer may consider the installation of an overflow riser.

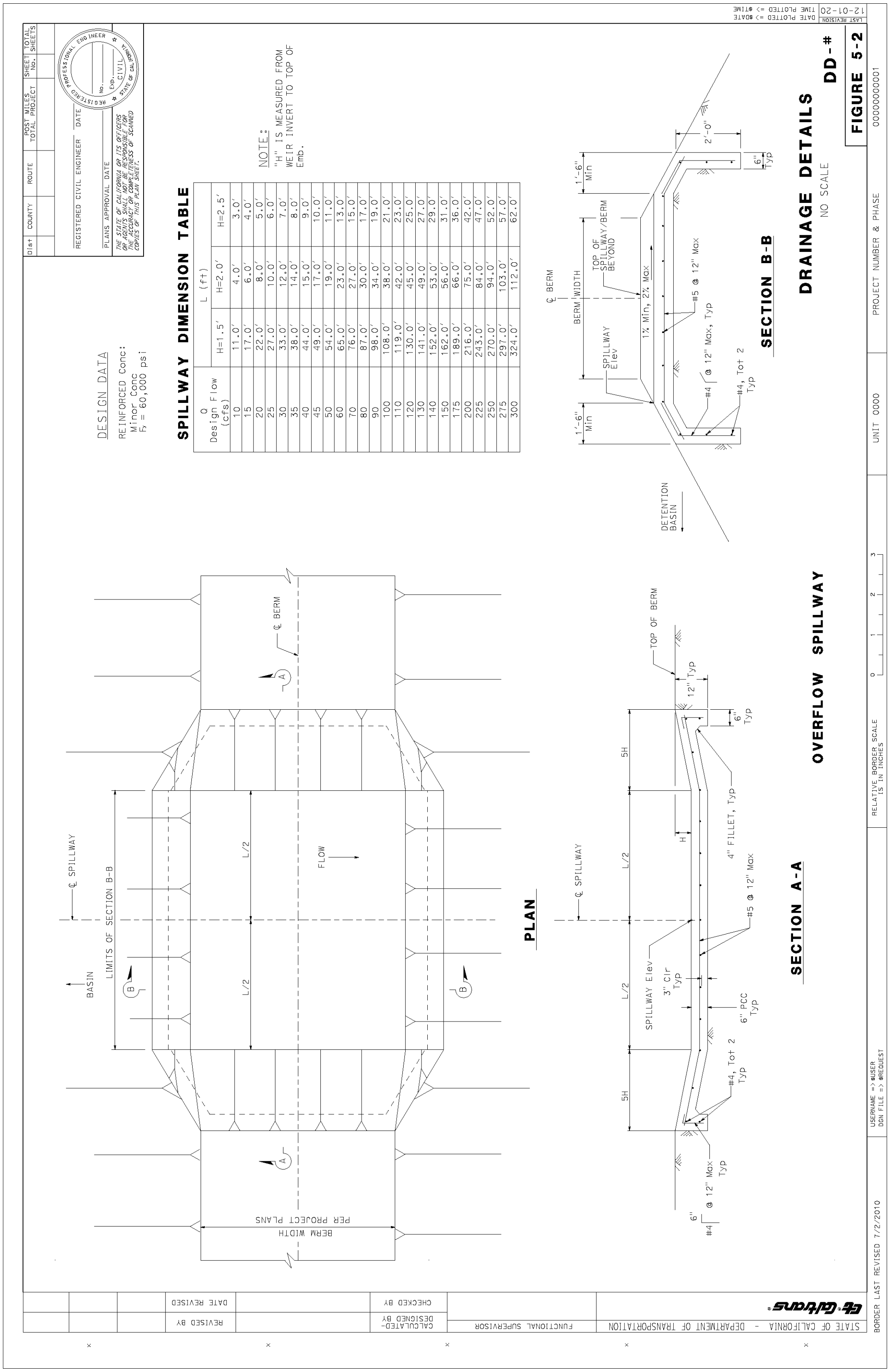
If the design overflow ($Q_{overflow}$) is less than what is shown on the "Spillway Dimension Table" on the overflow spillway Standard Detail, a site-specific design may be considered and then the standard detail would not be applicable.

Should the basin geometry require the spillway to be installed on a curve, or in a fashion not depicted on the Standard Detail, a site-specific design would be required.

If a basin is constructed such that the minimum 8 feet length (perpendicular to flow) of the overflow spillway cannot be achieved, consultation with District Maintenance is recommended concerning basin access and maintenance.

5.8 Design Example

Figures 5-3 and 5-4 show an example of an overflow spillway used on a project.



Q Design Flow (cfs)	L (ft) H=1.5'	H=2.0'	H=2.5'
10	11.0'	4.0'	3.0'
15	17.0'	6.0'	4.0'
20	22.0'	8.0'	5.0'
25	27.0'	10.0'	6.0'
30	33.0'	12.0'	7.0'
35	38.0'	14.0'	8.0'
40	44.0'	15.0'	9.0'
45	49.0'	17.0'	10.0'
50	54.0'	19.0'	11.0'
60	65.0'	23.0'	13.0'
70	76.0'	27.0'	15.0'
80	87.0'	30.0'	17.0'
90	98.0'	34.0'	19.0'
100	108.0'	38.0'	21.0'
110	119.0'	42.0'	23.0'
120	130.0'	45.0'	25.0'
130	141.0'	49.0'	27.0'
140	152.0'	53.0'	29.0'
150	162.0'	56.0'	31.0'
175	189.0'	66.0'	36.0'
200	216.0'	75.0'	42.0'
225	243.0'	84.0'	47.0'
250	270.0'	94.0'	52.0'
275	297.0'	103.0'	57.0'
300	324.0'	112.0'	62.0'

Figure 5-2. Drainage Details

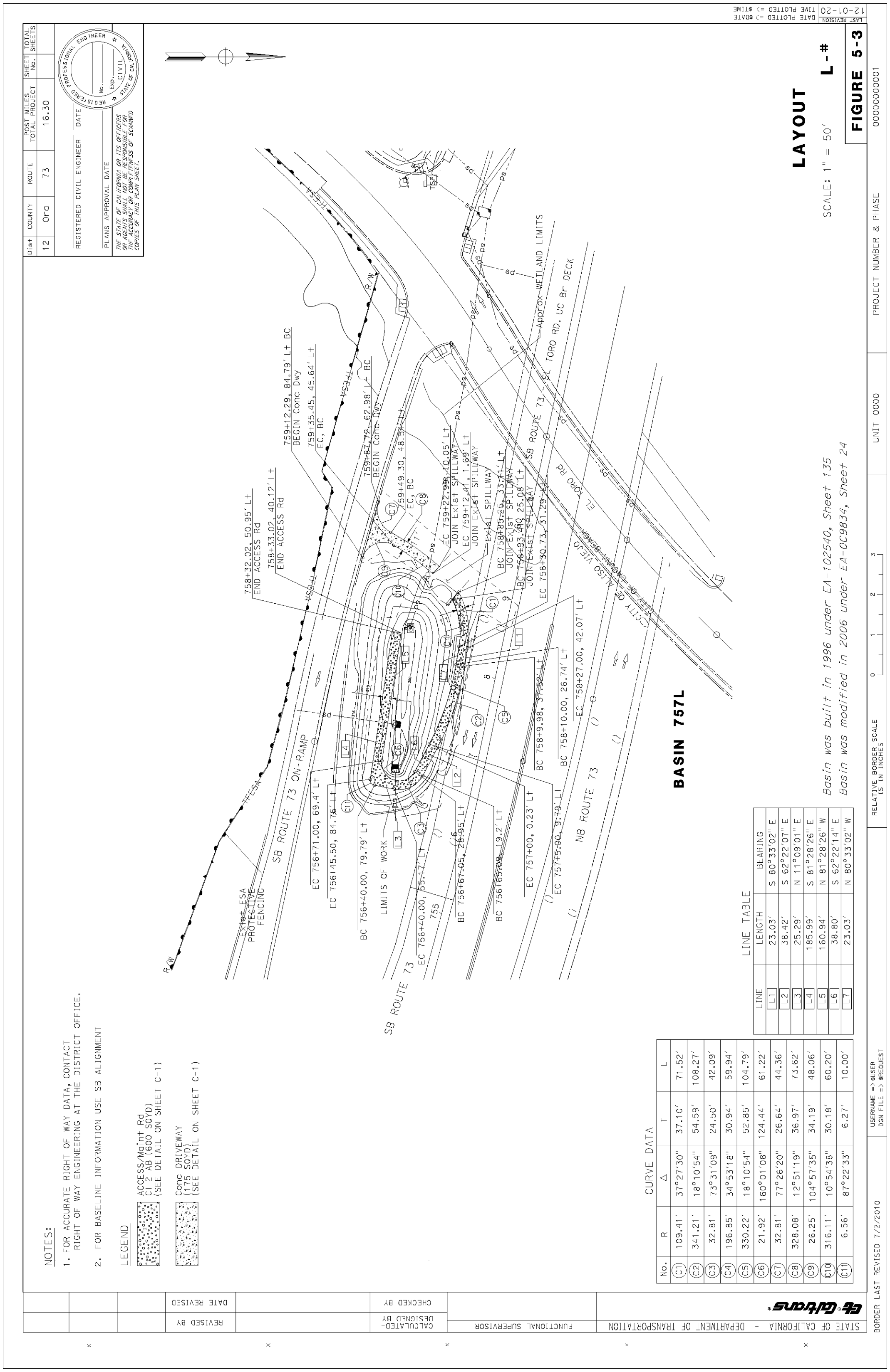


Figure 5-3. Layout

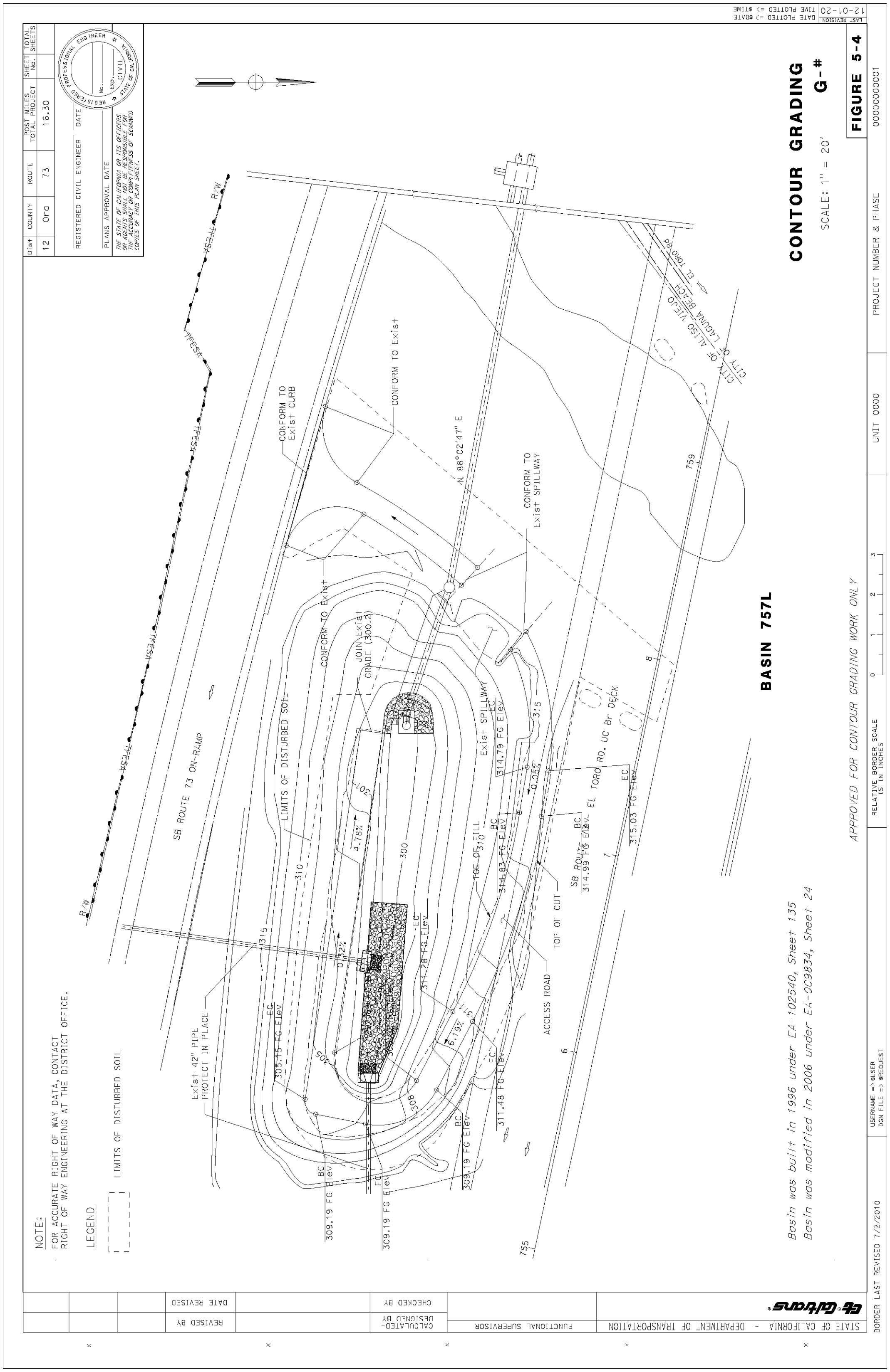


Figure 5-4. Contour Grading

This page intentionally left blank.

Section 6

Geomembrane Liner

A geomembrane liner is an impervious barrier placed below the invert and side slopes of a basin to prevent infiltration of runoff. The liner is typically used in detention devices and Austin Sand Filters –Partial and Full Sedimentation Devices (Earthen Type) where protection of groundwater or adjacent subgrades (e.g., where the stability of a slope, embankment, or structure is threatened) is desired. Geomembrane liners are also used in areas where groundwater levels are expected within 10 ft of the basin invert elevation. The PE should coordinate with the local RWQCB to determine if a geomembrane liner is required.

Figure 6-1 is the standard detail for a geomembrane liner.

6.1 Design Basis

The standard detail for a geomembrane liner was developed based on the following design criteria:

Table 6-1. Impermeable Liner Standard Detail Design Basis

Parameter	Preferred	Alternate
Material	Geomembrane, textured both sides	Clay
Seam Method (if geomembrane)	Welded	None
Anchor Type (if geomembrane)	Trench Anchor	None
Embankment Installation	Slope Installation	None
Parameter	Minimum	Maximum
Depth of Cover	1 foot	2 ft
Thickness (geomembrane)	30 mils	None

6.2 Getting Started

In order to determine the layout of a geomembrane liner, the engineer must know the geometry and dimensions of the basin to be lined. Additionally, the engineer must be cognizant of all potential penetrations of the liner, such as at inlet and outlet structures, as these penetrations must be identified and shown on the drawings.

6.3 Type/Size Selection

Generally, a geomembrane liner is preferred over a clay liner unless a sufficient local quantity of clay is available. The use of a clay liner is considered a special design, and if utilized will require site specific details, contract special provisions and quantities.

6.4 Layout

Layout of the geomembrane liner is site-specific and will match the shape of the basin. The engineer is cautioned that the geomembrane liner should be completely covered and not exposed to sunlight after installation.

6.5 Design Elements

Design elements for the geomembrane liner have been incorporated into the standard detail and nSSP. When the geomembrane liner is used for earthen berm Detention Basins, the engineer shall provide erosion control seeding or other detail to stabilize and protect the cover and reduce erosion.

6.6 PS&E Preparation

The limits of the geomembrane liner shall be clearly shown on the drainage plan, and the area of the liner shall be calculated to include basin walls and anchorage details. Quantities of "Geomembrane Liner" will be shown in a Quantity Summary Table. The standard detail shall be included with the drawings, and the geomembrane liner nSSP shall be included in the contract special provisions. The pay item to be included in the estimate shall be "Geomembrane Liner", with the quantity units of square yards.

6.7 Special Designs

Utilization of a clay liner is considered a special design, and thus, the geomembrane liner Standard Detail and nSSP are not applicable. To incorporate a special design that includes a clay geomembrane liner, the engineer must obtain approval from both District Maintenance and the District/Regional NPDES Coordinator.

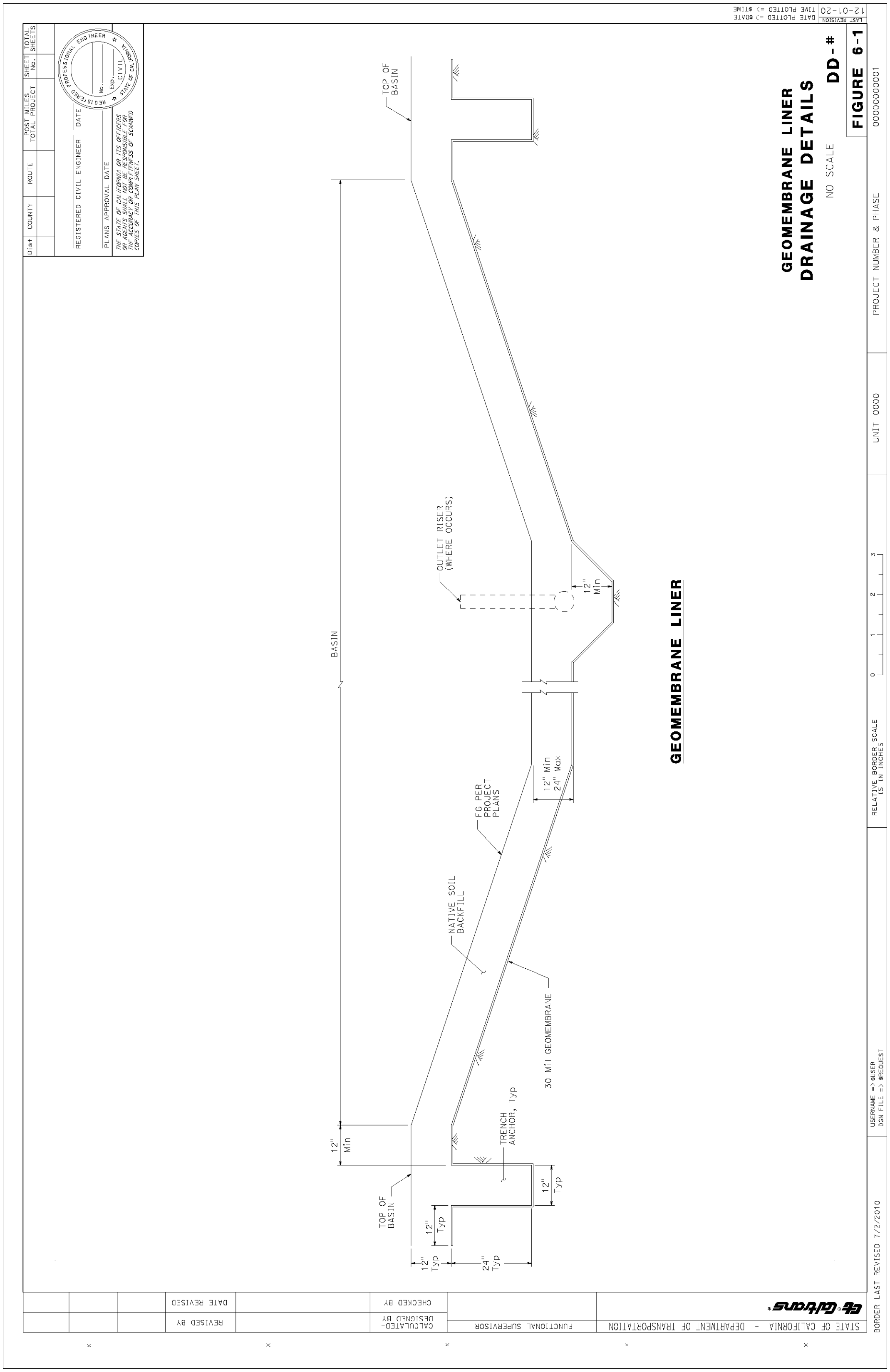


Figure 6-1. Geomembrane Liner

This page intentionally left blank.

Section 7

Low Flow Channel

Low flow channels are concrete channels constructed along the bottom of detention devices and Austin Sand Filter – Full Sedimentation Device (Earthen Type) to convey low flow runoff and/or base flow directly from the inlet to the outlet. The low flow channel also prevents standing water from accumulating within the device after a storm event. Channel cross sections can be trapezoidal or triangular (i.e., V-ditch). Low flow channels are designed to be mounted and crossed by maintenance equipment and vehicles.

Figure 7-1 is the standard detail for Type A and Type B low flow channels.

7.1 Design Basis

The standard detail for a low flow channel was developed based on the following design criteria:

Table 7-1. Low Flow Channel Standard Detail Design Basis

Parameter	Preferred	Alternate
Material	Concrete	None
Parameter	Minimum	Maximum
Side Slope	4H :1V	3H :1V
Bottom Width (trapezoidal section)	3 ft	10 ft
Depth	6 in	1 ft
Longitudinal Slope	Per Grading	

7.2 Getting Started

A low flow channel is a supplemental detail associated with Detention Basins and Austin Sand Filters – Full sedimentation Device (Earthen Type). A low flow channel consists of a reinforced concrete ditch along the low flow channel of the basin or filter device. Channel cross section is trapezoidal or V-ditch. The geometry of the channel is dependent upon the amount of low flow or nuisance flow to be carried through the basin or filter device.

7.3 Type/Size Selection

The standard detail provides four V-ditch sections and 32 trapezoidal sections for the engineer's use. In general, the section is selected to accommodate the low flow or nuisance flow to be conveyed through the basin or filter device. The greater the low flow, the larger the channel cross section.

Low flow channel inlet requirements dictate that the low flow channel be connected to the basin or filter inlets. The connection should transition flow smoothly from inlet to channel without erosion. The outlet of the channel is tied to the base slab of the water quality outlet riser or overflow riser of the basin or filter.

7.4 Layout

Low flow channel layout is similar to that used for drainage ditches. It is important to layout the low flow channel to match basin or filter geometry without excessive slope. The side slopes of the channel have been designed to allow maintenance vehicles and equipment to cross or travel along the channels without causing damage.

7.5 Design Elements

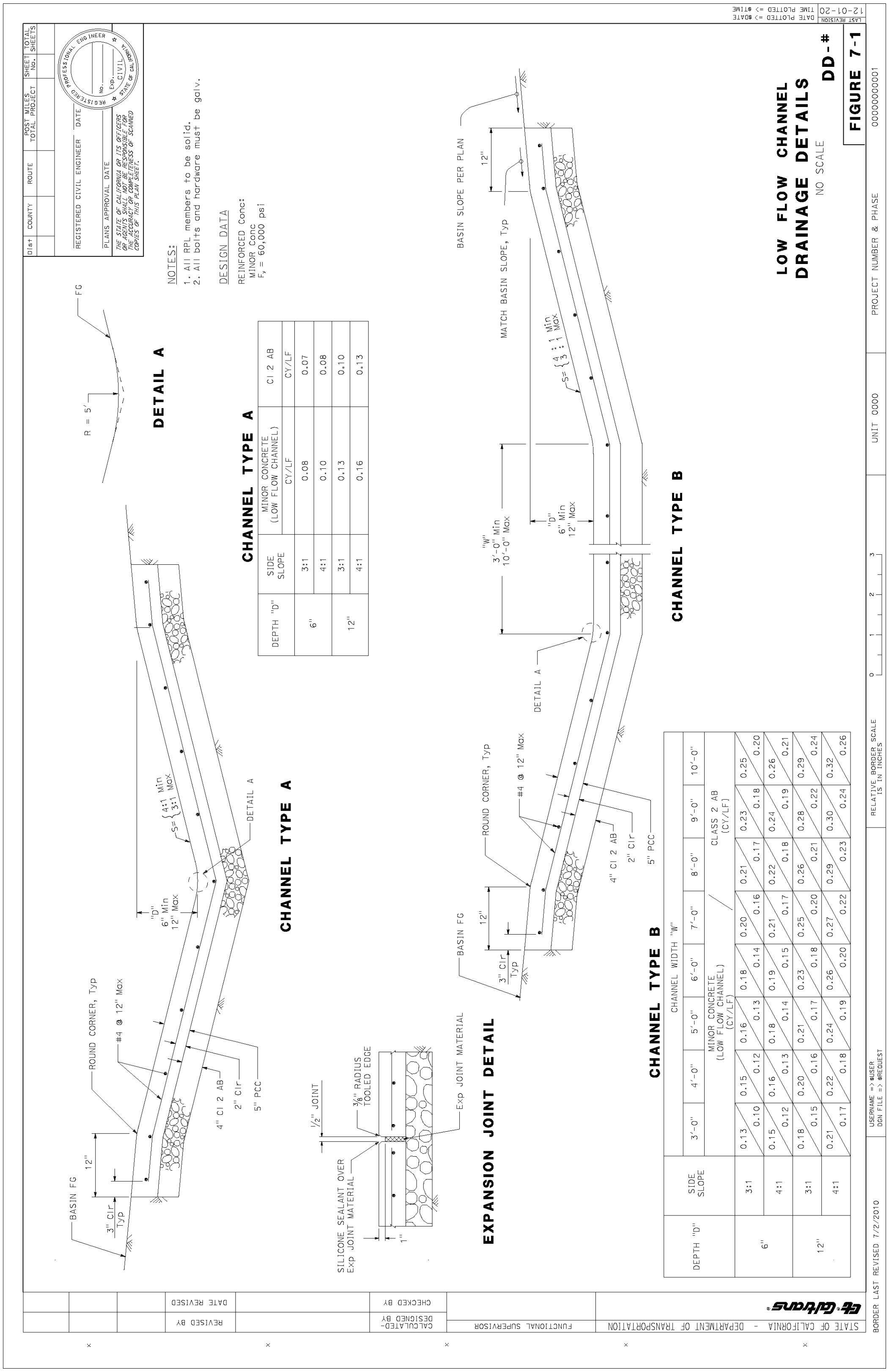
Low flow channels must be elevation matched and coordinated with basin outlet or treatment device inlet conditions. Additional design elements shall be included for the standard drainage inlet at the low flow channel outlet if water quality outlet risers or overflow risers are not utilized.

7.6 PS&E Preparation

Low flow channel layout with horizontal and vertical control is shown on a drainage plan (and profile at the discretion of the engineer). The plan shall clearly indicate the type of section to be constructed from the tables on the standard detail. Quantities of concrete shall be calculated from the layout and the tables on the standard detail and displayed in a Quantity Summary Table on the drawings as "Minor Concrete (Minor Structure)". The standard detail shall be included with the drawings. The pay item to be included in the estimate shall be "Minor Concrete (Minor Structure)", with the quantity units of cubic yards, unless payment is included in the TBMP bid item.

7.7 Special Designs

Special Designs include the use of typical sections not conforming to those shown on the Standard Detail. The use of low flow channels with cross slopes that are steeper than 3:1 or flatter than 4:1 are considered a special design.



CHANNEL TYPE A

DEPTH "D"	SIDE SLOPE	MINOR CONCRETE (LOW FLOW CHANNEL) CY/LF	Cl 2 AB CY/LF
6"	3:1	0.08	0.07
	4:1	0.10	0.08
12"	3:1	0.13	0.10
	4:1	0.16	0.13

CHANNEL TYPE B (each cell: MINOR CONCRETE (LOW FLOW CHANNEL) (CY/LF) / CLASS 2 AB (CY/LF))

DEPTH "D"	SIDE SLOPE	3'-0"	4'-0"	5'-0"	6'-0"	7'-0"	8'-0"	9'-0"	10'-0"
6"	3:1	0.13 / 0.10	0.15 / 0.12	0.16 / 0.13	0.18 / 0.14	0.20 / 0.16	0.21 / 0.17	0.23 / 0.18	0.25 / 0.20
	4:1	0.15 / 0.12	0.16 / 0.13	0.18 / 0.14	0.19 / 0.15	0.21 / 0.17	0.22 / 0.18	0.24 / 0.19	0.26 / 0.21
12"	3:1	0.18 / 0.15	0.20 / 0.16	0.21 / 0.17	0.23 / 0.18	0.25 / 0.20	0.26 / 0.21	0.28 / 0.22	0.29 / 0.24
	4:1	0.21 / 0.17	0.22 / 0.18	0.24 / 0.19	0.26 / 0.20	0.27 / 0.22	0.29 / 0.23	0.30 / 0.24	0.32 / 0.26

Figure 7-1. Low Flow Channel

This page intentionally left blank.

Section 8

Overflow Riser

An overflow riser may be used as the primary overflow structure for Infiltration Basins and wet basins that are not provided with an overflow spillway. Its purpose is to provide a release of flows above the WQV elevation to prevent water levels from overtopping the basin embankment. The overflow riser may be used in conjunction with an overflow spillway to direct initial overflow into an improved downstream drainage system. An overflow riser may also be used in situations when the water quality outlet riser does not meet the necessary overflow requirements.

Figures 8-2 and 8-3 are the standard details for Type 1 and Type 2 overflow risers.

8.1 Design Basis

The standard details for an overflow riser were developed based on the following design criteria:

Table 8-1. Overflow Riser Standard Detail Design Basis

Parameter	Preferred	Alternate
Material	CSP	None
Debris Rack Cage Material	Steel	None
Parameter	Minimum	Maximum
Design Flow Rate	Per HDM	
Height	Per WQV and Freeboard Requirements	
Diameter	48 in	

8.2 Getting Started

The overflow riser may be used as the primary spillway for overflow release out of a small basin, the first overflow release device in conjunction with an overflow spillway, or in the situation where an overflow spillway cannot be utilized. Two types of overflow risers have been provided as supplemental details; the outlet riser Type 1 directs outflow within a pipe located at the bottom of the basin. The outlet riser Type 2 directs outflow as deep as 5 feet below the bottom of the basin. If the installation of a single outlet riser does not meet basin overflow requirements, multiple overflow risers within the basin may be considered.

To begin selection of an overflow riser, the engineer must know the geometry of the basin and the elevation of the spillway and outlet at the basin low point. Comparison of the basin low point with the overflow spillway will give the engineer an indication of the height of the riser. It is desirable for the top of the riser (at the bottom of the debris rack) to be 1 ft below the spillway elevation. If an overflow riser is used in conjunction with an overflow spillway, then the discharge elevation of the overflow riser should be set at the WQV elevation.

8.3 Type/Size Selection

Multiple overflow riser types are provided to achieve the necessary hydraulic objectives and meet basin geometries. If the difference in WQV elevation and basin low point are less than 13 ft, the Type 1 overflow riser should be used. The Type 2 overflow riser is used when the difference between the WQV elevation and the basin low point is greater than 13 ft and/or it is necessary to establish the overflow riser outlet pipe up to 8.67 ft below the basin low point. It is recommended that the Type 1 overflow riser be used whenever possible due to the reduced installation cost and maintenance requirements.

8.4 Layout

There are four elevations that must be considered when designing an overflow riser. These are as follows:

H_{invert} = the elevation of the Basin invert;

H_{WQV} = the water surface elevation during a water quality event. This elevation is also coincident with the inlet elevation of the overflow riser;

H_{max} = the maximum water surface elevation anticipated during an overflow event; and

$H_{freeboard}$ = the elevation of the top of the embankment; $H_{freeboard} = H_{max} + 12''$

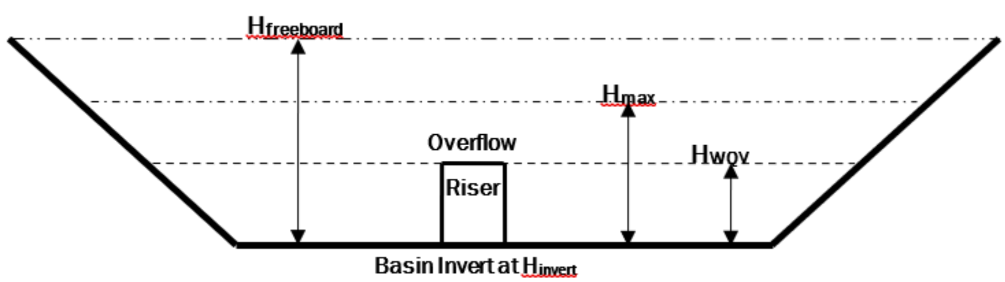


Figure 8-1. Basin Schematic Showing Elevations

Figure 8-1 can be used to determine the relationship of the riser to the basin. The overflow riser crest elevation shall be set so that a minimum of 1 foot of storage freeboard is available in the basin (where freeboard is the distance from the designed maximum basin water surface elevation to the top of the embankment).

The top of the inlet slab of the overflow riser is set at the low point of the basin and/or the low point of the low flow channel. The overflow riser outlet pipe will ultimately discharge to an existing or improved drainage system, and the engineer's attention is directed to prevention of erosion and scour at the outlet facilities. It is recommended that the basin outlet pipe be set at a slope to establish self-cleaning velocities per the HDM.

8.5 Design Elements

The engineer of the overflow riser must know the peak design inflow (Q_{in}) of the basin to effectively select the number of overflow risers to be installed. If the design Q_{in} per the HDM is greater than Q_{out} calculated for the single outlet riser, the engineer will specify additional overflow risers to meet the design $Q_{in.}$ If the basin is also provided with an overflow spillway as the primary overflow outlet, a lower value of Q may be considered as the design flow for the outlet riser. The outlet riser is provided with a maintenance access ladder. If the riser is less than 3 ft high, the ladder can be eliminated by a note on the plans.

8.6 PS&E Preparation

The overflow riser, with Type 1 (Figure 8-2) or Type 2 (Figure 8-3) clearly identified, shall be shown on the drainage plan. The relationship between the overflow riser basin slab and inlet elevation shall be shown on a drainage profile or detail. Quantities for overflow riser should be shown in a Quantity Summary Table on the drawings as "Minor Concrete (Minor Structure)" and "Miscellaneous Metal". Quantities of concrete and reinforcement are identified on the supplemental details; however, the engineer must know the height of the riser and ladder to determine metal quantities.

The standard details shall be included with the drawings. Note that the ladder details are per Standard Plans, and the debris rack and anchorage details of the riser to the concrete are per Supplemental BMP standard drawing "Water Quality Outlet Riser Miscellaneous Details No. 1", which must also be included with the drawings when using the overflow riser standard details. The SSP for the overflow riser includes "Miscellaneous Metal" and "Corrugated Steel Pipe", which shall be included in the contract special provisions. The pay items to be included in the estimate shall be "Minor Concrete (Minor Structure)", "Miscellaneous Metal", and "Corrugated Steel Pipe", with the quantity units of cubic yards, pounds, and lineal feet, respectively, unless payment is included in the TBMP bid item.

8.7 Special Designs

Overflow risers requiring a special design include risers higher than 12 ft above the basin invert or risers with outlet piping larger than 1 ft. Special design also includes riser pipe diameters different than provided (48 in). To use a riser taller than 12 ft, the engineer must consider overturning and buoyancy to redesign the concrete foundation of the riser. Special outlet conditions will require modifications to the details, quantities, and possibly the special provisions. Special designs should be discussed with District Maintenance and the District/Regional NPDES Coordinator.

8.8 Design Example

Figures 8-4, 8-5, and 8-6 represent sample installation depicting the use of an overflow riser. Figures 8-5 and 8-6 would be replaced by the appropriate standard details, and the engineer would add the necessary construction details to provide a connection to the outlet drainage system.

The wire mesh screen used for the overflow riser is intended to prevent clogging of the orifice(s) and the debris rack is used to prevent larger floatables from entering into the drainage system; neither achieves the full trash capture standard. The overflow riser can be modified to potentially classify the surrounding TBMP as a full trash capture system, equivalent to a Gross Solids Removal Device, if additional screening is provided to prevent particles that are 5 mm or greater from entering the outlet and trapping the debris within the confines of the TBMP. Standard meshes or screens have not been developed to achieve the 5 mm screening; therefore, the use of proprietary or special designs to provide this screening must be approved by the appropriate District functional units and OHSD.

The design engineer must consider the need to expand or alter the dimensions of the TBMP if the overflow riser is modified to achieve full trash capture considering potential clogging and longer drawdown times for water to drain through the mesh or screen. Maintenance access must also be considered for both the 5 mm screening device and the riser structure; access doors, hatches, or other design features should be considered to allow for cleaning and inspection.

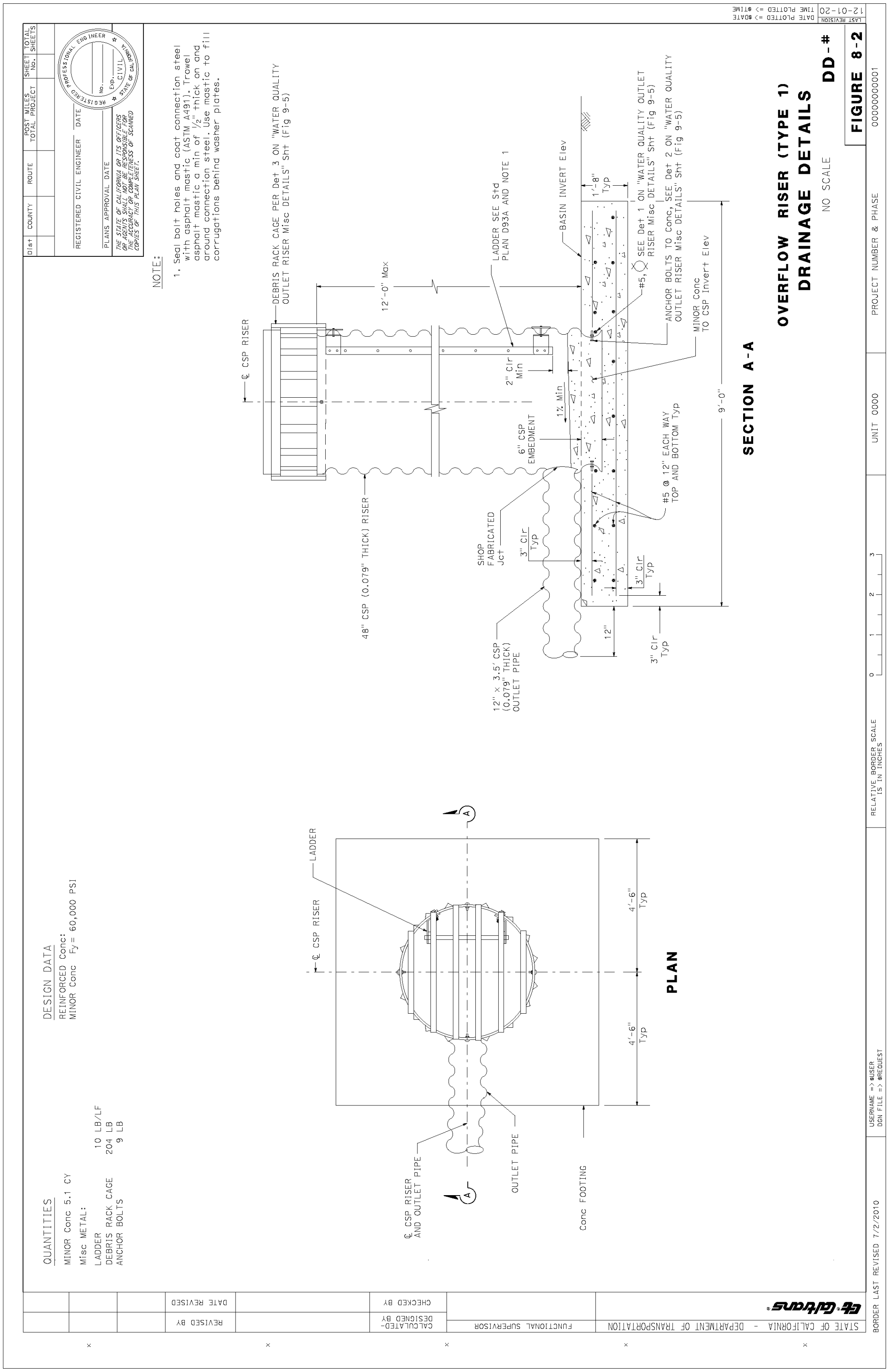


Figure 8-2. Overflow Riser (Type 1), Drainage Details

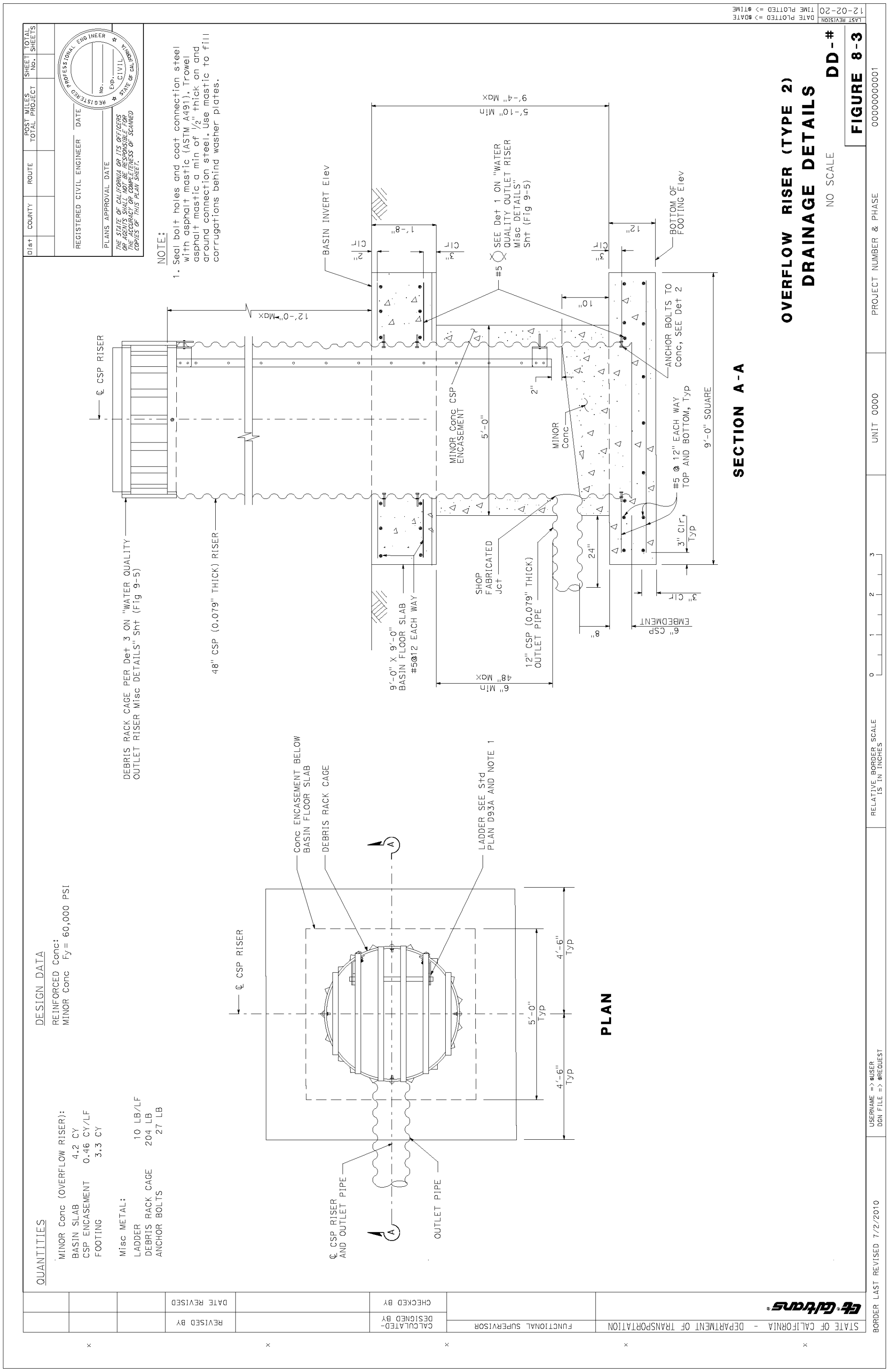


Figure 8-3. Overflow Riser (Type 2), Drainage Details

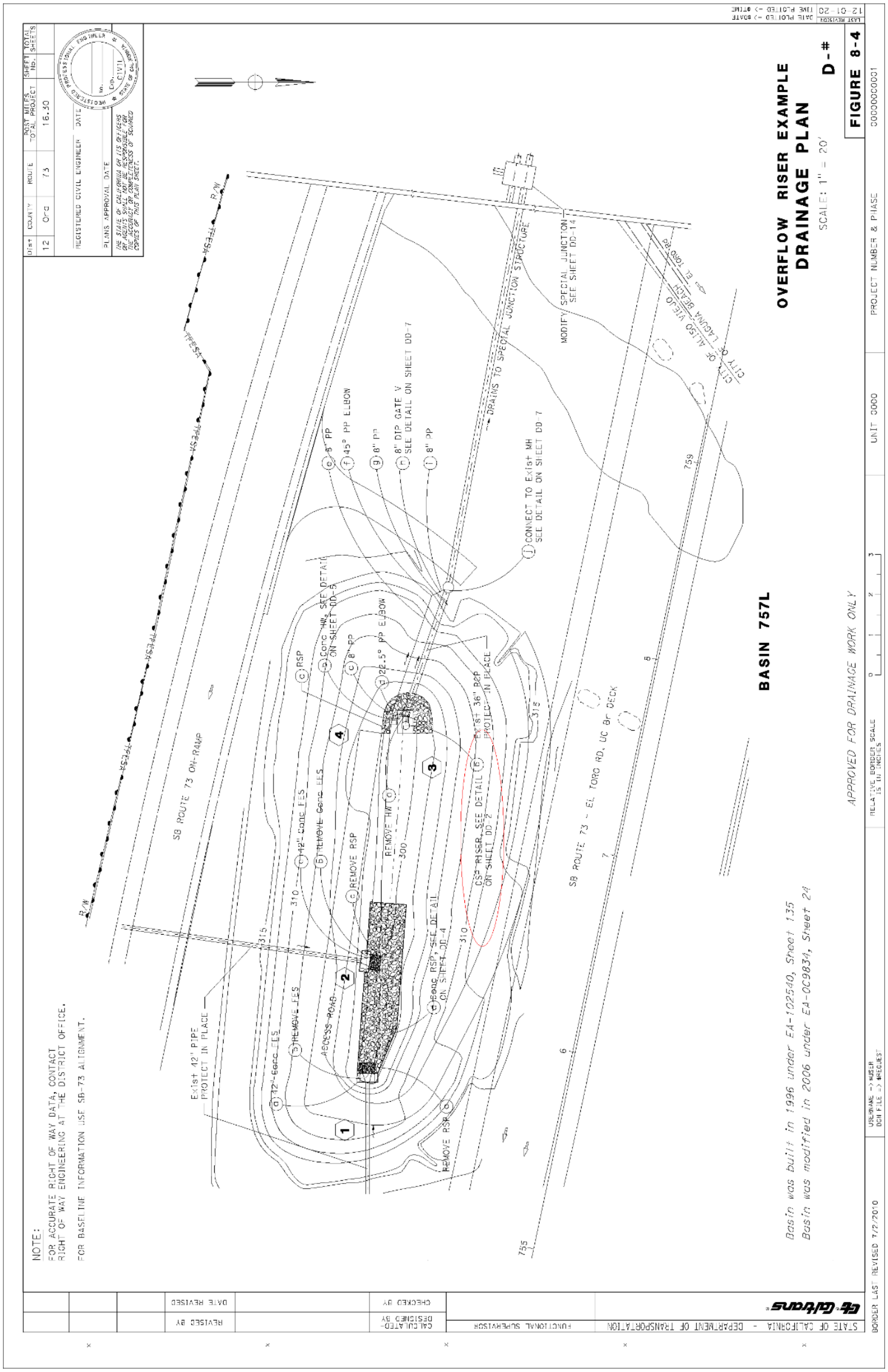


Figure 8-4. Basin Drainage Plan

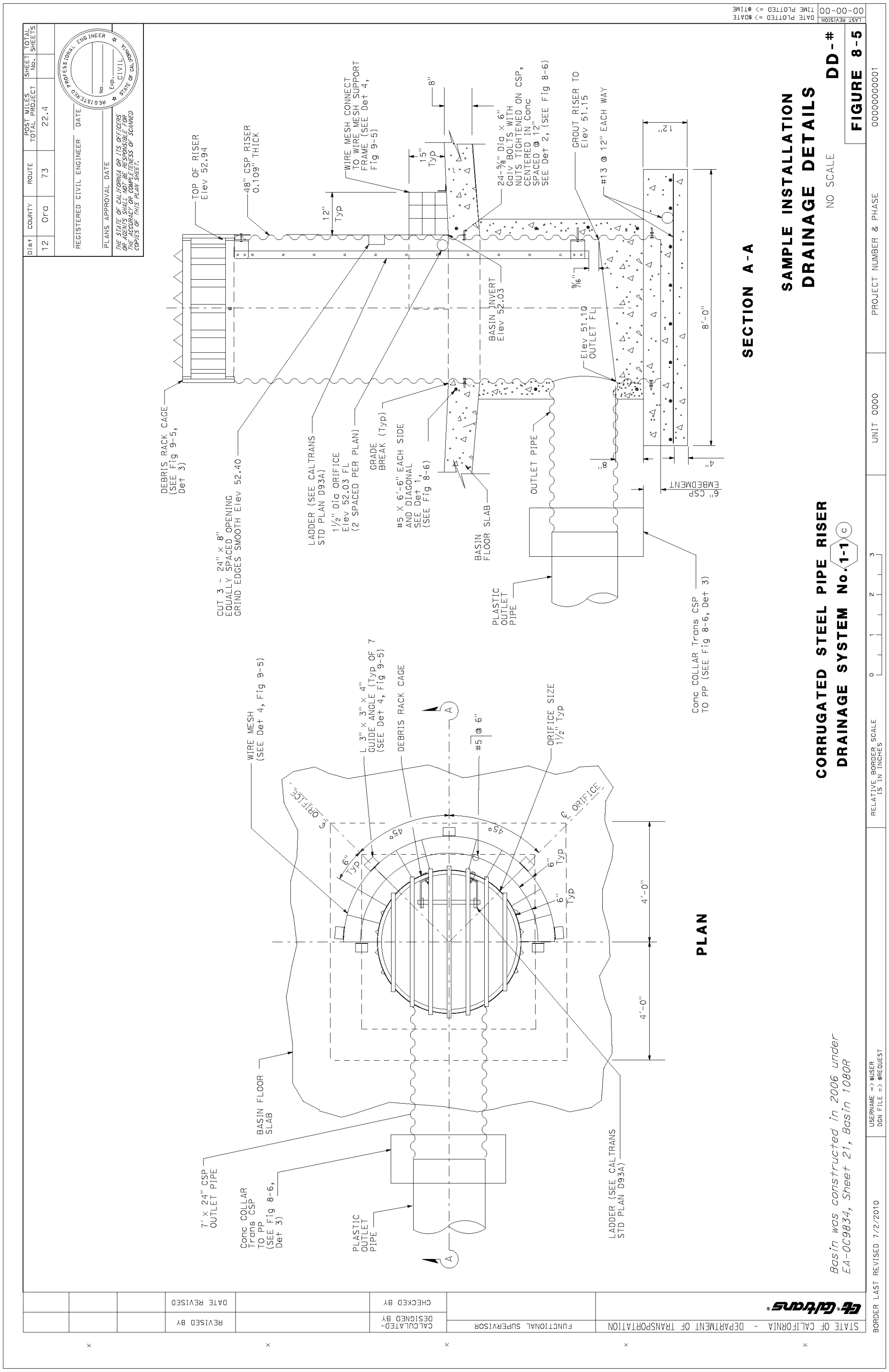


Figure 8-5. Basin Drainage Details

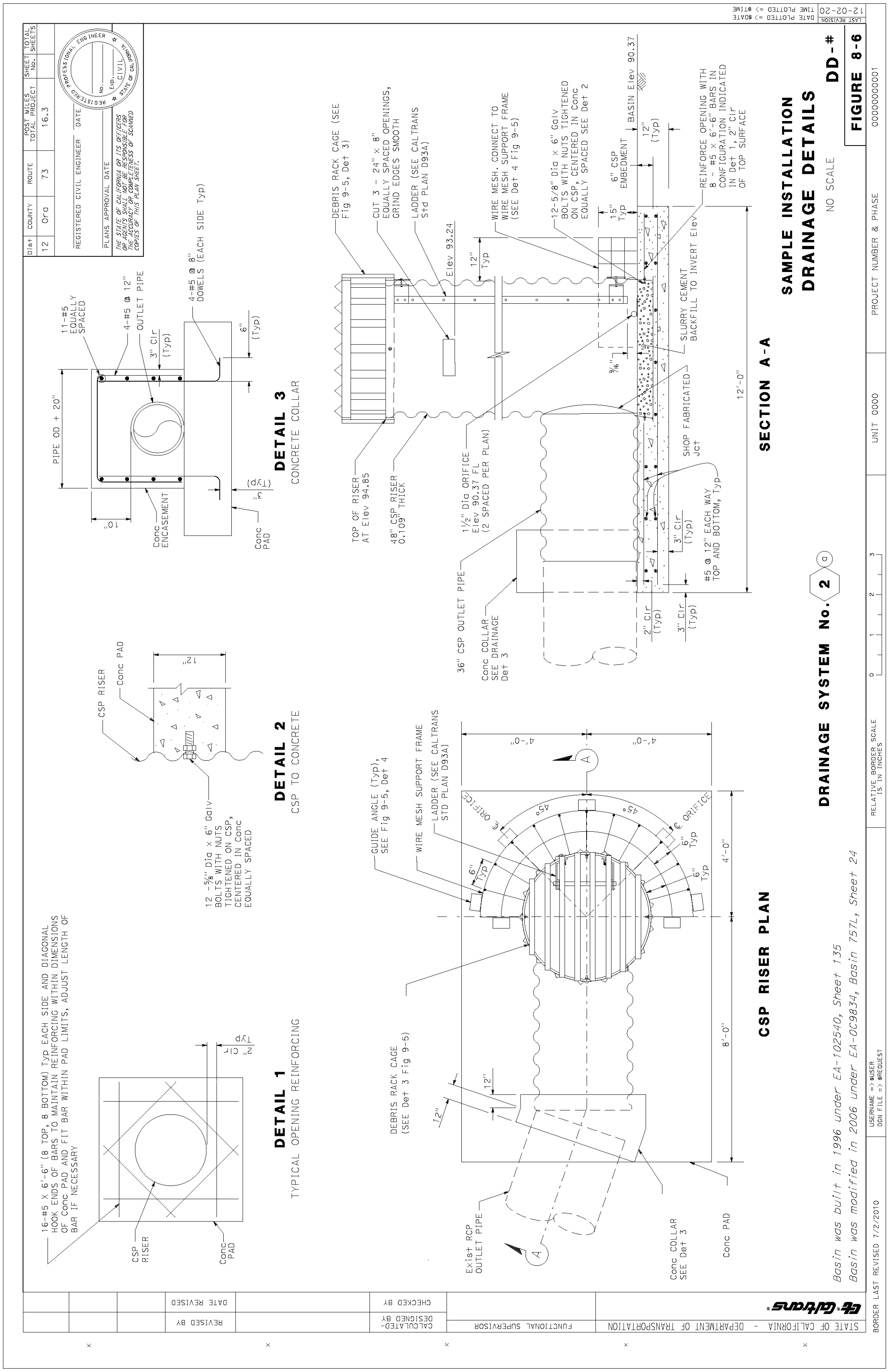


Figure 8-6. Basin Drainage Details

This page intentionally left blank.

Section 9

Water Quality Outlet Riser

Water quality outlet risers are the primary water quality outlet structures and can be configured to serve as the primary or secondary overflow structures for Detention Basins, Wet Basins, and Austin Sand Filter –Full Sedimentation Device (Earthen Type) BMPs. The purpose of Type 1 and Type 2 devices is to provide a release of both the WQV and overflow volumes. The purpose of a Type 3 device is to provide a controlled release of the WQV without provision for overflow. A Type 3 device is used in conjunction with another supplemental detail structure providing overflow release such as an overflow spillway or overflow riser. The release of the WQV from the water quality outlet riser is controlled with a system of orifices drilled through the riser at specified locations.

When used as an overflow device in addition to a water quality outlet, the basin overflow is controlled with the open top of the riser acting as a spillway (weir or orifice). For this reason, a separate overflow riser in conjunction with a water quality outlet riser is typically not required for detention devices. See Section 8 for discussion concerning the use of an overflow riser.

Figures 9-2 through 9-5 are the Standard Details for water quality outlet risers.

9.1 Design Basis

The Standard Details for water quality outlet risers were developed based on the following design criteria:

Table 9-1. Water Quality Outlet Riser Standard Detail Design Basis

Parameter	Preferred	Alternate
Material	CSP	None
Top (open/sealed)	Open with Debris Rack Cage	Sealed with Access
Riser Thickness	0.079 in	0.109 in
Parameter	**Minimum**	**Maximum**
Water Quality Volume	Up to 5,000 CF	15,000 CF
Overflow Design Volume	Per HDM	Per HDM
Design Basin or Filtration Device Drain Time	24 hrs	72 hrs
Height	16 in	12 ft
Diameter	48 in	None
Orifice Size (Diameter)	½ in	1 1/8 in
Number of Orifices	4	Per Drain Time
Wire Mesh Screen Opening	¼ in	0.75 x Orifice Size
Distance between Wire Mesh Screen & Riser	12 in	

9.2 Getting Started

Selection of the appropriate water quality outlet riser requires knowledge of the geometry, function, inflow (HDM event) and WQV of the basin or filter BMP device. The first design determination is the height of the riser (Type 1 and Type 2) above the basin invert or low point. In general, the height of the riser above the basin or filter device invert is determined by setting the elevation of the top of the riser at the same elevation as the water surface elevation anticipated during a water quality event. The elevations that must be considered when designing a water quality outlet riser are as follows:

H_{invert} = the elevation of the Basin invert;

H_{WQV} = the peak water surface elevation during a water quality event. This elevation is also coincident with the overflow inlet elevation of the water quality outlet riser;

H_{max} = the maximum water surface elevation anticipated during an overflow event; and

$H_{freeboard}$ = the elevation of the top of the embankment; $H_{freeboard} = H_{max} + 12"$

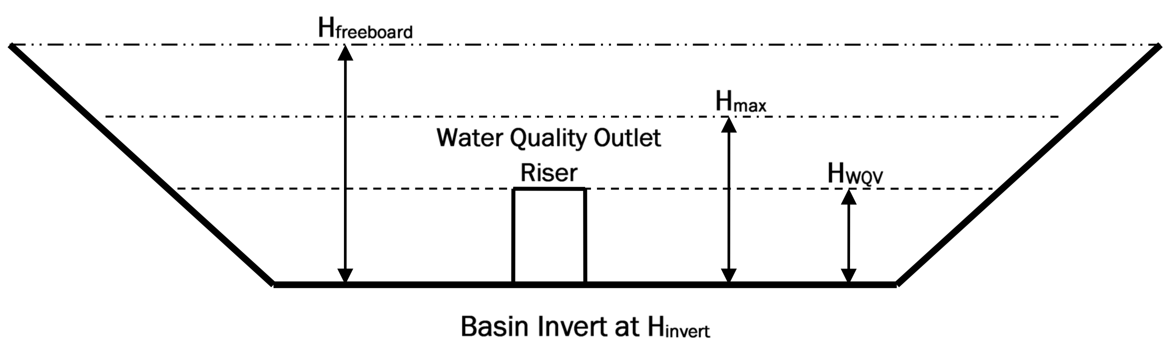


Figure 9-1. Basin Schematic Showing Elevations

For Type 1 and Type 2 risers, the overflow elevation should be set at the same elevation as the WQV surface elevation during an overflow event. The maximum head available to drive the overflow through the release device is the difference between H_{max} and H_{WQV}. The engineer must verify that the height of the riser does not exceed the maximum height as shown in the standard details (Figures 9-2, 9-3 and 9-4).

Once the height of the water quality outlet riser and the WQV have been determined, the engineer will utilize Section 3.2 of the Detention Basins Design Guidance (Caltrans 2020b) to determine the size and number of the orifices to meet the required drain time. A minimum of 4 orifices will be used, and when necessary multiple rows of orifices may be used to increase the outlet volume. A minimum of three-diameter spacing between orifice rows is recommended. A discharge time of 40 to 48 hours is the preferred drain time, with 24 hours the minimum and 96 hours the maximum drain time allowed to prevent insect vector issues associated with standing water.

9.3 Type/Size Selection

There are three types of water quality outlet risers available to the engineer, with orifice openings accommodating a WQV up to 15,000 cubic feet. The use of a Type 1 (Figure 9-2) or Type 2 (Figure 9-3) riser is dependent on the elevation of the basin or device outlet pipe. The Type 1 riser is used when the outlet pipe inlet is at or near the basin or device low point. The Type 2 riser is used when the outlet pipe inlet elevation is up to 8.67 ft below the basin floor or device low point. It is recommended that the Type 1 riser be used whenever possible due to the reduced installation cost and maintenance requirements. The Type 3 (Figure 9-4) water quality outlet riser is utilized when the riser is to be used for WQV release only, and overflow is provided by another device such as an overflow riser or overflow spillway.

9.4 Layout

The water quality outlet riser is located at the basin or filter low point. When used in conjunction with a low flow channel, the engineer must exercise care to verify conform from the low flow channel to the water quality outlet riser basin slab. The engineer must also consider locating the riser such that adequate clearance is provided around the device for maintenance and operations. The outlet of the riser will connect to the outlet drainage system of the basin. Release flows should be directed into existing or improved drainage systems, and the engineer's attention is directed to prevention of erosion and scour at the outlet end. It is recommended that the basin outlet pipe be set at a slope to established self-cleaning velocities per the HDM.

9.5 Design Elements

In general, the selection of the water quality outlet riser orifice size should correspond with the desired WQV, as indicated in the "Orifice Type Sizing Table" on the Standard Detail shown in Figure 9-5. The riser details include a stainless steel screen mesh to protect the orifices from clogging, slab and anchorage details, and reference to ladder details found elsewhere in the Standard Plans. If the height of the water quality outlet riser is less than 3 ft., the ladder can be eliminated by note.

The orifice size schedule is designed to achieve the required detention time and minimize the risk of clogging. The orifice size selected should be sufficient to drain the basin within 24 to 96 hours (also referred to as "drawdown time"). The 24-hour limit provides adequate settling time; the 96-hour limit mitigates vector control concerns.

The riser is securely fastened to a reinforced concrete foundation designed to resist overturning and uplift due to buoyancy. The foundation is sized to resist the buoyancy of an empty riser with a 1.25 factor of safety.

9.6 PS&E Preparation

The water quality outlet riser shall be shown on the drawings, with Type 1, Type 2, or Type 3 specified by note. Additionally, the orifice number, size and spacing shall be clearly identified on the drainage plan and details. The design WQV to be discharged by the riser shall be noted to clearly identify the orifice size and spacing requirements. The relationship of the riser basin slab and invert elevation shall be shown on a drainage profile or detail. The quantities for water quality outlet riser will be shown in a Quantity Summary Table on the drawings under "Minor Concrete (Minor Structure)", "Miscellaneous Metal", and "Corrugated Metal Pipe". Quantities of concrete and steel are identified on the standard details; however, the engineer must know the height of the riser and ladder to determine metal quantities.

The "Water Quality Outlet Riser Miscellaneous Details No. 1" standard detail (Figure 9-5) shall be included with the drawings when utilizing the Type 1, 2 or 3 risers. Note that the ladder details are per Standard Plans, and the debris rack and anchorage details of the riser to the concrete are depicted on the standard detail shown in Figure 9-5.

The SSPs for the water quality outlet riser include "Miscellaneous Drainage Facilities" and, "Miscellaneous Metal" and shall be included in the contract special provisions. The pay items in the estimate shall include "Minor Concrete (Minor Structure)", "Miscellaneous Metal", and "Corrugated Steel Pipe", with quantity units of cubic yards, pounds, and lineal feet, respectively, unless payment is included in the TBMP bid item.

9.7 Special Designs

Water quality outlet risers with a WQV less than 4,300 cubic feet or greater than 15,000 cubic feet were not considered in the development of the Type 1, 2 and 3 risers, and therefore will require a special design. When WQV is greater than 15,000 cubic feet, the engineer may consider the use of multiple standard riser devices; however, care must be exercised to verify that complete drainage is achieved, and vector control issues are eliminated. Alternatively, the engineer may recalculate the number and size of the riser orifices and replace the standard details with a special design.

If the geometry of the basin requires a water quality outlet riser greater than 12 ft in height, the riser basin slab must be designed to meet the overturning and buoyancy requirements. In some cases, the engineer is directed to consult with the District Hydraulics Branch.

The wire mesh screen used for the water quality outlet riser is intended to prevent clogging of the orifice(s) and the debris rack is used to prevent larger floatables from entering into the drainage system; neither achieves the full trash capture standard. The water quality outlet can be modified to potentially classify the surrounding TBMP as a full trash capture system, equivalent to a Gross Solids Removal Device, if additional screening is provided to prevent particles that are 5 mm or greater from entering the outlet and trapping the debris within the confines of the TBMP.

Standard meshes or screens have not been developed to achieve the 5 mm screening. The use of proprietary or special designs to provide this screening must be approved by the appropriate District functional units and OHSD. The design engineer must consider the need to expand or alter the dimensions of the TBMP if the water quality outlet riser is modified to achieve full trash capture considering potential clogging and longer drawdown times for water to drain through the mesh or screen. Maintenance access must also be considered for both the 5 mm screening device and the outlet structure; access doors, hatches, or other design features should be considered to allow for cleaning and inspection.

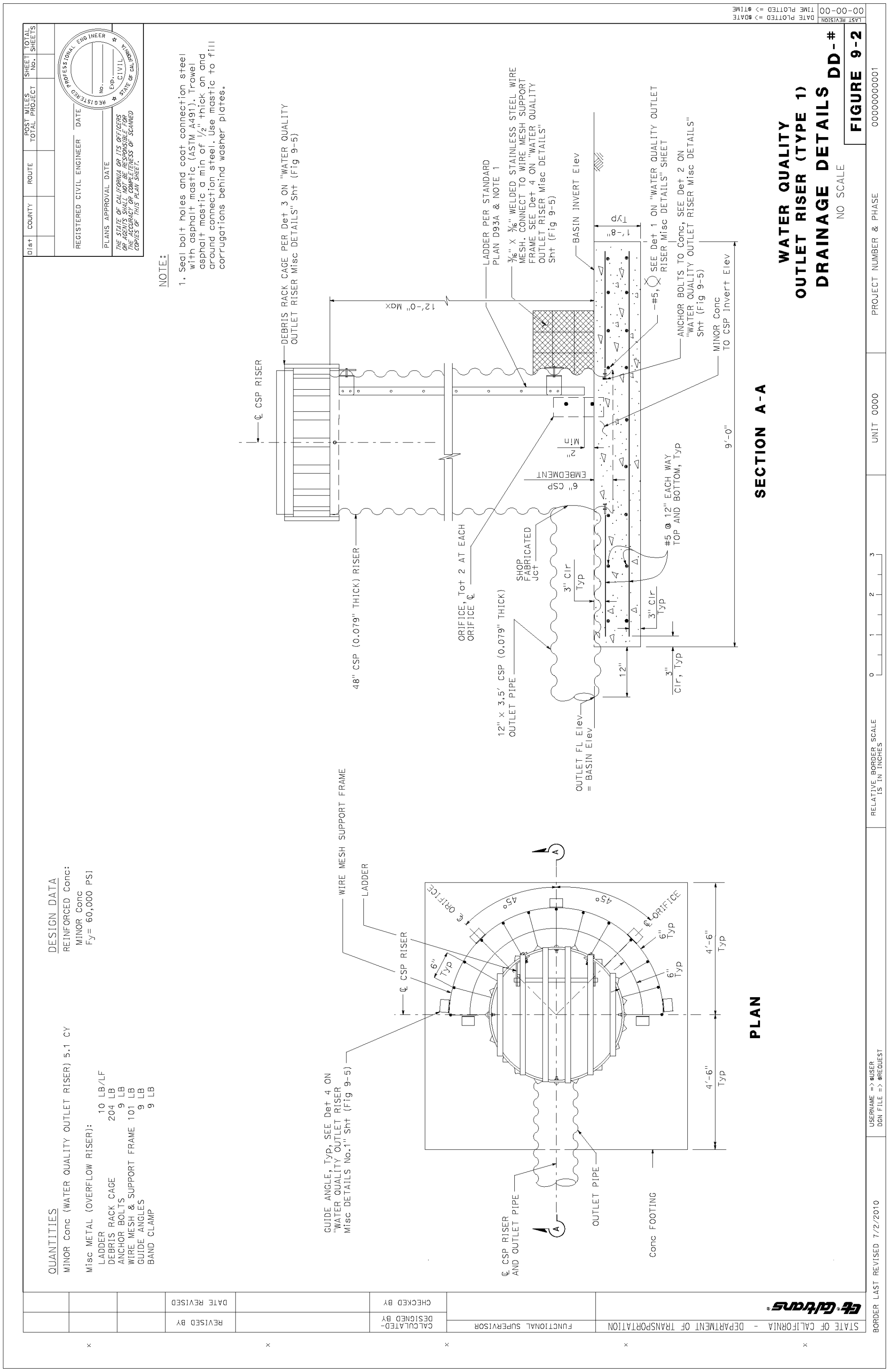


Figure 9-2. Water Quality Outlet Riser Type 1

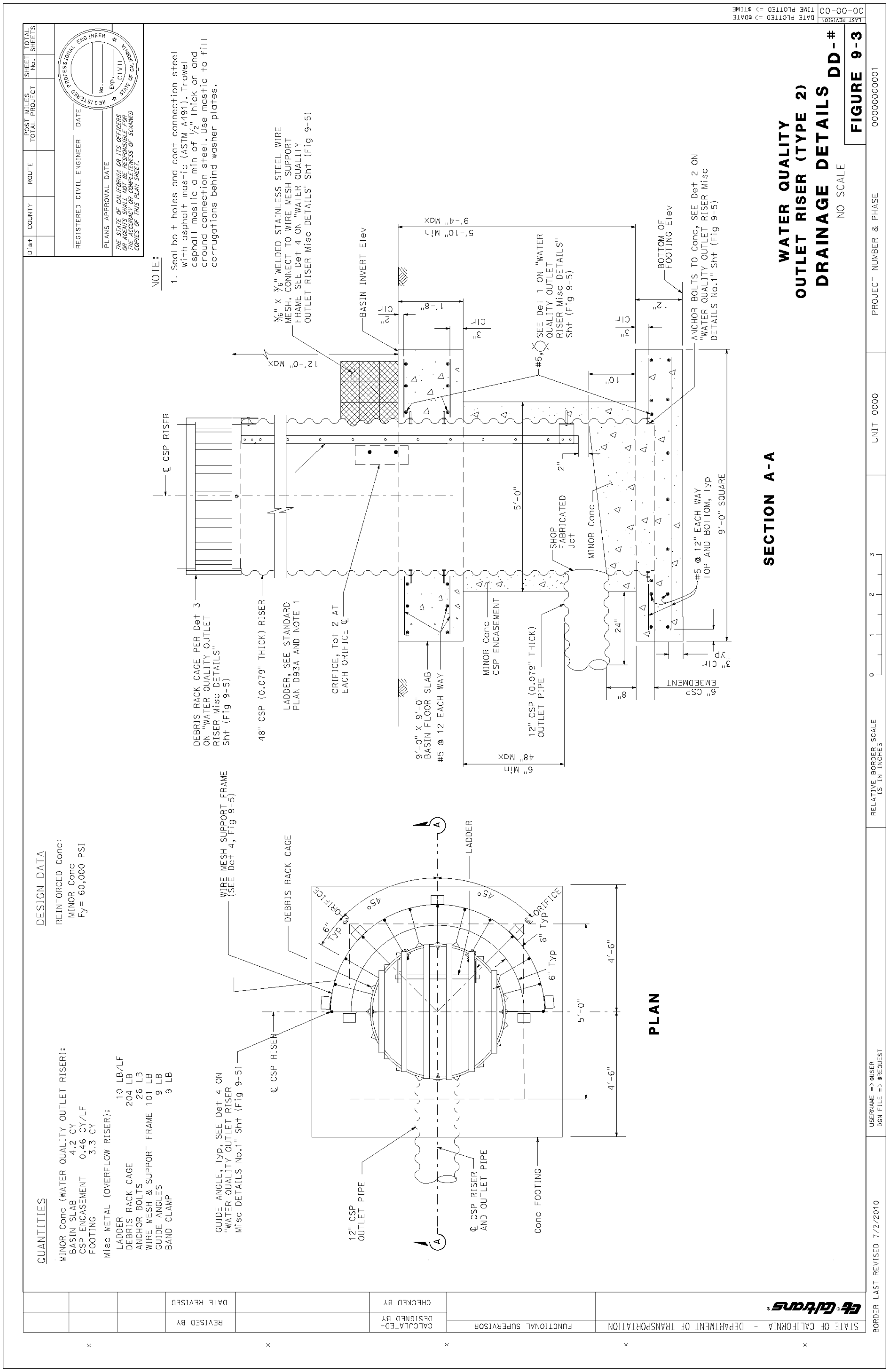


Figure 9-3. Water Quality Outlet Riser Type 2

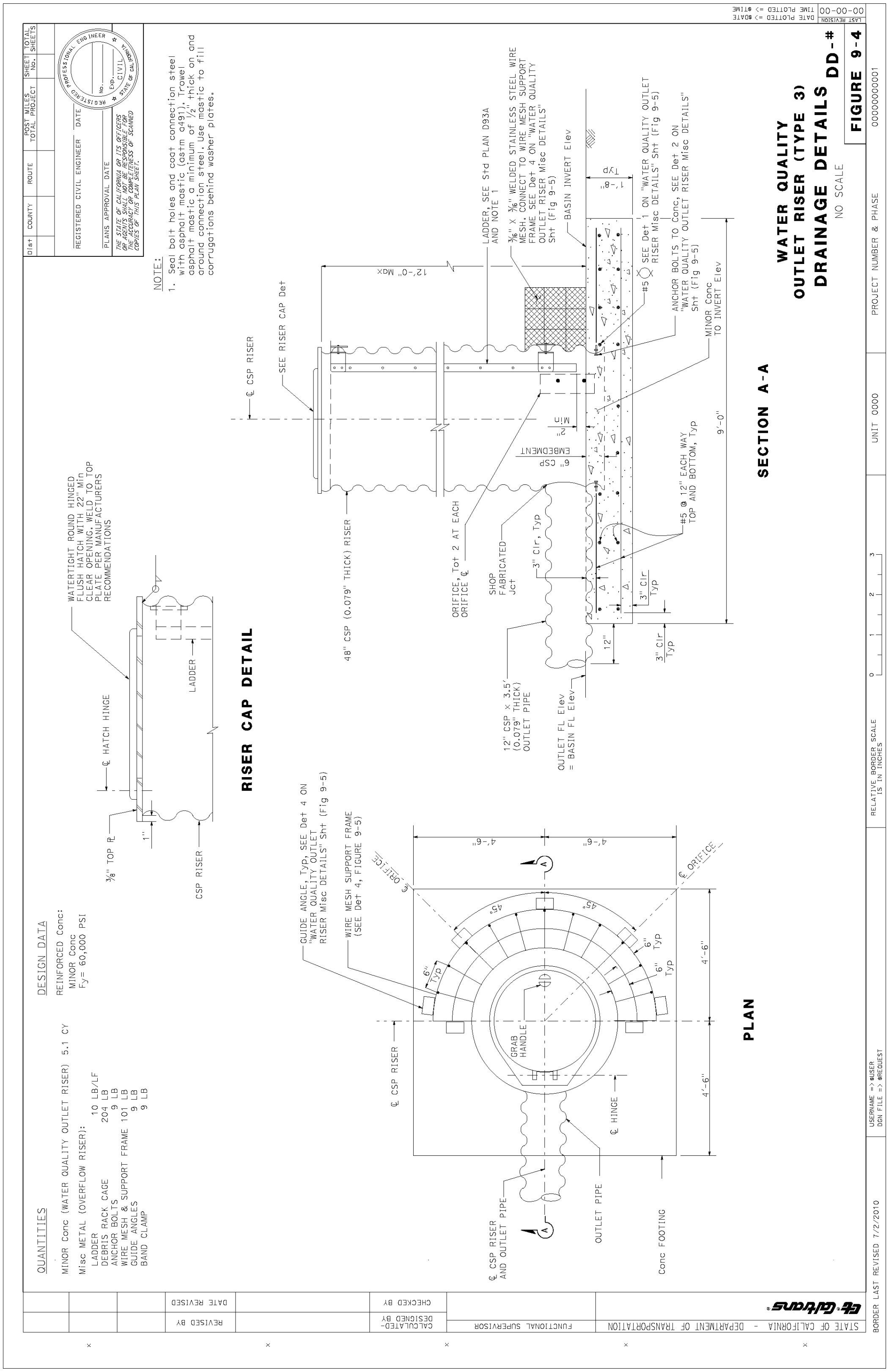


Figure 9-4. Water Quality Outlet Riser Type 3

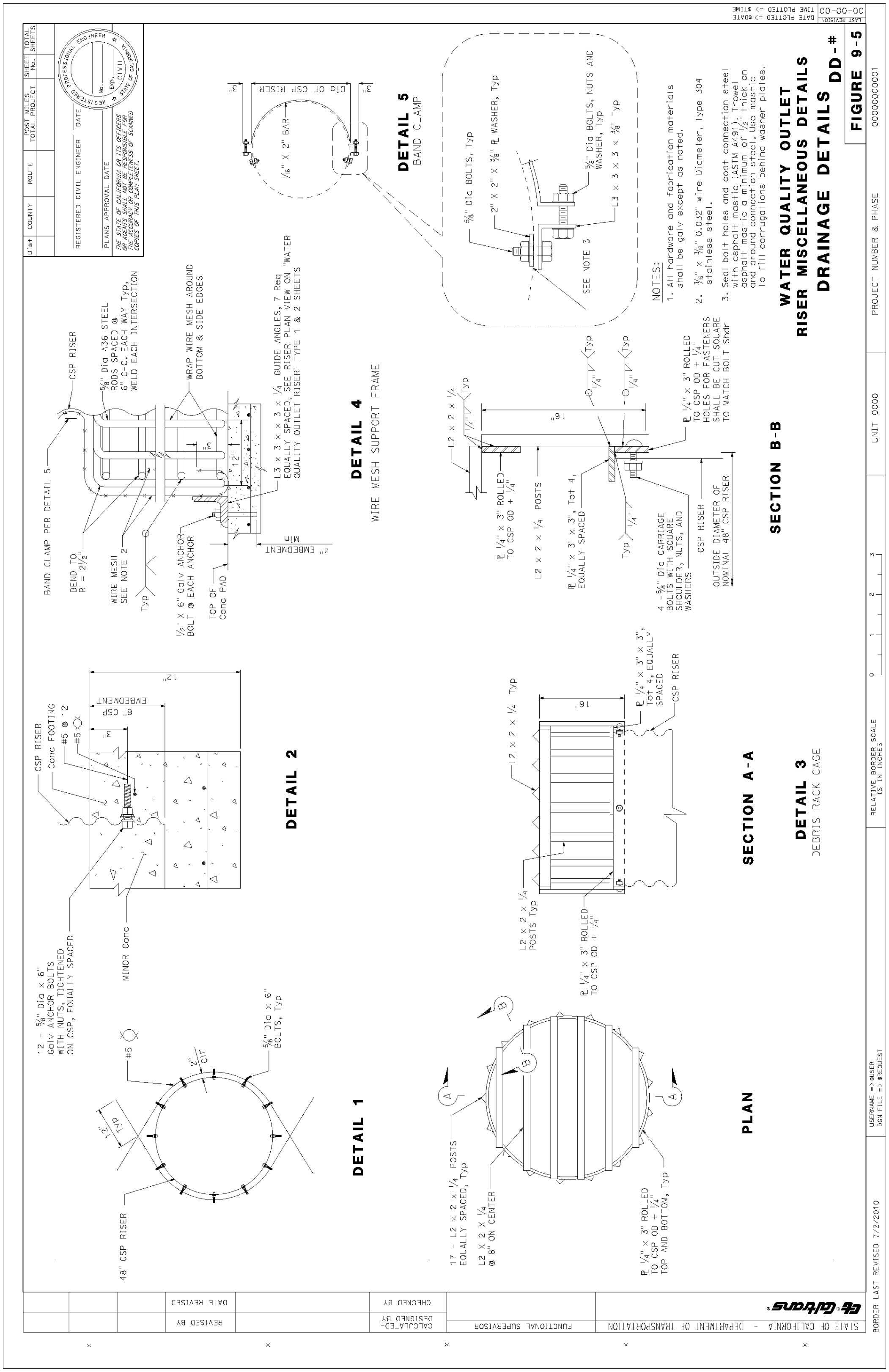


Figure 9-5. Water Quality Outlet Riser Miscellaneous Details

This page intentionally left blank.

Section 10

Maintenance Access Ramp (Earthen Berm)

Maintenance access ramps provide access in and out of detention devices, Austin Sand Filters – Full and Partial Sedimentation Devices (Earthen Type), Infiltration Basins, and Wet Basins to maintaining these BMP devices. Figure 10-1 provides a supplemental detail of an access ramp.

10.1 Design Basis

The standard detail for maintenance access ramp (earthen berm) were developed based on the following design criteria:

Table 10-1. Access Ramp (Earthen Berm) Standard Detail Design Basis

Parameter	Preferred	Alternate
Material	Concrete	Asphalt Concrete
Parameter	Minimum	Maximum
Slope	None	10%
Cross Slope	0%	+/- 2%
Width	10 ft	15 ft

10.2 Getting Started

Access ramps (earthen berm) are site and BMP device-specific, and the engineer must determine grading and layout to meet the above design criteria. The supplemental details are provided to assist the engineer with layout and provide a pre-designed typical section to meet the maintenance vehicle and equipment loading requirements. Generally, it is recommended that the access road within the basin or device have a nominal drainage cross slope to provide positive drainage of the ramp. On the ramp outside of the basin, standard design practice is recommended for drainage considerations.

10.3 Type/Size Selection

The engineer must determine the appropriate layout and cross section properties to meet the site-specific constraints of the project.

10.4 Layout

Layout should meet the needs of likely maintenance vehicles and equipment, so excessive slopes and small radii should be avoided. Cut and fill slopes shall meet those shown on the Standard Detail, but in no case shall exceed the recommendations of the project's Geotechnical Engineer. Egress and turnaround areas associated with the access ramps must also be considered during layout. If ramp drainage using cross slope cannot be utilized, a cut-side ditch may be used; however, the ditch outlet condition at the bottom of the ramp must be considered.

10.5 Design Elements

The use of an access ramp for access in and out of basins and low flow channels must be coordinated to conform to the other Supplemental Detail devices identified in this guidance document. Asphalt concrete surfacing of the ramp is not recommended within the basin or filter device due to saturation of the subgrade. The width of the top of berm will affect the access ramp, and vehicle access around the perimeter of the basin or filter device is recommended, especially in conjunction with overflow drain valve and overflow spillway supplemental details.

For long ramps, greater than 25 feet, and ramps with steep side slopes, the engineer shall consider adding a Type A Dike along the edge of the ramp to prevent drainage scour. With the addition of a dike, the engineer will extend the ramp at the bottom of the basin to reduce runoff water velocity to prevent basin bottom scour.

10.6 PS&E Preparation

Access ramps shall be shown in plan on the drainage or layout drawings. The typical cross section, if different from the Standard Detail, will be shown on project typical cross sections. The Standard Detail shall be included with the project plans. Volumes of concrete and aggregate base materials shall be calculated and displayed in a Quantity Summary Table on the drawings under "Minor Concrete (Minor Structure)" and "Class 2 Aggregate Base". The pay items to be included in the estimate shall be "Minor Concrete (Minor Structure)" and "Class 2 Aggregate Base", with the quantity units of cubic yards for both items, unless payment is included in the TBMP bid item.

10.7 Special Designs

Access ramps utilizing pavement other than concrete, and ramps with slopes greater than 10% will require a Special Design. Use of Special Design access ramps will require project-specific plans, SSPs and pay items. Use of special design access ramps should be pre-approved by the local Maintenance Supervisor.

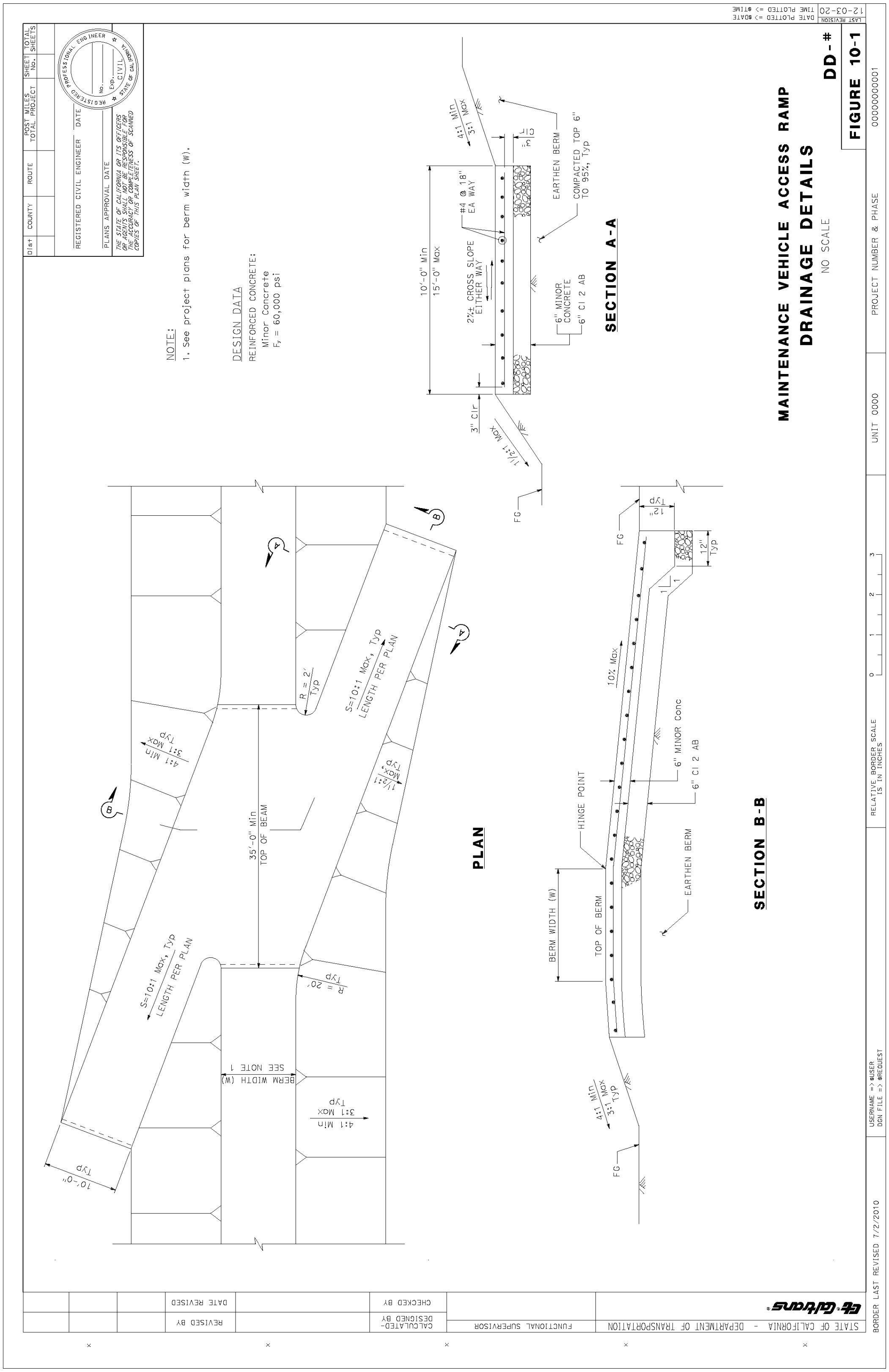


Figure 10-1. Construction Details Maintenance Vehicle Access Ramp

This page intentionally left blank.

Section 11

Sediment Forebay

Sediment Forebay can be considered just upstream of TBMP devices. The goal of the sediment forebay is to capture sediments before they enter the TBMP device, in order to increase the operational life of the filter bed within the device. Sediment forebay can be configured as a natural depression in a vegetated Biofiltration swale (earthen), or could be constructed as a more defined structure, with concrete walls constructed from k-rail or cast in place reinforced concrete. Each Sediment Forebay would be sized to hold a small volume, on the order of 5 to 10% of the WQV but would not be used to reduce the design WQV of the TBMP device. Vegetated earthen sediment forebays are preferred, as the limited volume usually could infiltrate within 96 hours after a storm ended.

Additional information will be developed for this section at a later date. Consult with the District Design Stormwater Coordinator if a Sediment Forebay is under consideration.

This page intentionally left blank.

Section 12

Weephole

A weephole is a small opening(s) within a drainage structure to allow for standing water to slowly drain into the surrounding soils to alleviate standing water and avoid vector issues within the drainage structure. Weepholes are used as a supplemental detail in Caltrans-Approved TBMPs such as Traction Sand Traps, media devices, and other vault type structures. Figure 12-1 shows the standard detail for a weephole used for drainage inlet type sand traps.

12.1 Design Basis

The standard detail for weephole was developed based on the following design criteria:

Table 12-1. Weephole Standard Detail Design Basis

Parameter	Preferred	Alternate
Shape	Circular	None
Wire Cloth Material	Hot-dipped galvanized steel	Stainless steel
Subbase Material	Permeable Material	Base Rock
Parameter	Minimum	Maximum
Weephole Diameter	10"	18"
Lifting Eye	1"	3"
Subbase Depth	12"	18"

12.2 Getting Started

A weephole is recommended for use where there is the potential for stormwater to accumulate within a BMP and present a vector issue. The drainage structure using a weephole may include an outflow pipe that is raised above the invert of the structure to create a trap for the collected debris and fines. The raised outlet will result in the accumulation of stormwater below the invert elevation of the outflow pipe. If not drained, the accumulated stormwater can present a vector issue. Additionally, subsequent rain events or higher flows can cause the accumulated sand to suspend and be carried into the outflow pipe. A weephole placed at the bottom of the inlet allows for the accumulated stormwater to drain into the surrounding soils.

12.3 Type/Size Selection

Multiple types of weephole designs are shown on the drawings. The weephole detail should be selected based on the drainage structure type.

12.4 Layout

A weephole should be considered for vault type TBMPs. The weephole design should consider the amount of debris or fines that is expected to enter vault or drainage structure, the infiltration characteristics of the native soil, and maintenance needs. These parameters are necessary to determine the dimensions of the subbase layer and potentially the need for additional upstream controls to allow for the appropriate capture of debris and infiltration of accumulated stormwater.

12.5 Design Elements

Design elements for weepholes have been incorporated into the standard detail. The weephole design includes a subbase layer to provide additional void space for stormwater to drain out of the drainage structure and infiltrate into the surrounding soils. Filter fabric is placed around the subsurface layer and a wire cloth is used to separate the drainage structure base from the subsurface layer to prevent the collected debris or fines (e.g. traction sand) and surrounding soils from clogging the layer. A removable concrete ring is placed to hold the wire mesh, filter fabric, and subsurface layer in place. The concrete ring is removable to allow for maintenance access to clean the weephole materials.

The design should consider construction phasing of the weephole to prevent clogging of the filter fabric and permeable material from sediment-laden runoff or construction debris related to construction of the inlet structure. To prevent construction related impacts, it is recommended that temporary filter fabric layer be used until the drainage structure is completed and the upstream watershed has been permanently stabilized,

12.6 PS&E Preparation

Weepholes shall be shown on the contract plans and incorporated into the details developed for the vault or drainage structure that will use the weephole. The drainage plans, profiles, or other sheets shall identify the dimensions and flowlines of inlet and outlet culverts. The quantity for the weephole can be determined as each by actual quantity determined in place, which would require an nSSP to be submitted for approval by the appropriate functional units and OHSD. The weephole can also be quantified by cubic yard of minor concrete (minor structure), filter fabric, and permeable material. The quantity should be summarized in a Quantity Summary Table. The quantity for reinforcement does not need to be calculated or summarized because it is included in the estimate for minor concrete (minor structure).

12.7 Special Designs

The standard weephole detail drawings provided in this section is for modified pipe inlet type Traction Sand Traps. Weephole structures should be considered for the bottom of all vault type devices to manage low flow drainage conditions and vector issues. Similar configurations as those presented in this standard weephole design can be used or other configurations can be designed. Alternative weephole design details must be shown on the contract plans and approved by the appropriate District functional units and OHSD.

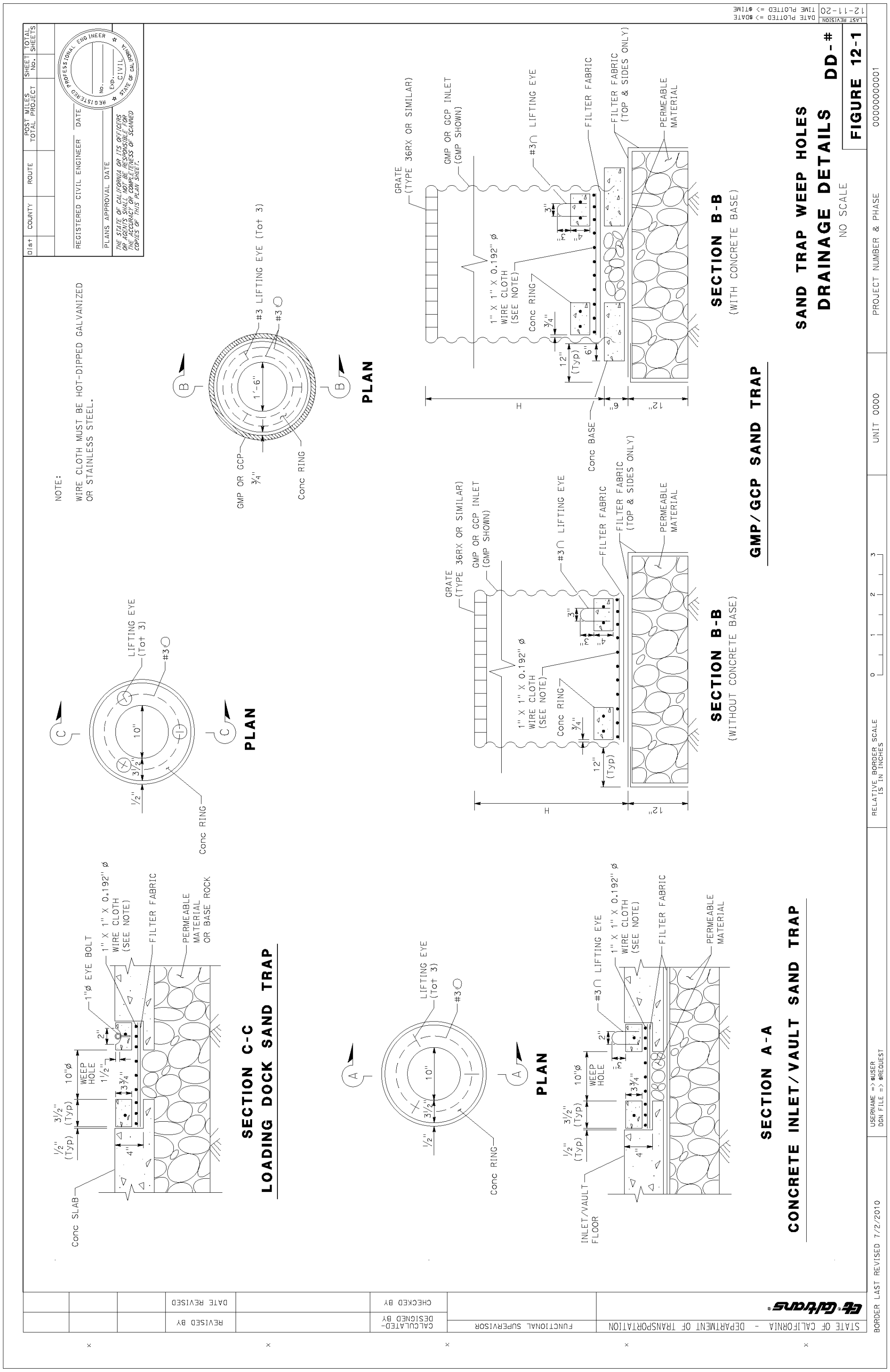


Figure 12-1. Weephole, Modified Pipe Inlet Type Traction Sand Trap

Section 13

Trash Baffle

A trash baffle is a structure used within a TBMP to prevent floatable material from being transported downstream. A trash baffle is used as a supplemental detail in Caltrans-Approved TBMPs such as Earthen Austin Sand Filter and Delaware Sand Filter devices. Figure 13-1 shows the standard detail for a trash baffle used for these devices.

13.1 Design Basis

The standard detail for trash baffle was developed based on the following design criteria:

Table 13-1. Trash Baffle Standard Detail Design Basis

Parameter	Preferred	Alternate
Plate Material	Plastic	Fiber Reinforced Plastic
Bracket Material	Galvanized Steel	None
Spacing between brackets	2'	None
Parameter	**Minimum**	**Maximum**
Weir and Baffle Opening Spacing	4"	6"
Wall Height	10"	6'

13.2 Getting Started

A trash baffle is recommended for use within media filter devices to prevent floatable trash and debris from being transported into the filter chamber from the sediment chamber. This condition can occur during storm events that result in the hydraulic grade being higher than the berm or wall separating the two chambers. In the Delaware Sand Filter, runoff is captured in the sediment chamber until the water surface overtops the center weir and allows runoff to enter the filter chamber. In the standard design, the center weir allows floatable material to pass into the filter chamber which may reduce BMP effectiveness. Designing a trash baffle on the center weir will prevent floatable material from entering the filter chamber.

The trash baffle presented in this document is not intended to achieve full trash capture but to prevent larger floatable materials from being carried into the sediment chamber of a media device or into downstream drainage facilities.

13.3 Type/Size Selection

The height of the baffle wall should consider the hydraulic grade line within sediment chamber during design storm events, and for a Delaware Sand Filter also consider the allowable height of standing water within the sediment chamber. The height of the wall should consider the need to act as a weir structure for overflow if the spacing between the wall and center weir becomes clogged.

The spacing between the trash baffle wall and the center weir must be a minimum of 4 inches to allow stormwater runoff that enters the TBMP to flow into sediment chamber of the media filter. A smaller spacing can result in clogging of the opening and prevent stormwater from flowing over the weir and into the sediment chamber. A larger opening can be proposed but will reduce the effectiveness of the trash baffle system by providing more room for floatables to flow through the opening and into sediment chamber.

13.4 Layout

A trash baffle should be considered where there is a potential for stormwater runoff containing floatable trash and debris to enter the TBMP. The trash baffle design should consider the amount of floatables material that is expected to enter the TBMP, the amount of runoff, hydraulic grade, and maintenance. These parameters are necessary to determine the wall height and opening width between weir trash baffle.

13.5 Design Elements

The trash baffle design elements have been incorporated into the standard detail. The design includes a center weir structure separating the sediment and filter chamber; the center weir can be the berm or structure used in the media filter design to separate the two chambers or a separate structure specially designed for the trash baffle. A galvanized support bracket structure is used to connect the trash baffle to the center weir. The standard detail does provide the typical spacing between the support brackets; however, the design engineer should determine the specific support bracket details and material thickness. Evaluate the additional forces on the structure separating the sediment chamber from the filter chamber created by the trash baffle to ensure that the structure will not overturn. The trash baffle wall should extend the width of the media filter separating the sediment and filter chambers. The material of the wall should be plastic or fiber reinforced plastic; the use of alternate materials may be considered, such as recycled plastic lumber that is used for the baffle wall described in Section 3 of this document. The baffle wall material and design must be approved by the Design Stormwater Coordinator, Structure Design, and OHSD.

13.6 PS&E Preparation

Trash baffle shall be shown on the contract plans and incorporated into the details developed for the TBMP using the baffle wall. The Drainage or Construction Detail sheets shall identify the trash baffle wall height and dimensions of the support bracket. The quantity for the trash baffle can be determined as each, which would require an nSSP to be submitted for approval by the appropriate functional units and OHSD. The trash baffle can also be quantified by cubic yard of minor concrete (minor structure) for the center weir, pound of miscellaneous iron and steel for the support bracket, and thousand foot board measure of plastic lumber. The quantity should be summarized in a Quantity Summary Table.

13.7 Special Designs

A standard trash baffle detail drawing is provided in this section. Similar configurations as those presented can be used or other configurations can be designed. Alternative baffle wall design details must be shown on the contract plans and approved by the appropriate District functional units and OHSD.

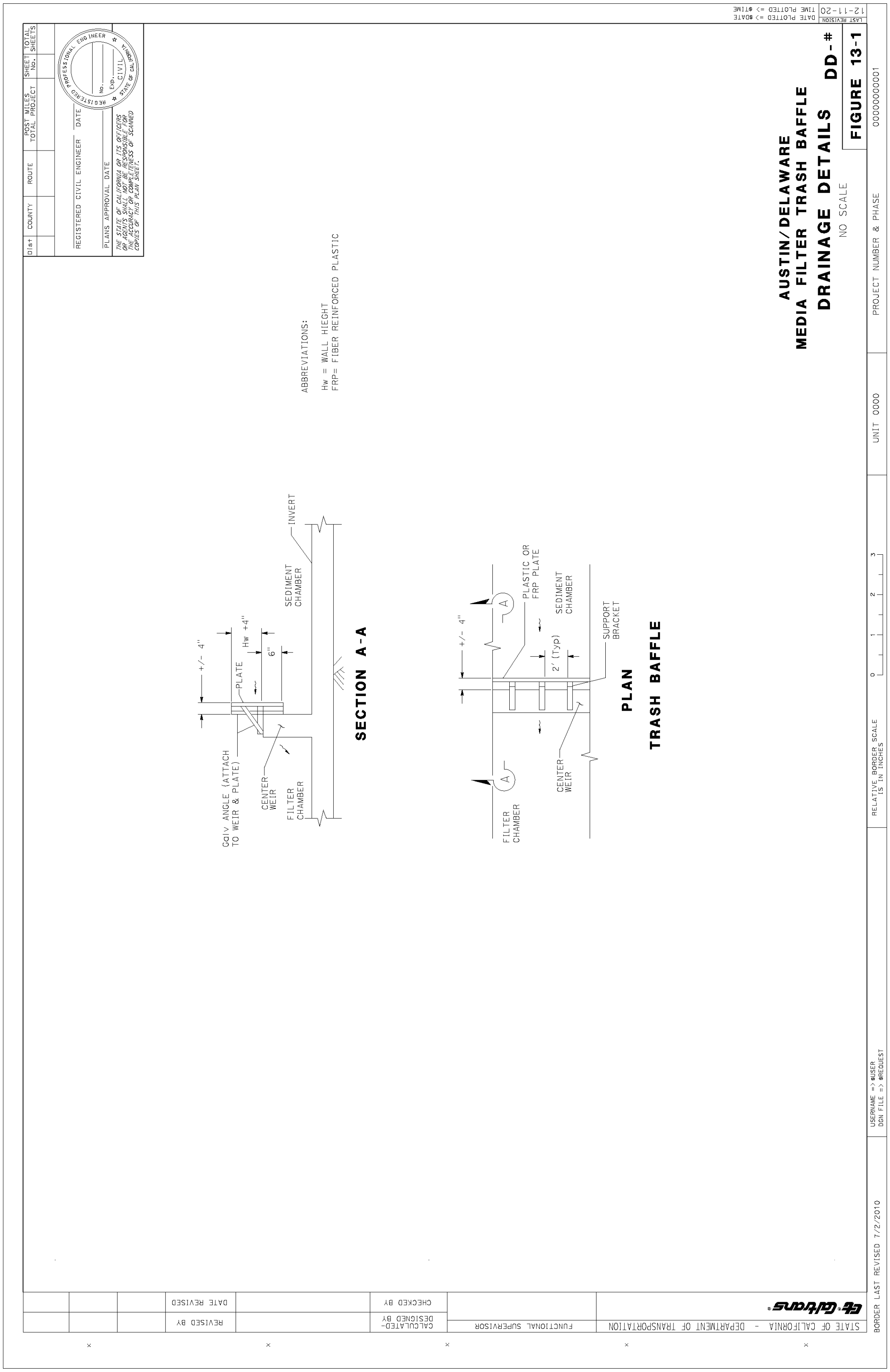


Figure 13-1. Trash Baffle

Section 14

References

California Department of Transportation (Caltrans), 2020a. Highway Design Manual 6th Edition, March 2020

California Department of Transportation (Caltrans), 2020b. Stormwater Quality Handbooks: Detention Basins Design Guidance

California Department of Transportation (Caltrans), 2019. Stormwater Quality Handbooks: Project Planning and Design Guide (PPDG), April 2019

This page intentionally left blank.