OPERATION & MAINTENANCE MANUAL

Water Quality Planter

Manual prepared: August 2019

DFI No. D00919, D00920, D00921, D00922

Figure 1: Typical Planter

1. Identification

Drainage Facility ID (DFI):	D00919
Facility Type:	Water Quality Planter
Construction Drawings:	49V-060
Locations:	District: 1 Highway No.: 009 Mile Post: 65.41 – 65.42

Drainage Facility ID (DFI):	D00920
Facility Type:	Water Quality Planter
Construction Drawings:	49V-060
Locations:	District: 1 Highway No.: 009 Mile Post: 65.41 – 65.42

Drainage Facility ID (DFI):	D00921
Facility Type:	Water Quality Planter
Construction Drawings:	49V-060
Locations:	District: 1 Highway No.: 009 Mile Post: 65.43 – 65.44

Drainage Facility ID (DFI):	D00922
Facility Type:	Water Quality Planter
Construction Drawings:	49V-060
Locations:	District: 1 Highway No.: 009 Mile Post: 65.44 – 65.44

2. Manual Purpose

The purpose of this manual is to outline inspection needs and summarize maintenance actions for water quality planters.

3. Facility Location

The location map below details the facility location. The highway, mile posts, side streets, access location, and stormwater flow directions are noted on the map.

Facility location type: Behind sidewalk

Flow direction: Varies

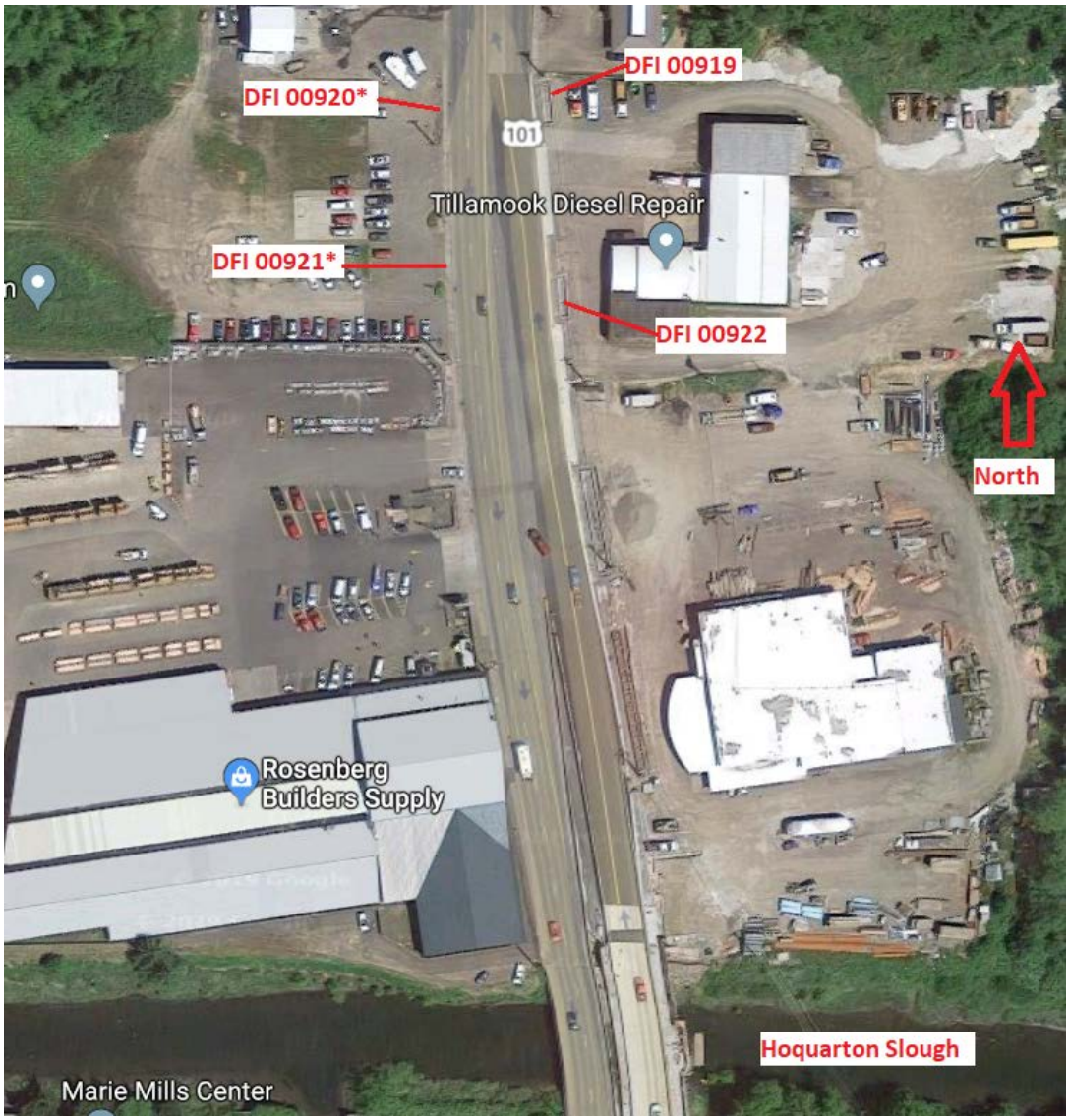


Figure 2: Facility Location Map

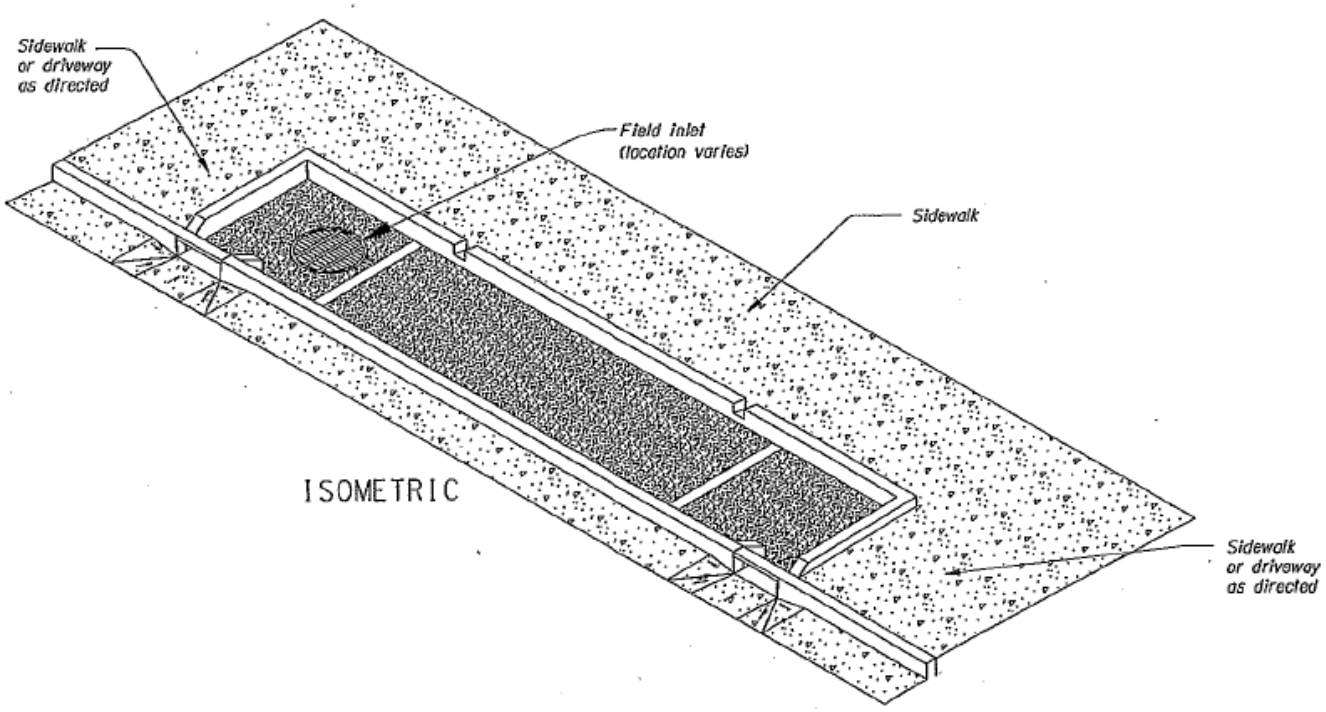
- - Note DFI 00920 & 00921 were not constructed at the time the aerial photograph was taken. This map will be updated.

4. Facility Summary

The length and width of the WQ Planter is based on the dimensions of the inside of the treatment cell.

The length and width of the WQ Planters are:

Facility DFI	Length (Feet)	Width (Feet)
D00919	34	6
D00920	31	5.5
D00921	26	5.5
D00922	32	5.5



Site Specific Information: The planters have blended compost and topsoil mixture. There are no bypass inlets on the planters. Water flows from the gutter, into curb openings, underneath the sidewalk and falls onto concrete splash pads before making contact with the plants and water quality soil mix. Below the 24" of water quality soil mix 3" of filter rock and 12" of granular drain rock exist. Finally, water exits the system through a 4" perf pipe and into the storm drain system. A clean out for the 4" pipe is shown in the photo below.

Figure 3: Facility Components

5. Facility Access

Maintenance access to the facility: Curb and gutter (travel lane)

☒ Lane Closure Needed

Water quality planters do not typically have access roads/access pads, nor are they gated, as they are located in urban areas alongside sidewalks and curbs. Use caution when accessing these facilities as there may be pedestrians or cyclists in the vicinity.

6. Operational Components / Maintenance Items

Classification and Standard Operational (Op) Plan:

This facility is classified as a:

☐ Filterra (Op Plan A)	☒ WQ Planter (Op Plan B)	☐ MWS (Op Plan C)
A Filterra is a single chamber treatment cell that utilizes filter media, a plant, and a perforated underdrain.	A WQ Planter is a single chamber treatment cell that utilizes plants, filter media, and a perforated underdrain. The auxiliary outlet is located inside of the treatment cell.	A Modular Wetland System is a three chamber treatment cell that utilizes plants, filter media, filter media cartridges, and a perforated underdrain network.
A standard operational plan illustrates the general facility footprint configuration and explains the purpose of each facility component. Operational plans (A and B) are provided in the Standard Operation Manual.		

See Appendix A for the site specific operational plan.

Operational Components

The facility components table (**Table 1)** has been provided to highlight the applicable components for this facility. The component is in use when the box contains an “x” (e.g. ☒).

The Standard Operation Manual for Water Quality Planters (implemented April 2018) outlines facility operation, typical footprint configuration, and component definitions and details. A link to the manual is attached to the feature marker in TransGIS.

https://gis.odot.state.or.us/TransGIS/

Maintenance Items

Operational components marked in **Table 1** should be inspected and maintained according to Section 7. Each facility component is defined and detailed in the Standard Operation Manual using the associated ID number indicated below.

Table 1: Facility Components		ID #
Facility Inlet		
Inlet Grate	☐	P1
Curb Inlet	☒	P2
Sidewalk Chute	☒	P3
Bypass Inlet	☐	P4
Treatment		
Plants (Tree or Shrub)	☒	P5
Grass	☒	P6
Water Quality Mix	☒	P7
Filter Media Cartridge	☐	P8
Planter Components		
Perforated Pipe	☒	P9
Outlet Grate	☒	P10
Outfall Type		
Waterbody (Creek/Lake/Ocean)	☐	P11
Ditch	☐	P12
Storm Drain System	☒	P13

7. Maintenance

Maintenance Frequency/Maintain Records

a. Full inspection annually. Preferably prior to the rainy season.
b. Clean and maintain as necessary. Refer to Activity 125 for conditions when maintenance is needed.
c. Keep a record of inspections, maintenance, and repairs.

Maintenance Guide/Maintenance Actions

The ODOT Routine Road Maintenance Water Quality and Habitat Guide (the *Blue Book*) outlines the standard maintenance actions for water quality facilities under Activity 125.

There are standard maintenance tables for standard ODOT designs. The maintenance tables describe the maintenance component, the defect or problem, the condition when

maintenance is needed, and the recommended maintenance to correct the problem. Use the following tables to maintain these water quality planters:

- Table 1 (General Maintenance): Contains general maintenance and inspection guidelines that are applicable to all ODOT water quality facilities. Maintenance of inlets, outlets, trash removal and noxious weeds is recommended seasonally.
- Table 3 (Maintenance of Water Quality or Biofiltration Swales): Contains maintenance information for swales. The planted area of these planters should be maintained as described for the bottom and sides of swales, by using equipment other than mowers to control plant height. Replant if needed with plants from the original plans, or as recommended by ODOT landscaping and stormwater staff.

The *Blue Book* can be viewed at the following website:
http://www.oregon.gov/ODOT/Maintenance/Documents/blue_book.pdf

8. Limitations

Vactors may be used at the inlet, outlet, and grated areas. No heavy equipment may be used in the planted areas.

9. Waste Material Handling

Material removed from the facility is defined as waste by the Department of Environmental Quality (DEQ). Refer to the road waste section of the ODOT Maintenance Yard Environmental Management System (EMS) Policy and Procedures Manual for disposal options:

http://www.oregon.gov/ODOT/HWY/OOM/pages/ems.aspx

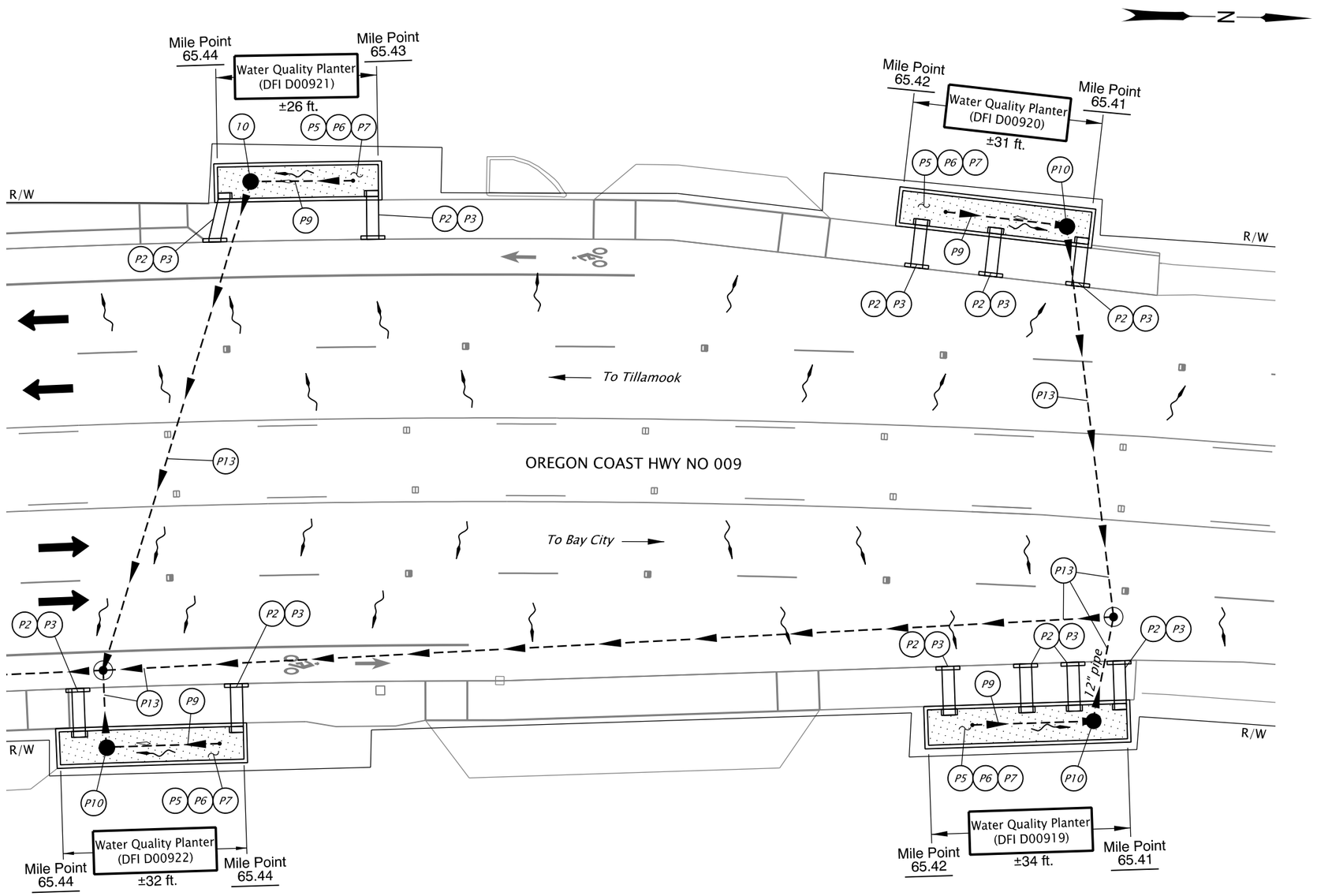
Contact any of the following for more detailed information about management of waste materials found on site:

ODOT Clean Water Unit	(503) 986-3008
ODOT Statewide Hazmat Coordinator	(503) 667-7442
ODOT Region 1 Hazmat Coordinator	(503) 731-8290
ODOT Region 2 Hazmat Coordinator	(503) 986-2647
ODOT Region 3 Hazmat Coordinator	(541) 957-3594
ODOT Region 4 Hazmat Coordinator	(541) 388-6186
ODOT Region 5 Hazmat Coordinator	(541) 963-1590
ODEQ Northwest Region Office	(503) 229-5263

A Appendix A – Site Specific Operational Plan

Contents:

Operational Plan: DFI D00919, D00920, D00921, D00922



LEGEND:

- Photo Location / Direction
- P# — Facility Component (see table 1 in O&M Manual)
- Manhole
- Bioretention Point Outlet
- Storm Pipe (Facility)
- Storm Pipe (Facility)
- Conveyance Direction
- Pavement/Facility Flow Path
- Traffic Flow Direction

Note:
For Typical Elevation and Typical Section see sht. 2.

OREGON DEPARTMENT OF TRANSPORTATION

Sht. 1 of 2

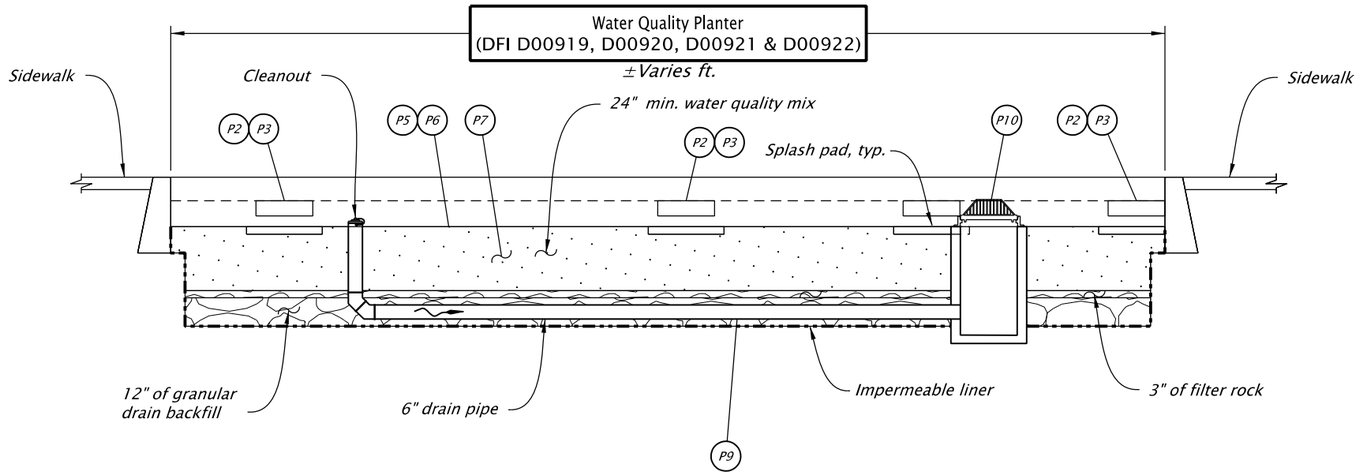
Prepared By: Chris Carman

Drafted By: Michael Skelton

DFI D00919, D00920, D00921 AND D00922
MAINTENANCE DISTRICT 1 HWY 009
WATER QUALITY PLANTERS
OREGON COAST HWY MP 65.41 - 65.44
TILLAMOOK COUNTY

D00919-D00922.dgn :: D00919-D00922_01 9/17/2019 10:03:14 AM hwye93l

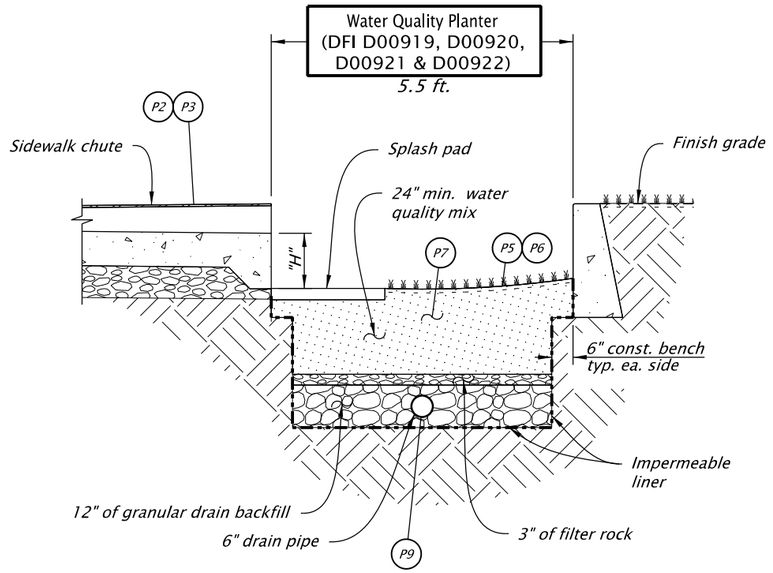
Rotation: 91.0009° Scale: 1"=20'



TYPICAL ELEVATION
N.T.S.

INDEX OF WATER QUALITY PLANTERS

DFI	MILE POINT		LENGTH ±(FT.)	WIDTH ±(FT.)	"H" DEPTH ±(IN.)
	BEGIN	END			
D00919	65.41	65.42	34	6	14
D00920	65.41	65.42	31	5.5	14
D00921	65.43	65.44	26	5.5	14
D00922	65.44	65.44	32	5.5	14



TYPICAL SECTION WITH SIDEWALK CHUTE INLET
N.T.S.

Sht. 2 of 2

OREGON DEPARTMENT OF TRANSPORTATION

Prepared By: Chris Carman

Drafted By: Michael Skelton

DFI D00919, D00920, D00921 AND D00922
MAINTENANCE DISTRICT 1 HWY 009
WATER QUALITY PLANTERS
OREGON COAST HWY MP 65.41 - 65.44
TILLAMOOK COUNTY

B Appendix B – Project Construction Plans

Contents:

Site Specific Subset of Project Contract Plan 49V-060

49V-060

INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
1	Title Sheet
1A, 1A-2	Index Of Sheets Cont.
1A-3	Std. Drg. Nos.
1B	Plan Sheet Layout

STATE OF OREGON

DEPARTMENT OF TRANSPORTATION

PLANS FOR PROPOSED PROJECT

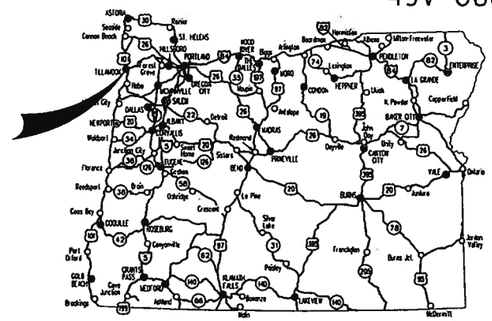
GRADING, DRAINAGE, STRUCTURES, PAVING, SIGNING, ILLUMINATION, SIGNALS, & ROADSIDE DEVELOPMENT

US101 @ OR6 (TILLAMOOK) SEC.

OREGON COAST HWY. & WILSON RIVER HWY.

TILLAMOOK COUNTY

MAY 2016



Overall Length Of Project - 0.4 Miles

ATTENTION:
Oregon Law Requires You To Follow Rules Adopted By The Oregon Utility Notification Center. Those Rules Are Set Forth In OAR 952-001-0010 Through OAR 952-001-0090. You May Obtain Copies Of The Rules By Calling The Center. (Note: The Telephone Number For The Oregon Utility Center is (503) 232-1987.)

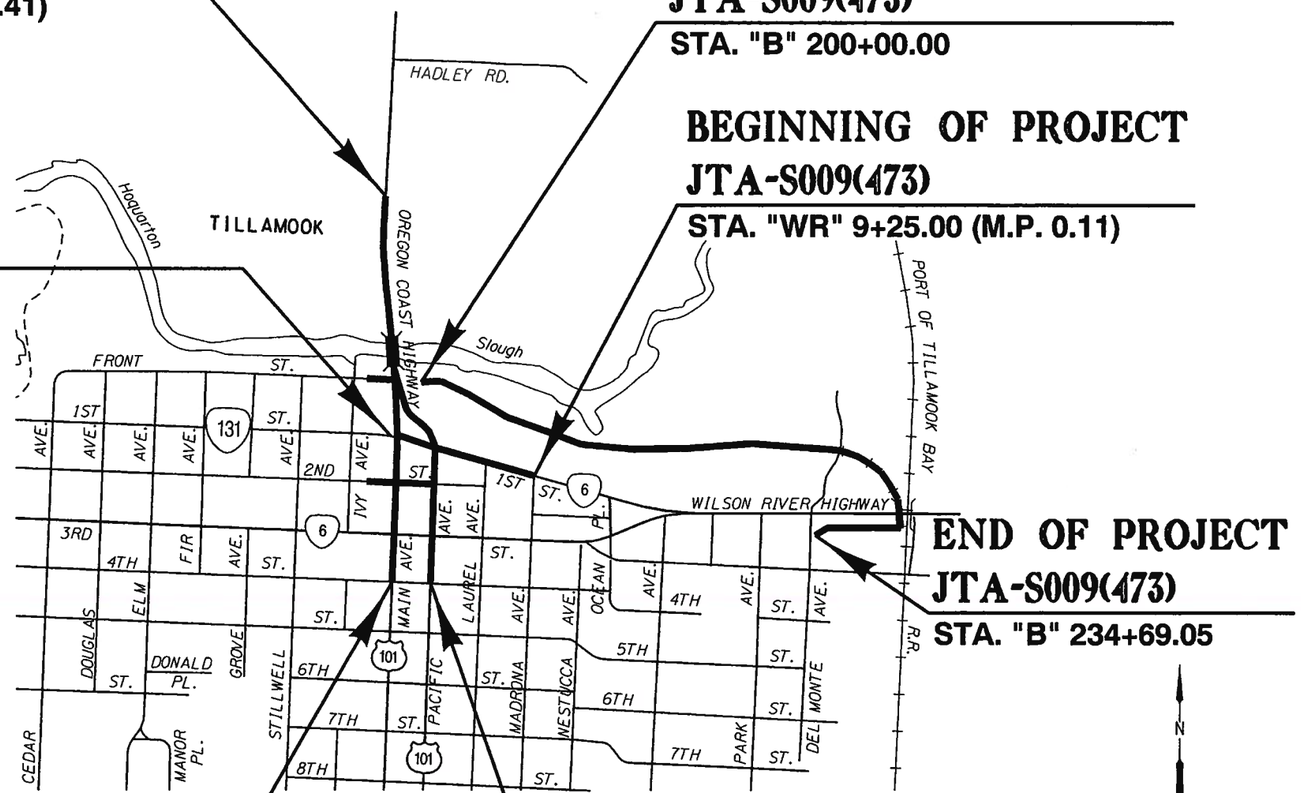
LET'S ALL WORK TOGETHER TO MAKE THIS JOB SAFE

END OF PROJECT
JTA-S009(473)
STA. "L" 412+03.00 (M.P. 65.41)

BEGINNING OF PROJECT
JTA-S009(473)
STA. "B" 200+00.00

BEGINNING OF PROJECT
JTA-S009(473)
STA. "WR" 9+25.00 (M.P. 0.11)

END OF PROJECT
JTA-S009(473)
STA. "WR" 17+62.63 (M.P. 9.07)



END OF PROJECT
JTA-S009(473)
STA. "B" 234+69.05

BEGINNING OF PROJECT
JTA-S009(473)
STA. "M" 191+93.00 (M.P. 65.78)

BEGINNING OF PROJECT
JTA-S009(473)
STA. "P" 192+68.00 (M.P. 65.81)

T. 1 S., R. 9 W., W.M.

OREGON TRANSPORTATION COMMISSION

Tammy Baney	CHAIR
David Lohman	COMMISSIONER
Susan Morgan	COMMISSIONER
Alando Simpson	COMMISSIONER
Sean O'Hollaren	COMMISSIONER
Matthew L. Garrett	DIRECTOR OF TRANSPORTATION

PLANS PREPAIRED FOR
OREGON DEPARTMENT OF TRANSPORTATION

QUINCY ENGINEERING

These plans were developed using ODOT design standards. Exceptions to these standards, if any, have been submitted and approved by the ODOT Chief Engineer or their delegated authority.

Approving Authority: 3/3/16
Signature & date

Jeff W. Olson, Principal
Print name and title

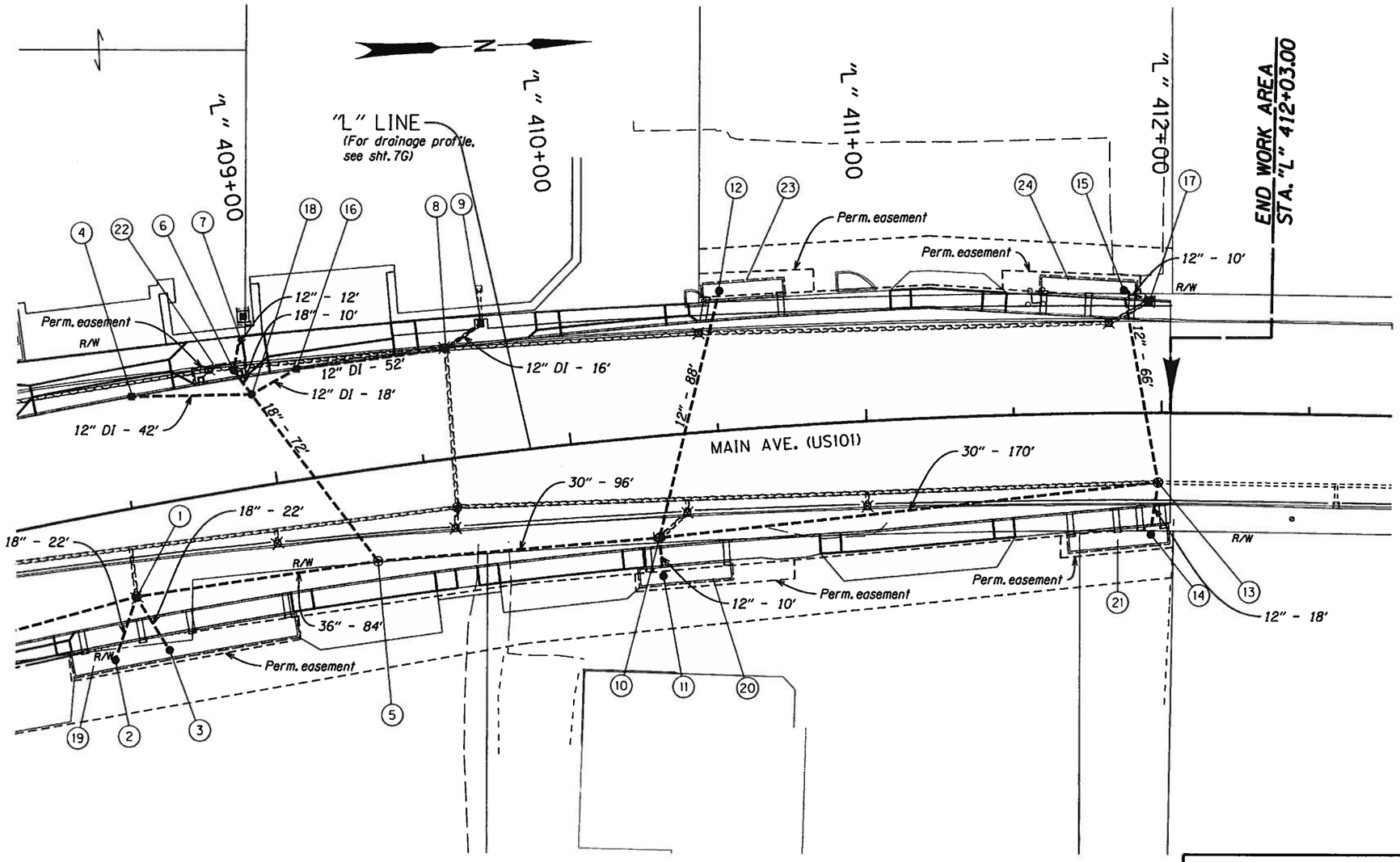
3/22/16
Concurrence by ODOT Chief Engineer

US101 @ OR6 (TILLAMOOK) SEC.
OREGON COAST HWY. & WILSON RIVER HWY.
TILLAMOOK COUNTY

FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION	JTA-S009(473)	1

Sec. 30, T. 1 S., R. 9 W., W.M., Sec. 25, T. 1 S., R. 10 W., W.M
TILLAMOOK

49V-060



(1) Sta. "L" 408+46.14, 29.54' Rt.
Const. shallow manhole, 72" dia.
Rim = 10.70
I.E. In= 4.30 (36" N)
I.E. In= 6.02 (18" NE)
I.E. In= 6.02 (18" E)
I.E. Out= 4.20 (36" S)
Inst. 18" storm sew. pipe - 44'
5' depth
Inst. 36" storm sew. pipe - 84'
10' depth

(2) Sta. "L" 408+34.98, 49.14' Rt.
Const. beehive inlet
Rim = 10.22
I.E. Out= 6.15 (18" W)
(For details, see sht. GJ-12)

(3) Sta. "L" 408+54.09, 49.31' Rt.
Const. beehive inlet
Rim = 10.00
I.E. Out= 6.13 (18" SW)
(For details, see sht. GJ-12)

(4) Sta. "L" 408+56.49, 37.04' Lt.
Const. type G-2 inlet with sump
Rim = 10.50
I.E. Out= 6.84 (12" N)

(5) Sta. "L" 409+30.07, 31.00' Rt.
Const. shallow manhole, 72" dia.
Rim = 10.90
I.E. In= 4.48 (30" N)
I.E. In= 5.78 (18" SW)
I.E. Out= 4.38 (36" S)
Inst. 18" storm sew. pipe - 72'
10' depth
Inst. 30" storm sew. pipe - 96'
10' depth

NOTES:
1. Field verify elevation call-outs noted with "±".
2. Utilities in conflict to be relocated by others prior to construction, unless otherwise noted.
3. Construction notes continued on sht. 7D.

------ Temporary Easement

Abandon pipe shown thus:

Remove inlet shown thus:

Remove manhole shown thus:

REGISTERED PROFESSIONAL ENGINEER
74238PE
OREGON
JAN 8, 2009
ASHLEY M. CANTLON
2-29-16
RENEWS: 12/31/2017

OREGON DEPARTMENT OF TRANSPORTATION

otak Otak Inc.
Manmi Global Partner
700 Washington St, Ste. 401
Vancouver, WA 98660
Phone: 360.373.9613 Fax: 360.737.9651

US101 @ OR6 (TILLAMOOK) SEC.
OREGON COAST HWY. & WILSON RIVER HWY.
TILLAMOOK COUNTY

Reviewed By - T Kraft
Designed By - A Cantlon
Drafted By - A Cobb/M McCandless

DRAINAGE PLAN

SHEET NO. 7C

(6) Sta. "L" 408+91.50, 39.87' Lt.
Const. beehive inlet
Rim = 10.07
I.E. In= 6.20 (12" W)
I.E. Out= 6.20 (18" NE)
(For details, see sht. GJ-12)
Inst. 12" storm sew. pipe - 12'
5' depth

(7) Sta. "L" 409+97.47, 57.31' Lt.
Connect to extg. storm sew. pipe
Location approx. Verify in field.

(8) Sta. "L" 409+62.08, 36.82' Lt.
Const. type G-2 inlet with sump
Rim = 10.80
I.E. In= 6.98 (12" S)
I.E. Out= 6.98 (12" E)
Inst. 12" DI storm sew. pipe - 16'
5' depth

(9) Sta. "L" 409+75.57, 43.78' Lt.
Const. type 3 inlet with sump
Rim = 11.03
I.E. In= 8.80 (6" W)
I.E. Out= 7.05 (12" SE)
Connect to extg. storm sew. pipe

(10) Sta. "L" 410+27.02, 34.12' Rt.
Const. shallow manhole, 60" dia.
Rim = 11.10
I.E. In= 6.57 (12" E)
I.E. In= 4.70 (30" N)
I.E. In= 6.29 (12" W)
I.E. Out= 4.60 (30" S)
Inst. 12" storm sew. pipe - 98'
5' depth
Inst. 30" storm sew. pipe - 170'
10' depth

(11) Sta. "L" 410+27.21, 47.08' Rt.
Const. beehive inlet
Rim = 10.50
I.E. Out= 6.63 (12" W)
(For details, see sht. GJ-12)

(12) Sta. "L" 410+53.87, 46.98' Lt.
Const. beehive inlet
Rim = 10.95
I.E. Out= 7.08 (12" E)
(For details, see sht. GJ-12)

(13) Sta. "L" 411+98.73, 23.43' Rt.
Const. shallow manhole, 60" dia.
Rim = 11.20
I.E. In= 5.02 (24" N) Extg.
I.E. In= 6.35 (12" E)
I.E. In= 6.39 (12" W)
I.E. Out= 4.92 (30" S)
Connect to extg. storm sew. pipe
Inst. 12" storm sew. pipe - 84'
5' depth

(14) Sta. "L" 411+96.30, 41.02' Rt.
Const. beehive inlet
Rim = 10.34
I.E. Out= 6.47 (12" W)
(For details, see sht. GJ-12)

(15) Sta. "L" 411+87.48, 41.53' Lt.
Const. beehive inlet
Rim = 10.55
I.E. In= 6.68 (12" NE)
I.E. Out= 6.68 (12" E)
(For details, see sht. GJ-12)
Connect to extg. storm sew. pipe
Inst. 12" storm sew. pipe - 10'
5' depth

(16) Sta. "L" 409+62.10, 37.13' Lt.
Const. type G-2 inlet with sump
Rim = 10.70
I.E. In= 6.72 (12" N)
I.E. Out= 6.72 (12" SE)
Connect to extg. storm sew. pipe
Inst. 12" DI storm sew. pipe - 52'
5' depth

(17) Sta. "L" 411+96.11, 37.13' Lt.
Const. type G-2 inlet with sump
Rim = 11.60
I.E. Out= 6.96 (12" SW)
Connect to extg. storm sew. pipe

(18) Sta. "L" 408+96.11, 30.96' Lt.
Const. shallow manhole, 60" dia.
Rim = 10.90±
I.E. In= 6.63 (12" S)
I.E. In= 6.24 (12" NW)
I.E. In= 6.14 (18" SW)
I.E. Out= 6.14 (18" NE)
Inst. 12" DI storm sew. pipe - 60'
5' depth
Inst. 18" storm sew. pipe - 10'
5' depth

(19) Sta. "L" 408+20.3 to Sta. "L" 408+98.7, Rt.
Const. Bioretention Pond D00923 - 681 Sq. Ft.
(For details, see shts. GJ thru GJ-15)

(20) Sta. "L" 410+19.0 to Sta. "L" 410+50.8, Rt.
Const. Bioretention Pond D00922 - 213 Sq. Ft.
(For details, see shts. GJ thru GJ-15)

(21) Sta. "L" 411+67.8 to Sta. "L" 412+01.8, Rt.
Const. Bioretention Pond D00919 - 245 Sq. Ft.
(For details, see shts. GJ thru GJ-15)

(22) Sta. "L" 408+78.2 to Sta. "L" 408+95.4, Lt.
Const. Bioretention Pond D00924 - 102 Sq. Ft.
(For details, see shts. GJ thru GJ-15)

(23) Sta. "L" 410+48.4 to Sta. "L" 410+74.8, Lt.
Const. Bioretention Pond D00921 - 182 Sq. Ft.
(For details, see shts. GJ thru GJ-15)

(24) Sta. "L" 411+60.0 to Sta. "L" 411+91.3, Lt.
Const. Bioretention Pond D00920 - 217 Sq. Ft.
(For details, see shts. GJ thru GJ-15)

REGISTERED PROFESSIONAL ENGINEER
74238PE
OREGON
JAN 8, 2009
ASHLEY M. CANTLON
2-29-16
RENEWS: 12/31/2017

OREGON DEPARTMENT OF TRANSPORTATION

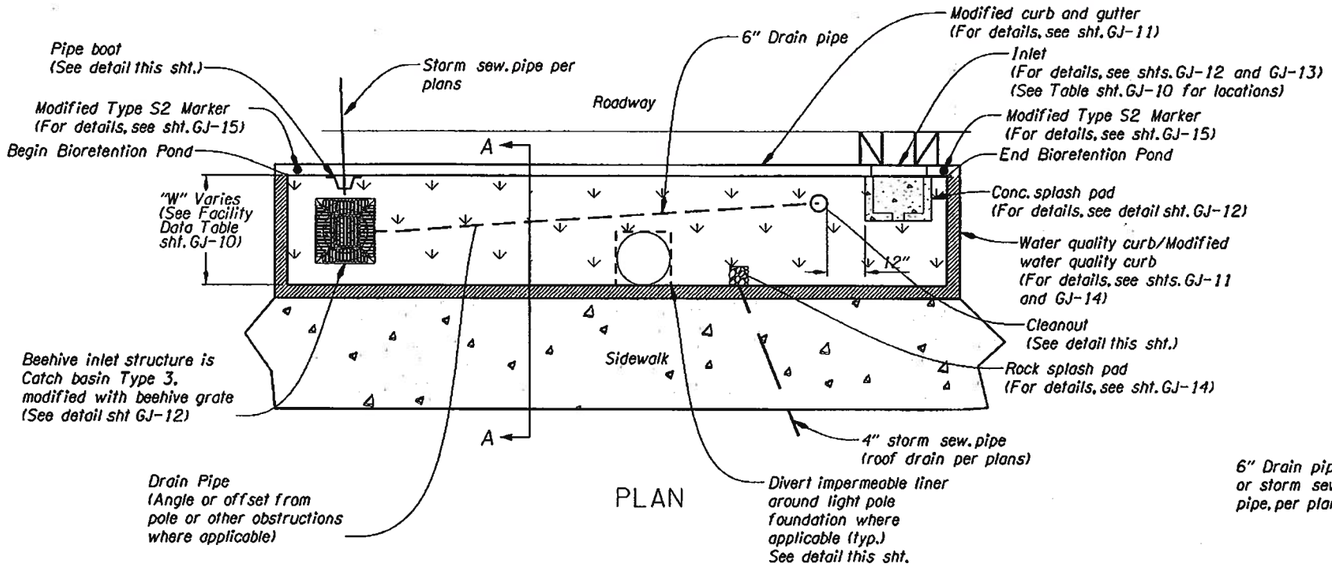
Otak Inc.
HanmiGlobal Partner
700 Washington St, Ste. 401
Vancouver, WA 98660
Phone: 360.373.9613 Fax: 360.737.9851

US101 @ OR6 (TILLAMOOK) SEC.
OREGON COAST HWY. & WILSON RIVER HWY.
TILLAMOOK COUNTY

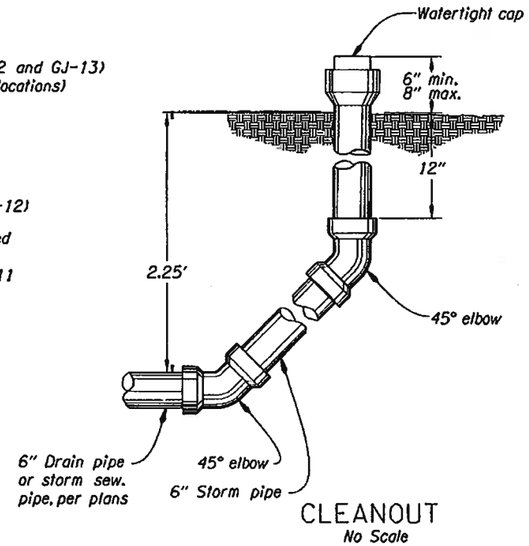
Reviewed By - T Kraft
Designed By - A Cantlon
Drafted By - A Cobb/M McCandless

DRAINAGE NOTES

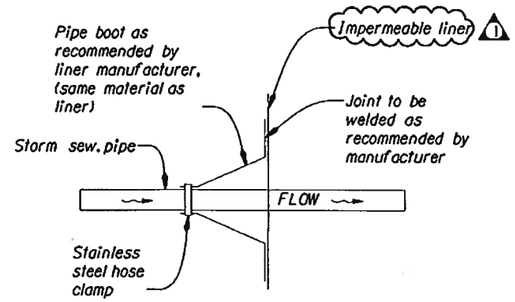
SHEET NO. 7D



PLAN

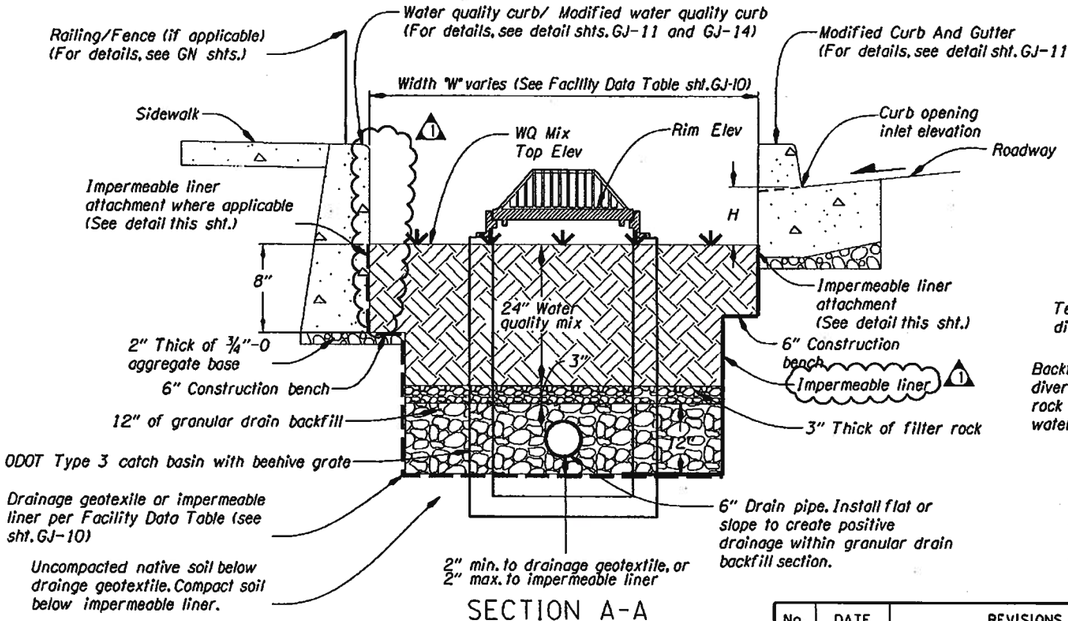


CLEANOUT
No Scale



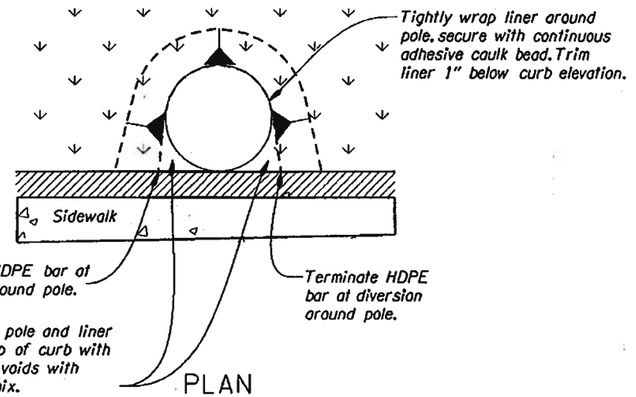
PIPE BOOT
No Scale

NOTE: Pipe boot required for all pipes entering and exiting facility through impermeable liner.

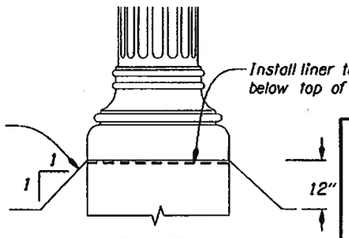


SECTION A-A

TYPICAL BIORETENTION POND
No Scale

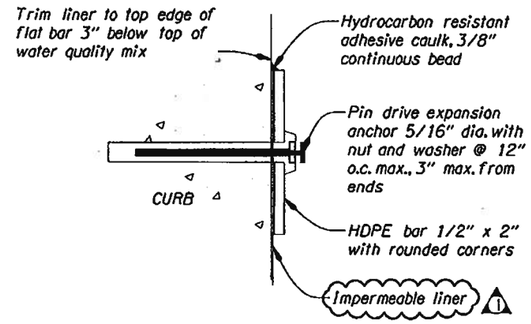


PLAN



ELEVATION

IMPERMEABLE LINER AROUND LIGHT POLE FOUNDATION
No Scale



NOTES:
1. Liner to extend from 3 in. below top of top soil to the bottom of excavation.

2. 3 in. of concrete is required on all sides of attachment.

IMPERMEABLE LINER ATTACHMENT
No Scale

No.	DATE	REVISIONS	BY
1	05-03-16	Remove variable "T" reference Remove reference to liner thickness	A.M.C.

GENERAL NOTES FOR ALL DETAILS:

1. Slope Drain Rock and Filter Rock layers to match bottom slope.

2. Slope drain pipe towards outlet.

3. Install Drain Rock splash pad downstream of check dam, see details sht. GJ-11.

4. Where catch basin structure protrudes through impermeable liner, cut liner in "X" shape to create rectangular hole to match size and shape of structure. Upon installation of catch basin, fold resulting triangular shaped fabric up sides of structure, and secure to structure with adhesive caulk. Backfill holes in liner with compacted topsoil.

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US101 @ OR6 (TILLAMOOK) SEC.
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TILLAMOOK COUNTY

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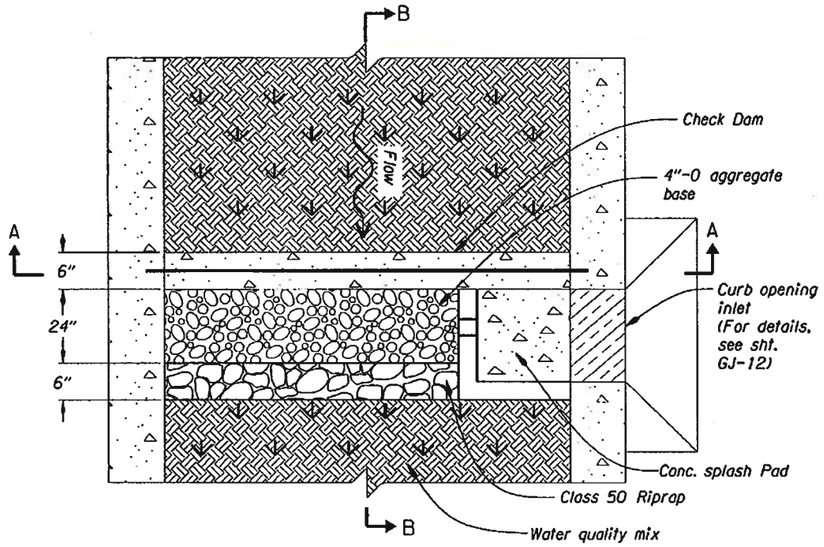
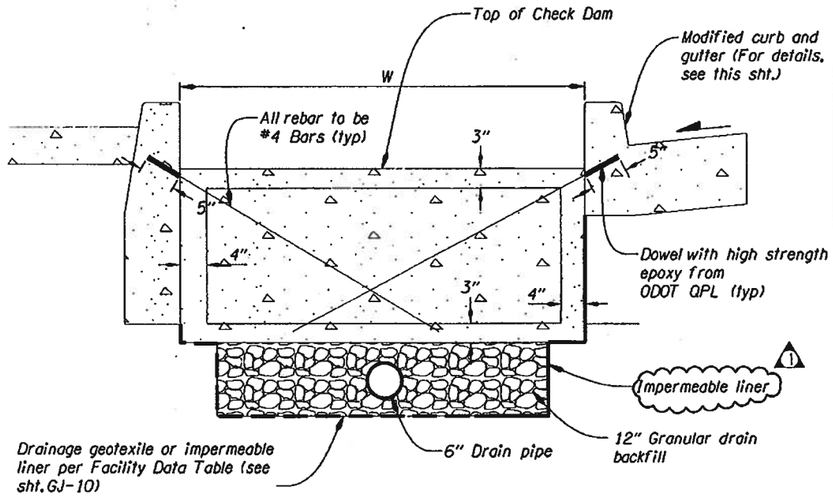
Drafted By - S Reiter

WATER QUALITY DETAILS

SHEET NO. GJ-9

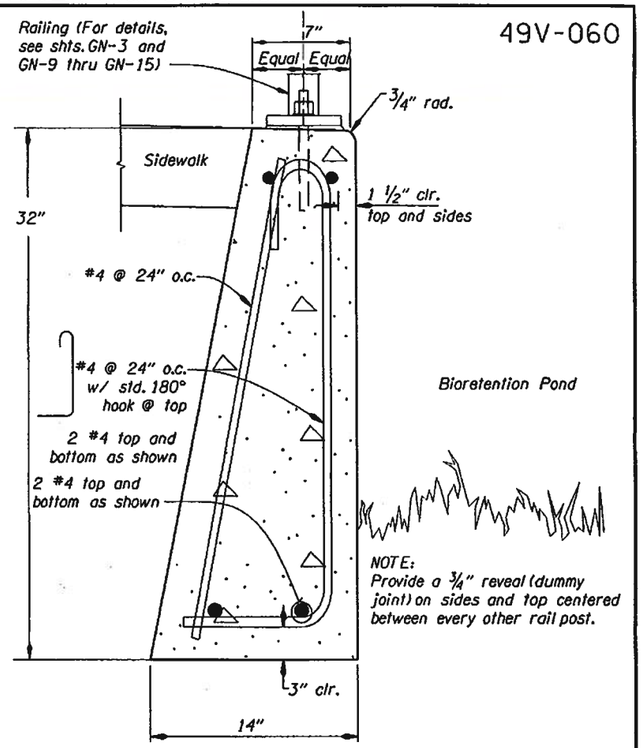


PLAN

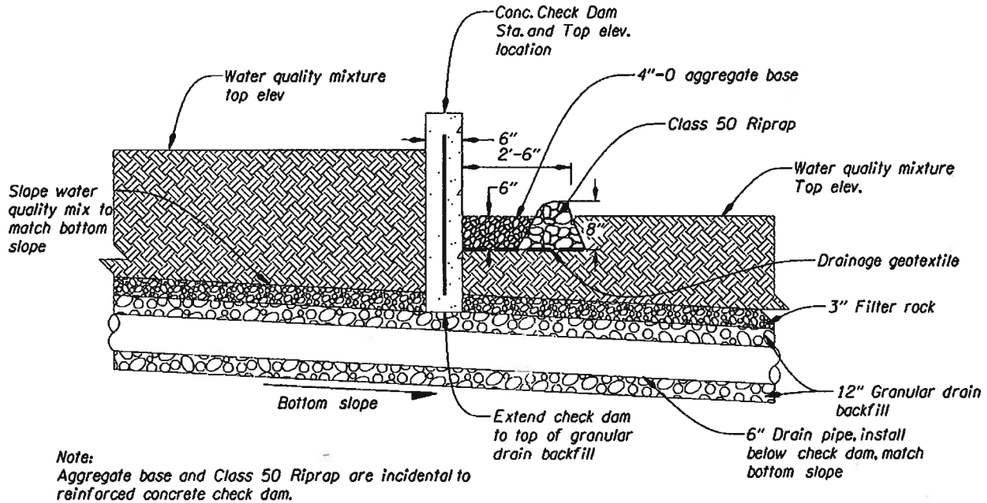


SECTION A-A

No.	DATE	REVISIONS	BY
1	05-03-16	Remove specified thickness	A.M.C.



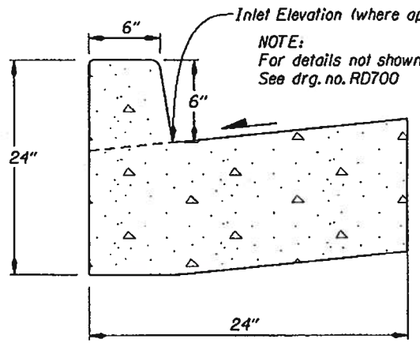
WATER QUALITY CURB
No Scale



Note:
Aggregate base and Class 50 Riprap are incidental to reinforced concrete check dam.

SECTION B-B

6" REINFORCED CONCRETE CHECK DAM
No Scale



MODIFIED CURB AND GUTTER
No Scale

GENERAL NOTES FOR ALL DETAILS:

1. Provide all reinforcing steel according to ASTM A706 or AASHTO M31 (ASTM A615) Grade 60

2. Provide Commercial Grade Class 3300 - 1½", 1", or ¾" concrete unless noted otherwise.

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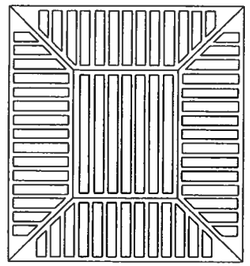
WATER QUALITY DETAILS

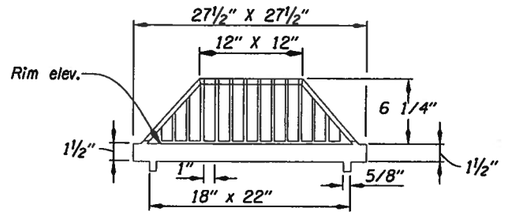
SHEET NO. GJ-11



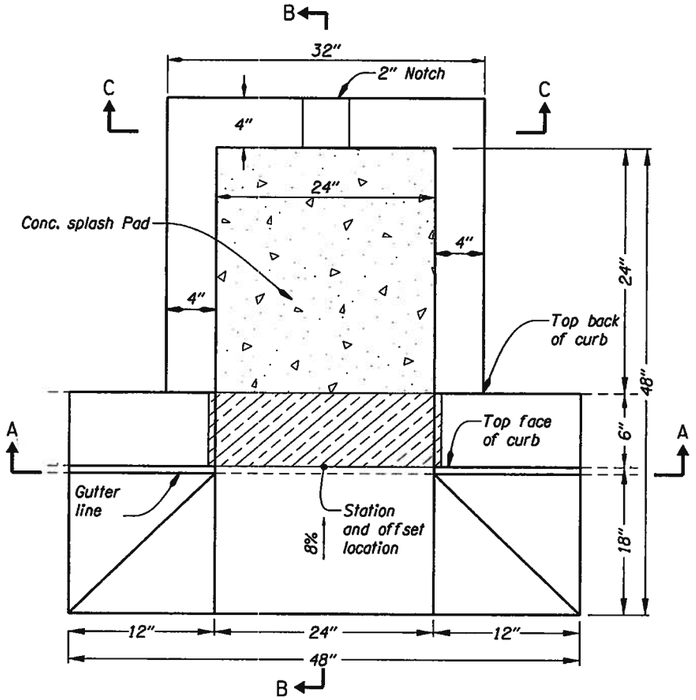
1. Beehive grate shall be model R-4347 or approved equal.

2. Type 3 Frame - Steel (modified) will be required for retrofit of beehive grate.

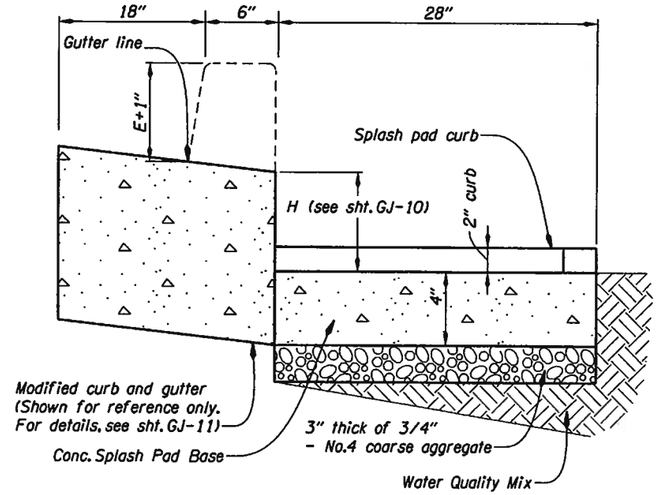
3. See Drg. No. RD378 for inlet base details.



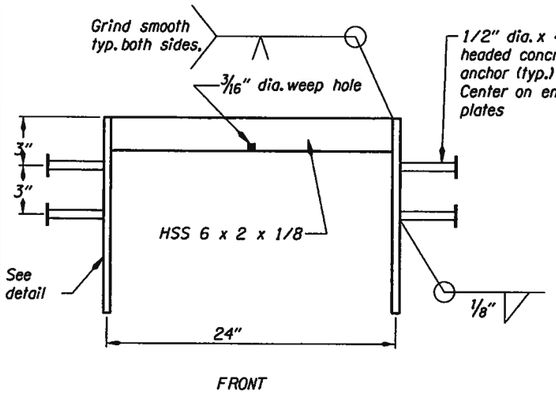
BEEHIVE INLET
No Scale



CURB OPENING INLET PLAN
No Scale



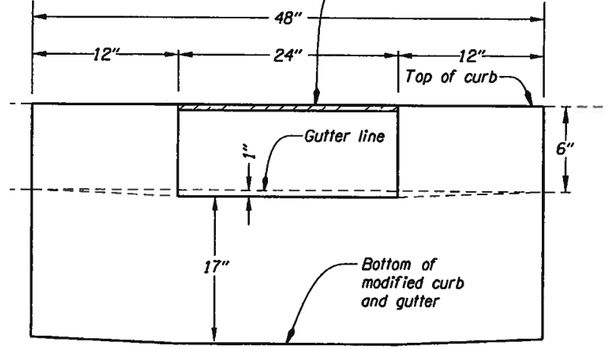
CURB OPENING INLET SECTION B-B
No Scale



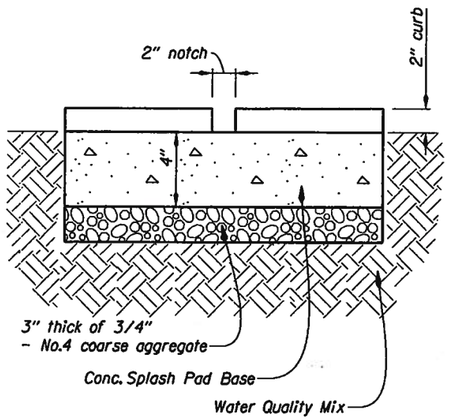
CONSTRUCTION NOTES

1. Headed concrete anchors shall meet the requirements of ASTM A-108.
2. HSS 6 x2 x1/8 Channel shall meet the requirements of ASTM A-500 Grade B.
3. End Plates shall meet the requirements of ASTM A-36.
4. Entire assembly shall be Hot-Dip Galvanized in accordance with ASTM A-123.
5. Single Bevel Groove Weld.

METAL INLET ASSEMBLY
No Scale



CURB OPENING INLET SECTION A-A
No Scale



CURB OPENING INLET SPLASH PAD SECTION C-C
No Scale

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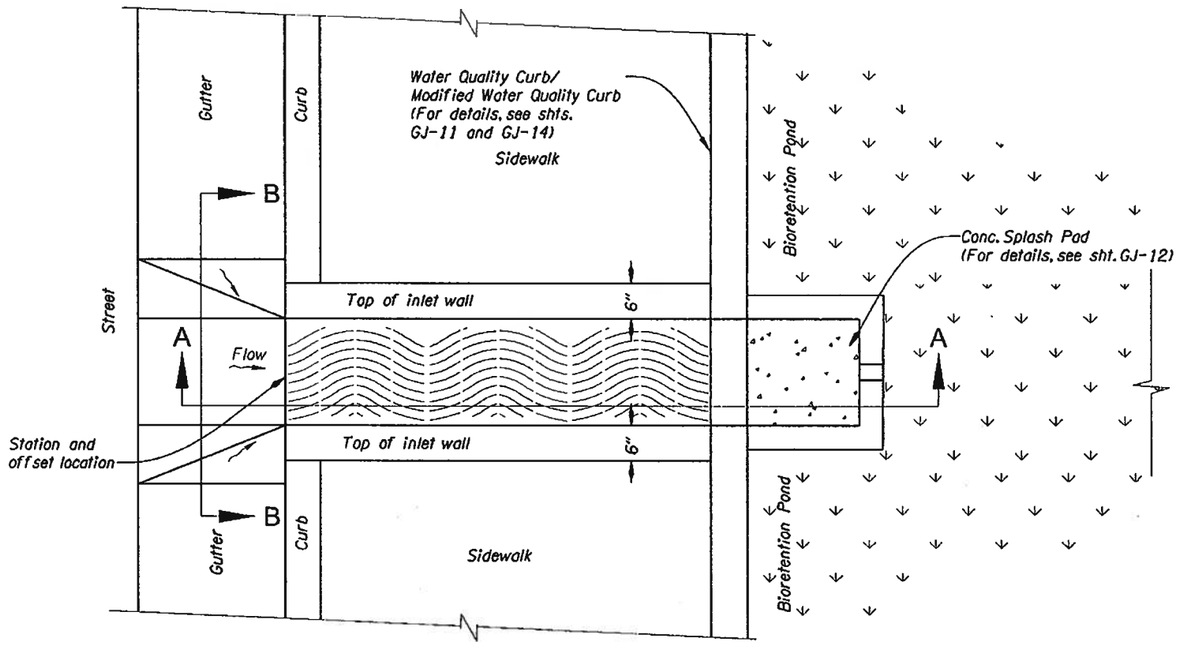
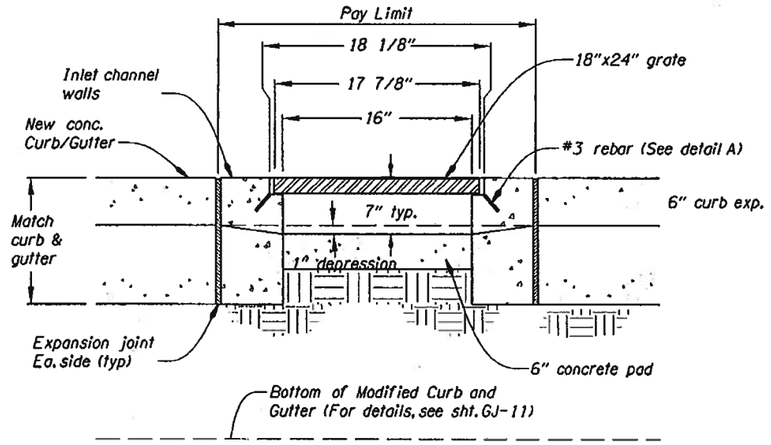
WATER QUALITY DETAILS

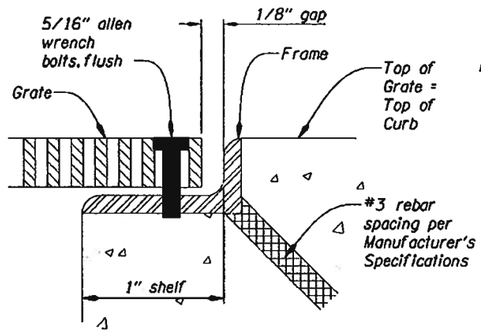
SHEET NO. GJ-12



PLAN VIEW

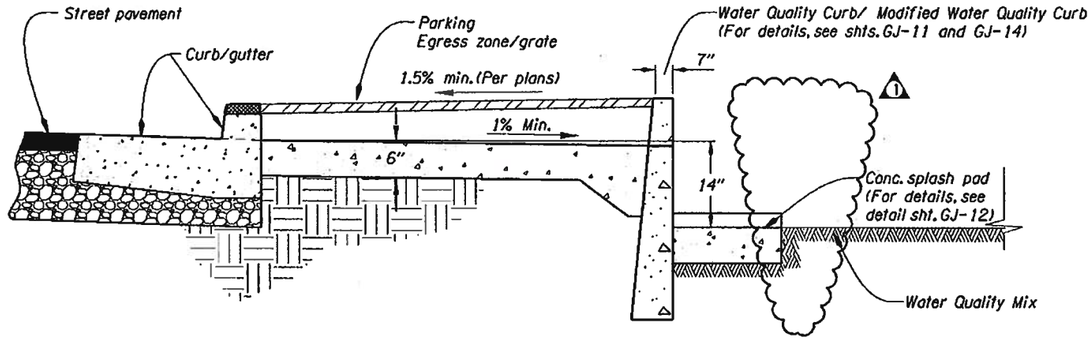


SECTION B-B



DETAIL A

Note: Maximum grate hole width (open) 1/4 inch.
Grate size 18"x24".
Cast iron Urban Accessories
Trench grate and frame.
Title Wave model or equal.



SECTION A-A

No.	DATE	REVISIONS	BY
1	05-03-16	Remove variable "T" reference	A.M.C.

CONCRETE CHANNEL INLET
No Scale

REGISTERED PROFESSIONAL ENGINEER
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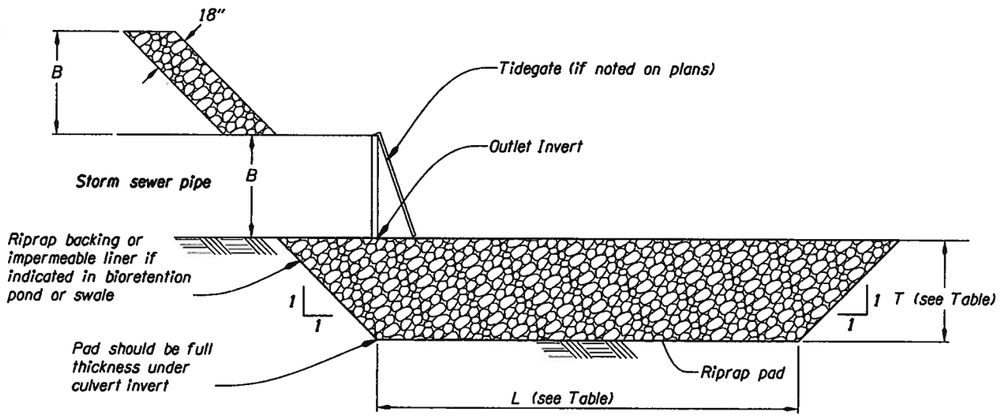
WATER QUALITY DETAILS

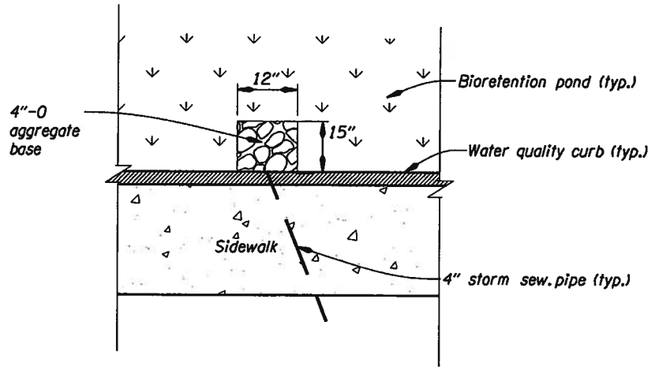
SHEET NO. GJ-13

49V-060

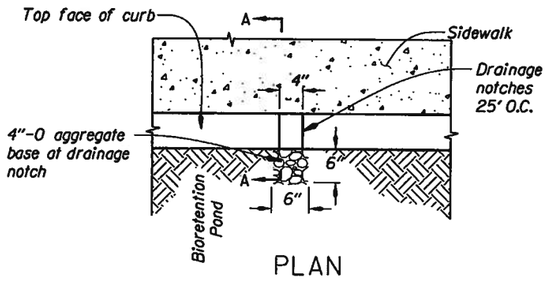


ELEVATION

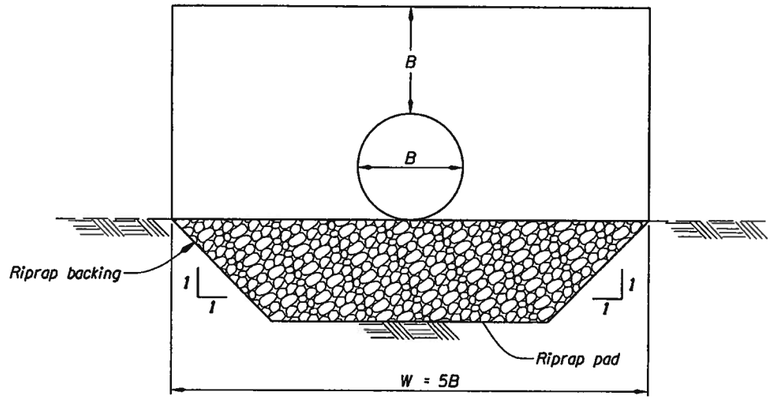
B = Diameter of storm sew. pipe, ft
L = Length of bottom of riprap pad, ft
T = Thickness of riprad pad, ft
W = Width of top of riprap pad, ft



PLAN VIEW



PLAN



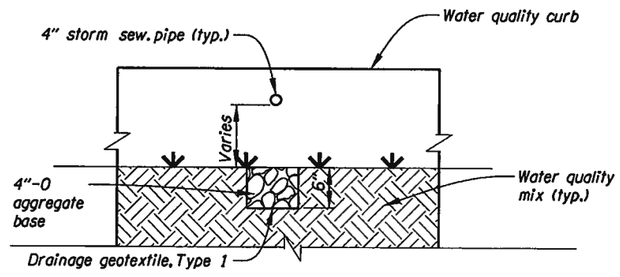
END VIEW

TABLE		
Riprap Class	L* (ft)	T (ft)
50	4B or 1.3	2.3
100	4B or 1.6	3.3

* Use min. value

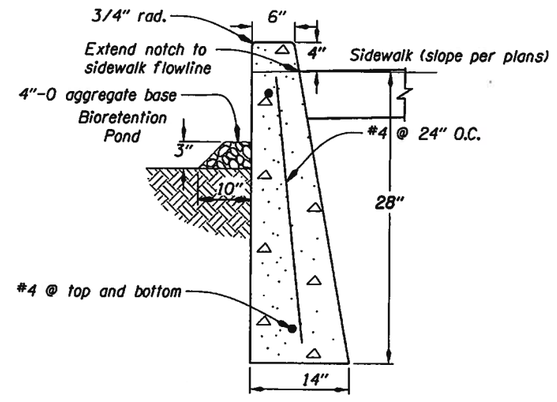
NOTES:
1. Do not excavate non-erodible rock in order to place riprap.
2. Riprap backing under class 50 riprap shall be riprap geotextile, Type 1.

STORM OUTFALL PROTECTION
No Scale



SECTION VIEW

ROCK SPLASH PAD
No Scale



SECTION A-A

NOTES:
1. Provide a 3/4" reveal (dummy joint) on sides and top at 10' O.C. and provide a 1/2" expansion joint at 50' O.C.

MODIFIED WATER QUALITY CURB
No Scale

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WATER QUALITY DETAILS

SHEET NO. GJ-14