

# OPERATION & MAINTENANCE MANUAL

## Water Quality Biofiltration Swale

Manual prepared: March 2019

DFI No. D01228



Figure 1: DFI No. D01228, looking southeast

## Identification

Drainage Facility ID (DFI): D01228  
Facility Type: Water Quality Biofiltration Swale  
Construction Drawings: (V-File Numbers) 42V-190  
Location: District: 2B  
Highway No.: 160  
Mile Post: 10.74 – 10.82 , [Left 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: South

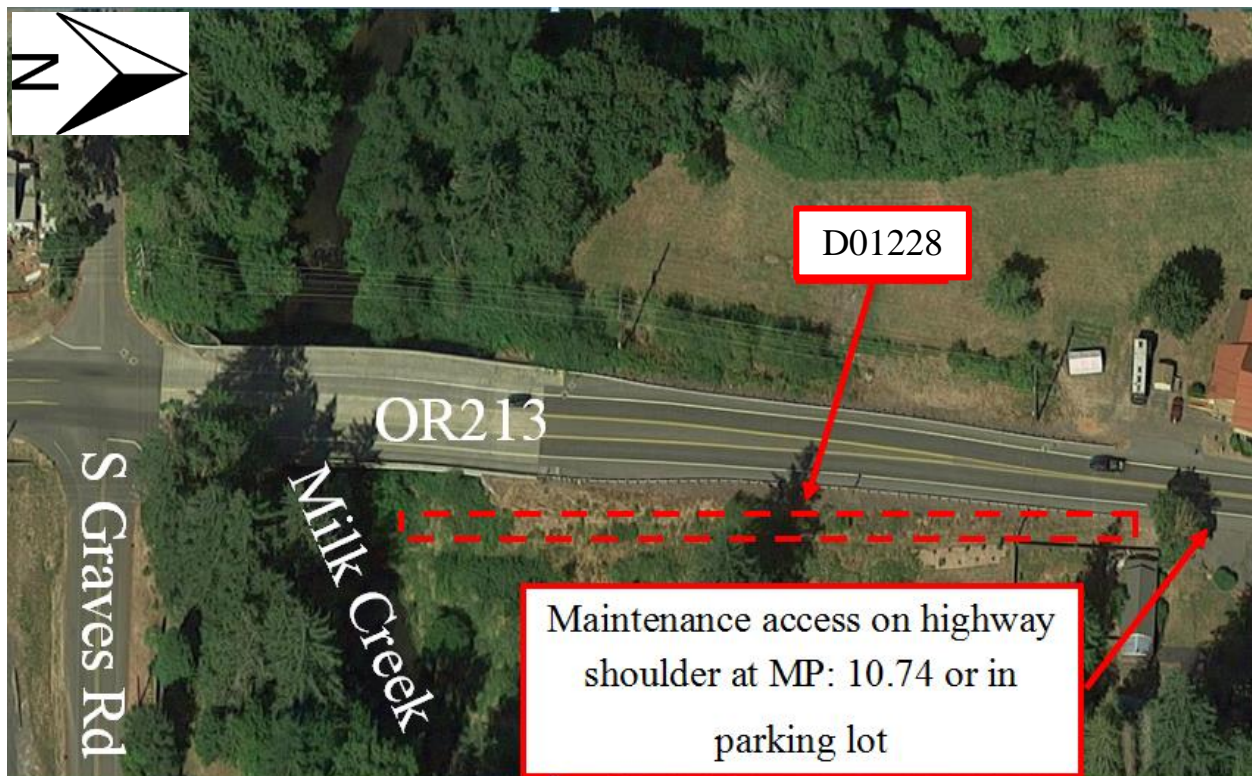


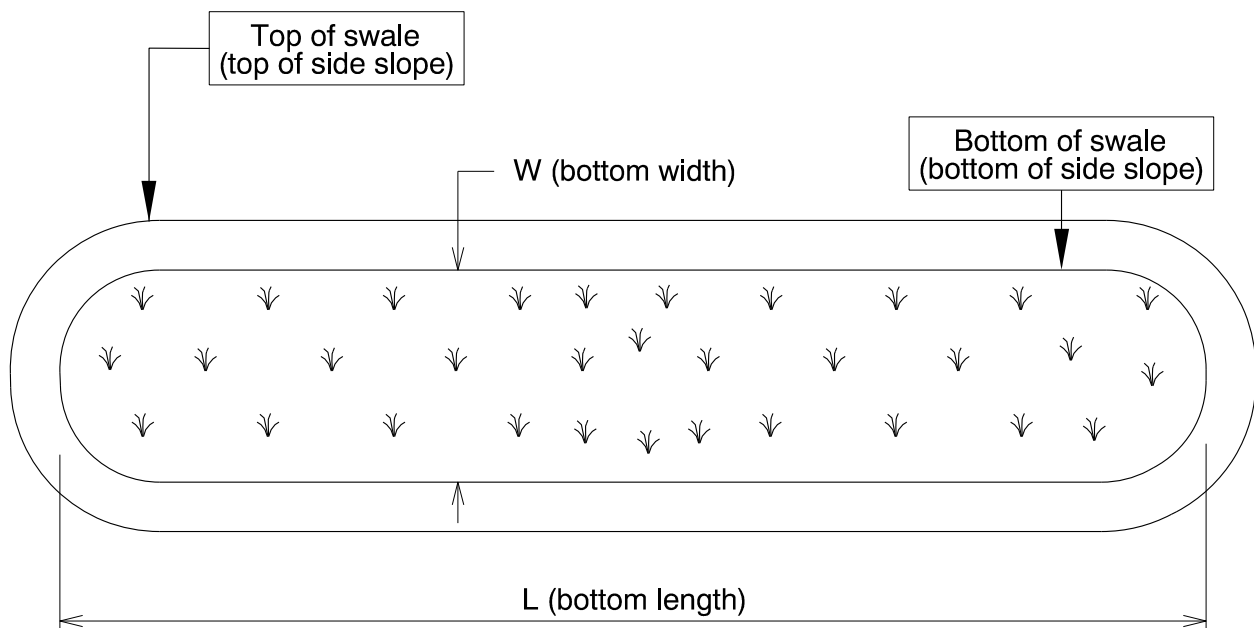
Figure 2: Facility location map

### 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:

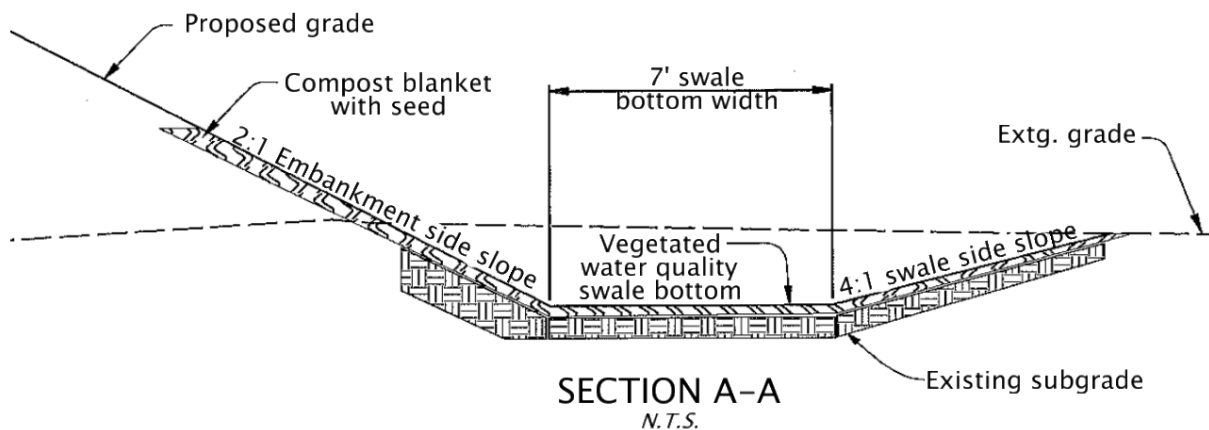
Bottom Length (feet)	Bottom Width (feet)
472.27	7



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:

	Foreslope		Backslope	
Depth (feet)	Rise (feet)	Run (feet)	Rise (feet)	Run (feet)
1	1	4	1	2



**Site Specific Information:** The water flows into this water quality facility through an open inlet at MP: 10.74. The water flows to the south through the facility and outlets into Milk Creek. There is no direct access to the water quality swale. There is a guardrail that blocks access. Maintenance trucks must park on the roadway shoulder at MP: 10.74 or use the nearby parking lot (shown in figure 3). This water quality facility is shown as “E\_SW” Swale Alignment in Appendix B, page GJ-8.

## 4. Facility Access

Maintenance access to the facility:

<input type="checkbox"/> Roadside pad	<input checked="" type="checkbox"/> Roadside shoulder
<input type="checkbox"/> Access road with Gate	<input type="checkbox"/> Access road without Gate



Figure 3: Maintenance access and parking

## 5. Operational Components / Maintenance Items

### Classification

This facility is classified as an:

<input checked="" type="checkbox"/> <b>On-line Swale</b>	<input type="checkbox"/> <b>Off-line Swale</b>
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:

<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
There is no bypass component. High flows drain 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:

<input checked="" type="checkbox"/> Operational Plan A	<input type="checkbox"/> Operational Plan B	<input type="checkbox"/> 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.

<b>Table 1: Swale Components</b>		<b>ID #</b>
<b>Manholes/Structures</b>		
Pre-treatment manhole	<input type="checkbox"/>	<b>S1</b>
Weir type flow splitter/flow splitter manhole	<input type="checkbox"/>	<b>S2</b>
Orifice type flow splitter/flow splitter manhole	<input type="checkbox"/>	<b>S3</b>
Standard manhole	<input type="checkbox"/>	<b>S4</b>
<b>Swale Inlet</b>		
Pavement sheet flow	<input type="checkbox"/>	<b>S5</b>
Inlet Pipe (s)	<input type="checkbox"/>	<b>S6</b>
Open channel inlet	<input checked="" type="checkbox"/>	<b>S7</b>
Riprap pad	<input type="checkbox"/>	<b>S8</b>
<b>Ground Cover</b>		
Grass bottom	<input checked="" type="checkbox"/>	<b>S9</b>
Grass side slopes	<input checked="" type="checkbox"/>	<b>S10</b>
Granular drain rock	<input type="checkbox"/>	<b>S11</b>
Compost Blanket with Seed	<input checked="" type="checkbox"/>	<b>S12</b>
<b>Underground Components</b>		
Geotextile fabric	<input type="checkbox"/>	<b>S13</b>
Water quality mix	<input type="checkbox"/>	<b>S14</b>
Perforated pipe	<input type="checkbox"/>	<b>S15</b>
Porous pavers (access grid)	<input type="checkbox"/>	<b>S16</b>
<b>Flow Spreader</b>		
Rock basin (used at inlet)	<input type="checkbox"/>	<b>S17</b>
Anchored board (midpoint of swale or every 50 feet along swale bottom)	<input type="checkbox"/>	<b>S18</b>
Other: describe type	<input type="checkbox"/>	<b>S19</b>
<b>Swale Outlet</b>		
Catch basin with grate	<input type="checkbox"/>	<b>S20</b>
Outlet Pipe (s)	<input type="checkbox"/>	<b>S21</b>
Open channel outlet	<input checked="" type="checkbox"/>	<b>S22</b>
Auxiliary Outlet: describe type	<input type="checkbox"/>	<b>S23</b>
<b>Outfall Type</b>		
Waterbody (Milk Creek)	<input checked="" type="checkbox"/> <b>C</b> <input type="checkbox"/> <b>L</b> <input type="checkbox"/> <b>O</b>	<b>S24</b>
Ditch	<input type="checkbox"/>	<b>S25</b>
Storm drain system	<input type="checkbox"/>	<b>S26</b>
<b>Outfall Components</b>		
Loose rip rap	<input checked="" type="checkbox"/>	<b>S27</b>
Riprap bank protection	<input type="checkbox"/>	<b>S28</b>



Figure 4: Beginning of the water quality facility, looking north





Figure 5: Water Quality Facility, looking south



Figure 6: Loose Rip Rap Outfall, looking south

## 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](http://www.oregon.gov/ODOT/Maintenance/Documents/blue_book.pdf)

## 7. Limitations

Access grid installed:

<input checked="" type="checkbox"/> No	<input type="checkbox"/> 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](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

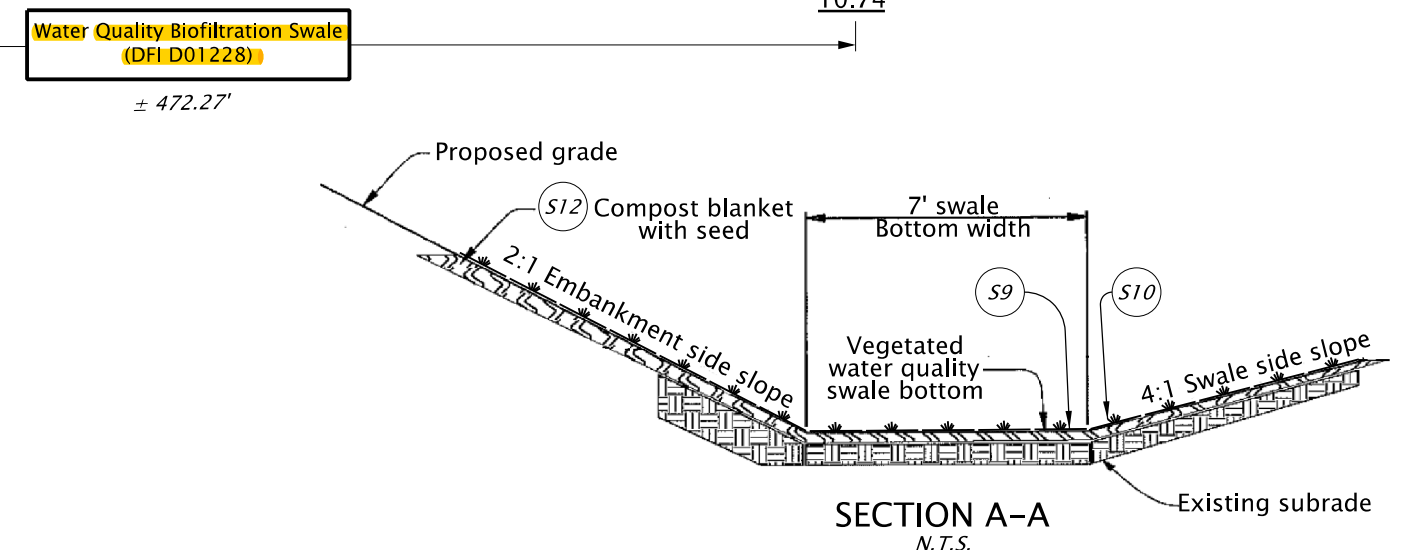
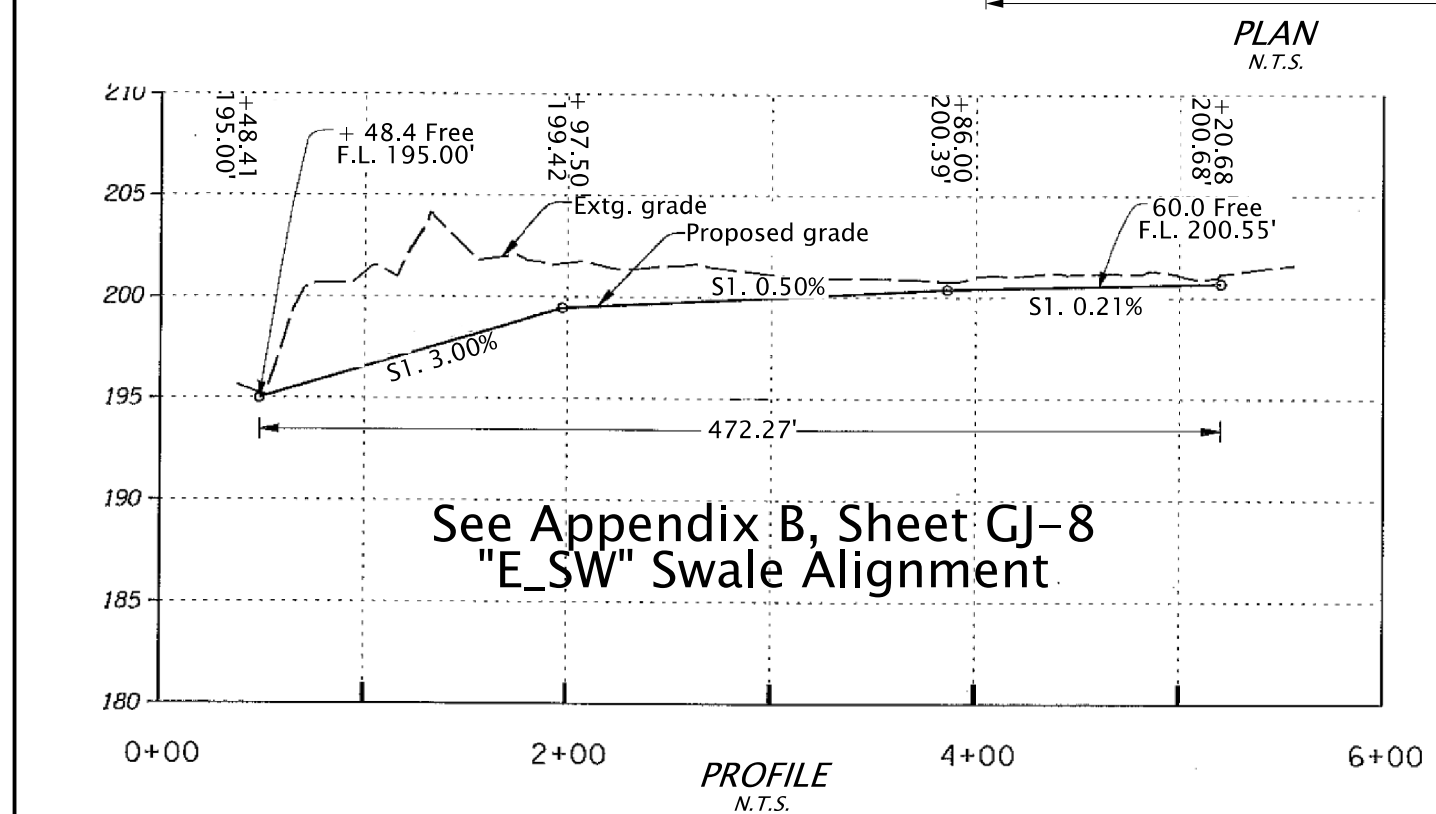
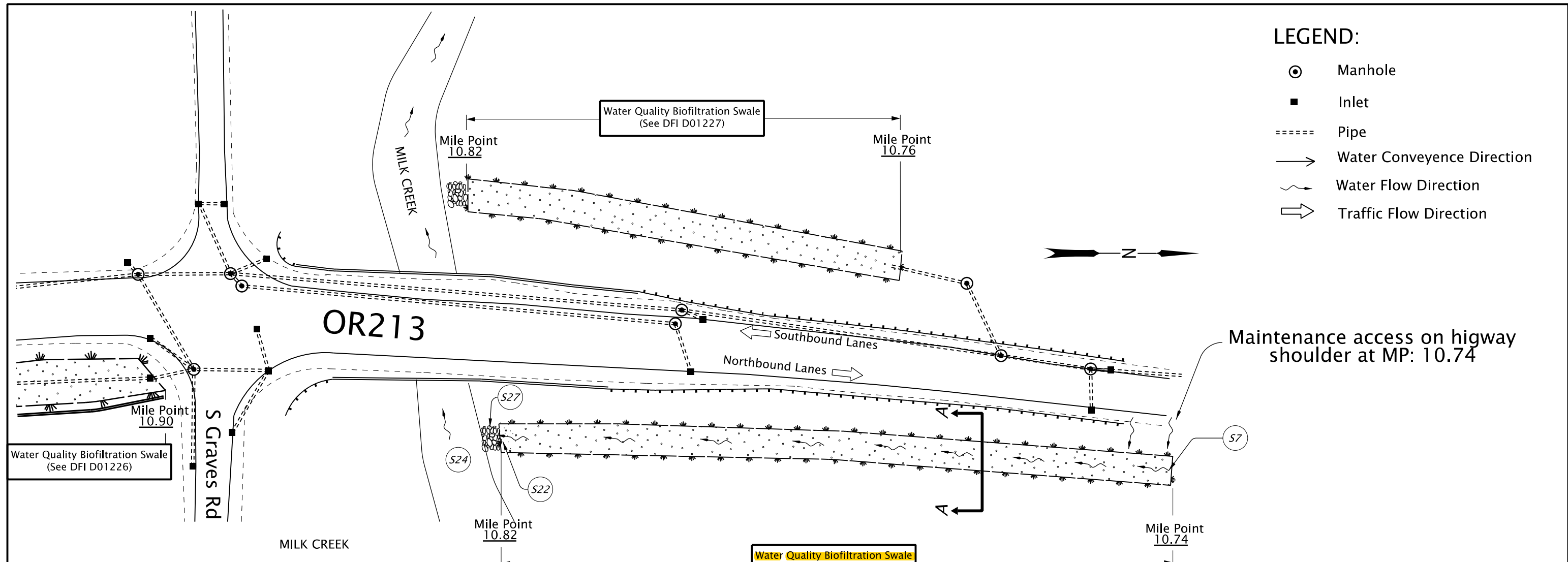
## **A Appendix A – Site Specific Operational Plan**

### **Contents:**

**Operational Plan: DFI D01228**

**LEGEND:**

- ⊙ Manhole
- Inlet
- ===== Pipe
- Water Conveyance Direction
- ~ Water Flow Direction
- ⇨ Traffic Flow Direction



Sht. 01 of 01

Prepared By: Katrina Sepulveda

Drafted By: Katrina Sepulveda

**DFI D01228**  
**MAINTENANCE DISTRICT 2B HWY 160**  
**Water Quality Biofiltration Swale**  
 Cascade Highway MP 10.74 - 10.82  
 Clackamas County

## **B Appendix B – Project Contract Plans**

### **Contents:**

**Site Specific Subset of Project Contract Plan 42V-190**

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

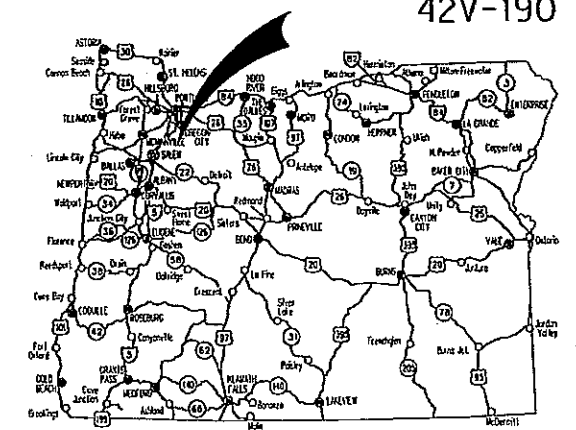
STATE OF OREGON  
DEPARTMENT OF TRANSPORTATION  
PLANS FOR PROPOSED PROJECT

GRADING, DRAINAGE, STRUCTURE, PAVING, AND SIGNING

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

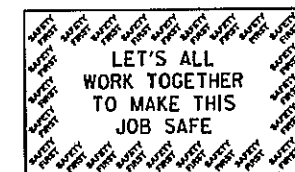
CLACKAMAS COUNTY  
NOVEMBER 2009

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



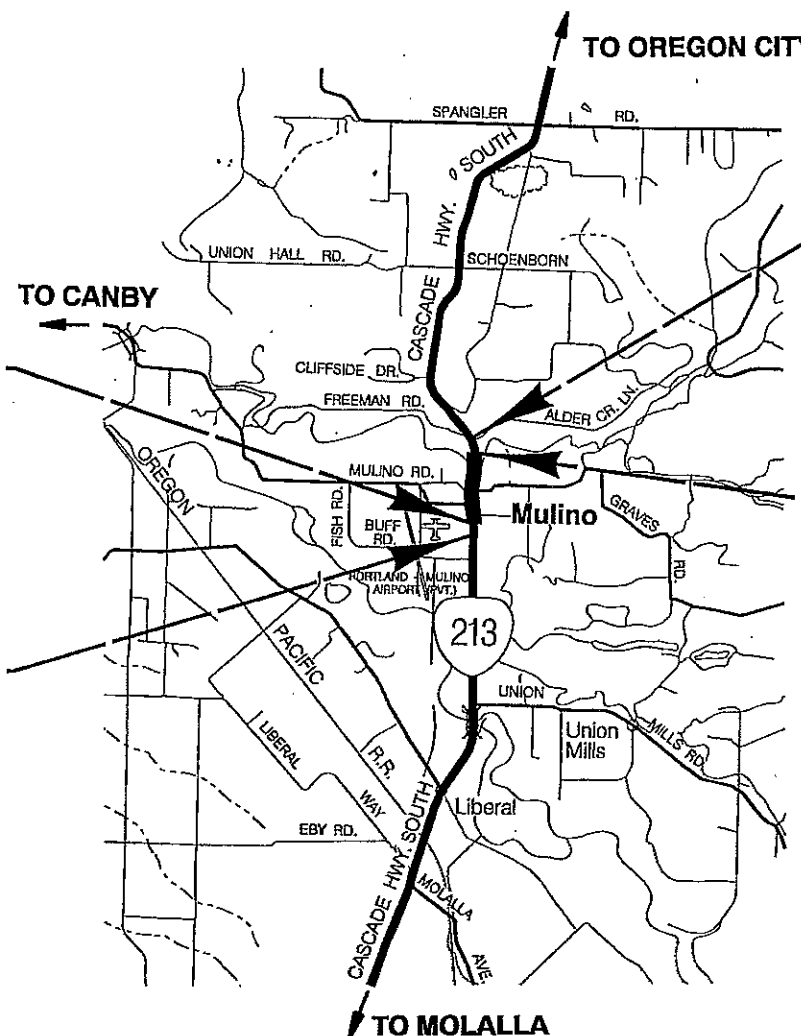
Overall Length Of Project - 0.86 Miles

**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.)



**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)**

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 G. 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

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



PECO. 5 000

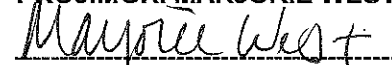
INDEX OF SHEETS, CONT'D.	
SHEET NO.	DESCRIPTION
2, 2A, 2A-2 Thru 2A-10	Typical Sections
2B, 2B-2 Thru 2B-7	Details
2C	Traffic Control Detail
2C-2	Detour Plan
2C-3 Thru 2C-12	Traffic Control Plans
2D, 2D-2 & 2D-3	Pipe Data Sheet
3	Alignment & General Construction
3A	Profile
3B	Drainage & Utilities
3C	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
<b>GEO/HYDRO</b>	
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
<b>PERMANENT PAVEMENT MARKINGS</b>	
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 - 3/4" - 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, - Pipe Fill Height Tables
- RD386, RD388, RD390
- RD400, RD405, RD410, RD415, - Guardrail
- RD420, RD425, RD435, RD450
- 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
- RDB10 - Barbed And Woven Wire Fences
- RDB15 - 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

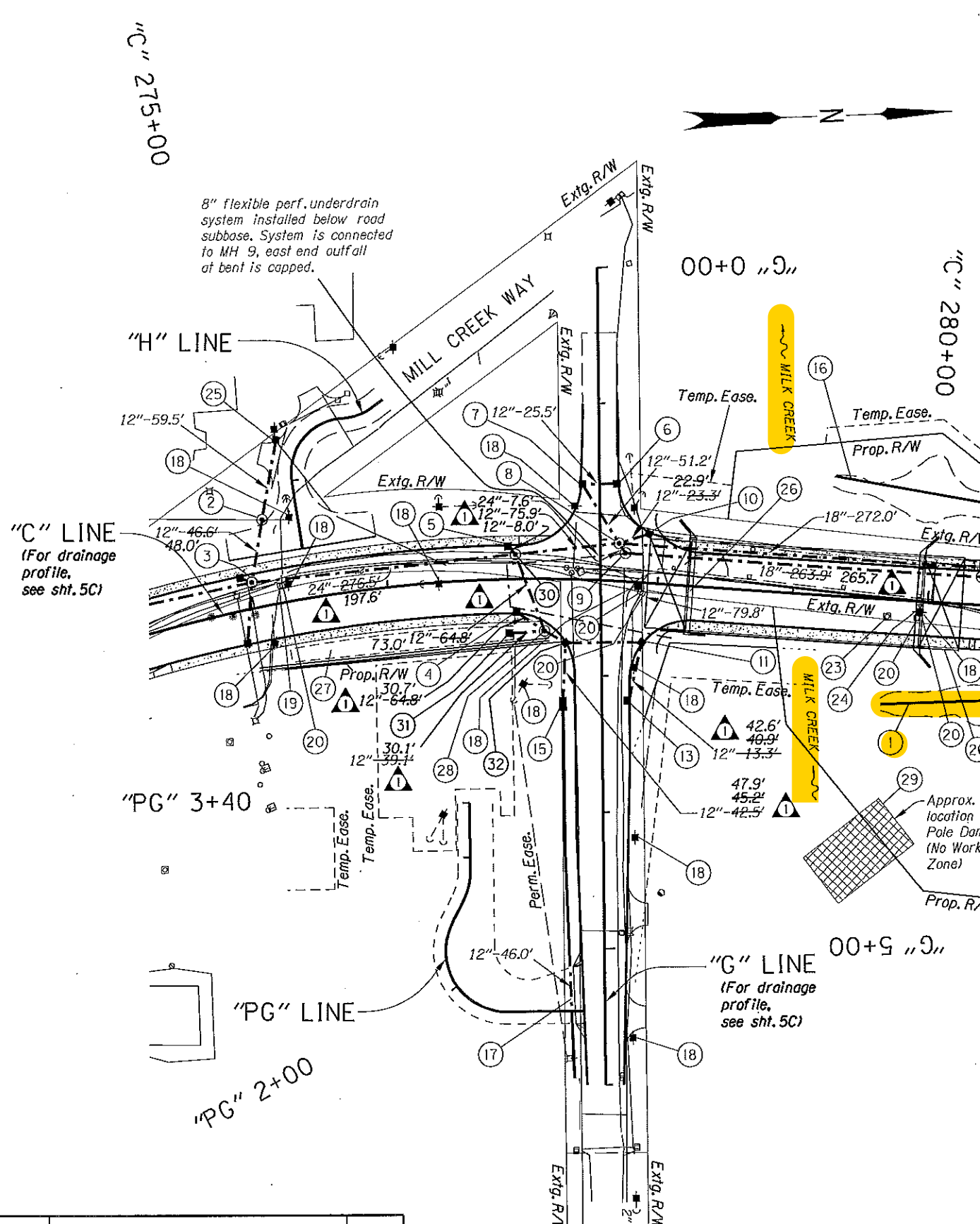
R/W Map No. 6B-32-9 And 5B-8-13

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


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-S16010451	1A

Standard Drawings located on the web at:  
[http://www.oregon.gov/ODOT/HWY/ENG/SERVICES/standard\\_drawings\\_home.shtml](http://www.oregon.gov/ODOT/HWY/ENG/SERVICES/standard_drawings_home.shtml)





- 17 Sta. "G" 5+10.9, 25.7' Rt. to Sta. "G" 5+56.9, 24.2' Rt. 22.2' Inst. 12" culv. pipe - 46.8' 48.5' 5' depth (For details, see sht. GJ-4)
- 18 Relocate power pole - 11 (By others)
- 19 Relocate TV riser (By others)
- 20 Relocate phone riser - 5 (By others)
- 21 Note deleted
- 22 Note deleted
- 23 Relocate stream gauge (By others)
- 24 Relocate phone pole (By others)
- 25 Sta. "C" 275+36.7, 118.9 Rt. Lt. Const. "M-E" inlet (For details, see sht. GJ-3)
- 26 Inst. casings - 4 (Incidental to end panel) (See bridge drgs.)
- 27 Sta. "C" 275+21, 30.5' Rt. to Sta. "C" 276+90, 31.5' Rt. Const. water quality swale (For details, see sht. GJ-6)
- 28 Sta. "C" 277+30.6, 39.7' Rt. Const. manhole Inst. 12" sew. pipe - 39.1' 70.2' 5' depth (For details, see sht. GJ-6)
- 29 See sht. GN-10
- 30 Sta. "C" 276+96.2, 19.6' Lt. Const. manhole 72" dia. Inst. 12" sew. pipe - 72.8' 5' depth Inst. 24" sew. pipe - 197.6' 5' depth (For details, see sht. GJ & GJ-4)
- 31 Sta. "C" 276+90.6, 39.7' Rt. Const. type "D" inlet (For details, see sht. GJ-6 & GJ-12)
- 32 Sta. "G" 2+72.2, 26.7' Rt. Const. "G2" inlet Inst. 12" sew. pipe - 103.1' 5' depth (For details, see sht. GJ-4 & GJ-5)
- 8 Sta. "C" 277+70.0, 27.7' Lt. Const. manhole, sedimentation 72" dia. w/ 4' sump Inst. temp. outfall pipe (For details, see sht. GG) Inst. 12" sew. pipe - 156.9' 74.5' 5' depth Inst. 24" sew. pipe - 273.5' 75.9' 20' depth Trench resurf. - 120 sq.yd. (For details, see shts. GJ, GJ-3 & GJ-4)
- 9 Sta. "C" 277+75.0, 20.7' Lt. Const. manhole Inst. 24" sew. pipe - 8.6' 7.6' 5' depth (For details, see sht. GJ)
- 10 Sta. "C" 277+90.8, Lt. Const. type "CG-2" inlet Inst. 12" sew. pipe - 79.8' 5' depth (For details, see sht. GJ-4)
- 11 Sta. "C" 277+90.3, Rt. Const. type "CG-2" inlet 42.6' Inst. 12" sew. pipe - 35.3' 40.9' 5' depth (For details, see sht. GJ-4 & GJ-5)
- 12 Sta. "G" 3+11.0, 29.2' Lt. Const. manhole Inst. 12" sew. pipe - 71.5' 5' depth (For details, see shts. GJ-4 & GJ-5)
- 13 Sta. "G" 3+18.22, Lt. Const. type "CG-2" inlet (For details, see sht. GJ-5)
- 14 Sta. "G" 3+10.5, 29.0' Rt. Const. manhole Inst. 12" sew. pipe - 40.7' 5' depth (For details, see sht. GJ-4)
- 15 Sta. "G" 3+20.1, 29.0' Rt. Const. type "M-E" inlet (For details, see sht. GJ-4)
- 16 Sta. "C" 279+25.0, 87.5' Lt. to Sta. "C" 282+24.3, 50.2' Lt. Const. ditch Ditch exc. - 45 cu.yd.
- 1 Sta. "C" 279+73.0, 82.7' Rt. to Sta. "C" 284+30, 34.4' Rt. Const. ditch - 295' Ditch exc. - 18 cu.yd.
- 2 Sta. "C" 275+17.4, 62.8' Lt. Const. manhole Inst. 12" sew. pipe - 59.5' 5' depth Connect To Existing Trench resurf. - 20 sq.yd. (For details, see sht. GJ-3)
- 3 Sta. "C" 275+01.9, 19.1' Lt. Const. manhole 72" dia. Inst. 24" sew. pipe - 369.7' 20' depth Inst. 12" sew. pipe - 100.4' 5' depth Trench resurf. - 225 sq.yd. (For details, see shts. GJ & GJ-3)
- 4 Sta. "C" 276+95.1, Rt. Const. "CG-2" inlet (For details, see sht. GJ-4)
- 5 Sta. "C" 276+89.7, Lt. Const. "CG-2" inlet Inst. 12" sew. pipe - 48.5' 5' depth Trench resurf. - 3 sq.yd. (For details, see sht. GJ-4)
- 6 Sta. "G" 1+59, Lt. Sta. "C" 277+67.4, Lt. Const. "CG-2" inlet (For details, see sht. GJ-4)
- 7 Sta. "G" 1+59, Rt. Sta. "C" 277+41.2, Lt. Const. "CG-2" inlet 26.8' Inst. 12" sew. pipe - 25.5' 10' 5" depth (For details, see sht. GJ-4)

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

**OREGON DEPARTMENT OF TRANSPORTATION**

REGION 1 - ROADWAY ENGINEERING SECTION

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

Design Team Leader - Lawrence Kretzler  
 Designed By - Timothy Fredette  
 Drafted By - Jaiid Heydarpour

**DRAINAGE AND UTILITIES**

SHEET NO. **5B**

REGISTERED PROFESSIONAL  
 ENGINEER  
 17837

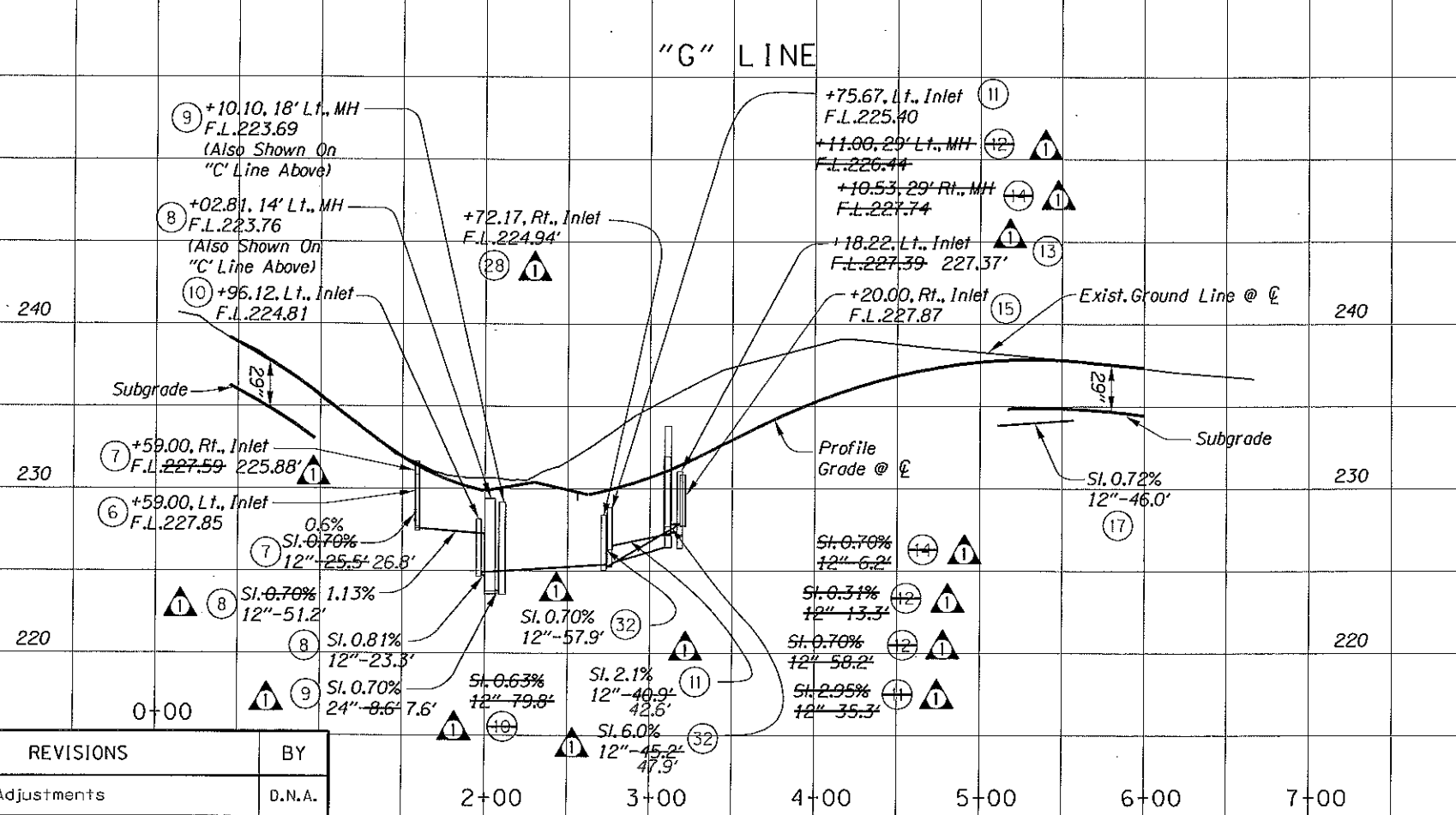
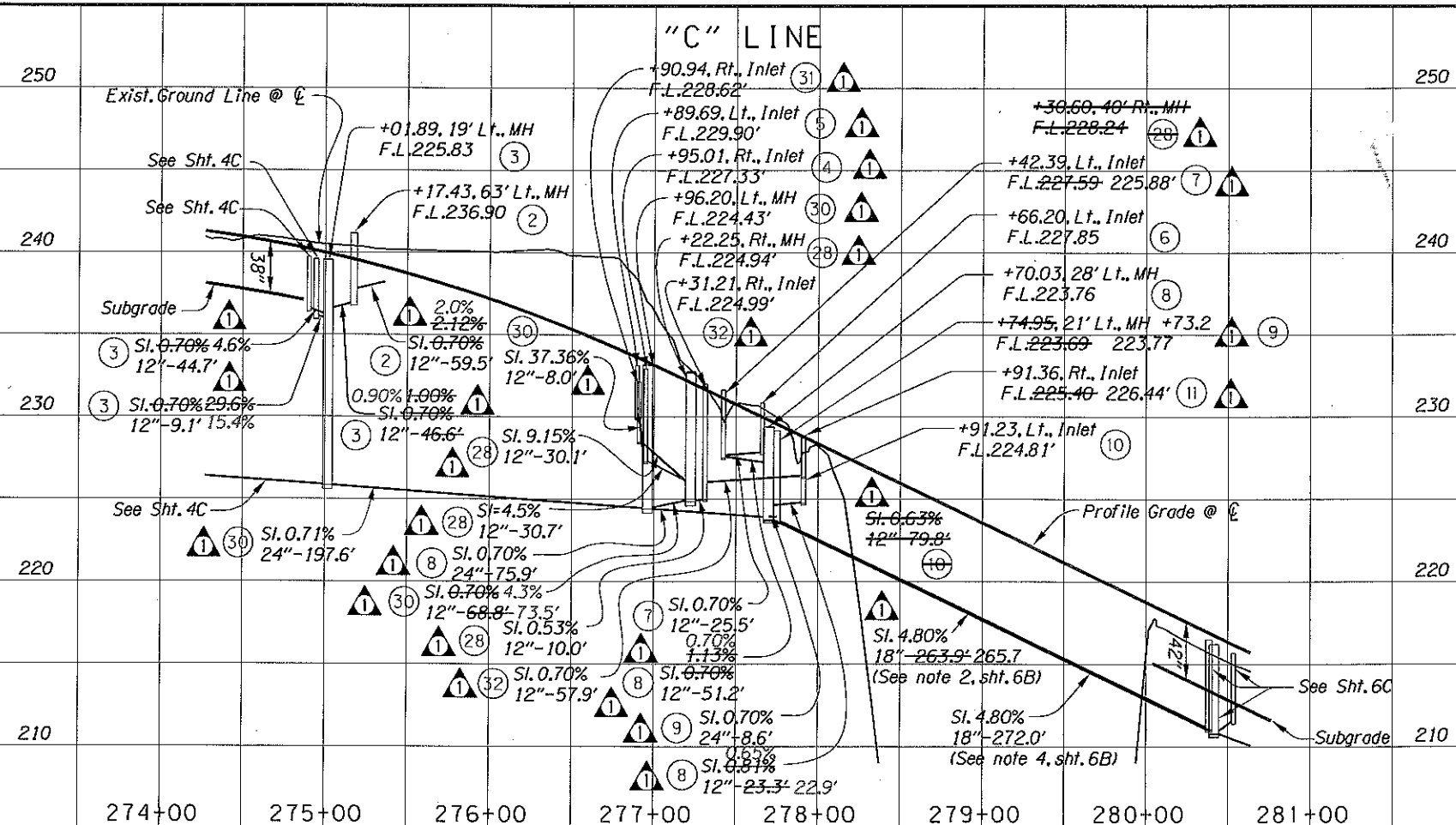
OREGON  
 JULY 25, 1995  
 TIMOTHY P. FREDETTE

RENEWAL DATE: 12-31-2009

No.	DATE	REVISIONS	BY
1	07-16-10	Drainage Adjustments	D.N.A.

Plug and abandon extg. pipe shown thus:

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

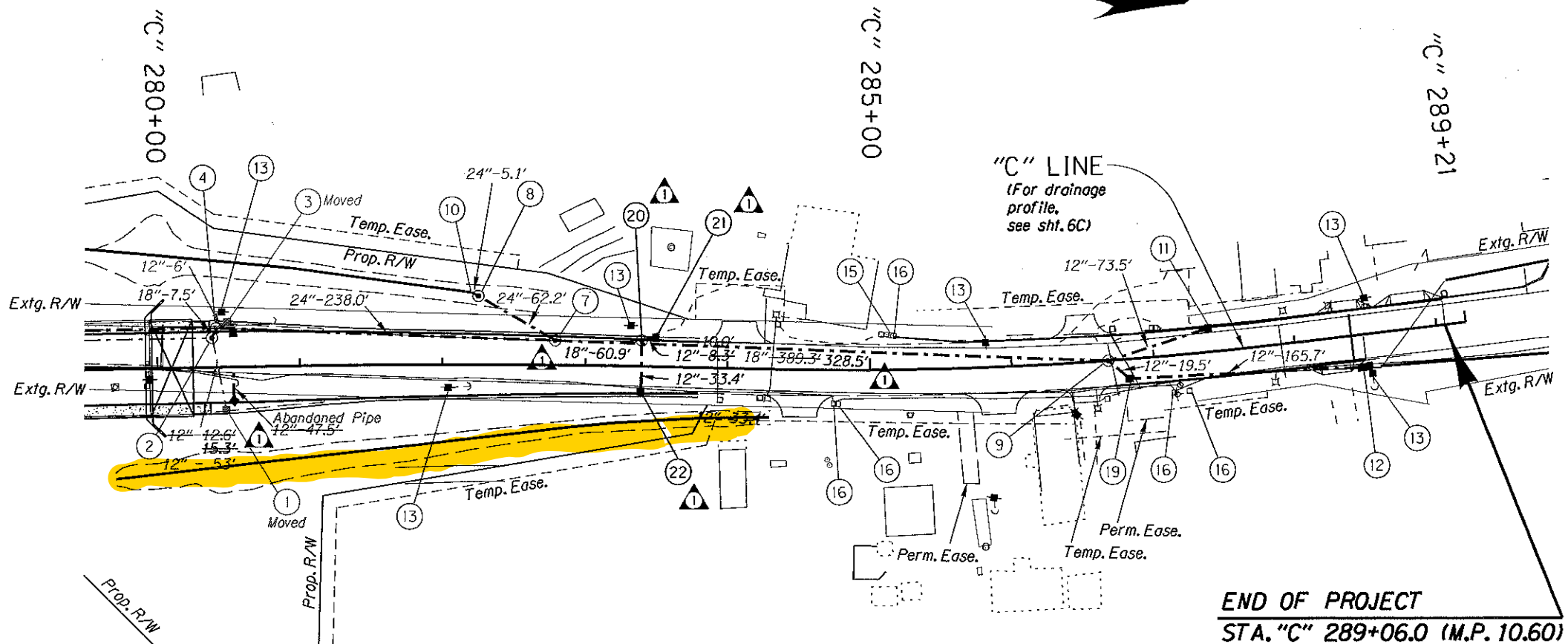
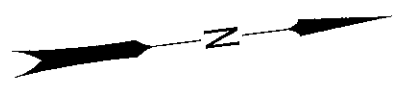


No.	DATE	REVISIONS	BY
1	07-16-10	Drainage Adjustments	D.N.A.

REGISTERED PROFESSIONAL  
 ENGINEER  
 17837  
 OREGON  
 JULY 25, 1995  
 TIMOTHY P. FREDETTE  
 RENEWAL DATE: 12-31-2009

**OREGON DEPARTMENT OF TRANSPORTATION**  
 REGION 1 - ROADWAY ENGINEERING SECTION  
 OR213:CASCADE HWY S (MILK CR BR)  
 MULINO SEC.  
 CASCADE HIGHWAY SOUTH  
 CLACKAMAS COUNTY  
 Design Team Leader - Lawrence Kretzler  
 Designed By - Timothy Fredette  
 Drafted By - Jalal Heydarpour  
**DRAINAGE PROFILE**  
 SHEET NO. 5C

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



**END OF PROJECT**  
 STA. "C" 289+06.0 (M.P. 10.60)

- ① Sta. "C" 280+53.5; Rt.  
 Const. type "CG-2" inlet  
 (For details, see sht. GJ-4)
- ① ② Sta. "C" 280+38.6, 20.7' Lt.  
 Const. manhole  
 Inst. 12" sew. pipe - 15.3' 5.3'  
 5' depth  
 Inst. 18" sew. pipe - 263.9' 265.7'  
 (170' pipe on structure)  
 (For details, see sht. GJ and bridge shts. 82340 & 82345)  
 (Pipe hangers & inserts are incidental to pipe on structure)
- ③ Sta. "C" 280+53.6; Lt.  
 Const. type "CG-2" inlet  
 Inst. 12" sew. pipe - 47.5'  
 5' depth  
 Trench resurf. - 9 sq.yd.  
 (For details, see sht. GJ-4)  
 (See drg. no. RD346)
- ① ④ Sta. "C" 280+41.6, 27.6' Lt.  
 Const. manhole 72" dia.  
 Inst. 18" sew. pipe - 7.5'  
 5' depth  
 Inst. 12" sew. pipe - 12.6' 12.6'  
 5' depth  
 Inst. 18" sew. pipe - 272.0'  
 (170' pipe on structure)  
 (For details, see shts. GJ, GJ-3 & GJ-4 and bridge shts. 82340 & 82345)  
 (Pipe hangers & inserts are incidental to pipe on structure)
- ① ⑤ Sta. "C" 282+72.6; Rt.  
 Const. type "CG-2" inlet  
 (For details, see sht. GJ-4)
- ① ⑥ Sta. "C" 282+70.0; Lt.  
 Const. type "CG-2" inlet  
 (For details, see sht. GJ-4)
- ① ⑦ Sta. "C" 282+78.7, 17.4' Lt.  
 Const. manhole 72" dia.  
 Inst. 24" sew. pipe - 238.0'  
 5' depth  
 Inst. 18" sew. pipe - 389.3' 60.9'  
 10' depth  
 Inst. 12" sew. pipe - 46.0'  
 5' depth  
 Trench resurf. - 330 sq.yd. 80 sq.yd.  
 (For details, see shts. GJ & GJ-4)

Plug and abandon extg. pipe shown thus:

- ① ②⑩ Sta. "C" 283+39.4, 14.4' Lt.  
 Inst. 18" sew. pipe - 328.5'  
 5' depth  
 Trench resurf. - 120 sq.yd.  
 (For details, see sht. GJ & GJ-4)
- ① ②⑪ Sta. "C" 287+40.0; Lt.  
 Const. type "CG-2" inlet  
 (For details, see sht. GJ-4)
- ① ②⑫ Sta. "C" 287+40.0; Lt.  
 Const. type "CG-2" inlet  
 (For details, see sht. GJ-4)
- ⑧ Sta. "C" 282+25.0, 48.1' Lt.  
 Const. manhole 62.5'  
 Inst. 24" sew. pipe - 62.2'  
 5' depth  
 (For details, see sht. GJ)
- ⑨ Sta. "C" 286+68.2; CL.  
 Const. manhole  
 Inst. 12" sew. pipe - 93.0'  
 5' depth  
 Trench resurf. - 31 sq.yd.  
 (For details, see sht. GJ)
- ⑩ Sta. "C" 282+20.0, 48.7' Lt.  
 Inst. 24" sew. pipe - 5.1'  
 5' depth  
 (For details, see sht. GJ)
- ⑪ Sta. "C" 287+40.0; Lt.  
 Const. type "CG-2" inlet  
 (For details, see sht. GJ-4)
- ⑫ Sta. "C" 288+46.9, 22.9' Rt.  
 Const. type "M-E" inlet  
 (For details, see sht. GJ-4)
- ⑬ Relocate power pole - 6  
 (By others)
- ⑭ Note deleted
- ⑮ Relocate TV riser  
 (By others)
- ⑯ Relocate phone riser - 5  
 (By others)
- ⑰ Note deleted
- ⑱ Note deleted
- ⑲ Sta. "C" 286+82.2; Rt.  
 Const. type "CG-2" inlet  
 Inst. 12" sew. pipe - 165.7'  
 5' depth  
 Trench resurf. - 20 sq.yd.  
 (For details, see sht. GJ-4)

OREGON DEPARTMENT OF TRANSPORTATION

REGION 1 - ROADWAY ENGINEERING SECTION  
 OR213: CASCADE HWY S (MILK CR BR)  
 MULINO SEC.  
 CASCADE HIGHWAY SOUTH  
 CLACKAMAS COUNTY

Design Team Leader - Lawrence Kretzler  
 Designed By - Timothy Fredette  
 Drafted By - Jalal Heydarpour

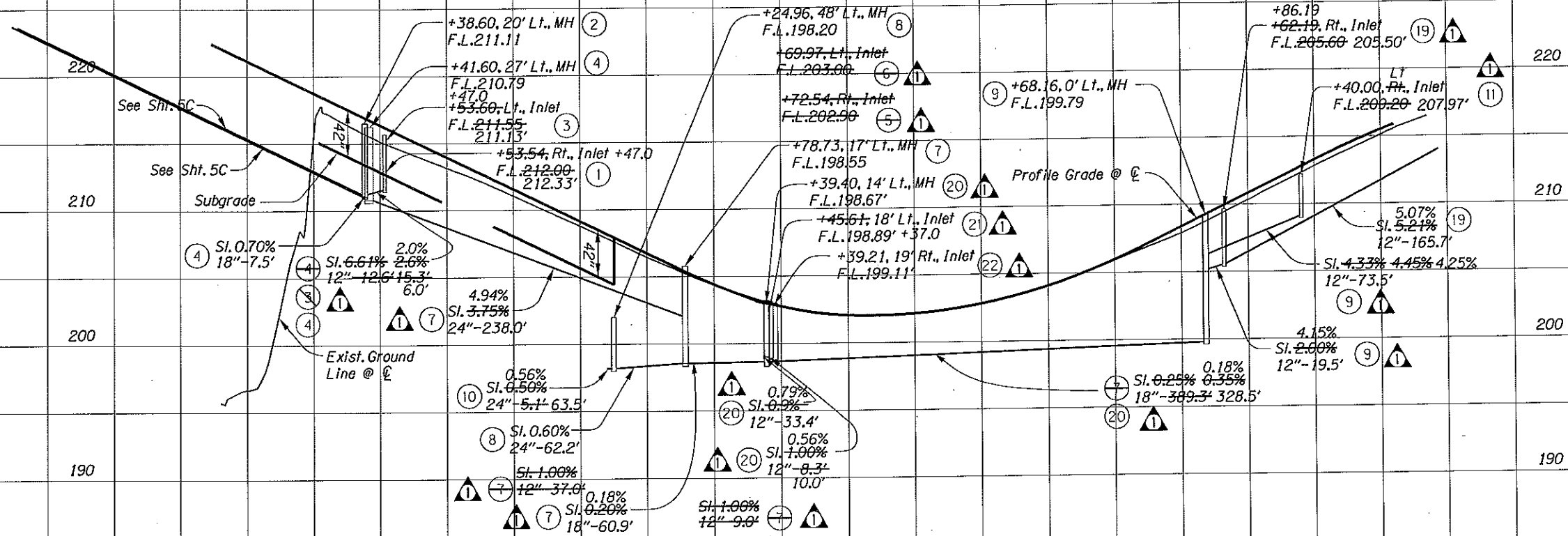
REGISTERED PROFESSIONAL  
 ENGINEER  
 17837  
 OREGON  
 JULY 25, 1995  
 TIMOTHY P. FREDETTE  
 RENEWAL DATE: 12-31-2009

**DRAINAGE AND UTILITIES**  
 SHEET NO. 6B

No.	DATE	REVISIONS	BY
①	07-16-10	Drainage Adjustments	D.N.A.

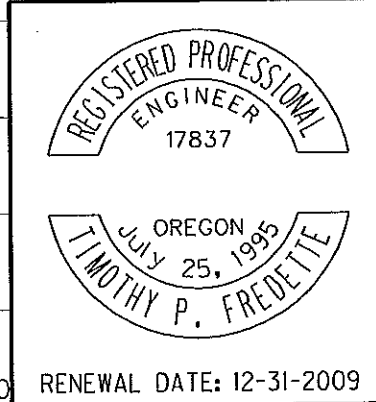
REVISED AS CONSTRUCTED  
21 SEP 2012 CONTRACT 14146  
PROJ.MGR. MARJORIE WEST

*Marjorie West*



(X) Construction Note Number, Sht. 6B

288+00



RENEWAL DATE: 12-31-2009

**OREGON DEPARTMENT OF TRANSPORTATION**

REGION 1 - ROADWAY ENGINEERING SECTION

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

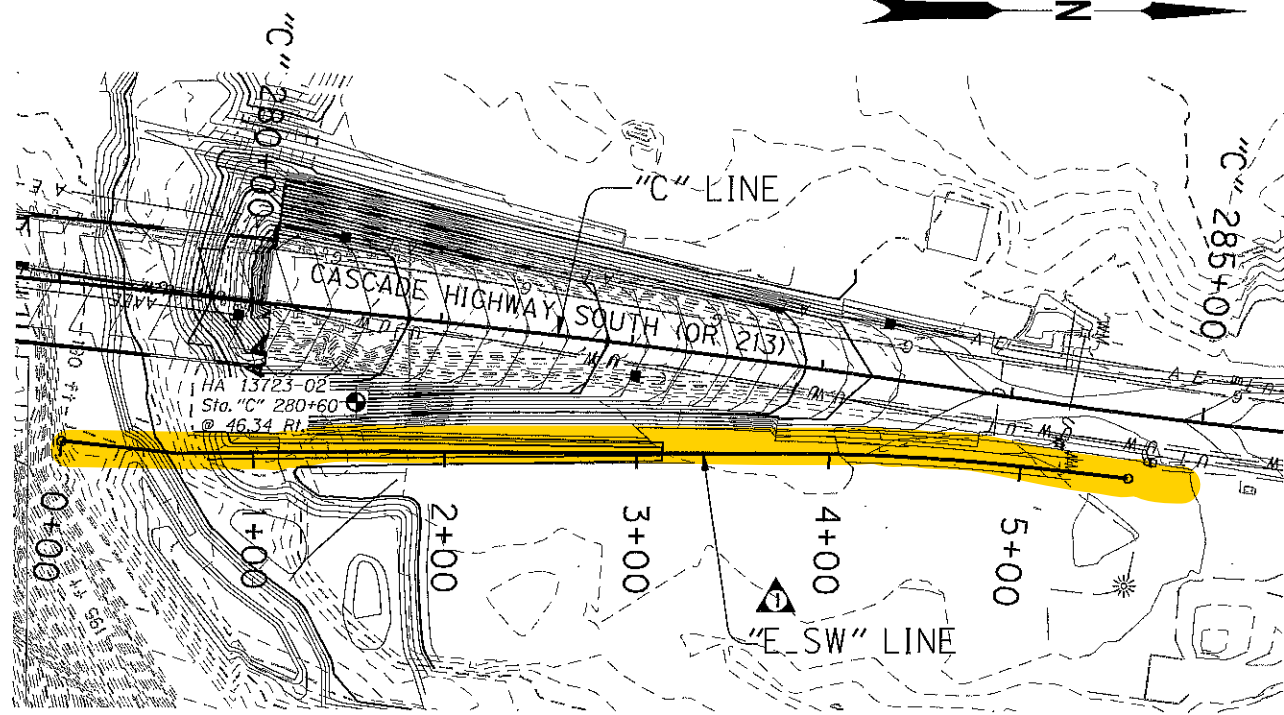
Design Team Leader - Lawrence Kretler  
Designed By - Timothy Fredette  
Drafted By - Jalal Heydarpour

**DRAINAGE PROFILE**

SHEET NO. 6C

No.	DATE	REVISIONS	BY
1	07-16-10	Drainage Adjustments	D.N.A.

281+00 282+00 283+00 284+00 285+00 286+00 287+00

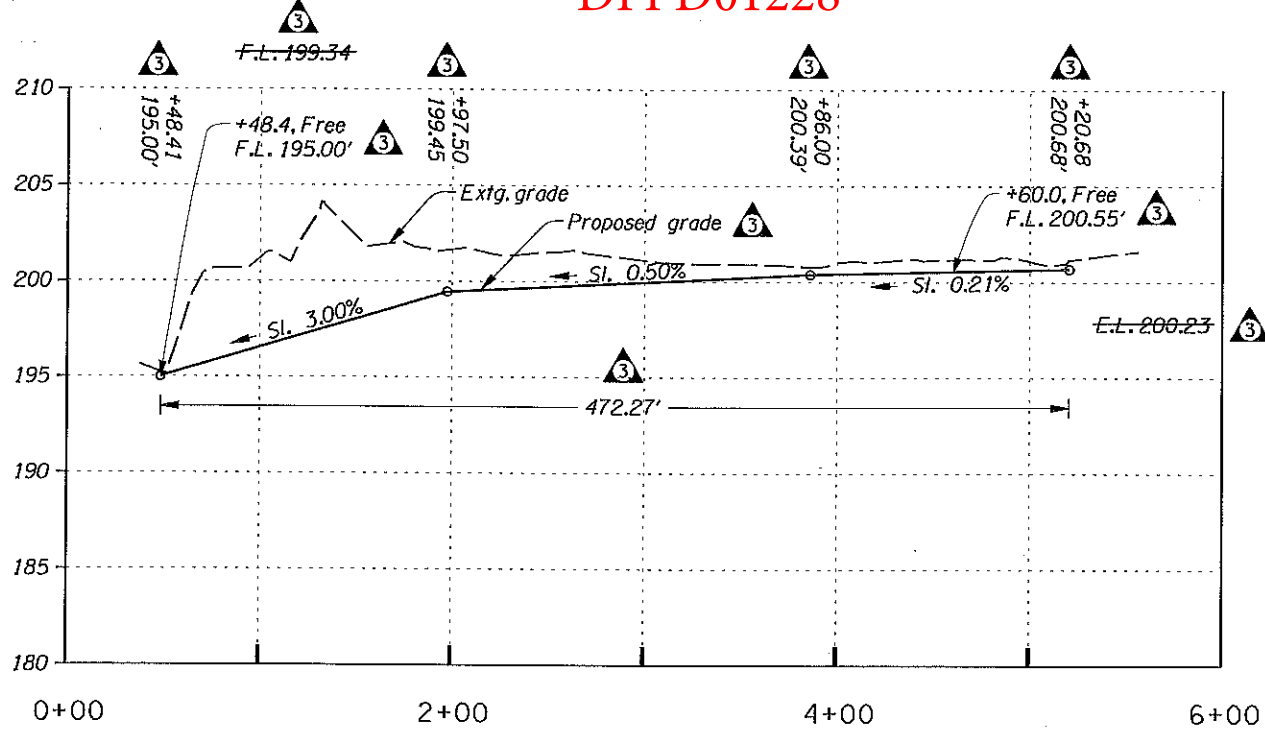


PLAN

Scale: 1"=100'

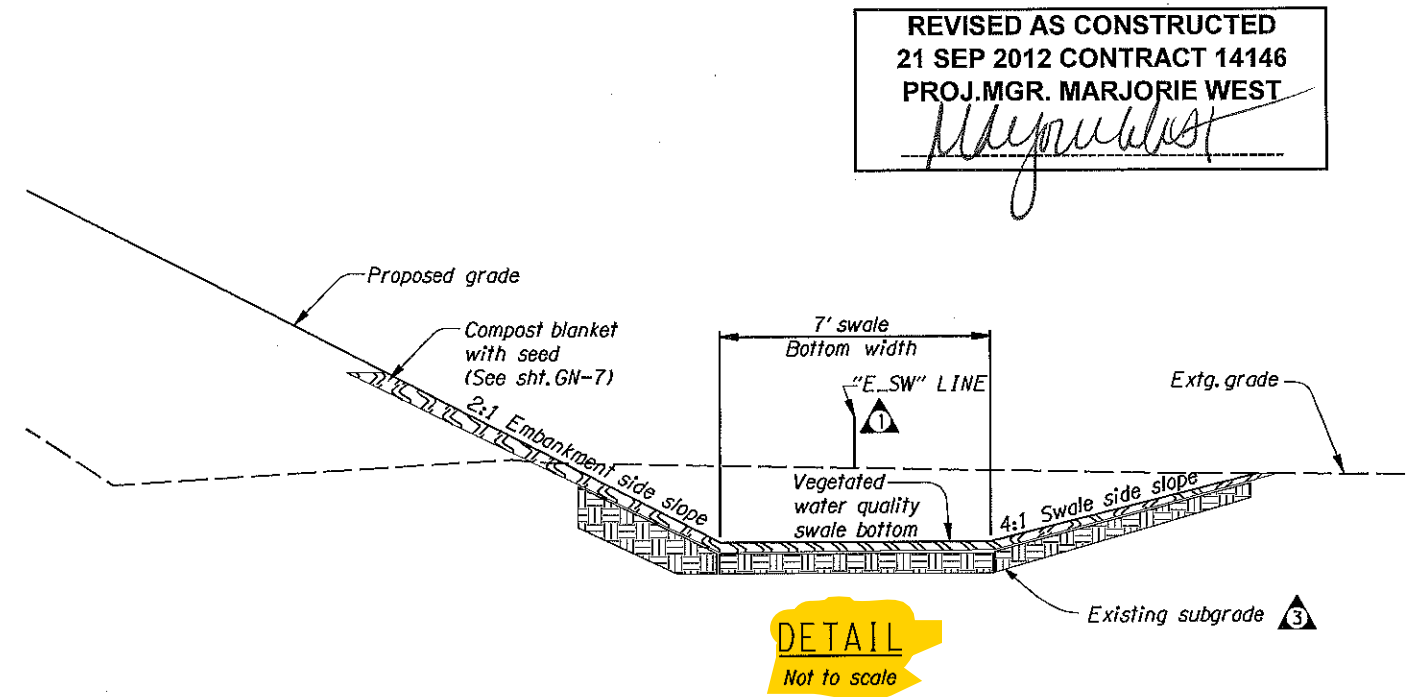
--- Extg. Contours  
 --- Proposed Contours

DFI D01228



① "E\_SW" 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  
*Marjorie West*

⊕ HA 13723-02 = Hand auger

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.

**OREGON DEPARTMENT OF TRANSPORTATION**

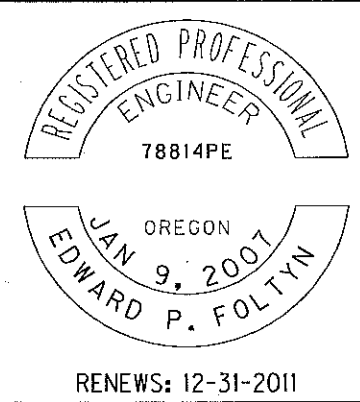
REGION 1 - Geo/Hydro/HazMat Unit

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-8

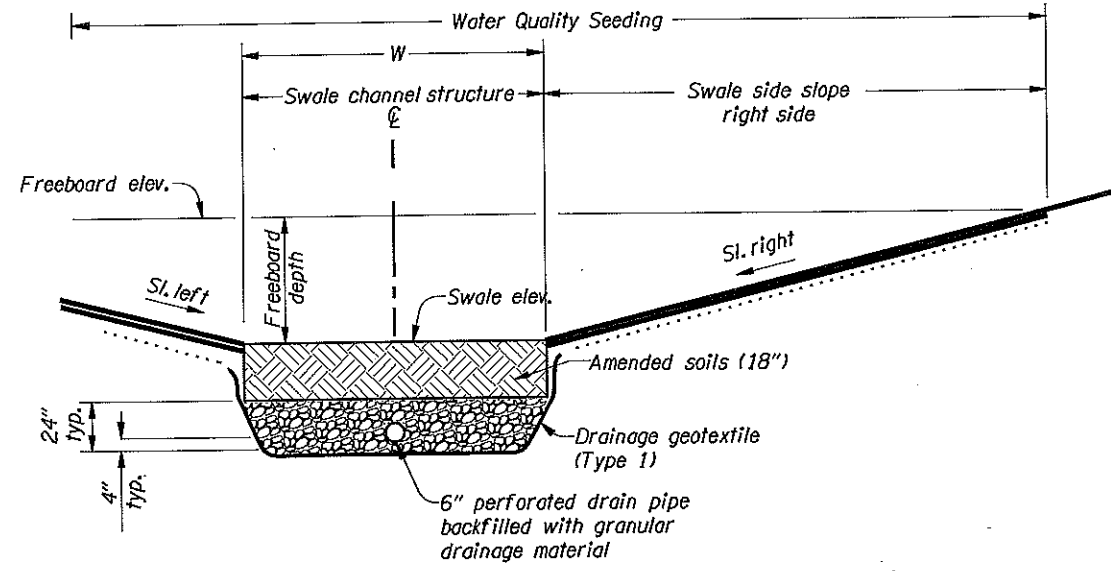
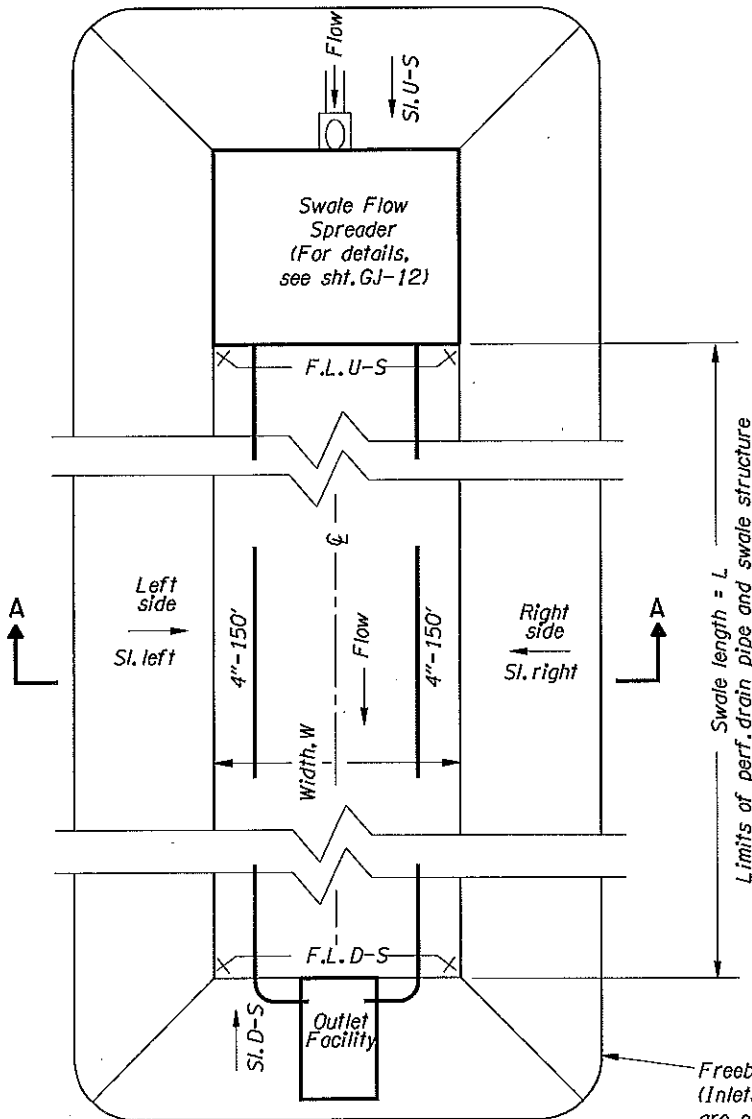


No.	DATE	REVISIONS	BY
①	02-04-10	Changed "E" Line to "E_SW" Line	E.P.F
②	02-04-10	Added swale length and inverts	E.P.F
③	07-01-10	Drainage Adjustments	D.N.A

**WATER QUALITY SWALE GENERAL DETAILS**  
**PLAN AND TYPICAL CROSS-SECTION**

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

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

Freeboard limits = Pay limits for swale.  
 (Inlets, paved end slopes and outlet facilities are not included in swale pay item.)

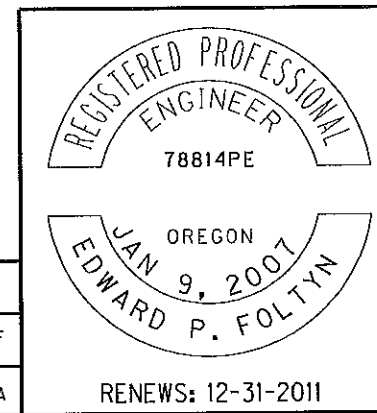
Note:  
 For swale specifics, refer to the table on this sht.

PLAN

Swale ID	L (ft)	W (ft)	F.L. U-S (ft)	F.L. D-S (ft)	Long. slope (%)	Side slopes (H:V)				Number of underdrain segments	Freeboard depth (ft)	Underdrain tie-in location	Swale outlet facility
						U-S	D-S	Left	Right				
"PGE_SW" Swale	164.6 <del>161</del>	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 <del>354.3</del>	7	198.18 <del>198.46</del>	196.69 <del>196.75</del>	0.50% <del>0.483%</del>	3:1	NA	4:1	2:1	NA	1	NA	Free outlet, (Class 50) loose riprap
"E_SW" Swale	427.3 <del>240.9</del>	7	200.55 <del>200.23</del>	195.00 <del>199.34</del>	Varies <del>0.369%</del>	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



**OREGON DEPARTMENT OF TRANSPORTATION**

**REGION 1 - Geo/Hydro/HazMat Unit**

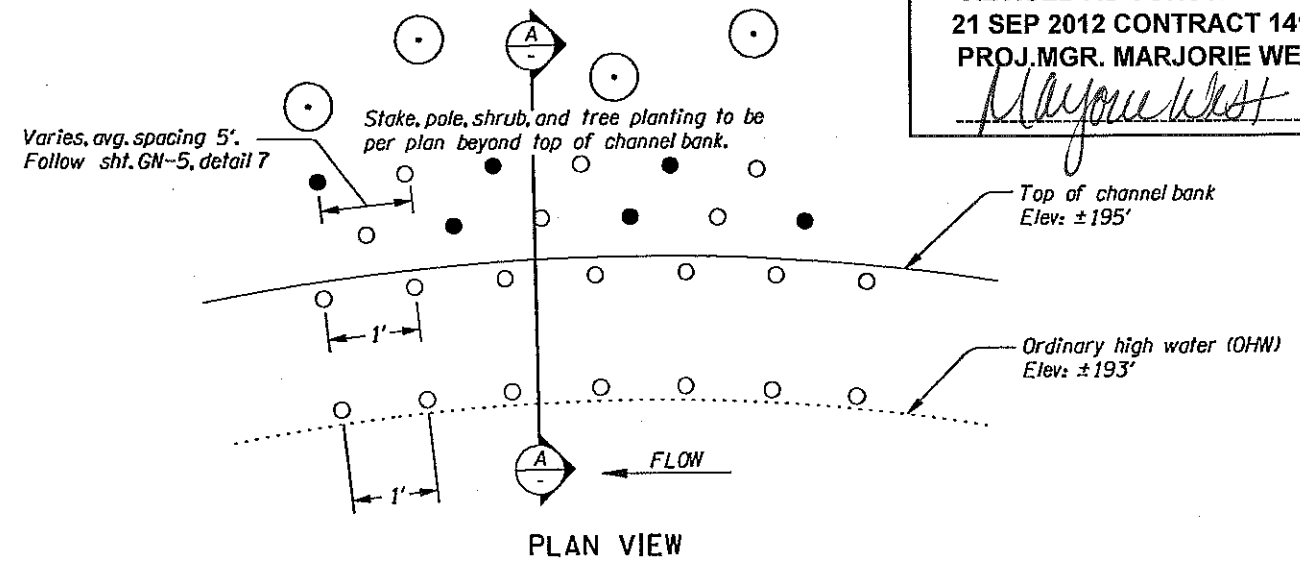
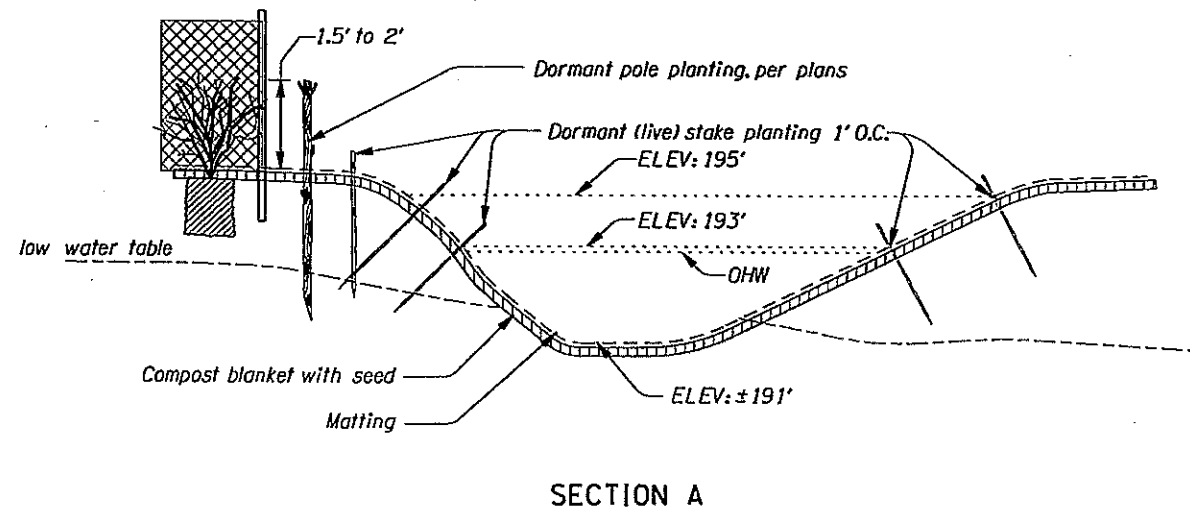
**OR213: CASCADE HWY S. (MILK CR BR) MULINO SEC.**  
 CASCADE HIGHWAY SOUTH  
 CLACKAMAS COUNTY

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

**WATER QUALITY DETAILS**

SHEET NO. **GJ-13**

ROADSIDE RESTORATION  
PLANTING DETAILS

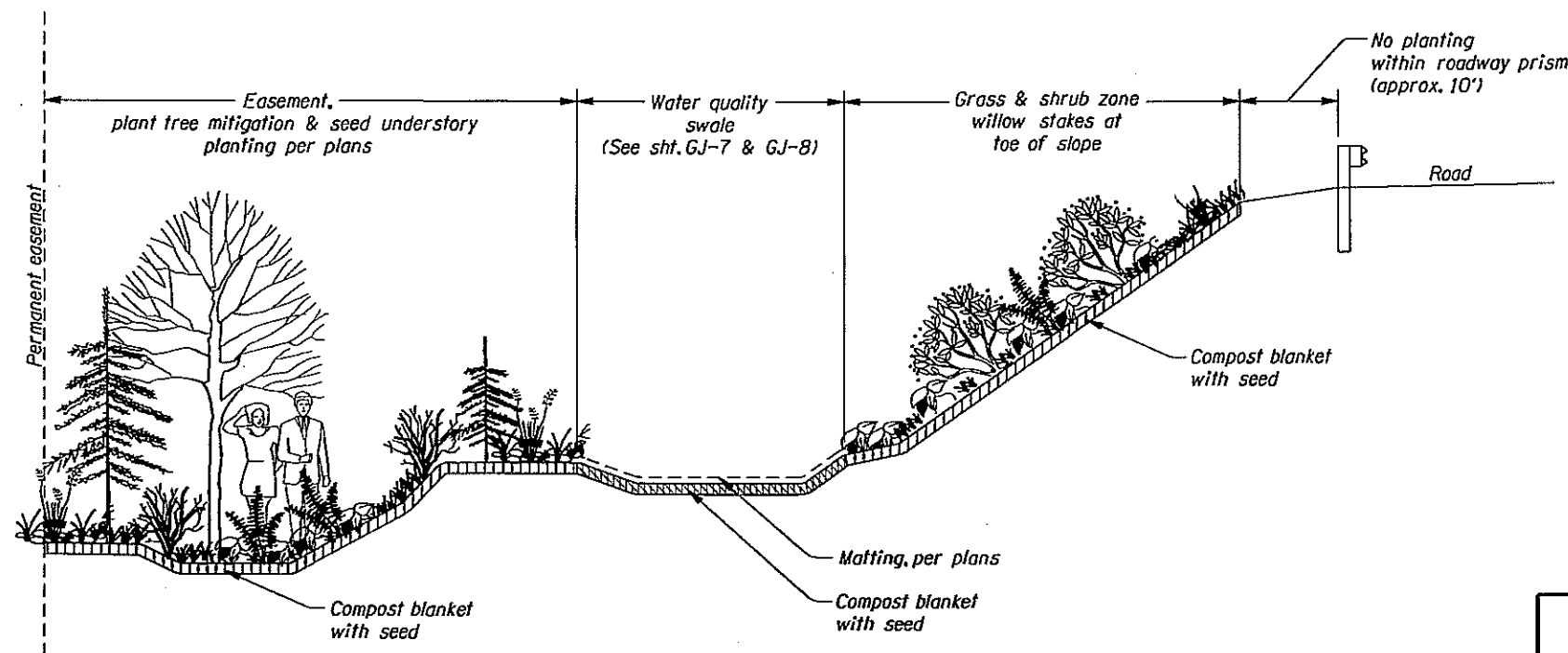


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21 SEP 2012 CONTRACT 14146  
PROJ.MGR. MARJORIE WEST  
*Marjorie West*

8 STREAMBANK/CHANNEL STAKE & POLE PLANTING  
Not To Scale

NOTES:

1. Staking to follow contours per planting plan for work at elev. ±195' and ±193'
2. See sht. GN-8, detail 11 for tree revetment & rock criteria. See grading plan for approximate placement, to be field coordinated with Agency.



9 TYPICAL ROADSIDE DEVELOPMENT SECTION AT ROAD EMBANKMENT  
AREA EAST & WEST SIDES OF ROAD (OR213)  
Not To Scale



OREGON DEPARTMENT OF TRANSPORTATION	
REGION 1 - ROADWAY ENGINEERING SECTION	
OR213-CASCADE HWY S (MILK CR BR) MULINO SEC. CASCADE HIGHWAY SOUTH CLACKAMAS COUNTY	
Design Team Leader - Lawrence Kretzler Designed By - Magnus Bernhardt Drafted By - Marco Singer	
ROADSIDE DEVELOPMENT DETAILS	SHEET NO. GN-7