OPERATION & MAINTENANCE MANUAL

Water Quality Biofiltration Swale

Manual prepared: March 2019

DFI No. D00888

Figure 1: DFI No. D00888, looking north

Identification

Drainage Facility ID (DFI):	D00888
Facility Type:	Water Quality Biofiltration Swale
Construction Drawings:	(V-File Numbers) 42V-190
Location:	District: 2B
	Highway No.: 160
	Mile Post: 10.41 – 10.44 (Right side)

1. Manual Purpose

The purpose of this manual is to outline inspection needs and summarize maintenance actions.

2. 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: Roadway shoulder

Flow direction: Varies – follows slope of swale

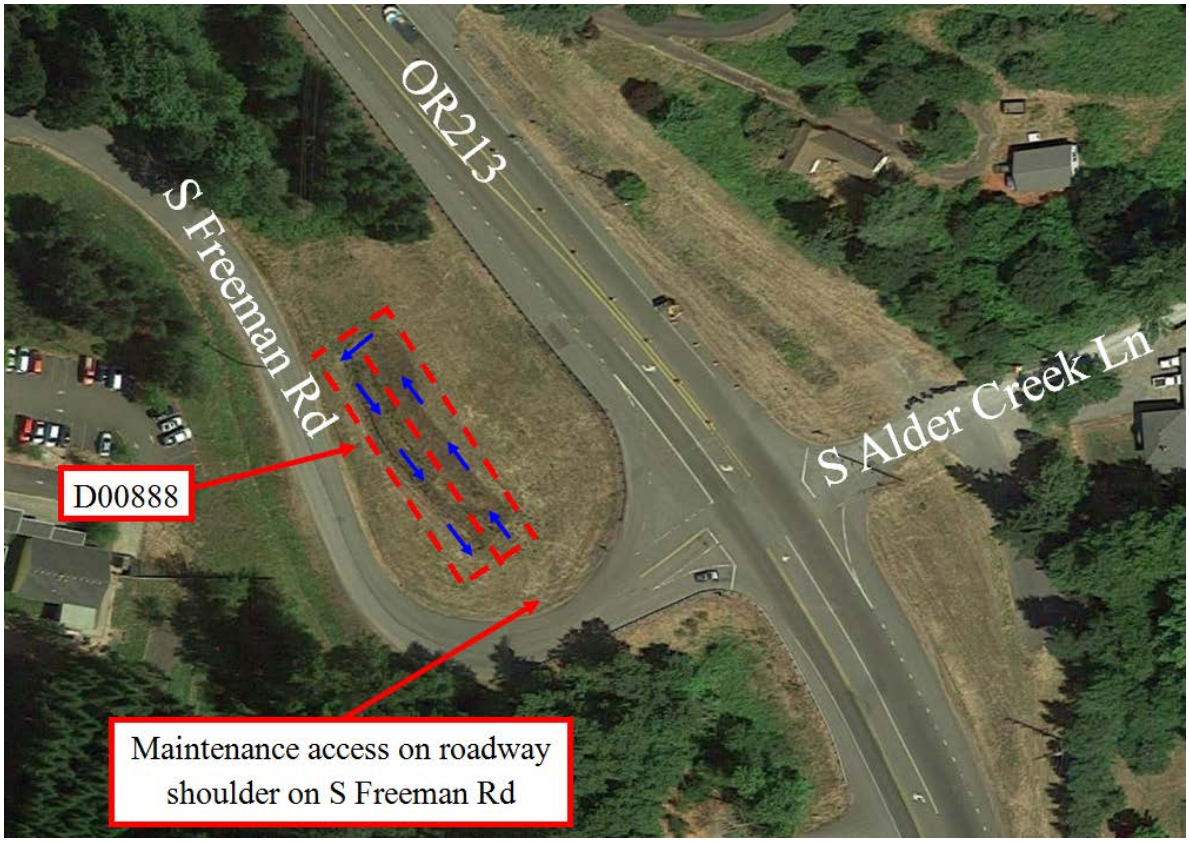


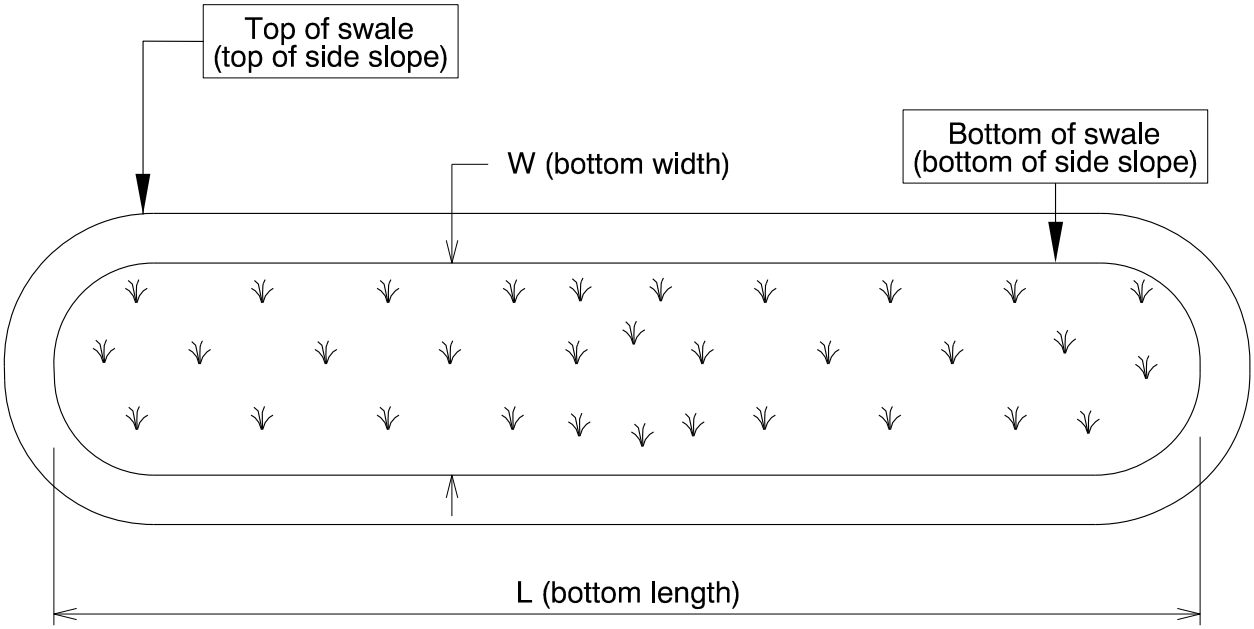
Figure 2: Facility location map

3. Facility Summary

The length and width of a swale is based on the bottom dimensions.

The bottom length and bottom width of the swale is:

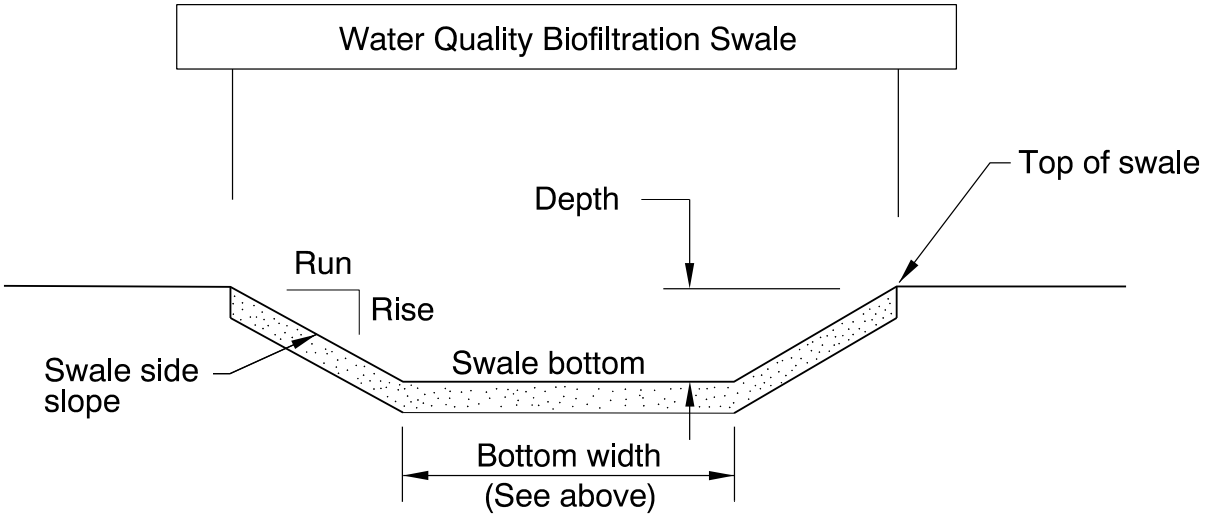
Bottom Length (feet)	Bottom Width (feet)
295	4.5



The depth of the swale is the vertical distance measured from the bottom of the swale to the top. The slope of the swale sides is presented by a vertical distance (rise) followed by the horizontal distance (run).

Depth and side slopes:

Depth (feet)	Rise (feet)	Run (feet)
1	1	3



Site Specific Information: The water quality facility is outside of the project limits (Appendix B). Water is collected through an inlet from OR213. It enters a storm pipe, flows through a manhole and then enters the water quality facility through an inlet pipe at MP: 10.44 (approximately). The water flows to the northeast for about 150 feet and makes a sharp turn at MP: 10.41. The water then flows to the southeast before exiting the facility at MP: 10.44. The water leaves the water quality facility through a type “D” inlet and enters the storm drain system. There are two precast 42” tall barriers that separate the two portions of the swale with native soil filled in between. There are supposed to be five check dams (compacted aggregate base) in the swale located approximately fifty feet apart. There were no visible check dams in place when the pictures were taken (March 2019). The swale alignment can be found in Appendix B under “S1” swale on sheet GJ-9 and GJ-10.

4. Facility Access

Maintenance access to the facility:

☐Roadside pad	☒Roadside shoulder
☐Access road with Gate	☐Access road without Gate

Figure 3: Maintenance Access

5. Operational Components / Maintenance Items

Classification

This facility is classified as an:

☒ On-line Swale	☐ Off-line Swale
A swale that does not include a high flow bypass component; flow drains into and through the facility	**A swale that treats low/small flows and diverts high flows using a bypass component**

Bypass Component

This facility includes a high flow bypass component:

☒ No	☐ Yes
There is no bypass component. High flows drains into and through the facility	**There is a bypass component. Only low/small flows drain into the swale. High flows are diverted around the swale using a bypass component**

Operational Components

A swale has many components that assist with treatment, conveyance, and reducing flow velocity to minimize erosion. The components in use can vary depending if the facility was designed to operate on-line or off-line. 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 Biofiltration Swales (implemented March 2017) 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/

Operational Plan

The applicable standard operational plan for this facility is:

☐ Operational Plan A	☒ Operational Plan B	☐ Operational Plan C
An on-line swale with roadside ditches	**An on-line swale with piped inlets and outlets**	**An off-line swale with a piped high flow bypass**
A standard operational plan illustrates the general facility footprint configuration and explains the purpose of each facility component. Operational plans (A, B, C) are provided in the Standard Operation Manual.		

See Appendix A for the site specific operational plan.

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: Swale Components		ID #
Manholes/Structures		
Pre-treatment manhole	☐	**S1**
Weir type flow splitter/flow splitter manhole	☐	**S2**
Orifice type flow splitter/flow splitter manhole	☐	**S3**
Standard manhole	☒	**S4**
Swale Inlet		
Pavement sheet flow	☐	**S5**
Inlet Pipe (12" CMP)	☒	**S6**
Open channel inlet	☐	**S7**
Riprap pad	☐	**S8**
Ground Cover		
Grass bottom	☒	**S9**
Grass side slopes	☒	**S10**
Granular drain rock	☐	**S11**
Plantings	☐	**S12**
Underground Components		
Geotextile fabric	☒	**S13**
Planting mix	☒	**S14**
Perforated pipe	☒	**S15**
Porous pavers (access grid)	☐	**S16**
Flow Spreader		
Rock basin (used at inlet)	☐	**S17**
Anchored board (midpoint of swale or every 50 feet along swale bottom)	☐	**S18**
Other: Check dams	☒	**S19**
Swale Outlet		
Type "D" Inlet	☒	**S20**
Outlet Pipe (s)	☐	**S21**
Open channel outlet	☐	**S22**
Auxiliary Outlet: describe type	☐	**S23**
Outfall Type		
Waterbody (**C**reek/**L**ake/**O**cean)	☐ **C** ☐ **L** ☐**O**	**S24**
Ditch	☐	**S25**
Storm drain system	☒	**S26**
Outfall Components		
Riprap pad	☐	**S27**
Riprap bank protection	☐	**S28**

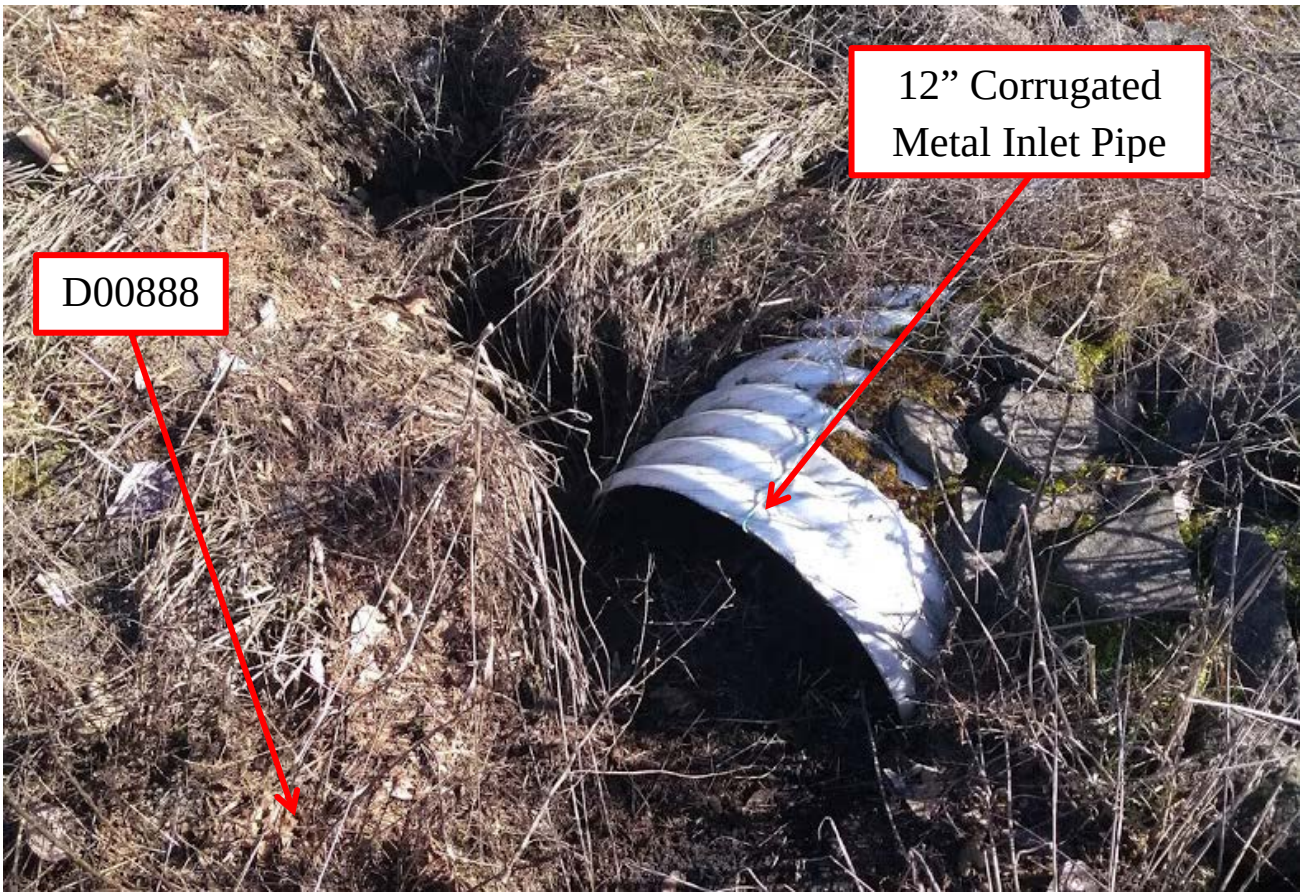


Figure 4: Swale Inlet

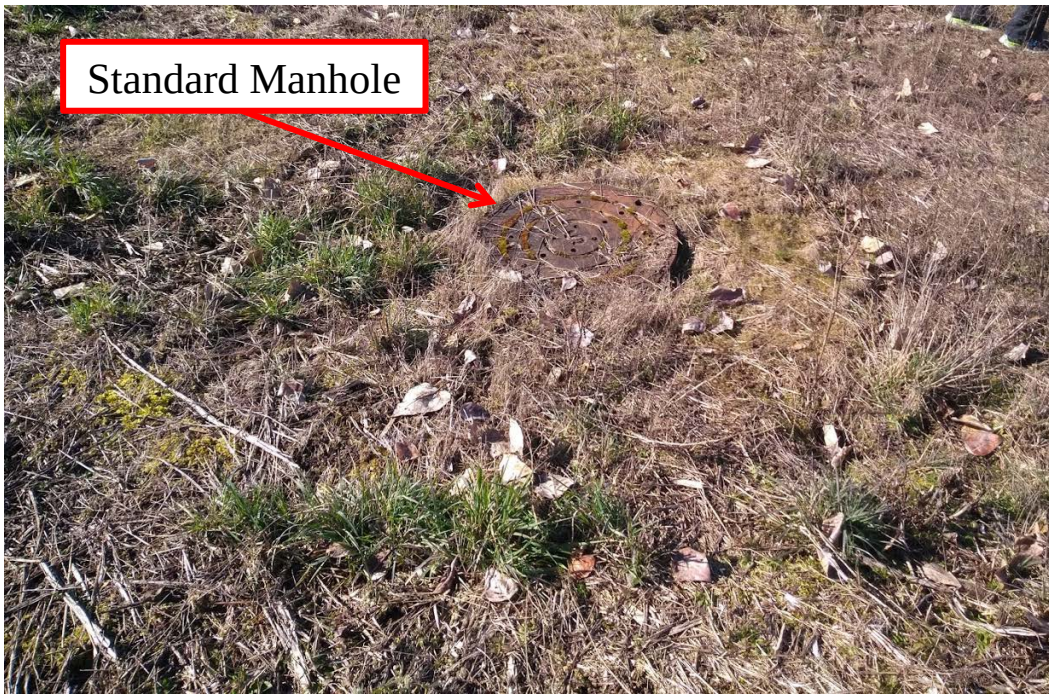


Figure 5: Water flows through standard manhole, then through swale

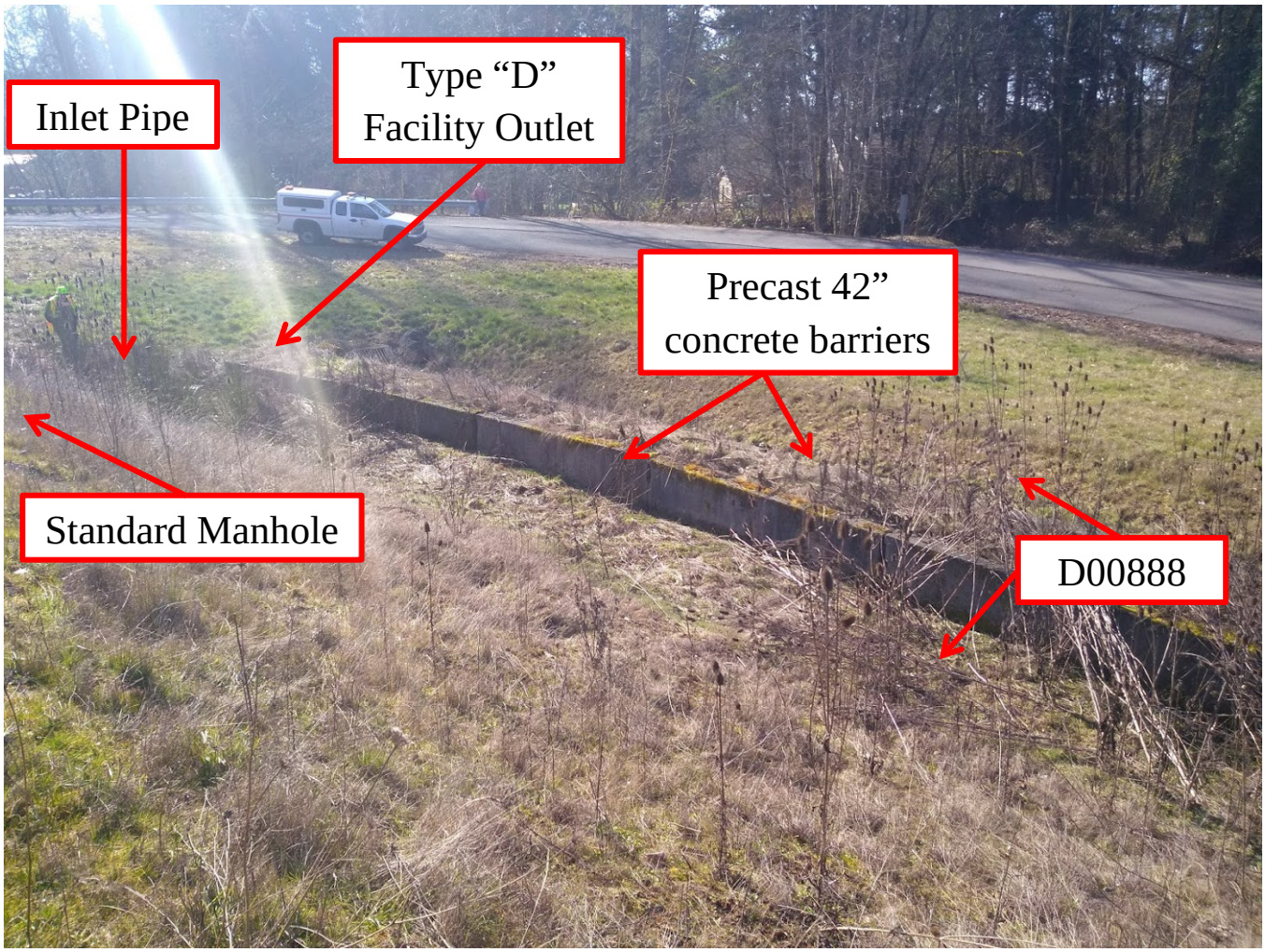


Figure 6: Swale components

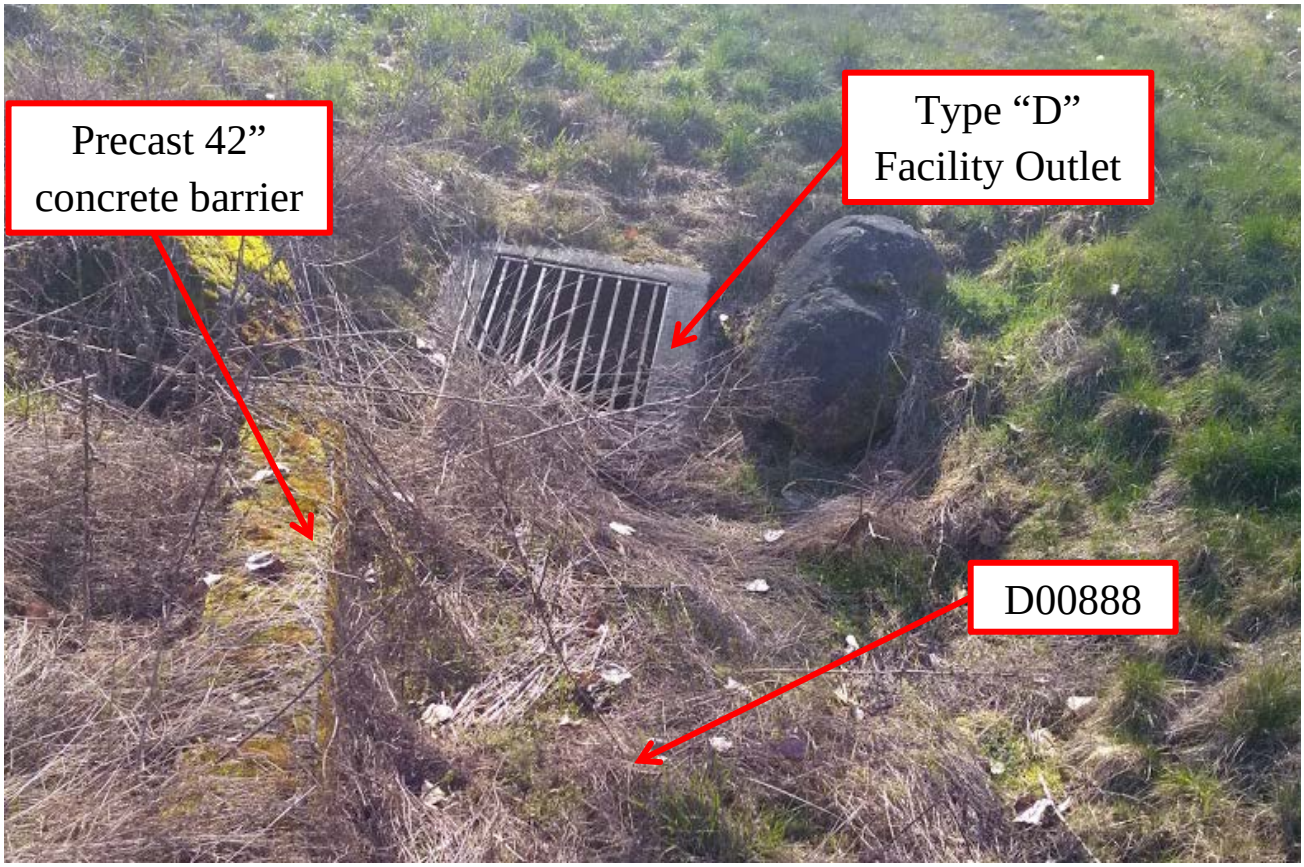


Figure 7: Swale outlet

6. Maintenance

Maintenance Frequency/Maintain Records

a. Inspect 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 ODOT swales:

- Table 1 (General Maintenance): Contains general maintenance and inspection guidelines that are applicable to all ODOT water quality facilities
- Table 3 (Maintenance of Water Quality or Biofiltration Swales): Contains maintenance information for swales

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

7. Limitations

Access grid installed:

☒ No	☐ Yes
There are no porous pavers installed in this swale	

Swales are designed to allow equipment access along the bottom. If an access grid is **NOT** installed, vehicles entering the swale can create depressions (tire ruts), damage vegetation, and damage structural components (e.g. flow spreaders). These conditions may result in poor treatment and drainage performance.

Equipment wheels should be kept on the tops and side slopes. Mower arms may be run along the swale bottom.

8. Waste Material Handling

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

http://www.oregon.gov/ODOT/Maintenance/Documents/ems_manual.pdf

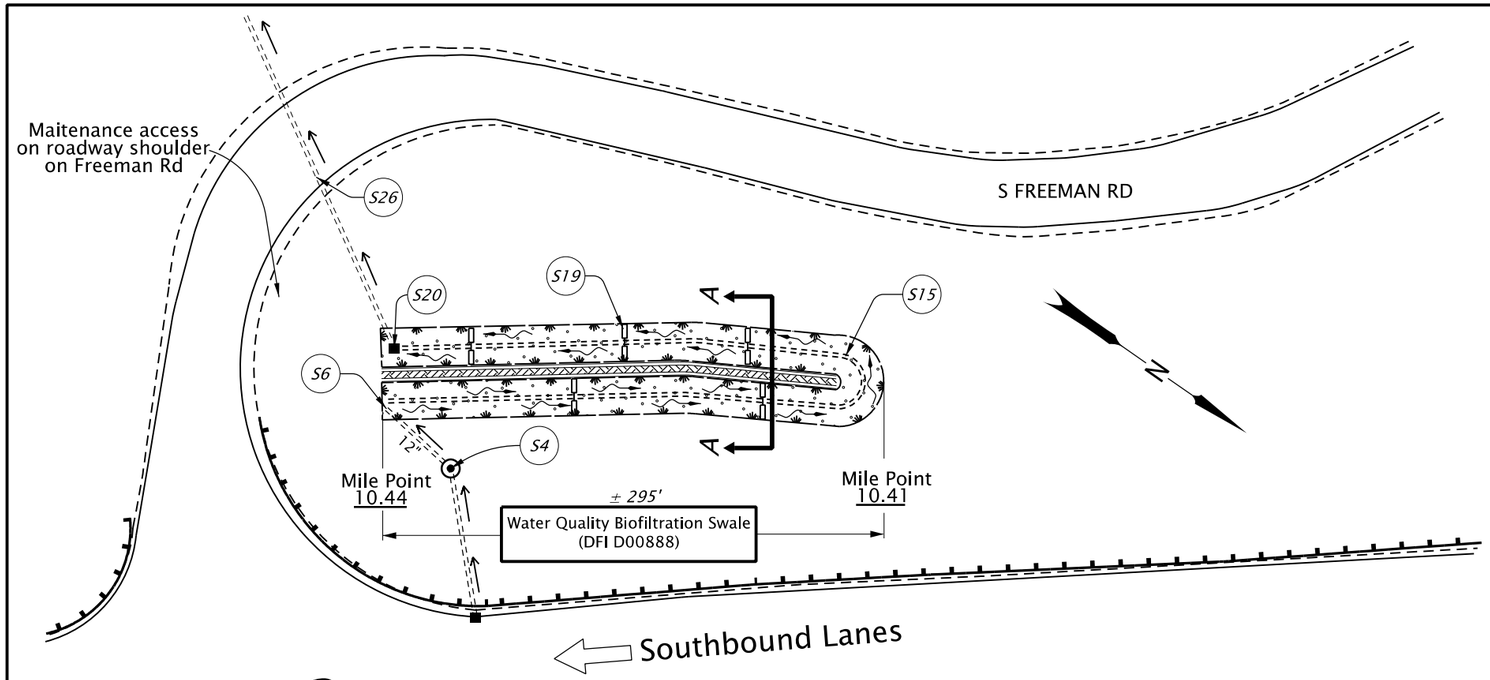
Contact any of the following for more detailed information about management of waste materials found on site:

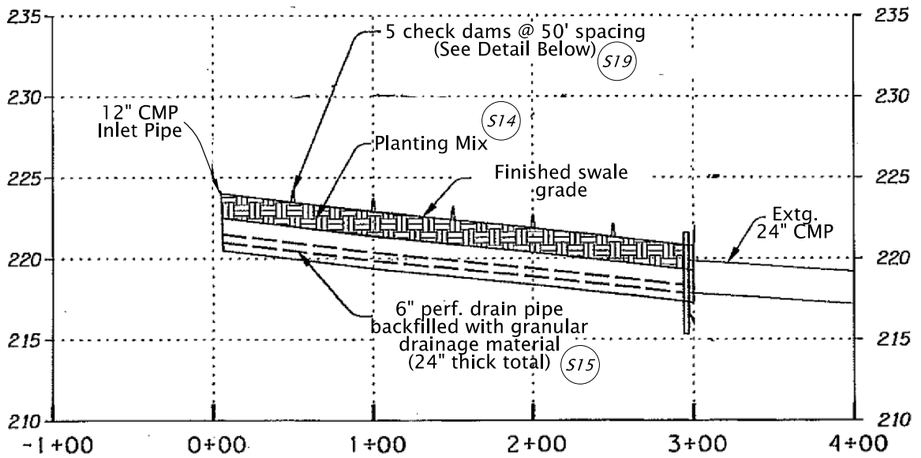
ODOT Clean Water Unit	(503) 986-3008
ODOT Statewide Hazmat Coordinator	(503) 667-7442
ODOT Region 1 Hazmat Coordinator	(503) 731-8290
ODOT Region 2 Hazmat Coordinator	(503) 986-2647
ODOT Region 3 Hazmat Coordinator	(541) 957-3594
ODOT Region 4 Hazmat Coordinator	(541) 388-6186
ODOT Region 5 Hazmat Coordinator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

A Appendix A – Site Specific Operational Plan

Contents:

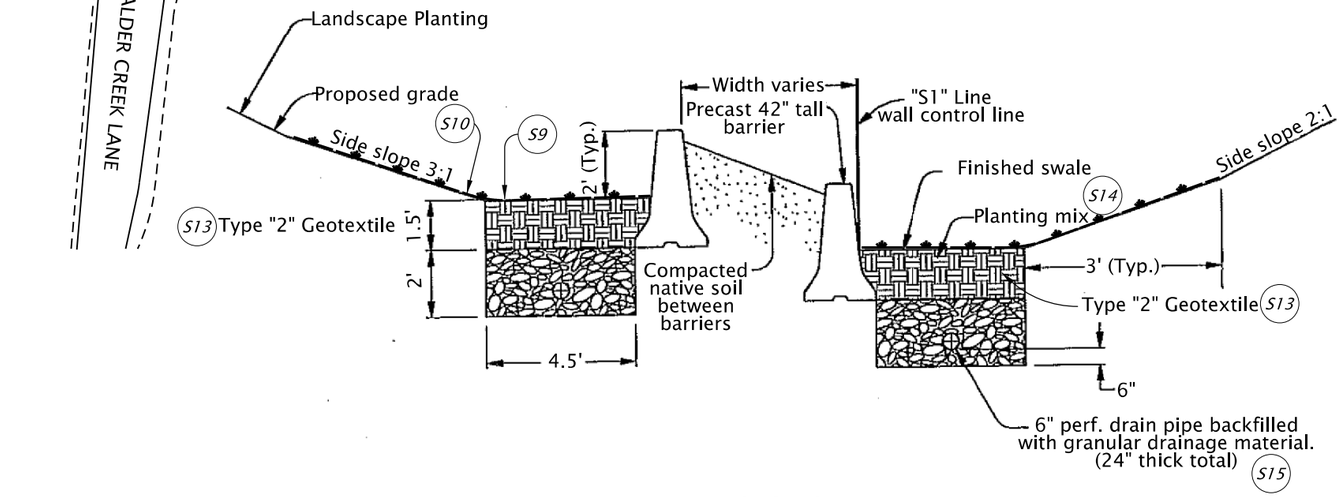
Operational Plan: DFI D00888



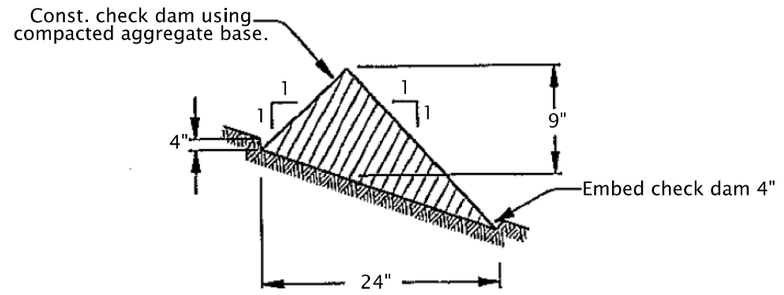


PROFILE
N.T.S.

See Appendix B, Sheet GJ-9 and GJ-10
"S1" Swale Alignment



SECTION A-A
N.T.S.



CHECK DAM DETAIL S19
N.T.S.

LEGEND:

- Manhole
- Inlet
- Pipe
- Water Conveyence Direction
- Water Flow Direction
- Traffic Flow Direction
- Check Dam

Sht. ## of ##

OREGON DEPARTMENT OF TRANSPORTATION

Prepared By: Katrina Sepulveda

Drafted By: Katrina Sepulveda

DFI D00888
MAINTENANCE DISTRICT 2B HWY 160
Water Quality Bioinfiltration Swale
Cascade Highway MP 10.41 - 10.44
Clackamas County

D00888.dgn :: Default 3/18/2019 12:04:19 PM hwyr65q

B Appendix B – Project Contract Plans

Contents:

Site Specific Subset of Project Contract Plan 42V-190

Partial Plan Set

Contract Plans

42V-190

INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
1	Title Sheet
1A & 1A-2	Index Of Sheets Cont'd. & Std. Drg. Nos.

STATE OF OREGON

DEPARTMENT OF TRANSPORTATION

PLANS FOR PROPOSED PROJECT

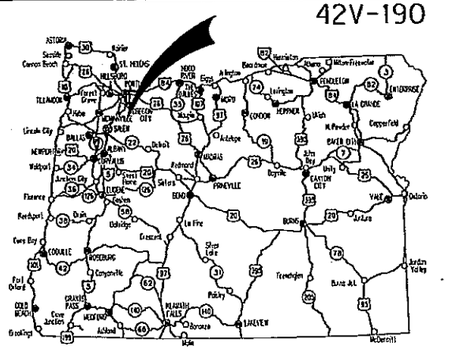
GRADING, DRAINAGE, STRUCTURE, PAVING, AND SIGNING

OR213:CASCADE HWY S (MILK CR BR) MULINO SEC.

CASCADE HIGHWAY SOUTH

CLACKAMAS COUNTY
NOVEMBER 2009

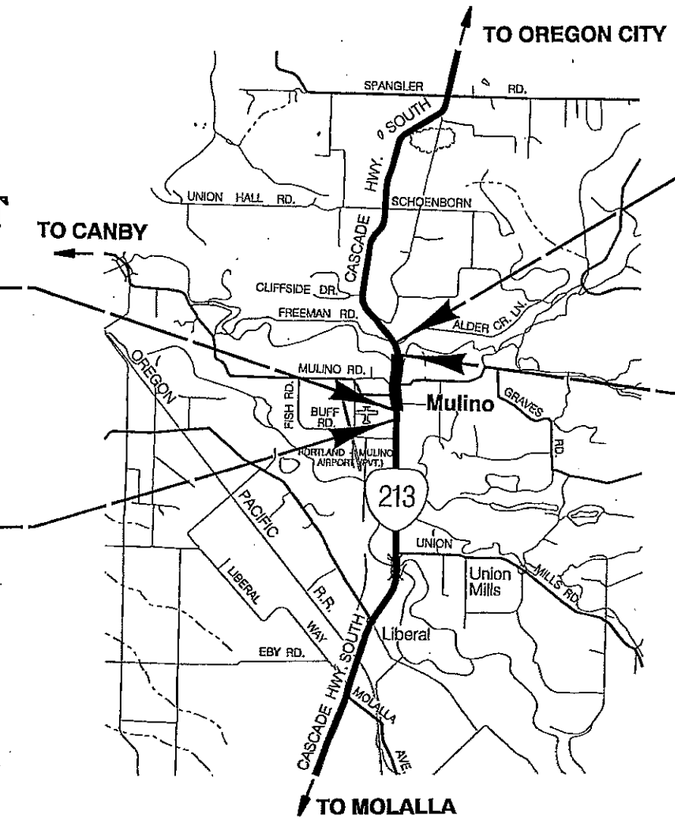
NOT REVISED AS CONSTRUCTED
21 SEP 2012 CONTRACT 14146
PROJ.MGR. MARJORIE WEST
Marjorie West



Overall Length Of Project - 0.86 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



BEGINNING OF PROJECT
X-BRF-NTSA-S160(045)
STA. "C" 262+20 (M.P. 11.18)

BEGINNING OF CONTRACT PROJECT
STA. "C" 252+55 (M.P. 11.36)

END OF CONTRACT PROJECT
STA. "C" 294+00 (M.P. 10.50)

END OF PROJECT
X-BRF-NTSA-S160(045)
STA. "C" 289+06.0 (M.P. 10.59)

N

T. 4 S., R. 2 E., W.M.

OREGON TRANSPORTATION COMMISSION

Gail Achterman	CHAIR
Michael Nelson	VICE-CHAIR
Janice Wilson	COMMISSIONER
Alan Brown	COMMISSIONER
David Lohman	COMMISSIONER
Matthew L. Garrett	DIRECTOR OF TRANSPORTATION

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: Naveen S. Chandra
Naveen G. Chandra, P.E.
Project Delivery Manager, Region 1

B Johnson
Concurrence by ODOT Chief Engineer

OR213:CASCADE HWY S (MILK CR BR) MULINO SEC.
CASCADE HIGHWAY SOUTH
CLACKAMAS COUNTY

FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION	X-BRF-NTSA-S160(045)	1

PE00 .3 000

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INDEX OF SHEETS, CONT'D.

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2, 2A, 2A-2 Thru 2A-10	Typical Sections
2B, 2B-2 Thru 2B-7	Details
2C	Traffic Control Detail
2C-2	Detour Plan
2C-3 Thru 2C-12	Traffic Control Plans
2D, 2D-2 & 2D-3	Pipe Data Sheet
3	Alignment & General Construction
3A	Profile
3B	Drainage & Utilities
3C	Drainage Profile
3D	Right of Way
4	Alignment & General Construction
4A	Profile
4B	Drainage & Utilities
4C	Drainage Profile
4D	Right of Way
5	Alignment & General Construction
5A	Profile
5B	Drainage & Utilities
5C	Drainage Profile
5D	Right of Way
6	Alignment & General Construction
6A	Profile
6B	Drainage & Utilities
6C	Drainage Profile
6D	Right of Way
GEO/HYDRO	
GA, GA-2 Thru GA-4	Erosion Control Plans
GB & GB-2	Geotechnical Data
GC, GC-2 Thru GC-4	Retaining Wall, Plan, Profile & Detail
GG	Temporary Water Management
GH	Bridge Scour Countermeasure
GJ, GJ-2 Thru GJ-5	Pipe Profiles
GJ-6 Thru GJ-11	Water Quality Plan, Profile & Detail
GN, GN-2 Thru GN-19	Roadside Development Plan
PERMANENT PAVEMENT MARKINGS	
ST Thru ST-4	Striping Plan

Standard Drg. Nos.

RD100	- Mailbox Support
RD101	- Mailbox Installation
RD250	- Thrust Blocking
RD254	- Hydrant Installation
RD270	- Combination Air-Release Air Vacuum Valve Assembly
RD274	- ¾" - 2" Water Service Connection
RD300	- Trench Backfill, Bedding, Pipe Zone And Mult. Installations
RD302	- Street Cut
RD316	- Sloped Ends For Metal Pipe
RD318	- Sloped Ends For Concrete Pipe
RD326	- Coupling Bands For Corrugated Metal Pipe
RD330	- Metal Pipe Slope Anchors
RD336, RD342, RD344, RD346	- Manholes
RD356	- Manhole Cover & Frames
RD360	- Manhole Frame Adjustment
RD364, RD366, RD368, RD370	- Concrete Inlets
RD380, RD384, RD386, RD388, RD390	- Pipe Fill Height Tables
RD400, RD405, RD410, RD415, RD420, RD425, RD435, RD450	- Guardrail
RD500	- Precast Concrete Barrier Pin And Loop Assembly
RD515	- Median Barrier Anchoring Details
RD530	- Guardrail Transition To Concrete Barrier
RD545	- Precast Tall (42") Concrete Barrier
RD610	- Asphalt Pavement Details
RD700	- Curbs
RD715	- Approaches & Non-Sidewalk Dwys.
RD720	- Sidewalks
RD735	- Curb Line Sidewalk Dwys. Or Alleys
RD755	- Sidewalk Ramp Details
RD756, RD757	- Sidewalk Ramp Placement
RD759	- Truncated Dome Detectable Warning Surface Details And Locations
RD770, RD771	- Pedestrian Handrail
RD810	- Barbed And Woven Wire Fences
RD815	- Chain Link Fence
RD1005	- Check Dams
RD1010, RD1015, RD1020	- Inlet Protection
RD1025, RD1030, RD1035	- Sediment Barrier
RD1040	- Sediment Fence
RD1045	- Temporary Slope Drains
RD1055	- Matting

BR139, BR141, BR145	- Expansion Joints
BR165	- Bridge End Panel Details
BR200	- Concrete Bridge Rail Type F
BR203	- Transition Conc. Br. Rail To Guard Rail
BR233	- Thrie-Beam Rail
BR250	- Pedestrian Rail
BR270	- Rail Transition Details Flex Beam Rail To Three Tube Rail
BR273	- Thrie Beam Rail Retrofit For Curb And Parapet Rail
BR286	- Retrofit For Steel Handrail With Sidewalk
BR321	- BT90 And BT96 Girders
BR350	- Temp. Diaphragm Beam For Prestressed Conc. Girders
BR705	- Standard Retaining Walls Front Face Battered 1" Per Ft.
TM200	- Sign Installation Details
TM201	- Miscellaneous Sign Placement Details
TM204	- Flag Board Mounting Details
TM211, TM212	- Signing Details
TM221, TM222	- Milepost Marker Details
TM223, TM224	- Directional Sign Layout
TM492	- Ramp Meter Layout And Details
TM500, TM501, TM502, TM503	- Pavement Marking Standard Details
TM515	- Raised Pavement Markers
TM517	- Recessed Pavement Markers
TM520, TM521	- Durable Pavement Markings
TM525	- Turn Arrow Marking Details
TM530	- Intersection Pavement Markings
TM539	- Median And Left Turn Channelization Details
TM560, TM561	- Alignment Layout
TM570	- Traffic Delineators
TM576	- Traffic Delineator Installation
TM602	- Triangular Base Breakaway Multi-Direction Slip Base
TM670	- Perm. Signing Wood Post Supports Sizing Charts
TM671	- 3 Second Gust Wind Speed Isotach
TM676	- Sign Attachments
TM677	- Sign Mounts
TM681, TM687, TM688	- Square Tube Sign Supports
TM800	- Tables, Abrupt Edge And PCMS Details
TM820	- Temporary Barricades
TM821	- Temporary Sign Supports
TM830	- Temporary Concrete Barrier And Rumble Strips
TM831	- Temporary Impact Attenuators
TM840, TM841, TM842	- Closure Details
TM850	- 2-Lane, 2 Way Roadways
TM851	- Non-Freeway Multi-Lane Sections
TM870	- Bridge Construction

R/W Map No. 6B-32-9 And 5B-8-13

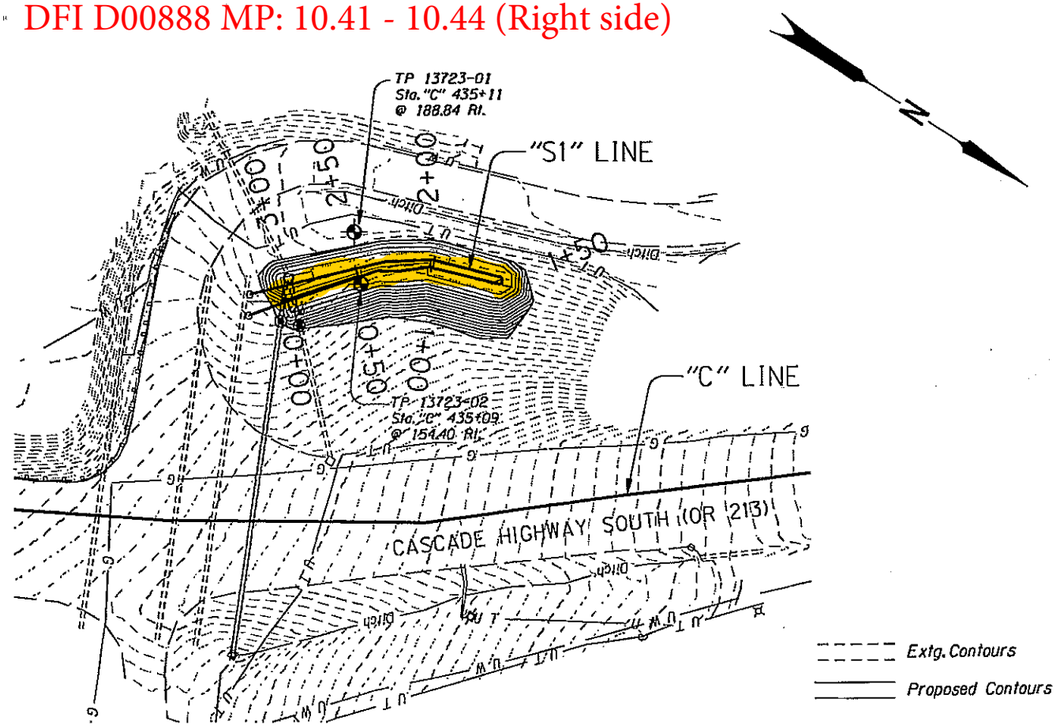
REVISED AS CONSTRUCTED
21 SEP 2012 CONTRACT 14146
PROJ.MGR. MARJORIE WEST
Marjorie West

OR213:CASCADE HWY S (MILK CR BR)
MULINO SEC.
CASCADE HIGHWAY SOUTH
CLACKAMAS COUNTY

FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION	X-BRF-NTSA-S160(045)	1A

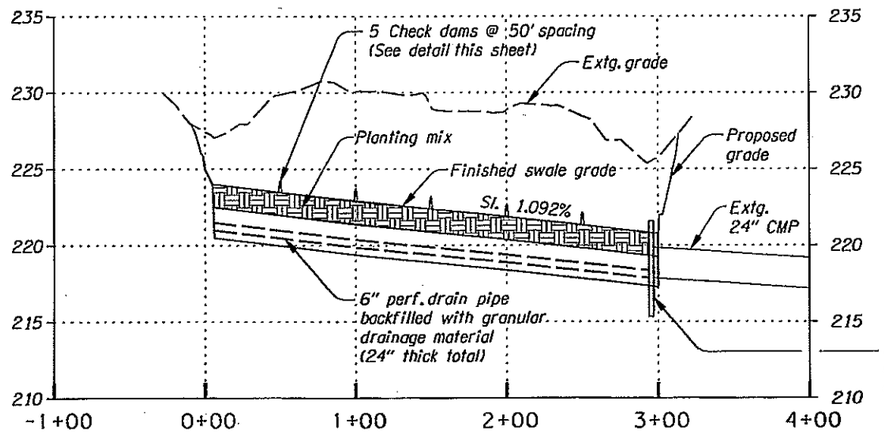
Standard Drawings located on the web at:
http://www.oregon.gov/ODOT/HWY/ENGSERVICES/standard drawings home.shtml

DFI D00888 MP: 10.41 - 10.44 (Right side)



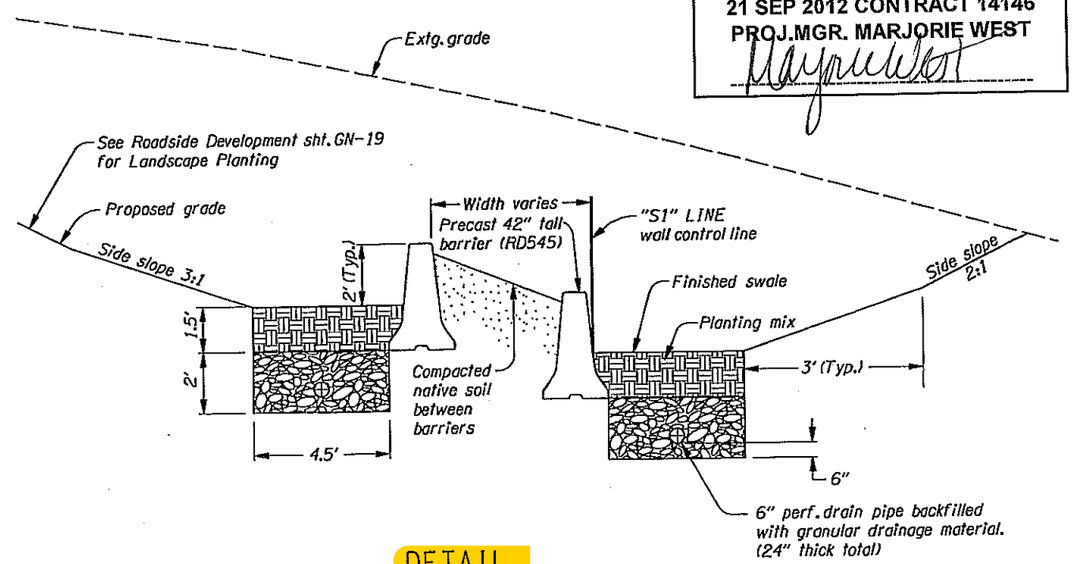
PLAN

Scale: 1"=100'



"S1" SWALE PROFILE

Horz. Scale: 1"=100'
Vert. Scale: 1"=10'



DETAIL

Not to scale

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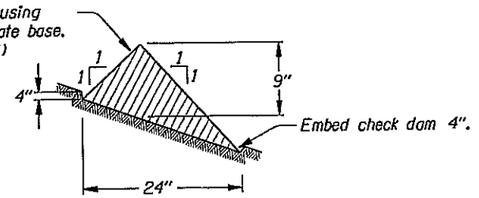
21 SEP 2012 CONTRACT 14146
PROJ.MGR. MARJORIE WEST

Notes:

Sta. "S1" 0+00.00
Remove extg. stormwater MH
Const. water quality swale - 295'
Ditch excavation - 1550 cu. yd.
Planting mix - 83 cu. yd.
Inst. 6" perf. drainage pipe - 295'
Drainage geotextile type "2" - 500 sq. yd.
Const. left curb with precast tall (42") barrier - 295'

Sta. "S1" 2+95.00
Remove extg. field inlet structure
Const. ditch type "D" inlet
Connect extg. 24" CMP outlet pipe



CHECK DAM DETAIL

Not to scale

TP 13723-01 = Test pit

Drill logs for test borings shown on this drawing are available upon request. Contractor shall refer to geotechnical reports and drill logs and information contained therein.

REGISTERED PROFESSIONAL ENGINEER
78814PE
OREGON
JAN 9, 2007
EDWARD P. FOLTYN
RENEWAL DATE: 12-31-2009

OREGON DEPARTMENT OF TRANSPORTATION

REGION 1 - Geo/Hydro/HazMat Unit

OR213: CASCADE HWY S. (MILK CR BR) MULINO SEC.
CASCADE HIGHWAY SOUTH
CLACKAMAS COUNTY

Reviewed By - Bruce Council
Designed By - Ed Foltyn
Drafted By - Charlotte Gerken

WATER QUALITY PLAN, PROFILE & DETAIL

SHEET NO. GJ-9

DFI D00888 MP: 10.41 - 10.44 (Right side)

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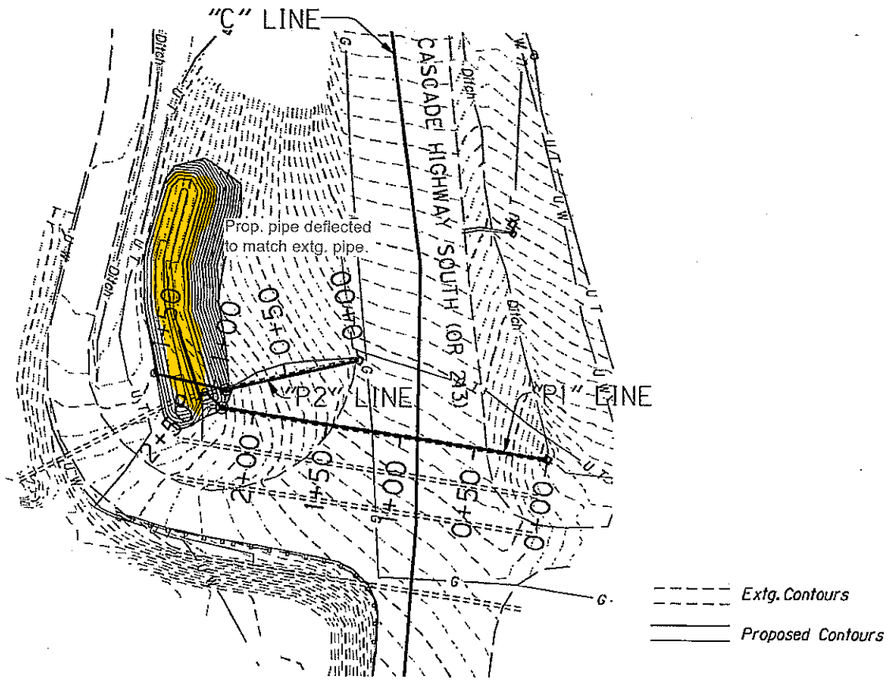
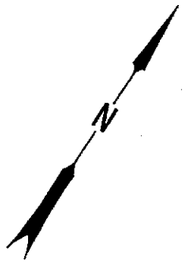
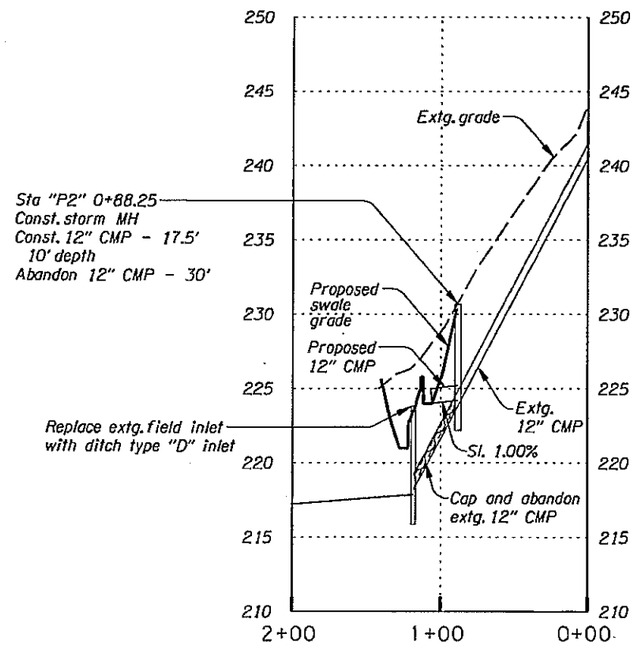
21 SEP 2012 CONTRACT 14146
PROJ.MGR. MARJORIE WEST



PLAN



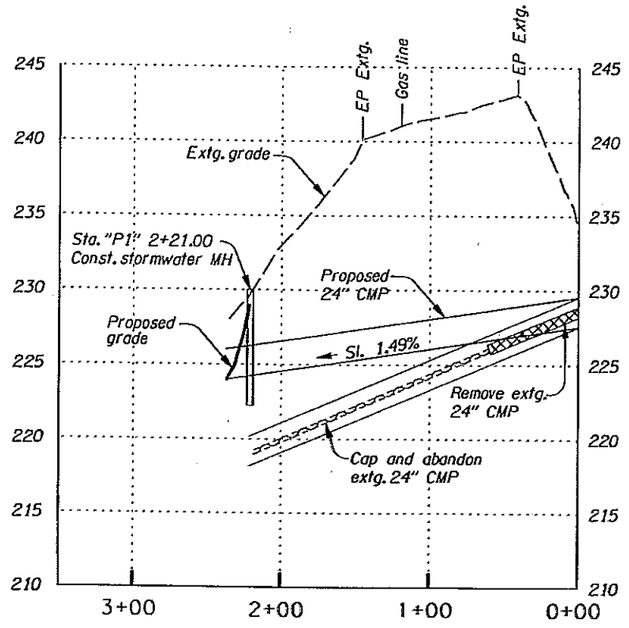


"P2" DRAINAGE PROFILE

Horz. Scale: 1"=100'
Vert. Scale: 1"=20'

Notes:

Sta. "P2" 0+88.30
Const. stormwater MH
Abandon and plug extg. 12" CMP - 32'
Connect extg. 12" CMP
Const. 12" CMP - 19'
Trench resurfacing - 35 sq.yd.
(For details, see landscaping plans)



"P1" DRAINAGE PROFILE

Horz. Scale: 1"=100'
Vert. Scale: 1"=20'

Notes:

Sta. "P1" 0+00.00
Remove extg. 24" CMP - 85'
Abandon and plug extg. 24" CMP - 160'
Const. 24" CMP - 221'
Trench resurfacing - 120 sq.yd.

Sta. "P1" 2+21.00
Const. stormwater MH
Const. 24" CMP

Plug or abandon pipe shown thus: ≈≈≈
Remove pipe shown thus: ⊠⊠⊠

OREGON DEPARTMENT OF TRANSPORTATION

REGION 1 - Geo/Hydro/HazMat Unit

REGISTERED PROFESSIONAL ENGINEER
78814PE
OREGON
JAN 9, 2007
EDWARD P. FOLTYN

RENEWAL DATE: 12-31-2009

OR213: CASCADE HWY S. (MILK CR BR) MULINO SEC.
CASCADE HIGHWAY SOUTH
CLACKAMAS COUNTY

Reviewed By - Bruce Council
Designed By - Ed Foltyn
Drafted By - Charlotte Gerken

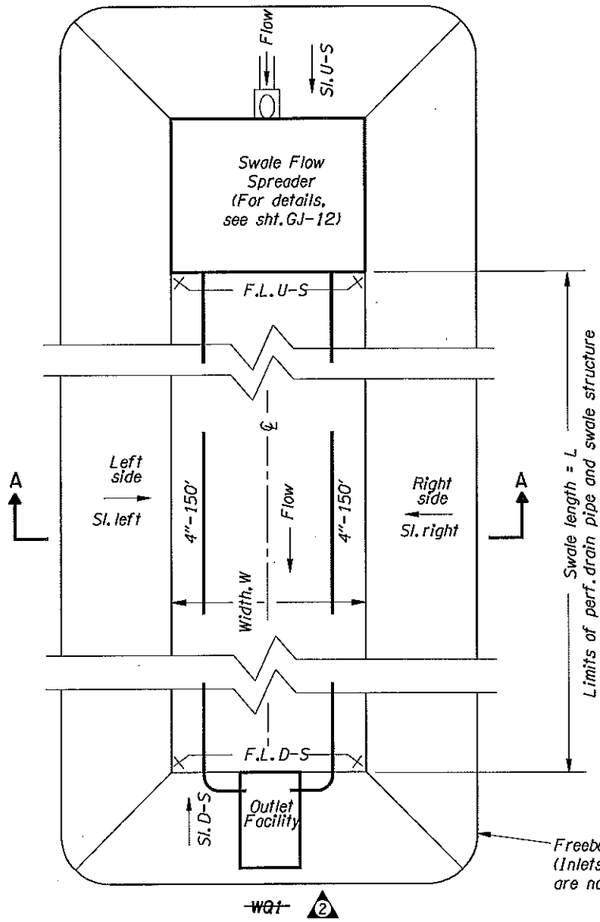
WATER QUALITY
PLAN & PROFILE

SHEET NO.
GJ-10

⚠1 WATER QUALITY SWALE GENERAL DETAILS

PLAN AND TYPICAL CROSS-SECTION

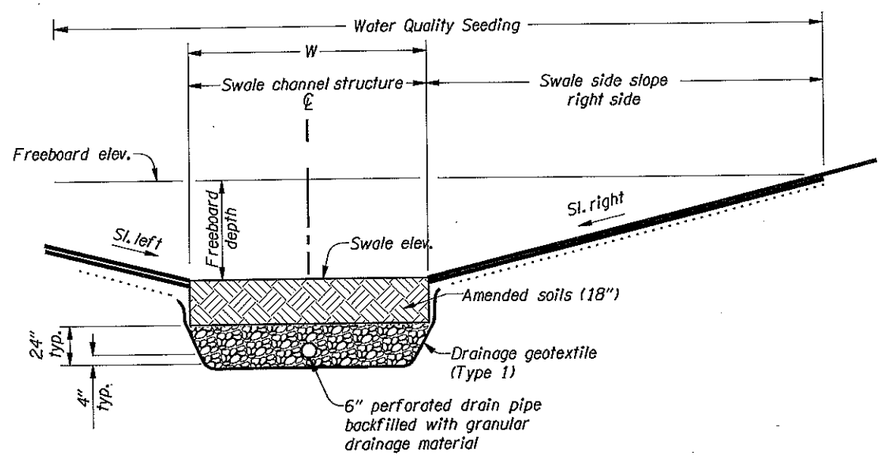
REVISED AS CONSTRUCTED
21 SEP 2012 CONTRACT 14146
PROJ.MGR. MARJORIE WEST
Marjorie West



~~WQ1~~ ⚠2

Note:
For swale specifics, refer to the table on this sht.

PLAN



For additional Section A-A details, see also sht. GN. For inflow, outflow locations and elevations see sht. GJ.

Note:
See sht. GN for seeding, planting, and swale bottom medium details.

SECTION A-A

Swale ID	L (ft) ⚠2	W (ft)	F.L. U-S (ft) ⚠2	F.L. D-S (ft) ⚠2	Long. slope (%) ⚠2	Side slopes (H:V) U-S	Side slopes (H:V) D-S	Side slopes (H:V) Left	Side slopes (H:V) Right	Number of underdrain segments	Freeboard depth (ft)	Underdrain tie-in location	Swale outlet facility
"PGE_SW" Swale	164.6 ~~161~~	3	237.68	231.86	Varies (follows sidewalk slope	3:1	3:1	3:1	3:1	1		"D" mod. inlet	"D" mod. inlet
"W_SW" Swale	~~299.3 354.3~~	7	~~198.18 198.46~~	~~196.69 196.75~~	~~0.50% 0.483%~~	3:1	NA	4:1	2:1	NA	1	NA	Free outlet, (Class 50) loose riprap
"E_SW" Swale	~~427.3 240.9~~	7	~~200.55 200.23~~	~~195.00 199.34~~	Varies ~~0.369%~~	3:1	NA	2:1	4:1	NA	1	NA	Free outlet, (Class 50) loose riprap
"S1" Swale	295	4.5	224	200.78	1.092%	3:1	2:1	Vert. (barrier)	3:1	1	1	"D" mod. inlet	"D" mod. inlet

Notes:
1) U-S = Upstream
2) D-S = Downstream
3) See site plans for pipe inverts at inlets

No.	DATE	REVISIONS	BY
⚠1	02-04-10	Added this entire sheet	E.P.F
⚠2	07-01-10	Drainage Adjustments	D.N.A

REGISTERED PROFESSIONAL ENGINEER
78814PE
OREGON
JAN 9, 2007
EDWARD P. FOLTYN
RENEWS: 12-31-2011

OREGON DEPARTMENT OF TRANSPORTATION

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Reviewed By - Bruce Council
Designed By - Ed Foltyn
Drafted By - Charlotte Gerken

WATER QUALITY DETAILS

SHEET NO. GJ-13