

# OPERATION & MAINTENANCE MANUAL

DFI No. : D00297

Facility Type: Water Quality Manhole



**AUGUST, 2011**



## 1. Identification

Drainage Facility ID (DFI): **D00297**

Facility Type: Water Quality Manhole

Construction Drawings: (V-File Number) 34V-095

Location: District: 2B

Highway No.: 092

Mile Post: 9.99; (beg./end)]

Description: This facility is located along the Lower Columbia River Highway, US30 (Hwy 2W [092]), a few miles north of the St. John's Bridge, where N.W. Newberry Road intersects the highway at the Miller Creek bridge overcrossing. Access may be obtained from N.W. Newberry Road.

## 2. Facility Contact Information

Contact the Engineer of Record, Region Technical Center, or Geo-Environmental's Senior Hydraulics Engineer for:

- Operational clarification
- Maintenance clarification
- Repair or restoration assistance

Engineering Contacts:

Region Technical Center Hydro Unit Manager

Or

Geo-Environmental Senior Hydraulics Engineer (503) 986-3365.

## 3. Construction

Engineer of Record: [ODOT Designer – Technical Services  
Headquarters, David Polly, P.E., 503-986-3738

Facility construction: 2001

Contractor: N/A

#### 4. Storm Drain System and Facility Overview

This water quality manhole is an underground facility designed to treat stormwater runoff. The system is a proprietary product called CDS<sup>®</sup> manufactured by Contech Construction Products, Inc. The underground vortex system provides treatment using 'continuous deflective separation' by removing or separating the solids from the water via a fiberglass separation chamber and inlet, a separation screen, and a sump at the bottom. This facility contains an Operation and Maintenance manual as prepared by the manufacturer and is provided in Appendix C.

This facility is located along the Lower Columbia River Highway, US30 (Hwy 2W [092]), a few miles north of the St. John's Bridge, where N.W. Newberry Road intersects the highway at the Miller Creek bridge overcrossing. Access may be obtained from N.W. Newberry Road.

Stormwater runoff, accumulating on the surrounding roadway impervious surfaces near the intersection of the road approach to the highway, is collected by a catch-basin inlet and conveyed by a 12-inch pipe to the facility. The stormwater is treated by the proprietary structure, (Five feet in depth), before being released through 12-inch diameter outlet pipe to a rock-lined outfall and creek, below.

##### A. Maintenance equipment access:

Once turning onto N.W. Newberry Road, from US30 (Hwy 2W [92]), access may be obtained from a gravel entrance behind the guardrail flare located on the southside of the Newberry Road approach to the highway.

##### B. Heavy equipment access into facility:

- Allowed (no limitations)
- Allowed (with limitations); A flared guardrail section parallels the northern-half of the facility to a point where a tightly turning gravel entrance occurs as the entrance to the facility. The site also has a steep slope on the Miller Creek side of the site to the south.
- Not allowed

##### C. Special Features:

- Amended Soils
- Porous Pavers
- Liners
- Underdrains



Photo 1: Looking southeast toward the manhole with the highway on the left.



Photo 2: Looking into the water quality manhole through one of its access lids. It appears this manhole may need retrofitting to allow for greater clearances, facilitating easier maintenance.

## 5. Facility Haz Mat Spill Feature(s)

The water quality manhole can be used to store a volume of liquid by blocking the 12-inch diameter outlet pipe located at the outlet of the facility near the bottom of the slope alongside Miller Creek. However, this is not likely a viable option, because of the location of the outlet pipe in proximity to the manhole. This pipe is noted as point C on the Operational Plan, Appendix A.

## 6. Auxiliary Outlet (High Flow Bypass)

Auxiliary Outlets are provided if the primary outlet control structure can not safely pass the projected high flows. Broad-crested spillway weirs and over flow risers are the two most common auxiliary outlets used in stormwater treatment facility design. The auxiliary outlet feature is either a part of the facility or an additional storm drain feature/structure.

The auxiliary outlet feature for this facility is:

Designed into facility

As stormwater flows exceed the unit's design capacity a diversion weir routes the water around a separation chamber, effectively bypassing the treatment features, so that flows exit the manhole and leave any captured pollutants behind, to be retained in the separation cylinder and sump below. See Appendix C.

Other, as noted below

## 7. Maintenance Requirements

Routine maintenance table for non-proprietary stormwater treatment and storage/detention facilities have been incorporated into ODOT's Maintenance Guide. These tables summarize the maintenance requirements for ponds, swales, filter strips, bioslopes, and detention tanks and vaults. Special maintenance requirements in addition to the routine requirements are noted below when applicable.

The ODOT Maintenance Guide can be viewed at the following website:

<http://www.oregon.gov/ODOT/HWY/OOM/MGuide.shtml>

Maintenance requirements for proprietary structures, such as underground water quality manholes and/or vaults with filter media are noted in Appendix C when applicable.

The following stormwater facility maintenance table (See ODOT Maintenance Guide) should be used to maintain the facility outlined in this

Operation and Maintenance Manual or follow the Maintenance requirements outlined in Appendix C when proprietary structure is selected below:

- Table 1 (general maintenance)
- Table 2 (stormwater ponds)
- Table 3 (water quality biofiltration swales)
- Table 4 (water quality filter strips)
- Table 5 (water quality bioslopes)
- Table 6 (detention tank)
- Table 7 (detention vault)
- Appendix C (proprietary structure)
- Special Maintenance requirements: See Appendix C and the Proprietary Structure Maintenance Requirements for an O&M Manual specifically written for the water quality structure.

Note: Special maintenance Requirements Require Concurrence from ODOT SR Hydraulics Engineer.

## **8. Waste Material Handling**

Material removed from the facility is defined as waste by DEQ. Refer to the roadwaste section of the ODOT Maintenance Yard Environmental Management System (EMS) Policy and Procedures Manual for disposal options: <http://egov.oregon.gov/ODOT/HWY/OOM/EMS.shtml>

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

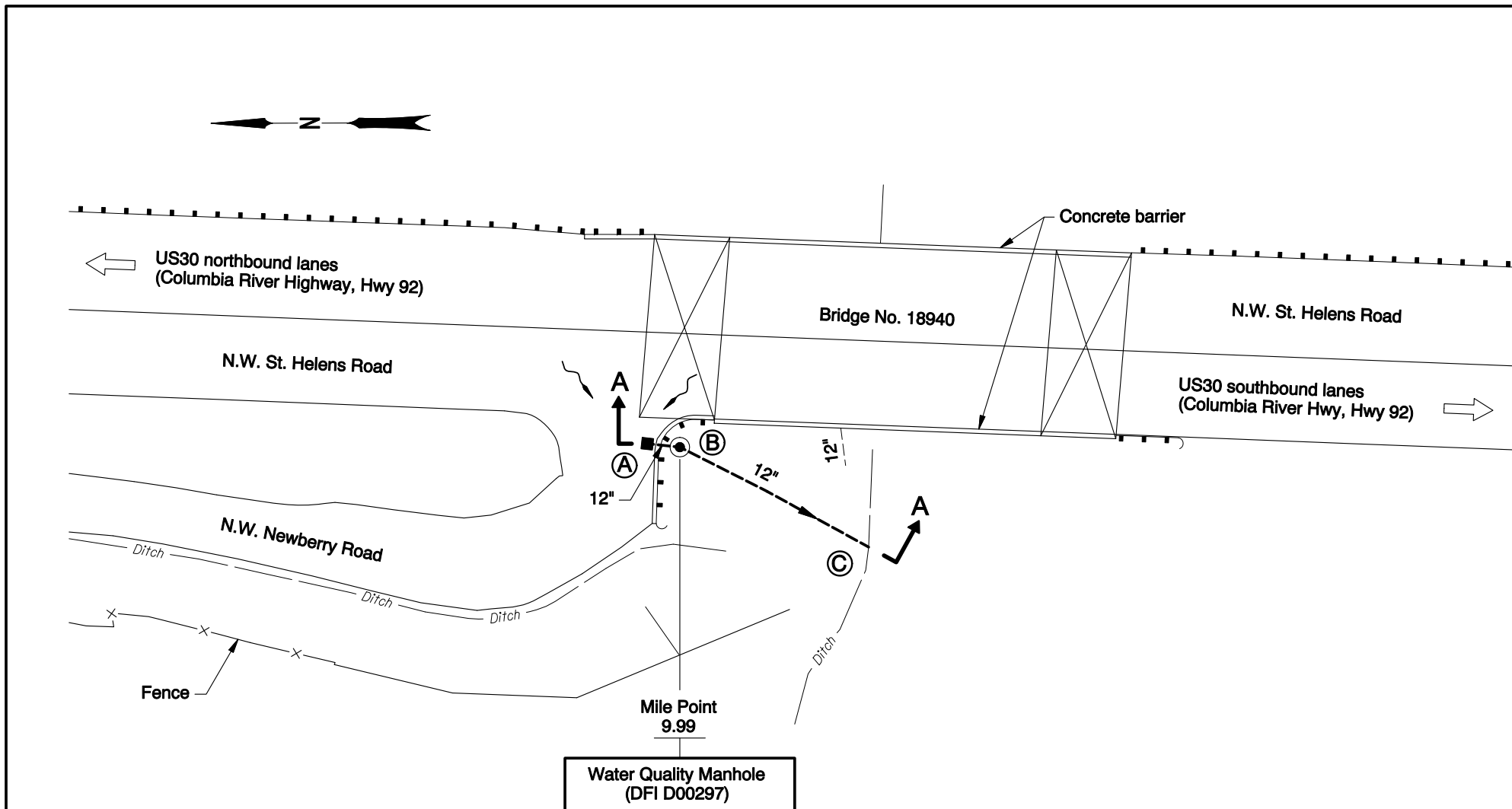
ODOT Clean Water Unit	(503) 986-3008
ODOT Statewide Hazmat Coordinator	(503) 229-5129
ODOT Region Hazmat Coordinator	(503) 731-8304
ODEQ Northwest Region Office	(503) 229-5263

# Appendix A

## Content:

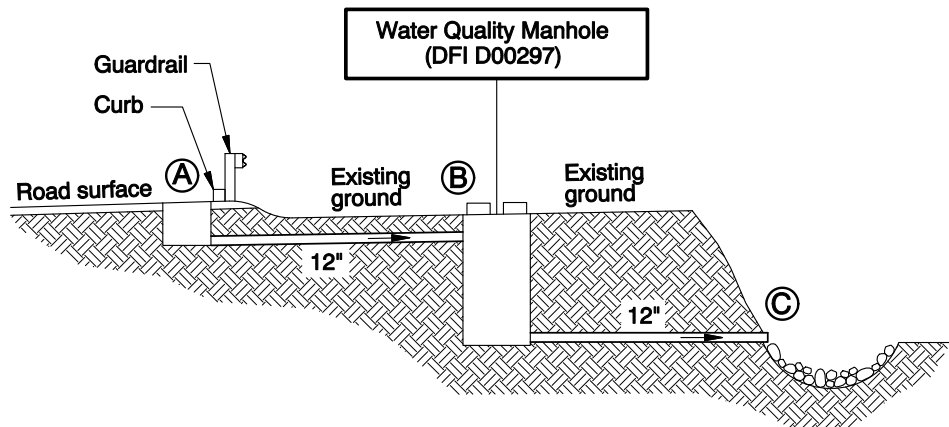
- **Operational Plan and Profile Drawing(s)**



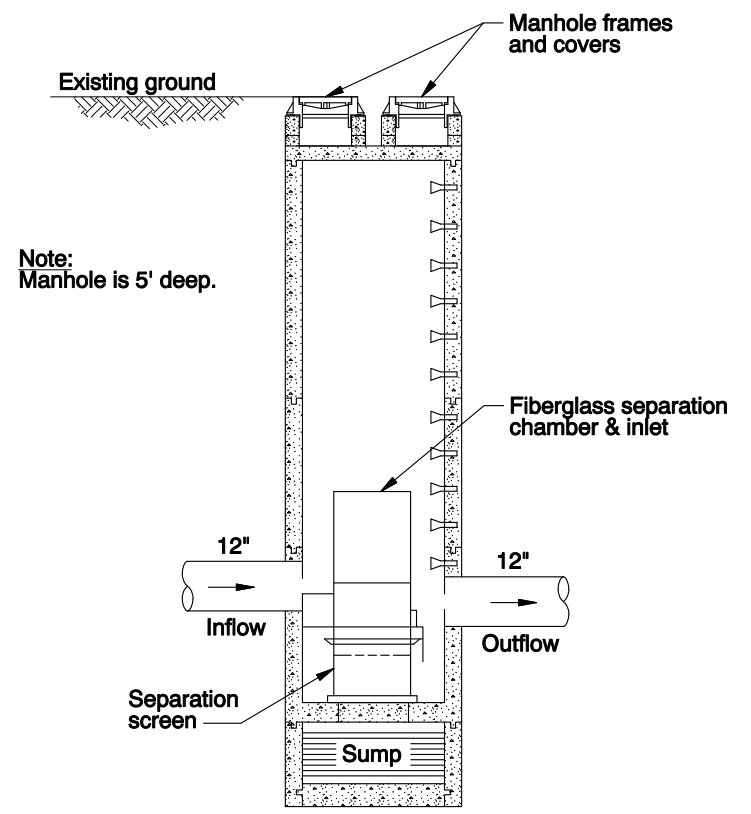


Water Quality Manhole  
(DFI D00297)

**PLAN**  
N.T.S.



**SECTION A-A**  
N.T.S.



Note:  
Manhole is 5' deep.

**WATER QUALITY MANHOLE -CDS UNIT AT POINT (B)**  
N.T.S.

- LEGEND:**
- Photograph location / direction
  - Stormwater Inlet
  - Water Quality Manhole
  - Pipe outfall to riprap-lined ditch
  - Manhole
  - Inlet
  - Storm Pipe (Facility)
  - Storm Pipe
  - Conveyance Direction
  - Pavement / Facility Flow Path
  - Guardrail

Sht. 1 of 1 OREGON DEPARTMENT OF TRANSPORTATION

Prepared By: Wynee Hu  
Drafted By: Y. Garzenelli

**DFI D00297**  
**MAINTENANCE DISTRICT 2B HWY 92**  
**WATER QUALITY MANHOLE**  
COLUMBIA RIVER HIGHWAY MP 9.99  
MULTNOMAH COUNTY

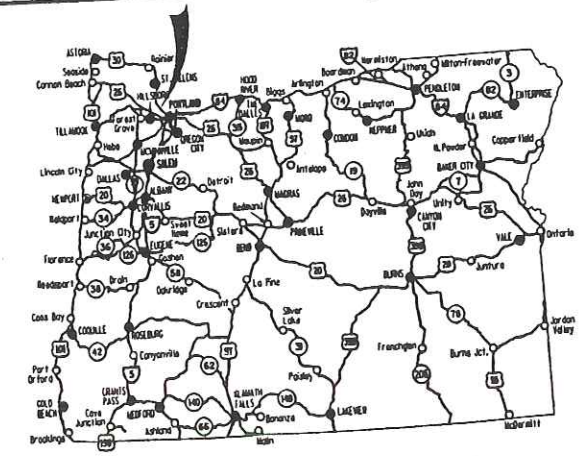
# Appendix B

## Content:

- **ODOT Project Plan Sheets**
  - *Cover/Title Sheet*
  - *Water Quality/Detention Plan Sheets*
  - *Other Details*

STATE OF OREGON  
DEPARTMENT OF TRANSPORTATION  
PLANS FOR PROPOSED PROJECT

**GRADING, STRUCTURE, PAVING, & PAVEMENT MARKERS**  
**MILLER CR. (HALF VIADUCT) BR. SEC.**  
**COLUMBIA RIVER HIGHWAY (LOWER)**  
MULTNOMAH COUNTY  
JULY 2001



Overall Length Of Project - 0.10 km (0.06 Mile)

INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
1	Title Sheet
1A	Standard Drawing Nos.
2	Typical Sections
2A, 2A-2	Details
2B Thru 2B-11 Incl.	Traffic Control Plans
2C, 2C-2	Erosion Control Details
2C-3	Erosion Control Plans
2D	Pipe Data
3, 4	Alignment & General Construction
4A	General Construction
4B	Profile
5	Alignment & General Construction

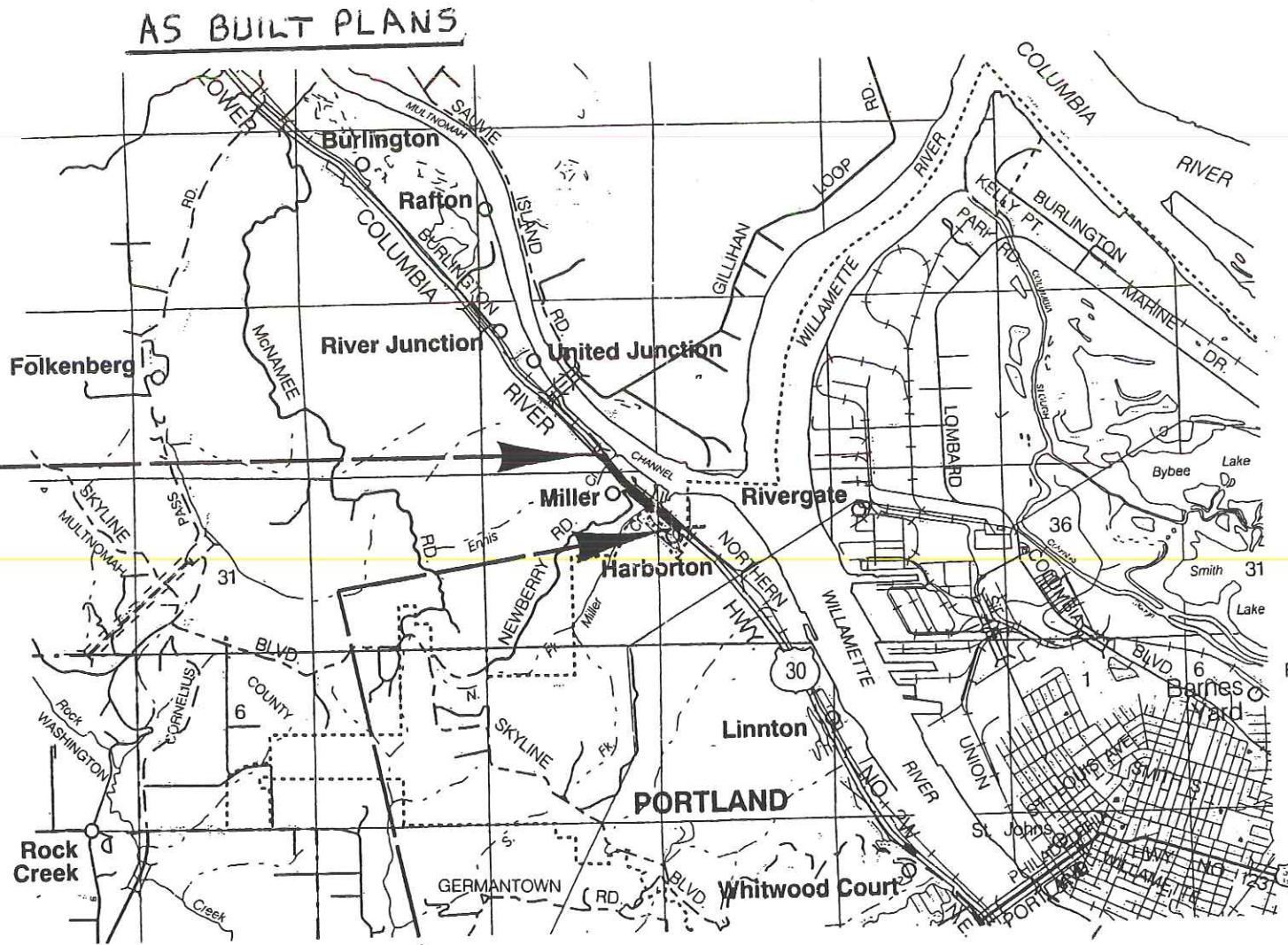
DRAWING NO.	DESCRIPTION
<b>BRIDGE NO. 18940</b>	
60011	Plan & Elevation
60012 Thru 60018 Incl.	Foundation Plans
60019	Staging
60020	Footing Plan
60021, 60022	Deck Plan & Details
60023, 60024	Standard Bulb-I Beam Details
60025, 60026	Bent 1 & 2
60027	Bearings & Miscellaneous Details
60028, 60029	Wall Details

**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 From The Center,  
Or Answers To Questions About The Rules By Calling (503) 232-1987.



**X-BRF-STP-S02W(23)**  
**BEGINNING OF PROJECT**  
STA. P13 + 887 (M.P. 10.01)



RECEIVED  
DEC 23 2002  
2nd FLOOR  
TECHNICAL SERVICES  
BRANCH

**X-BRF-STP-S02W(23)**  
**END OF PROJECT**  
STA. 13 + 981 (M.P. 9.95)

- OREGON TRANSPORTATION COMMISSION
- |                   |                            |
|-------------------|----------------------------|
| Steven H. Corey   | CHAIRMAN                   |
| Gail L. Achterman | COMMISSIONER               |
| Stuart Foster     | COMMISSIONER               |
| Randall Papé      | COMMISSIONER               |
| John Russell      | COMMISSIONER               |
| Bruce A. Warner   | DIRECTOR OF TRANSPORTATION |



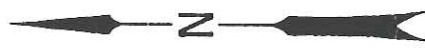
Jeffrey Scheick

TECHNICAL SERVICES MANAGING ENGINEER

**MILLER CR. (HALF VIADUCT) BR. SEC.**  
**COLUMBIA RIVER HIGHWAY (LOWER)**  
MULTNOMAH COUNTY

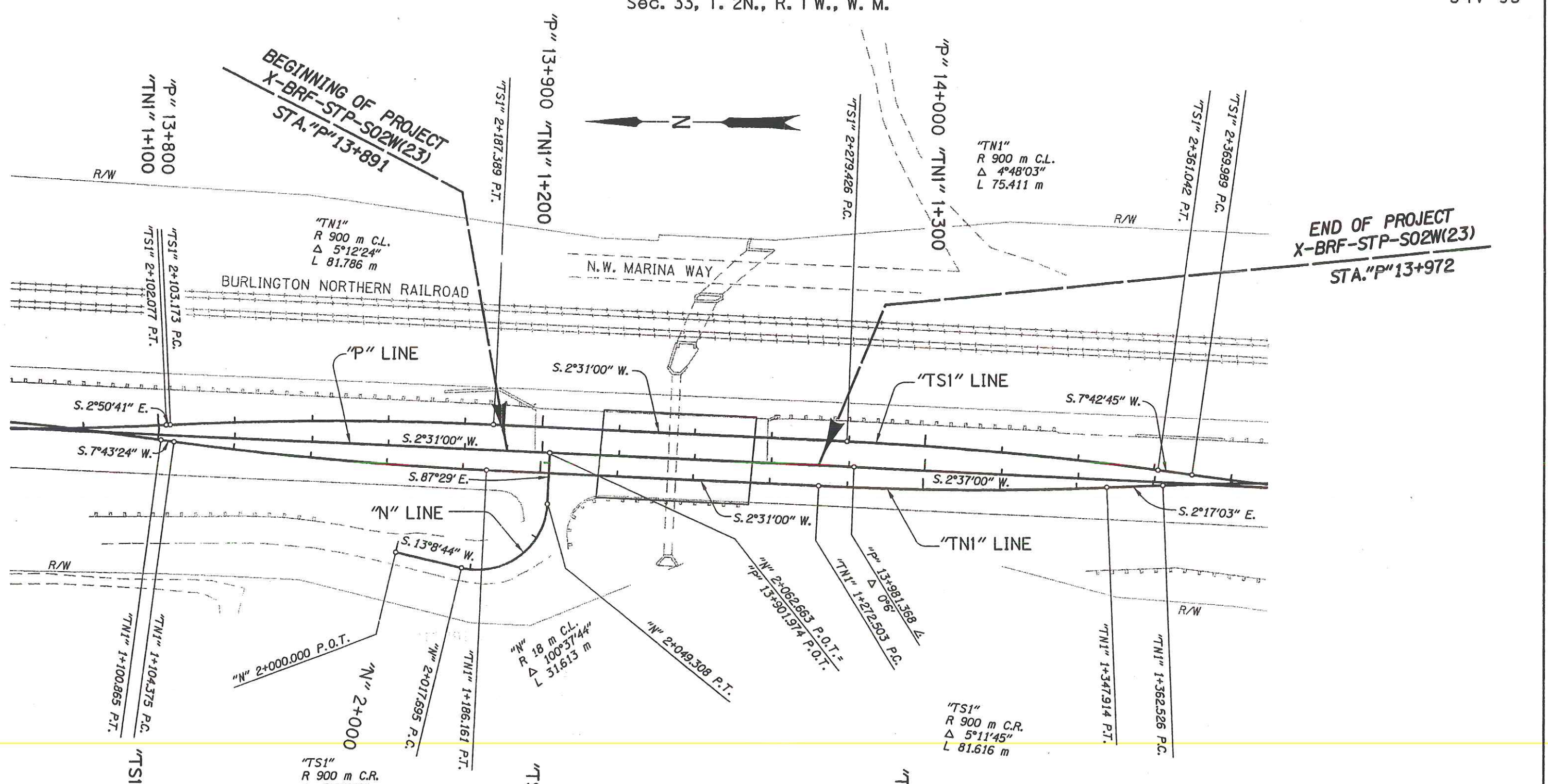
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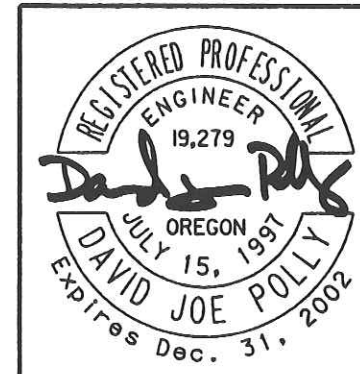


BEGINNING OF PROJECT  
X-BRF-STP-S02W(23)  
STA. "P" 13+891

END OF PROJECT  
X-BRF-STP-S02W(23)  
STA. "P" 13+972



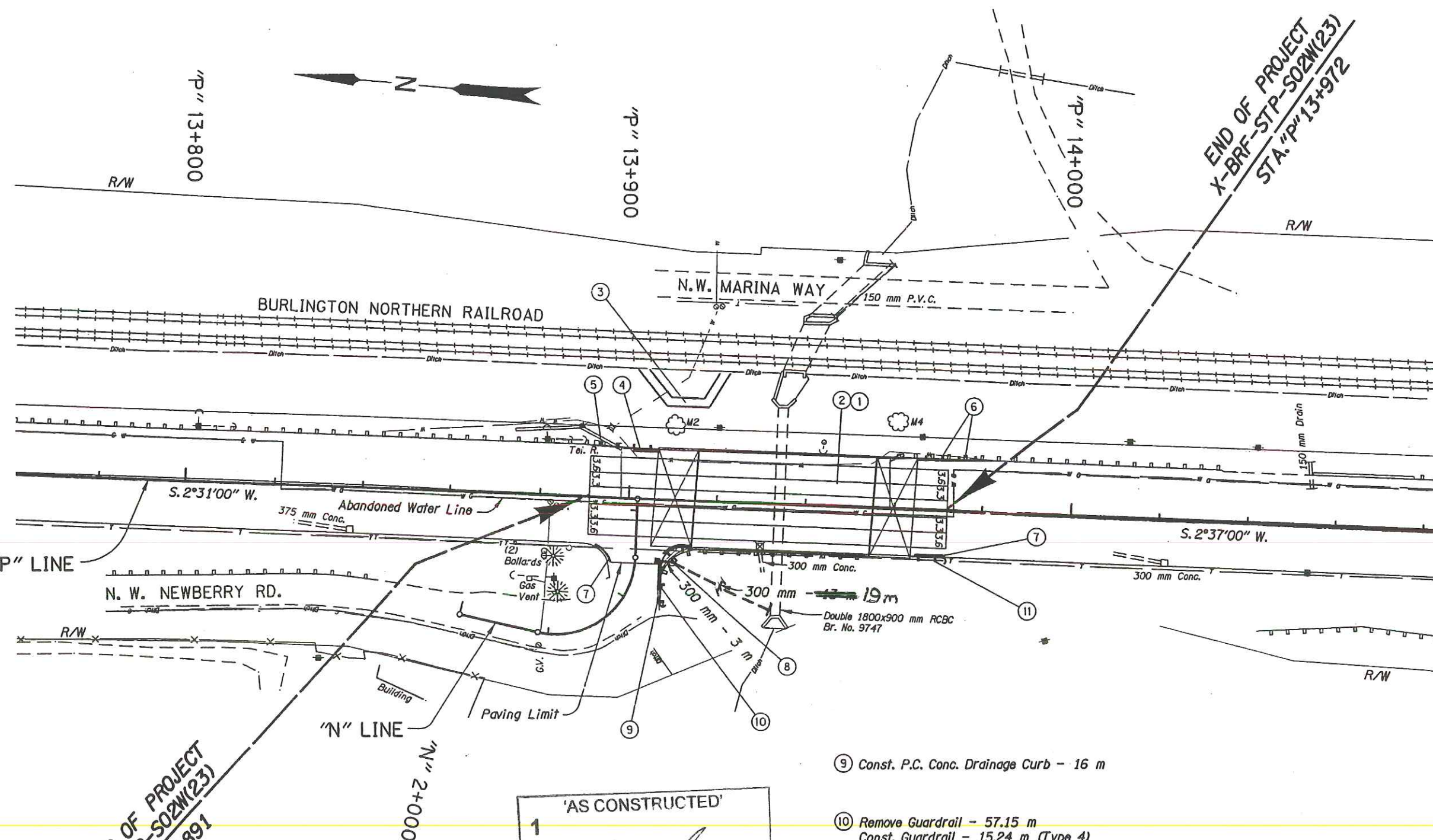
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*David Joe Polly*  
Project Manager



<b>OREGON DEPARTMENT OF TRANSPORTATION</b> ROADWAY ENGINEERING SECTION	
<b>MILLER CR. (HALF VIADUCT) BR. SEC.</b> COLUMBIA RIVER HIGHWAY (LOWER) MULTNOMAH COUNTY	
Design Team Leader - David Joe Polly Designed By - Kathy Fry Drafted By - Jim Holeman	
<b>ALIGNMENT</b>	SHEET NO. <b>4</b>

14-MAY-2001 13:13

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- ① Bridge No. 05921  
Remove "Half Viaduct"  
Remove Bridge Rail
- ② Bridge No. 18940  
Const. Bridge - 40 m  
Rdwy Width - 22 m  
And Reinf. Panels At Bridge Ends  
(For Drg. No., See Sht. 1)
- ③ Const. Stone Embankment Drain Trench  
(For Details, See Sht. 2A-2)  
(Earthwork Incl. In Main Rdwy. Distr.)
- ④ Const. P.C. Conc. Drainage Curb - 4 m  
(For Details, See Sht. 2A-2)  
(See Drg. No. RD700)
- ⑤ Sta. "P" 13+890.6 To Sta. "P" 13+905.8.Lt.  
Remove Guardrail - 19 m  
Const. Guardrail - 15.24 m (Type 2A)  
Conn. To Extg. Guardrail  
Extra For Long Posts - 7  
Flare Rate=0, E=0, W=0  
(3.81 m Tangent, 11.43 m Taper To Extg.)  
(See Drg. Nos. RD400, RD405, RD415,  
RD440 & RD445)
- ⑥ Sta. "P" 13+964.4 To Sta. "P" 13+981.3.Lt.  
Remove Guardrail - 16.9 m  
Const. Guardrail - 7.62 m (Type 2A)  
- 3.81 m (Type 3)  
Const. Bridge Transition  
Conn. To Extg. Guardrail  
Extra For Long Posts - 10  
Flare Rate=0, E=0, W=0
- ⑦ Remove Curb - 14.2 m  
Const. Type "C" Curb - 14.2 m  
Conn. To Extg. Curb
- ⑧ Sta. "N" 2+048.8, 5.5 m Rt., 8.5 m Rt.  
Const. W.Q. Structure, 0.00-0.10 CMS  
Const. Type "G-2" Inlet  
Inst. 300 mm Sew. Pipe - 16 m  
Tr. Exc. - 10 m  
(See Drg. Nos. RD336, RD357 & RD366)

- ⑨ Const. P.C. Conc. Drainage Curb - 16 m
- ⑩ Remove Guardrail - 57.15 m  
Const. Guardrail - 15.24 m (Type 4)  
(Reflectorized)  
Inst. Thrie Beam Terminal Connector  
Inst. Guardrail Transition  
(1.905 m On Tangent)  
Flare Rate=0, E=0, W=0  
Const. Anchor (Type 1 Mod.)  
Inst. End Piece (Type B)  
(For Details, See Sht. 2A)
- ⑪ Sta. "P" 13+964.4 To Sta. "P" <sup>13+968.2</sup> ~~13+972~~ Rt.  
Const. Guardrail - ~~7.62~~ <sup>3.81</sup> m (Type 2A)  
Flare Rate=0, E=0, W=~~0~~ <sup>1.22</sup>  
~~Const. Anchor (Type 1 Mod.)~~  
Inst. End Piece (Type B)  
(See Drg. No. RD700)

All Dimensions Are Shown In Meters (m)  
Unless Otherwise Noted.

**OREGON DEPARTMENT OF TRANSPORTATION**  
ROADWAY ENGINEERING SECTION

**MILLER CR. (HALF VIADUCT) BR. SEC.**  
COLUMBIA RIVER HIGHWAY (LOWER)  
MULTNOMAH COUNTY

Design Team Leader - David Joe Polly  
Designed By - Kathy Fry  
Drafted By - Jim Holeman  
Water Quality Design By - Henry M. Allen

**GENERAL CONSTRUCTION**

SHEET NO. **4A**

REGISTERED PROFESSIONAL  
ENGINEER  
19,279  
DAVID JOE POLLY  
JULY 15, 1997  
Expires Dec. 31, 2002

'AS CONSTRUCTED'

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8  
0  
1

*MD [Signature]*  
Project Manager

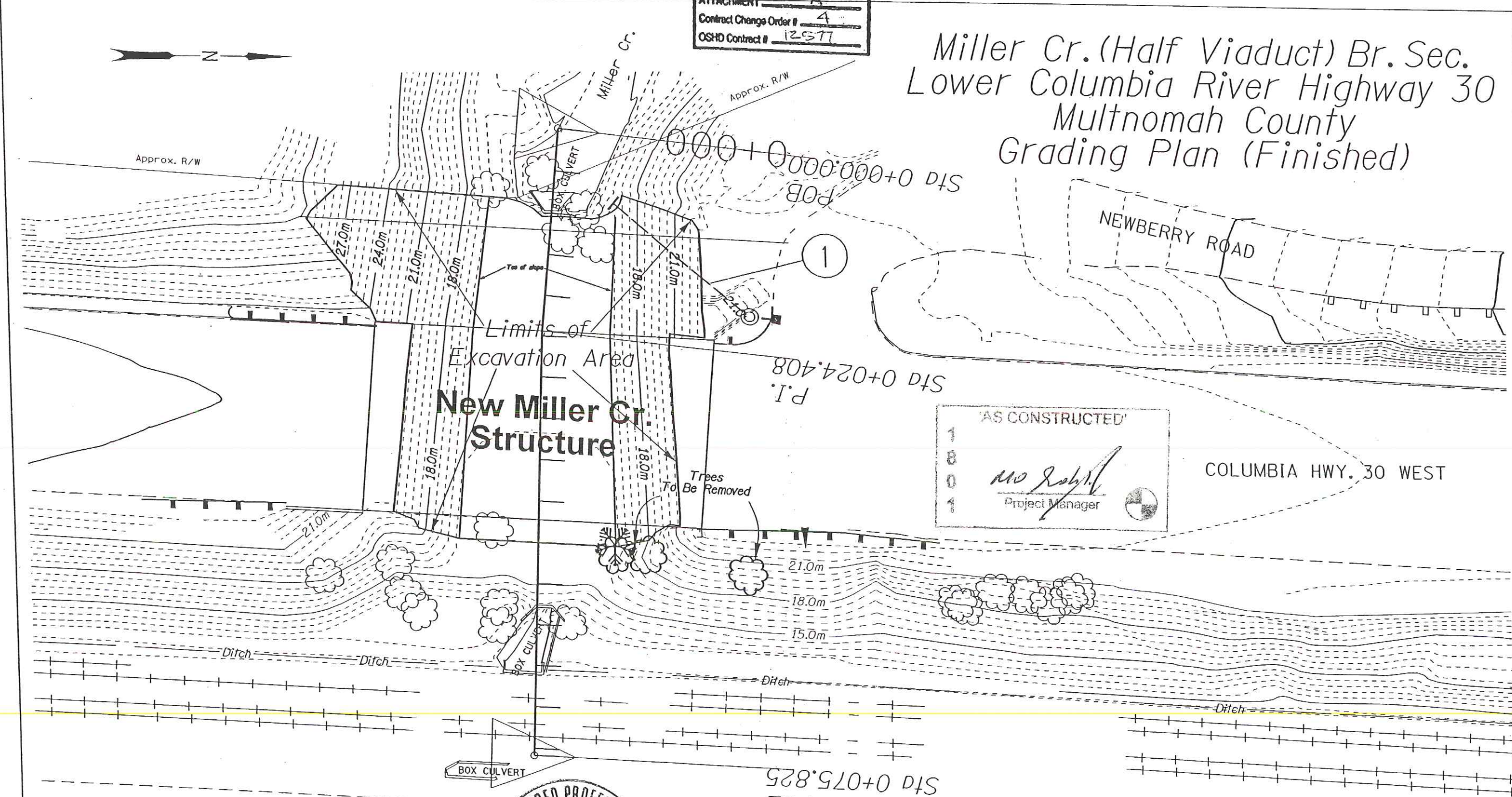
Remove Inlet Shown Thus:

LEGEND  
M4 = 400 mm Maple Tree  
M2 = 250 mm Maple Tree

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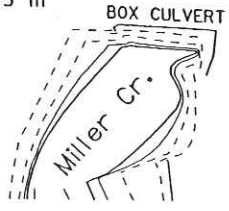
Page 1 of 2 Pages  
 ATTACHMENT A  
 Contract Change Order # 4  
 OSHD Contract # 12577

Miller Cr. (Half Viaduct) Br. Sec.  
 Lower Columbia River Highway 30  
 Multnomah County  
 Grading Plan (Finished)



'AS CONSTRUCTED'  
 1801  
 Mo Sahli  
 Project Manager

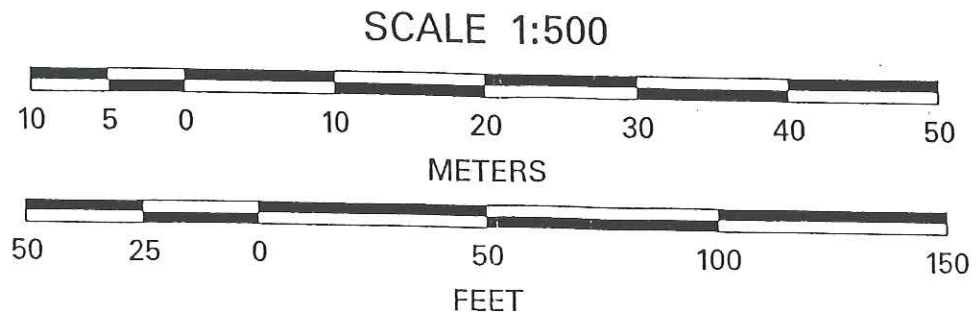
① Install 300 mm storm pipe - 19 m  
 Flowline at Manhole - 21.50  
 Flowline at Outfall - 16.00



REGISTERED PROFESSIONAL ENGINEER  
 49378PE  
 Mo Sahli  
 OREGON  
 JAN. 15, 2002  
 MOHAMAD SAHLI

EXPIRATION DATE: 6/30/02

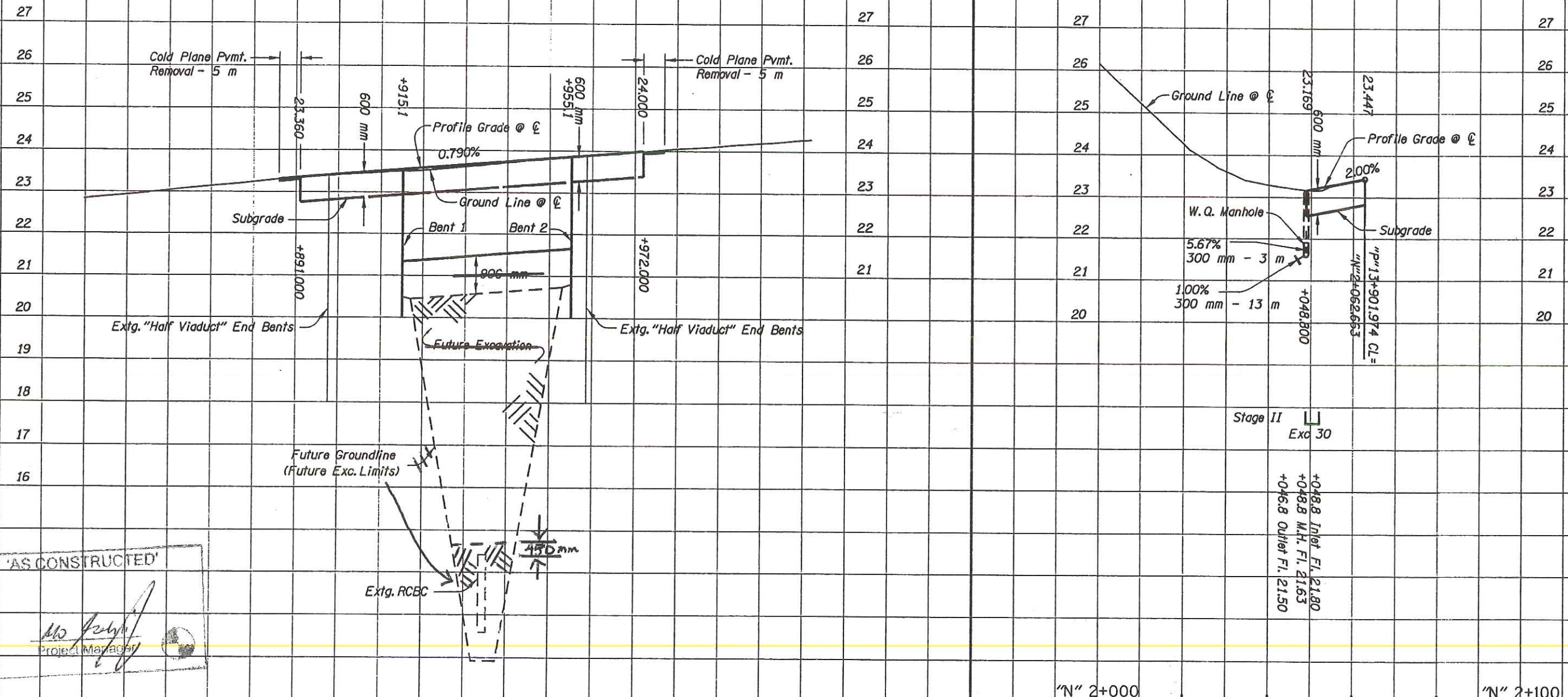
Designed by: Rick Jacobson  
 Reviewed by: Mo Sahli  
 Date: April 2, 2002



\* SEE ATTACHED AS BUILT PLAN & PROFILE

"P" LINE

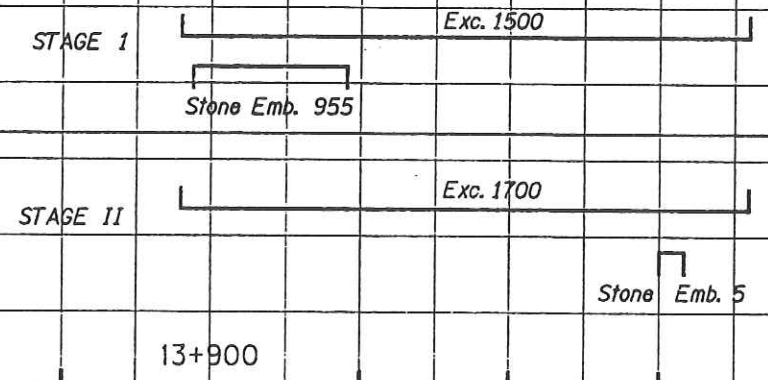
"N" LINE



1804

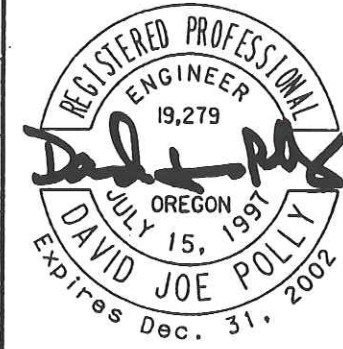
**'AS CONSTRUCTED'**

*David Joe Polly*  
Project Manager



"N" 2+000

"N" 2+100



**OREGON DEPARTMENT OF TRANSPORTATION**  
ROADWAY ENGINEERING SECTION

**MILLER CR. (HALF VIADUCT) BR. SEC.**  
COLUMBIA RIVER HIGHWAY (LOWER)  
MULTNOMAH COUNTY

Design Team Leader - David Joe Polly  
Designed By - Kathy Fry  
Drafted By - Jim Holeman

**PROFILE**

SHEET NO.  
**4B**

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# Appendix C

## Content:

- **Proprietary Structure Maintenance Requirements**



# CDS Guide

## Operation, Design, Performance and Maintenance



## CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs. Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs. The pollutant removal capacity of the CDS system has been proven in lab and field testing.

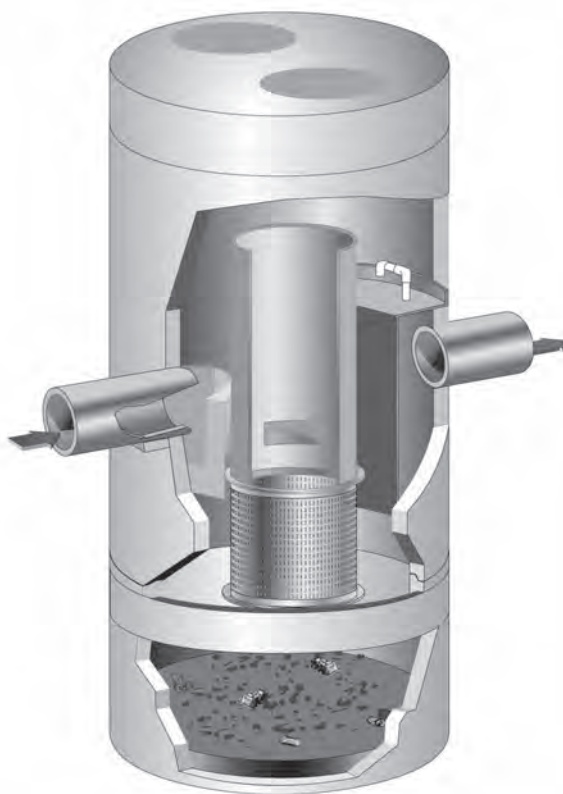
### Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



## Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ and Probabalistic Method are used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125-microns ( $\mu\text{m}$ ). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75-microns ( $\mu\text{m}$ ).

### Water Quality Flow Rate Method

In many cases, regulations require that a specific flow rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval (i.e. the six-month storm) or a water quality depth (i.e. 1/2-inch of rainfall).

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the treatment flow rate around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and reduces the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore they are variable based on the gradation and removal efficiency specified by the design engineer.

### Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to

calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

### Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program CONTECH developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic rational method is an extension of the rational method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (i.e.: 2-year storm event). Under this method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

### Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus helping to prevent re-suspension or re-entrainment of previously captured particles.

### Hydraulic Capacity

CDS hydraulic capacity is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. As needed, the crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulics.

## Performance

### Full-Scale Laboratory Test Results

A full-scale CDS unit (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This full-scale CDS unit was evaluated under controlled laboratory conditions of pumped influent and the controlled addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSD) of the test materials were

analyzed using standard method "Gradation ASTM D-422 with Hydrometer" by a certified laboratory. UF Sediment is a mixture of three different U.S. Silica Sand products referred as: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation ( $d_{50} = 20$  to  $30 \mu\text{m}$ ) covering a wide size range (uniform coefficient  $C_u$  averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer  $d_{50}$  ( $d_{50}$  for NJDEP is approximately  $50 \mu\text{m}$ ) (NJDEP, 2003). The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size ( $d_{50}$ ) of 106 microns. The PSDs for the test material are shown in Figure 1.

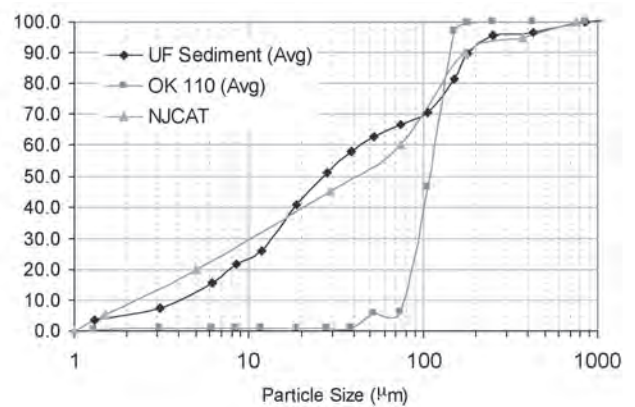


Figure 1. Particle size distributions for the test materials, as compared to the NJCAT/NJDEP theoretical distribution.

Tests were conducted to quantify the CDS unit (1.1 cfs (31.3-L/s) design capacity) performance at various flow rates, ranging from 1% up to 125% of the design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC – ASTM Standard Method D3977-97) and particle size distribution analysis.

## Results and Modeling

Based on the testing data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve for the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation assuming sandy-silt type of inorganic components of SSC. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand).

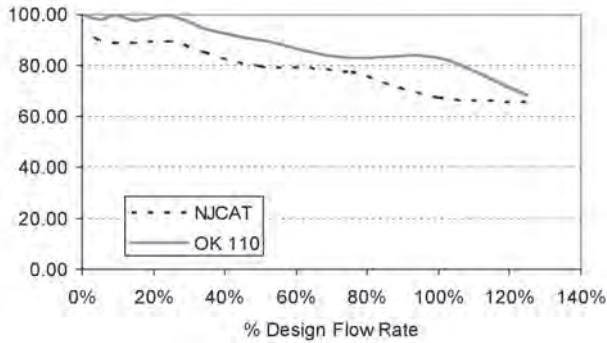


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (WADOE, 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). Supported by the laboratory data, the model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at 100% of design flow rate, for this particle size distribution (d50 = 125 μm).

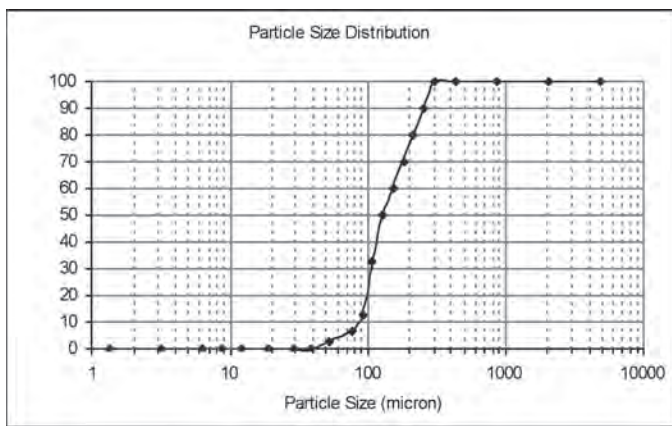


Figure 3. PSD with d50 = 125 microns, used to model performance for Ecology submittal.

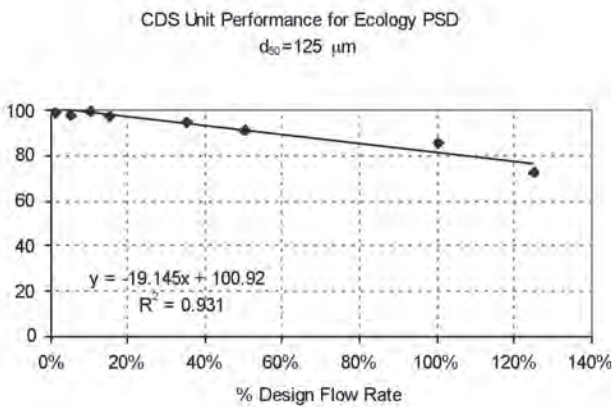


Figure 4. Modeled performance for CDS unit with 2400 microns screen, using Ecology PSD.

## Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, e.g., unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help insure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Additionally, installations should be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions to inlet and/or separation screen. The inspection should also identify evidence of vector infestation and accumulations of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If sorbent material is used for enhanced removal of hydrocarbons then the level of discoloration of the sorbent material should also



be identified during inspection. It is useful and often required as part of a permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (screen/cylinder) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained behind the screen. For units possessing a sizable depth below grade (depth to pipe), a single manhole access point would allow both sump cleanout and access behind the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine if the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

## Cleaning

Cleaning of the CDS systems should be done during dry weather conditions when no flow is entering the system. Cleanout of the CDS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should be pumped out also if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash can be netted out if you wish to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. Confined Space Entry procedures need to be followed. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd <sup>3</sup>	m <sup>3</sup>
CDS2015-4	4	1.2	3.0	0.9	0.5	0.4
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.





## Support

- Drawings and specifications are available at [www.contechstormwater.com](http://www.contechstormwater.com).
- Site-specific design support is available from our engineers.



800.925.5240

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# **OPERATIONS AND MAINTENANCE GUIDELINES**

## **CDS Stormwater Treatment Unit**

### **INTRODUCTION**

The CDS unit is an important and effective component of your storm water management program and proper operation and maintenance of the unit are essential to demonstrate your compliance with local, state and federal water pollution control requirements.

The CDS technology features a patented non-blocking, indirect screening technique developed in Australia to treat water runoff. The unit is highly effective in the capture of suspended solids, fine sands and larger particles. Because of its non-blocking screening capacity, the CDS unit is un-matched in its ability to capture and retain gross pollutants such as trash and debris. In short, CDS units capture a very wide range of organic and in-organic solids and pollutants that typically result in tons of captured solids each year such as: Total suspended solids (TSS) and other sedimentitious materials, oil and greases, trash, and other debris (including floatables, neutrally buoyant, and negatively buoyant debris). These pollutants will be captured even under very high flow rate conditions.

CDS units are equipped with conventional oil baffles to capture and retain oil and grease. Laboratory evaluations show that the CDS units are capable of capturing up to 70% of the free oil and grease from storm water. CDS units can also accommodate the addition of oil sorbents within their separation chambers. The addition of the oil sorbents can ensure the permanent removal of 80% to 90% of the free oil and grease from the storm water runoff.

### **OPERATIONS**

The CDS unit is a non-mechanical self-operating system and will function any time there is flow in the storm drainage system. The unit will continue to effectively capture pollutants in flows up to the design capacity even during extreme rainfall events when the design capacity may be exceeded. Pollutants captured in the CDS unit's separation chamber and sump will be retained even when the units design capacity is exceeded.

### **CDS UNIT INSPECTION**

Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection (and cleanout) of the separation chamber (screen/cylinder) & sump and another allows inspection (and cleanout) of sediment captured and retained behind the screen.

The unit should be periodically inspected to determine the amount of accumulated pollutants and to ensure that the cleanout frequency is adequate to handle the predicted pollutant load being processed by the CDS unit. The unit should be periodically inspected for indications of vector infestation, as well. The recommended cleanout of

## Patented continuous deflection separation (CDS) technology

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs. The pollutant removal capability of the CDS system has been proven in the lab and field.

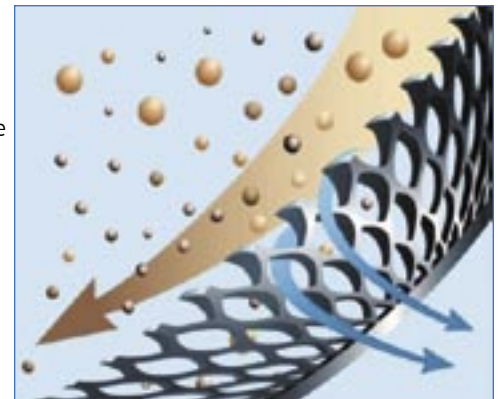
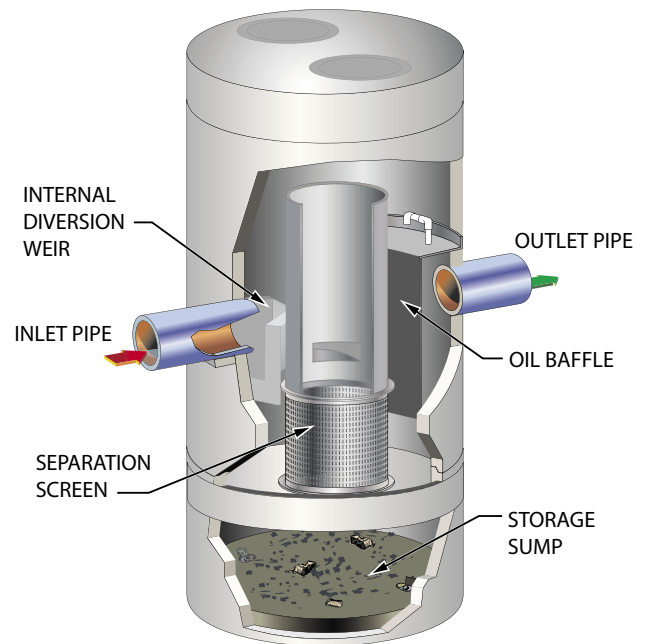
### How does it work?

Stormwater enters the CDS unit's diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed. All flows up to the system's treatment design capacity enter the separation chamber.

Swirl concentration and screen deflection forces floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During flow events exceeding the design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants will not wash out.



### CDS

- Removes sediment, trash, and free oil and grease
- Patented screening technology captures and retains 100% of floatables, including neutrally buoyant and all other material greater than the screen aperture
- Operation independent of flow
- Performance verified through lab and field testing
- Unobstructed maintenance access
- Customizable/flexible design and multiple configurations available
- Separates and confines pollutants from outlet flow
- Grate inlet available
- Multiple screen aperture sizes available

# Available Models

Refer to the following tables for our standard models, sizes, and treatment capacities. Drawings and specifications are available at [contechstormwater.com](http://contechstormwater.com).

We encourage you to contact your local stormwater consultant for site-specific design assistance. In many cases our products can be customized to fit your particular project's needs.

Local regulations may impact design requirements.

	CDS Model	Structure Diameter <sup>1</sup>		Typical Depth Below Invert		Water Quality Flow <sup>2</sup>		Screen		Sump Storage	
		ft	m	ft	m	125 $\mu$ m cfs	L/s	Diameter/Height ft	m	yd <sup>3</sup>	m <sup>3</sup>
Inline	PMIU20_15	4	1.2	3.7	1.1	0.7	19.8	2.0/1.5	0.6/0.5	0.5	0.4
	PMIU20_15_4	4	1.2	3.5	1.1	0.7	19.8	2.0/1.5	0.6/0.5	0.5	0.4
	PMSU20_15	5	1.5	4.4	1.3	0.7	19.8	2.0/1.5	0.6/0.5	1.1	0.8
	PMSU20_20	5	1.5	5.0	1.5	1.1	31.1	2.0/2.0	0.6/0.6	1.1	0.8
	PMSU20_25	5	1.5	5.3	1.6	1.6	45.3	2.0/2.5	0.6/0.8	1.1	0.8
	PMSU30_20	6	1.8	5.5	1.7	2.0	56.6	3.0/2.0	0.9/0.6	2.1	1.6
	PMSU30_30	6	1.8	6.5	2.0	3.0	85.0	3.0/3.0	0.9/0.9	2.1	1.6
	PMSU40_30	8	2.4	7.8	2.4	4.5	127.4	4.0/3.0	1.2/0.9	5.6	4.3
Offline	PMSU40_40	8	2.4	8.8	2.7	6.0	169.9	4.0/4.0	1.2/1.2	5.6	4.3
	PSWC30_20	6	1.8	5.3	1.6	2.0	56.6	3.0/2.0	0.9/0.6	1.9	1.5
	PSW30_30	varies	varies	6.3	1.9	3.0	85.0	3.0/3.0	0.9/0.9	5.8	4.4
	PSWC30_30	6	1.8	6.3	1.9	3.0	85.0	3.0/3.0	0.9/0.9	2.1	1.6
	PSWC40_30	7	2.1	7.7	2.3	4.5	127.4	4.0/3.0	1.2/0.9	1.9	1.5
	PSWC40_40	7	2.1	8.8	2.7	6.0	169.9	4.0/4.0	1.2/1.2	1.9	1.5
	PSW50_42	varies	varies	8.8	2.7	9.0	254.9	5.0/4.2	1.5/1.3	1.9	1.5
	PSWC56_40	8	2.4	8.8	2.7	9.0	254.9	5.6/4.0	1.7/1.2	1.9	1.5
	PSW50_50	varies	varies	9.5	2.9	11.0	311.5	5.0/5.0	1.5/1.5	1.9	1.5
	PSWC56_53	8	2.4	10.1	3.1	14.0	396.4	5.6/5.3	1.7/1.6	1.9	1.5
	PSWC56_68	8	2.4	11.8	3.6	19.0	538.0	5.6/6.8	1.7/2.1	1.9	1.5
	PSWC56_78	8	2.4	12.8	3.9	25.0	707.9	5.6/7.8	1.7/2.4	1.9	1.5
	PSW70_70	varies	varies	13.0	4.0	26.0	736.2	7.0/7.0	2.1/2.1	3.9	3.0
	PSW100_60	varies	varies	11.0	3.4	30.0	849.5	10.0/6.0	3.0/1.8	6.9	5.3
	PSW100_80	varies	varies	13.0	4.0	50.0	1415.8	10.0/8.0	3.0/2.4	6.9	5.3
PSW100_100	varies	varies	15.0	4.6	64.0	1812.3	10.0/10.0	3.0/3.0	6.9	5.3	

1. Structure diameter represents the standard inside dimension of the concrete structure. Offline systems will require additional concrete diversion components.

2. Water Quality Flow is based on 80% removal of a particle size distribution with an average particle size of 125 microns. This flow also represents the maximum flow prior to which bypass occurs. Test results are based on use of a 2400 micron screen.

Cast-in-place system are available to treat higher flows. Check with your local representatives for specifications.

**Notes:** Systems can be sized based on a water quality flow (e.g. 1 inch storm) or on a net annual basis depending on the local regulatory requirement. When sizing based on a water quality storm, the required flow to be treated should be equal to or less than the listed water quality flow for the selected system. Systems sized based on a water quality storm are generally more conservatively sized. Additional particle size distributions are available for sizing purposes upon request. Depth below invert is measured to the inside bottom of the system. This depth can be adjusted to meet specific storage or maintenance requirements. Contact our support staff for the most cost effective sizing for your area.