TAMARACK NEIGHBORHOOD DRAINAGE

PRELIMINARY DESIGN HYDRAULIC REPORT

Prepared for:

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April 2013

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Introduction

The City of Sammamish is interested in upgrading stormwater facilities in the Tamarack neighborhood to resolve existing drainage problems and support future development. The Tamarack neighborhood has localized drainage problems in the vicinity of 209th Avenue NE and erosion in open ditches along NE 4th Street. Planned development in this neighborhood is not supported by the existing privately installed infrastructure. The goal of the proposed drainage improvements is to provide solutions to existing drainage problems and support future development without causing impacts to natural resources or existing infrastructure.

This report documents the Tamarack Neighborhood Drainage Preliminary design. It is a follow up to Design Alternatives for Inglewood and Tamarack Neighborhood Drainage Projects, Technical Memorandum by Windward Environmental, December 2011 (Windward Memo). Osborn Consulting, Inc. (OCI) is a subconsultant to Windward on this project. The Windward Memo documents project background, existing conditions, and qualitative alternatives analysis. This report provides a brief summary of the project background and existing conditions, hydrologic and hydraulic analysis, and documentation of the preliminary design. The Tamarack Neighborhood Drainage Preliminary Design includes:

- Proposed collection and conveyance system that improves the existing drainage issues and allows for future development of property.
- Discharge to Lake Sammamish via existing ditch-culvert system on Louis Thompson Road. King County flow control exemption shall be verified during final design.
- Consists of 1,265 linear feet of new pipe, 1,738 linear feet of upsized pipe, and 14 new catch basins.
- Provides enhanced water quality treatment for 0.5 acres of City right of way.
- Estimated project cost is $974,000.

Existing Condition summary

Evaluation of the current site conditions consisted of a review of existing utility plans and maps, review of GIS data, field reconnaissance, and survey data. The existing site can be divided into four areas: the Tlingit Subdivision Section, the Private Road Section, the 209th Avenue NE Section, and the NE 4th Street Section. Details for the sections are outlined in **Table 1**. Plan sheets are provided in **Attachment A**.

Table 1: Section Details

	Tlingit Subdivision	Private Road	209th Ave NE	NE 4th Street
Vicinity	205th Ave NE, 206th Ave NE, and NE 5th Place	Grassy area and steps between NE 5th Place and NE 4th Street	209th Ave NE from NE 4th Street to cul-de-sac	NE 4th Street from 211th Ave NE to Private Road
Existing Storm Drainage	1,367 LF 12-inch pipe, 171 LF 72-inch pipe, 134 LF 18-inch pipe; 4 MHs, 8 CBs	299 LF 8-inch pipe; 2 MHs, 3 CBs	386 LF 12-inch pipe; 1 CB	91 LF 12-inch pipe/culvert; 2 CBs; ditch flow
Information Resources	Previous utility replacement/ extension plans, survey data	Survey data	GIS data and field reconnaissance	GIS data and field reconnaissance
Plan Sheets	1-3	4	5	6

The ditch along the north side of NE 4th Street is armored with large rocks, but shows signs of erosion and degradation due the amount of runoff.

Design Summary

The preliminary design is based on Alternative B in the Windward Memo (See **Figure 1**). The preferred alternative from the memo was Alternative C, where the proposed storm pipes on NE 4th Street tightline through a private ravine at the west end. Alternative C, however, is not possible as the owner of the property with the ravine is building a house on the property. The preliminary design based on Alternative B connects to the existing stormwater conveyance system in the Tlingit subdivision beginning on NE 5th Place. The Preliminary Design is comprised of a proposed collection system and an upsizing of the existing collection system. These design elements, typical design assumptions, and the cost estimate are described below. The Tamarack Neighborhood Drainage Preliminary Plans are included as **Attachment A**.

New Collection System

A new collection system is proposed in the Private Road, 209th Avenue NE, and NE 4th Street Sections. **Table 2** describes the proposed components.

Table 2: New Collection Systems

	Private Road	**209th Ave NE**	**NE 4th Street**
New Conveyance	346 LF 18-inch pipe	10 LF 12-inch pipe, 200 LF ditch	909 LF 12-inch pipe
New Structures	1 CB Type 2 48-inch	1 CB Type 1	1 CB Type 2 48-inch, 9 CB Type 1
New Water Quality	0	0	5 Filterra® Structures
New Curb & Gutter	0	0	1,590 LF

Additional information about the proposed NE 4th Street collection system is bulleted below.

- The existing rock-lined ditch along the north side of NE 4th Street will remain in place.
- The new collection system along NE 4th Street will divert stormwater from the ditch to the pipe system and alleviate the existing erosion in the ditch.
- Filterra® units are proposed offset from the catch basins behind a concrete flume on alternating sides of the street.
- New curb and gutter are included in the construction cost estimate and on the plans. New curb is essential to the performance of the proposed water quality treatment system.
- Clean water from private residential development can connect at tap into the 12-inch collection line directly, or stub outs from the overflow catch basins to the property line can be added during final design. Design of future development connections will be the responsibility of private property owners.
- Two new 18-inch stormwater pipes and one Manhole Type 2-48” connect the proposed system along NE 4th Street (via the Private Road section) to the existing system on NE 5th Place (in the Tlingit Subdivision section).

Upsize the Existing Collection System

The existing collection systems in the Tlingit Subdivision and Private Road Sections are currently undersized to manage the stormwater from the new collection system. The proposed changes are in **Table 3**.

Table 3: Upsized Collection Systems

	Tlingit Subdivision	Private Road
Upsized Conveyance	1,402 LF 18-inch pipe, 134 LF 24-inch pipe	137 LF 12-inch pipe, 65 LF 18-inch pipe
Replaced Structures	1 CB Type 2 48-inch	1 CB Type 1

Typical Design Assumptions

The Preliminary Design was developed using survey, as-built, GIS and field observation data. The proposed alignment in the NE 4th Street Section flows on the south curb of NE 4th Street until it meets up with the Private Road Section. Sewer lines run approximately down the middle of the road in the NE 4th Street Section. Water lines are also present along NE 4th Street. Sewer and stormwater pipes cross once at Private Road Section, and several times within the Tlingit Subdivision Section. No information exists about other utilities in the Tlingit Subdivision Section. Utility conflicts shall be determined and addressed during final design.

The proposed stormwater system has steep pipe slopes. Pipe slopes range from 1.0% to over 25% but are typically in the 10% to 20% range. Proposed pipe slopes generally follow the slope of the topography and some pipe slopes were modified to improve conveyance capacity.

The proposed pipe type is PVC, however, any WSDOT schedule A smooth interior wall pipe is acceptable. Conveyance systems were analyzed using a Manning's roughness of n=0.013, so additional hydraulic analysis would be required prior to approval of corrugated pipe.

The minimum distance from structure rim to pipe invert is 4-feet. This distance ensures minimum 2-feet of cover over 18-inch pipe and compatibility with proposed water quality treatment facilities which have a rim to invert distance of 3.5-feet. Shoring or extra excavation is required for all depths of 4-feet or more. Several pipes have rim to invert depths greater than 4-feet to maintain minimum slopes for conveyance and/or maintain minimum cover over the pipe at sag locations.

Project Cost Estimate

The preliminary design project cost estimate is $974,000. The project cost estimate includes construction cost plus design cost.

Construction Cost:	$740,000
Design Cost:	$234,000
Total Project Cost:	$974,000

The construction cost was established using unit prices for key design elements of the proposed design (i.e. pipe, structures, and site restoration) and includes a contingency of 30% and sales tax. Design costs including estimates for easement acquisition, engineering design, permitting, and construction management are included to estimate a total project cost. A copy of the cost estimate is included in **Attachment B**.

Hydrologic and Hydraulic Analysis

A hydrologic and hydraulic analysis was performed using Manning's Equation and flows for the 100-year storm event. Flows were determined by others using MGSFlood, and can be found in **Attachment C**. Existing conditions were analyzed to determine if the capacity of downstream pipes were sufficient for the current cumulative flow. Proposed conditions were determined to utilize the minimum slopes and pipe sizes to carry the cumulative flow for all sections. The proposed pipes were assumed to have smooth interiors and a Manning's coefficient (n) of 0.013.

Design Criteria and Results

This section demonstrates compliance with the King County Surface Water Design Manual (SWDM), 2009, minimum drainage requirements as supplemented by Chapter PWS.20 Storm Drainage of the City of Sammamish Interim Public Works Standards (Ordinance No. O2000-60). King County Core Requirements 1 through 9 are outlined below.

1. **Discharge at the natural location**
   The natural discharge location is Lake Sammamish via an existing conveyance system along Louis Thompson Road NE. The proposed system connects to the existing conveyance system at 205th Avenue NE and Louis Thompson Road NE.

2. **Offsite analysis**
   Downstream pipes are assumed to be sufficiently sized to handle the additional flow. A downstream analysis shall be performed during final design.

3. **Flow control**
   Flow control is not required for project directly discharging to Lake Sammamish per King County SWDM Direct Discharge Exemption. A downstream analysis shall be performed during final design to confirm conveyance capacity from the project outfall to the lake.

4. **Conveyance System**
   Manning's Equation analysis of the Preliminary Design demonstrates conveyance capacity for the 100-year flow. King County conveyance requirements allow pipe system structures to overtop for runoff events that exceed the 25-year design capacity, provided the overflow from a 100-year event does not create or aggravate a severe flooding or erosion problem. This allowance may present opportunities to reduced pipe diameter and project cost during final design.

5. **Erosion and sediment control**
   Erosion and sediment control plans shall be completed during final design.

6. Maintenance and operations

Maintenance and operations plans shall be completed during final design.

7. Financial guarantees and liability

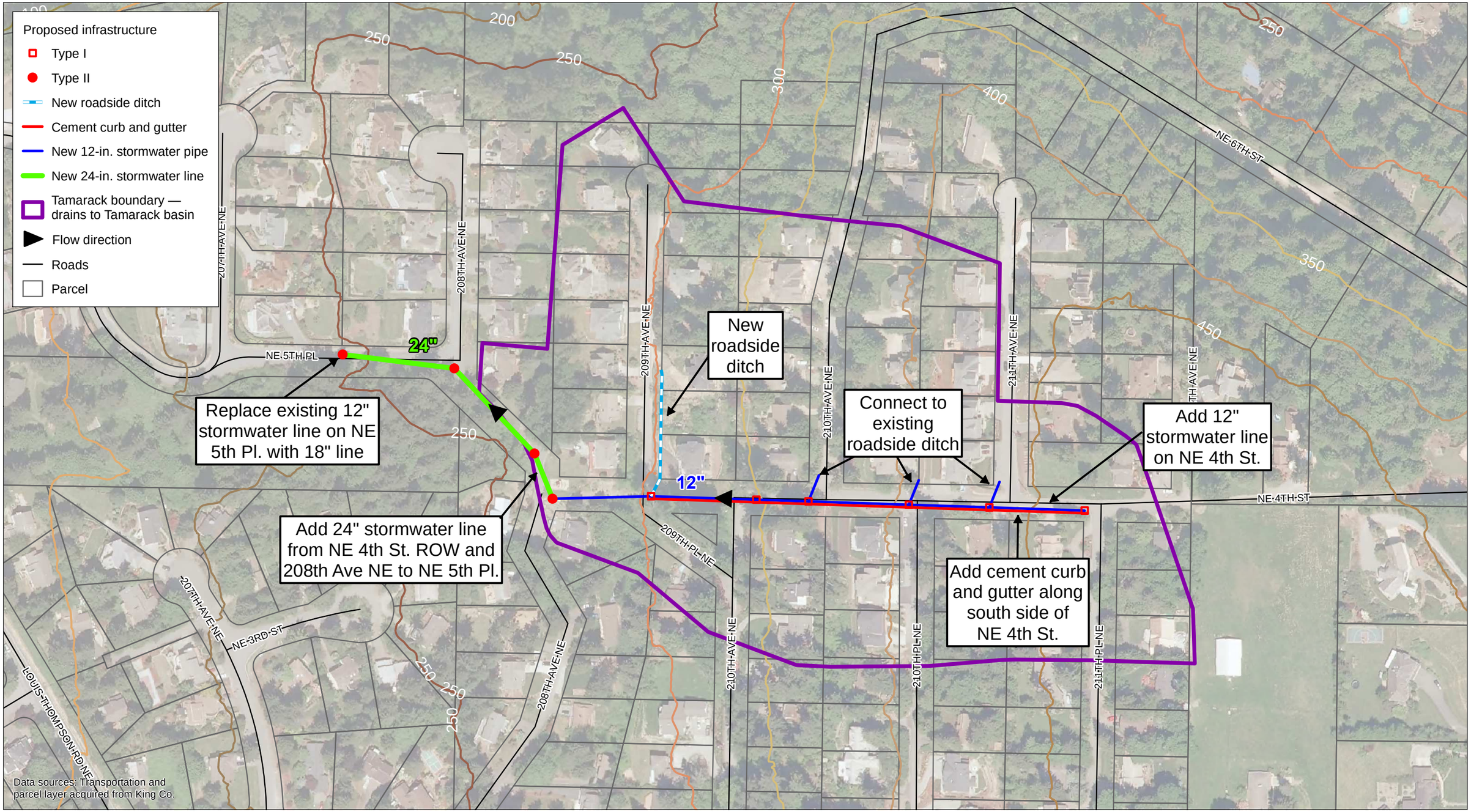
Not Applicable.

8. Water quality

Filterra® Bioretention Systems were designed in accordance with the Engineering Design Assistance Kit (DAKit) v01-WA (select sheets included as **Attachment D**). A total of 5 Filterra® units (4-ft by 4-ft) provide enhanced water quality treatment for City of Sammamish right of way (0.5 acres of pollution generating impervious surface).

Enhanced treatment is provided because Lake Sammamish is a King County Sensitive Lake Water Quality treatment area.

The size and quantity of Filterra® units, or approved equal, shall be adjusted during final design. The Preliminary Design assumes water quality treatment for driveways will be the responsibility of private property owners.



Wind Ward LLC environmental

N

0 0.05 0.1 Miles

0 200 400 Feet

Figure 1. Tamarack Alternative B

DRAFT

Prepared by MTY, 12/15/11; MAP #8959; W:\Projects\City of Sammamish Neighborhood Drainage\Data\GIS\Maps, and Analysis

ATTACHMENT A

TAMARACK NEIGHBORHOOD DRAINAGE PRELIMINARY PLANS

CITY OF SAMMAMISH

TAMARACK NEIGHBORHOOD DRAINAGE

PROJECT NO. XXXX

PRELIMINARY PLANS

DRAWING LIST:

VICINITY MAP
1" = 250'

OWNER:
CITY OF SAMMAMISH
ERIC LAFRANCE, PE
SENIOR STORMWATER ENGINEER
801 228TH AVENUE SE
SAMMAMISH, WA 98075
(425) 295-0562

SURVEYOR:
AXIS SURVEYING & MAPPING
13005 NE 126TH PL
KIRKLAND, WA 98034
(425) 823-5700
1-800-933-AXIS

BACKGROUND SOURCE:
BACKGROUND INFORMATION SHOWN ON THESE PLANS ARE FROM:
- CITY OF SAMMAMISH AND KING COUNTY PROVIDED GIS DATA
- TOPOGRAPHIC SURVEY FOR SAMMAMISH TAMARACK BASIN PROVIDED BY AXIS 8/29/12
- AS BUILT WATER AND SEWER PLANS BY SAMMAMISH PLATEAU WATER AND SEWER DISTRICT12/11/96
- PLAT OF TLINGIT ADDITION PLANS BY MYRON ANDERSON & ASSOCIATES 7/83

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LAURA RUPPERT
STATE OF WASHINGTON
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City of Sammamish Washington

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ENGINEER: Osborn Consulting Inc.
1800 - 112th Avenue NE, Suite 220E
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DRAWN BY: MLP
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TAMARACK STORMWATER IMPROVEMENTS COVER

10-110024 OCI PROJECT NO.

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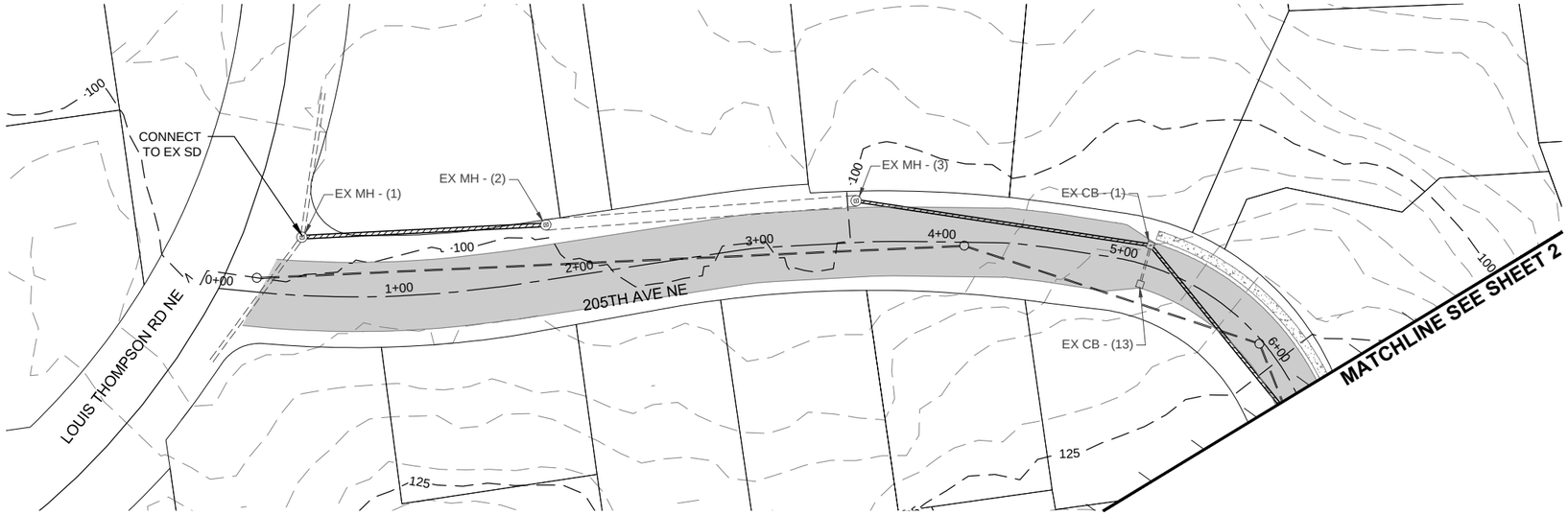
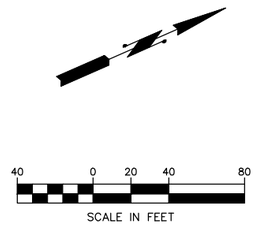
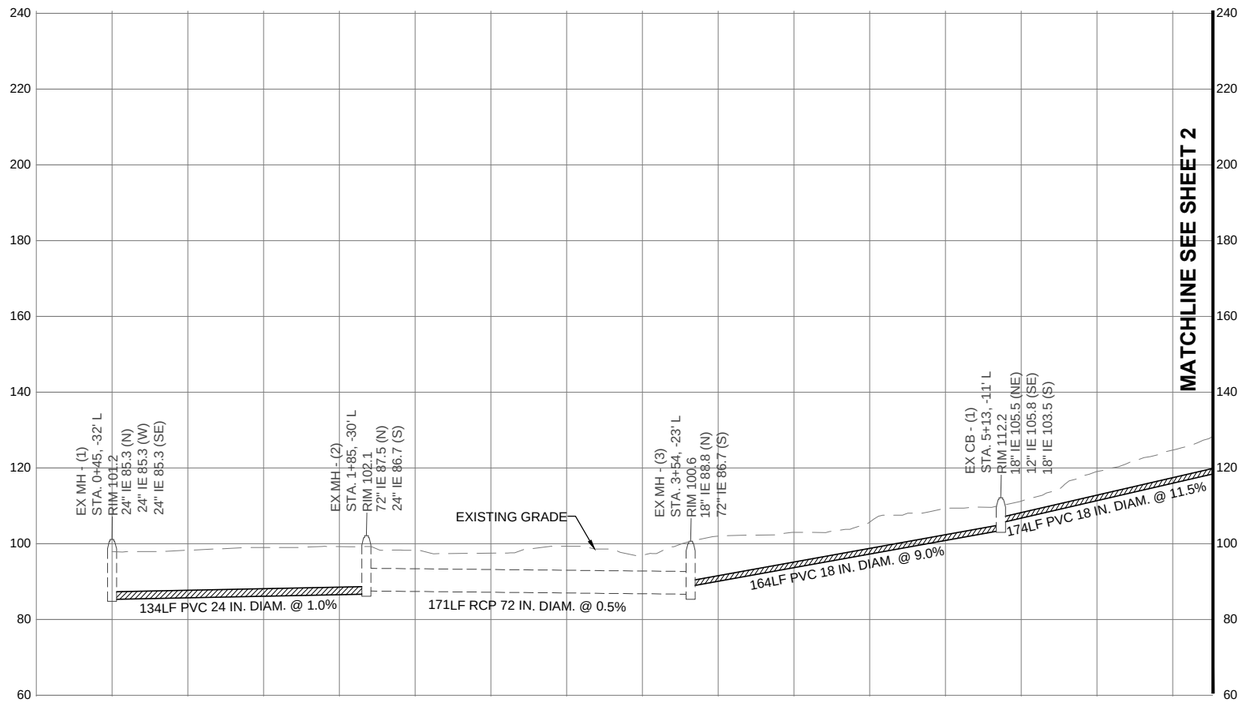
- PROPOSED CURB AND GUTTER







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TAMARACK STORMWATER IMPROVEMENTS 205TH AVE NE

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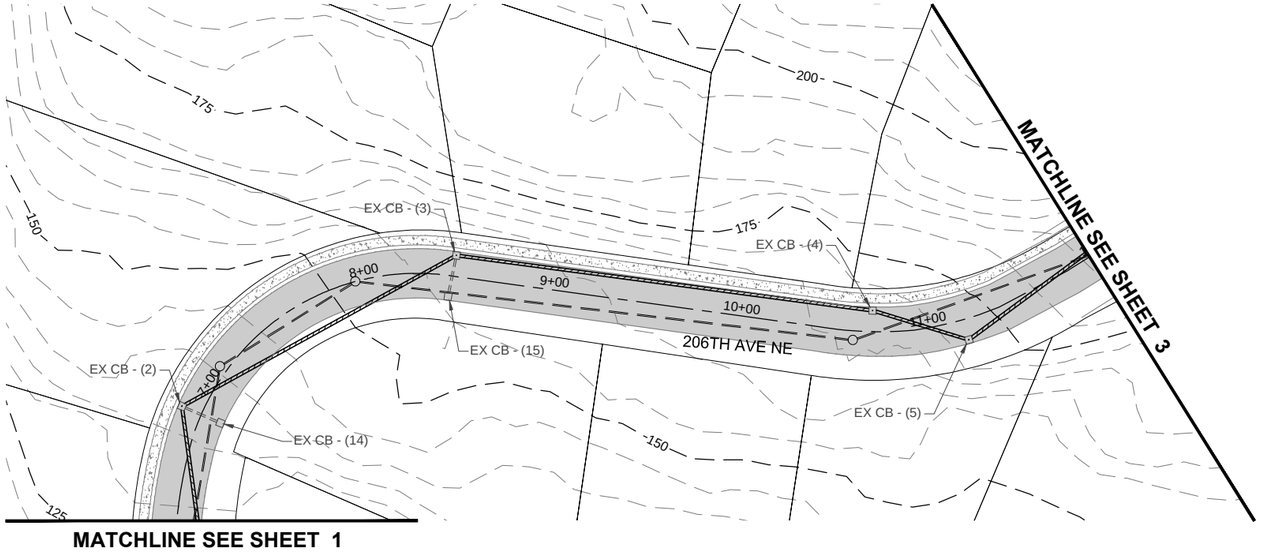

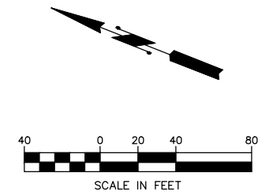

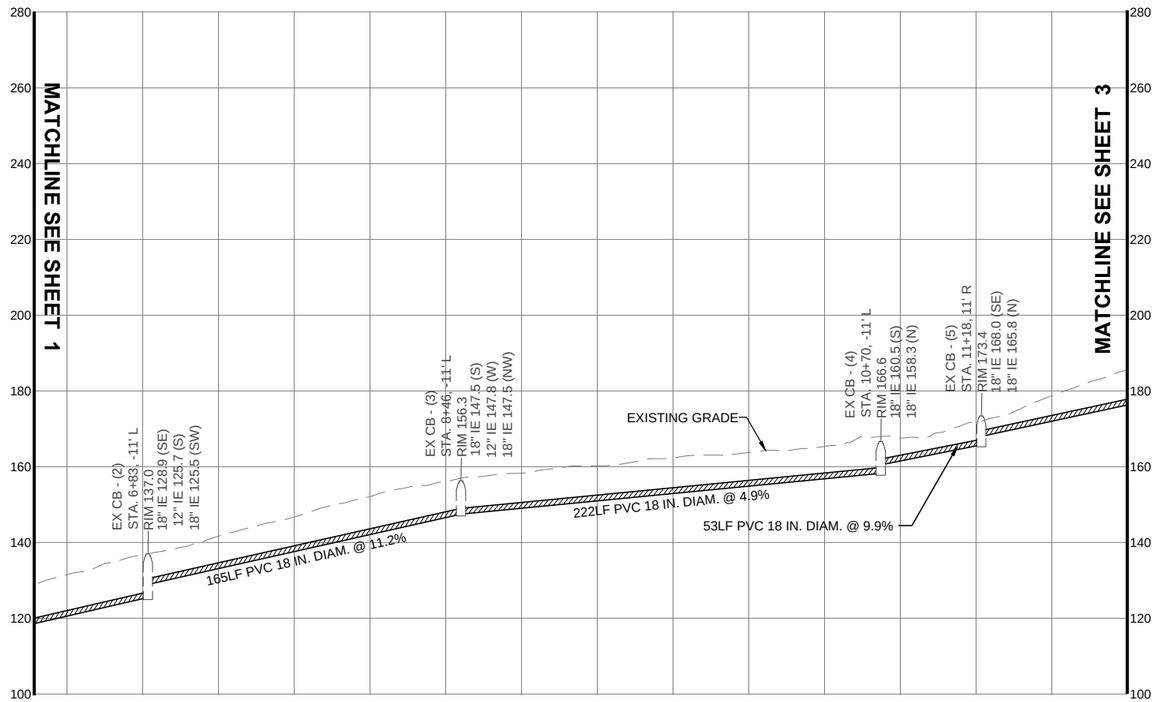

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206TH AVE NE

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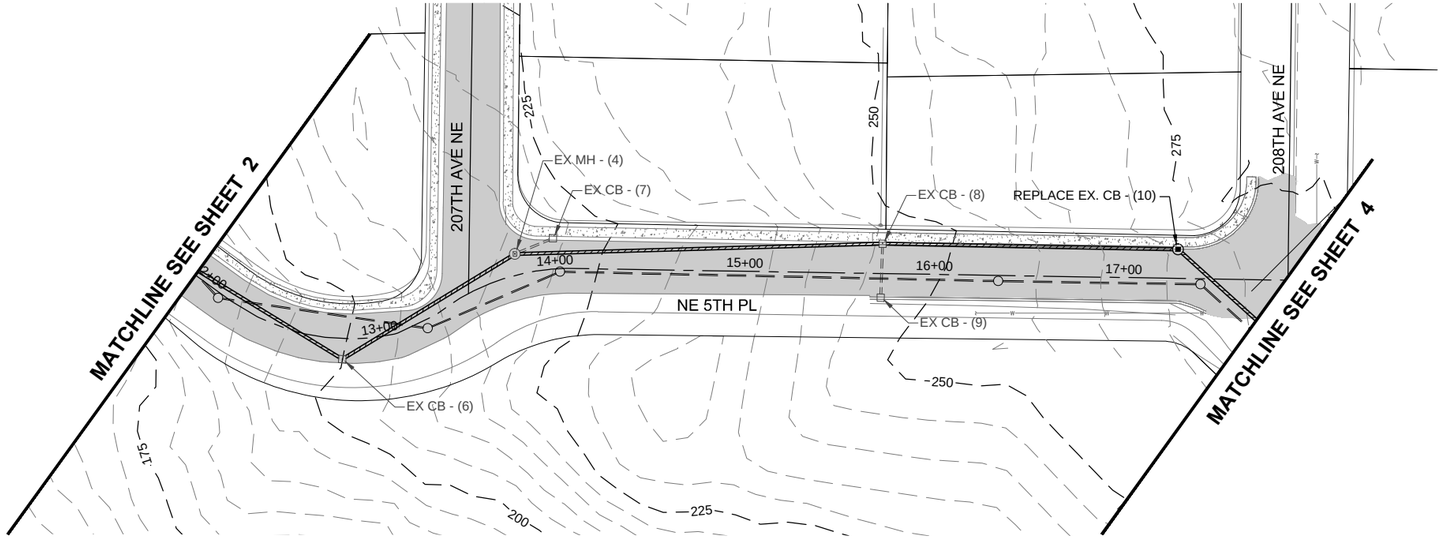

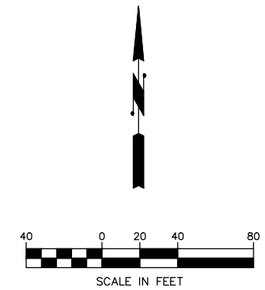

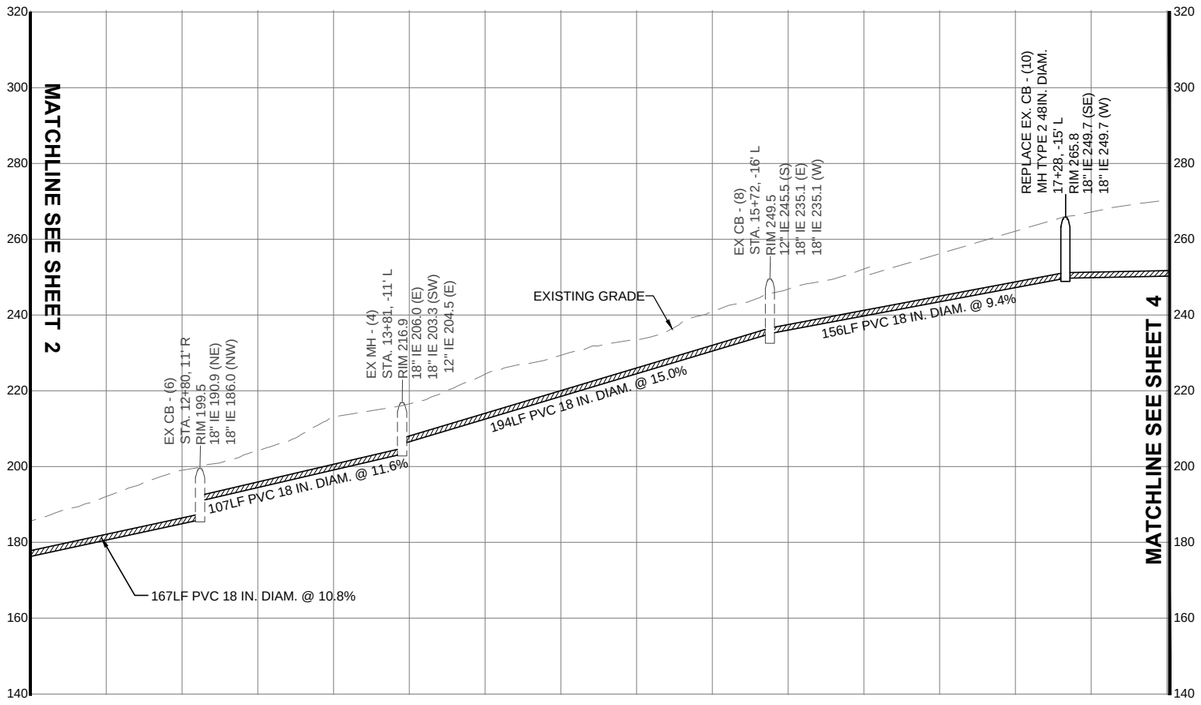

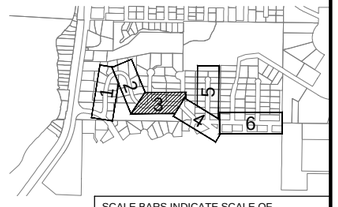

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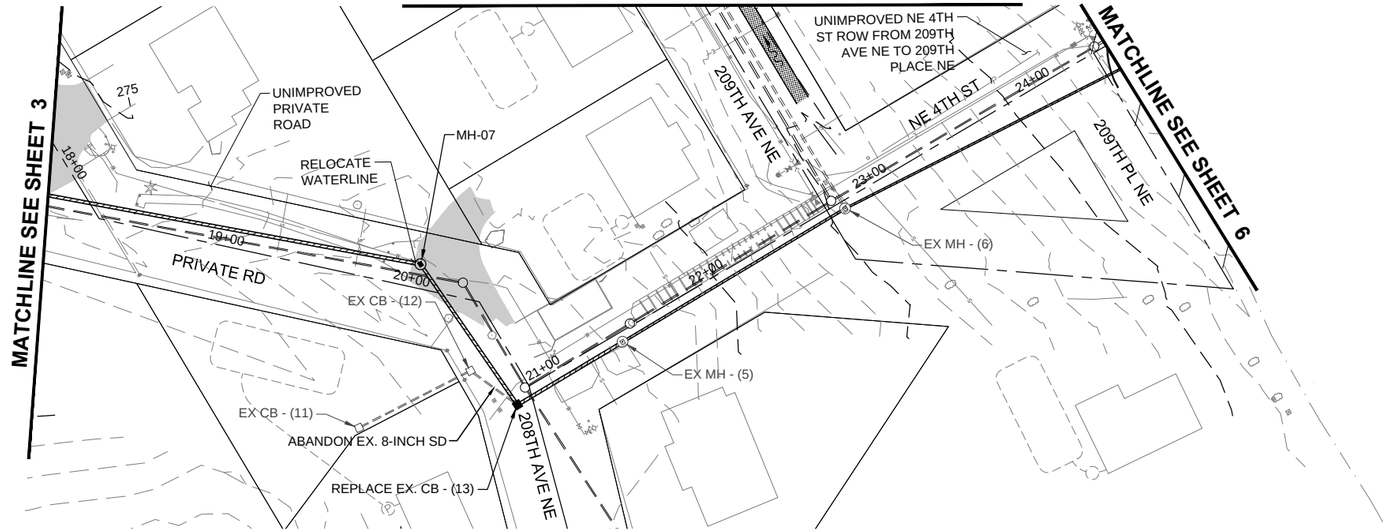

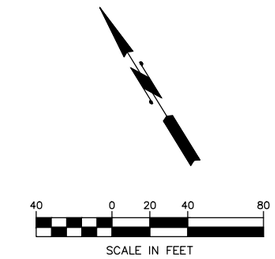

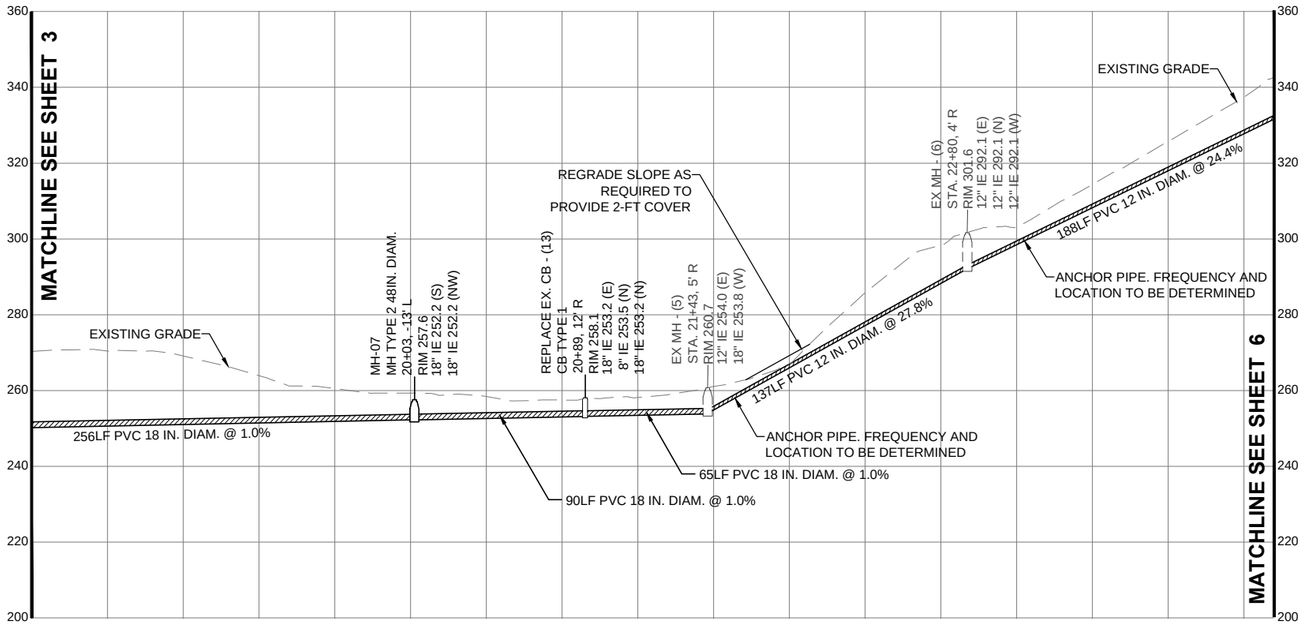

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PRIVATE RD & NE 4TH ST

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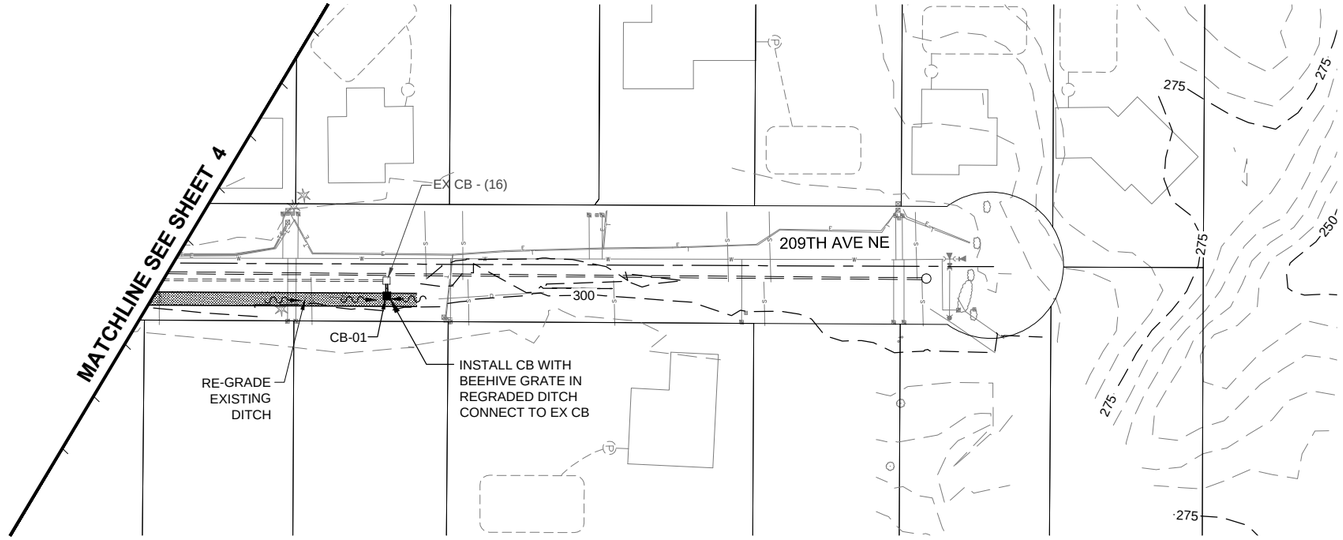
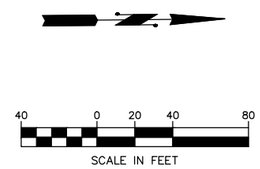
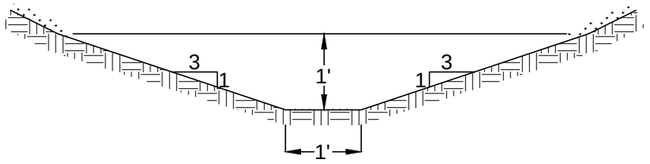






TYPICAL DITCH SECTION
N.T.S

SCALE BARS INDICATE SCALE OF FULL-SIZE (22 X 34 INCH) DRAWINGS. FOR REDUCED SIZE DRAWINGS ADJUST SCALE ACCORDINGLY.

Call 2 Working Days Before You Dig
1-800-424-5555
Utilities Underground Location Center
(ID,MT,ND,OR,WA)

LAURA RUPPERT — STATE OF WASHINGTON — 43848 — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY PLANS – NOT FOR CONSTRUCTION

NO.	DATE	BY	CKD.	REVISION

City of Sammamish Washington

OSBORN CONSULTING INCORPORATED

ENGINEER: Osborn Consulting Inc.
1800 - 112th Avenue NE, Suite 220E
Bellevue, Washington 98004
TEL: (425) 451 - 4009
FAX: (425) 451 - 4901

DESIGNED BY: RDP
DRAWN BY: MLP
CHECKED BY: LCR
DATE: DEC 2012

TAMARACK STORMWATER IMPROVEMENTS 209TH AVE NE

10-110024 OCI PROJECT NO.

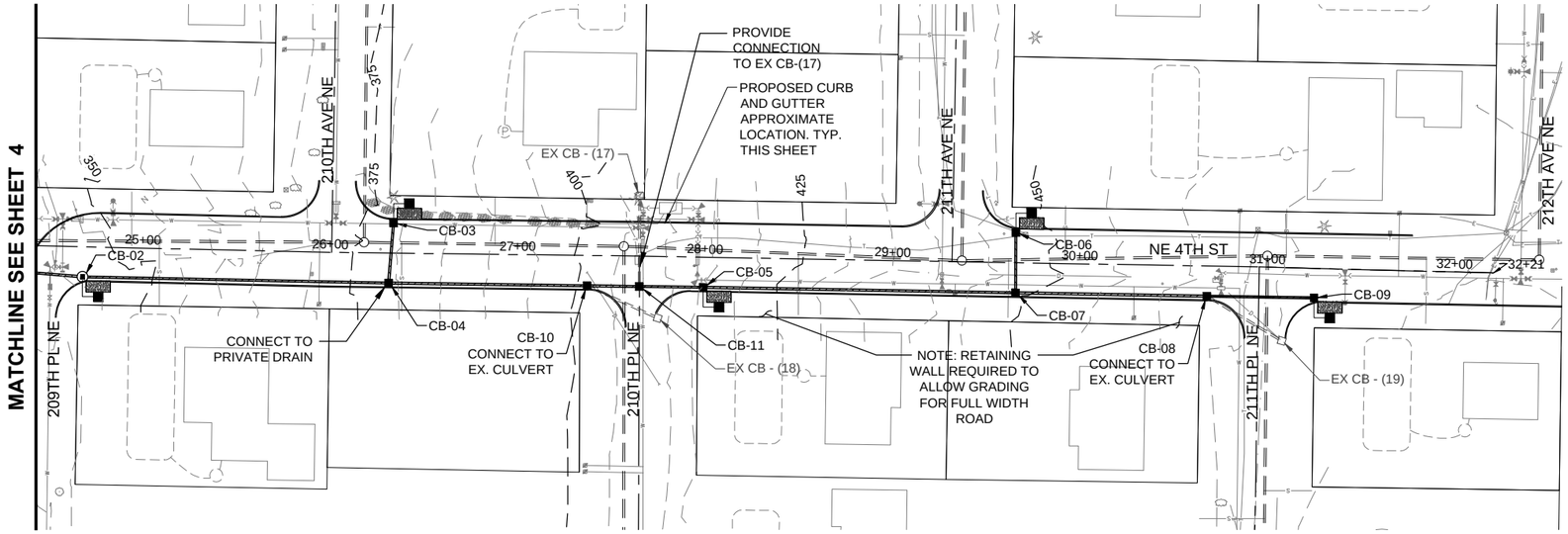
SHEET 5 OF 7

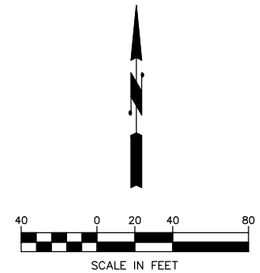
PLOTTING DATE: 4/22/2013 USER: Marie FILE NAME: G:\Projects\10-110024 Sammamish SW\CAD\Tamarack\Tamarack.dwg

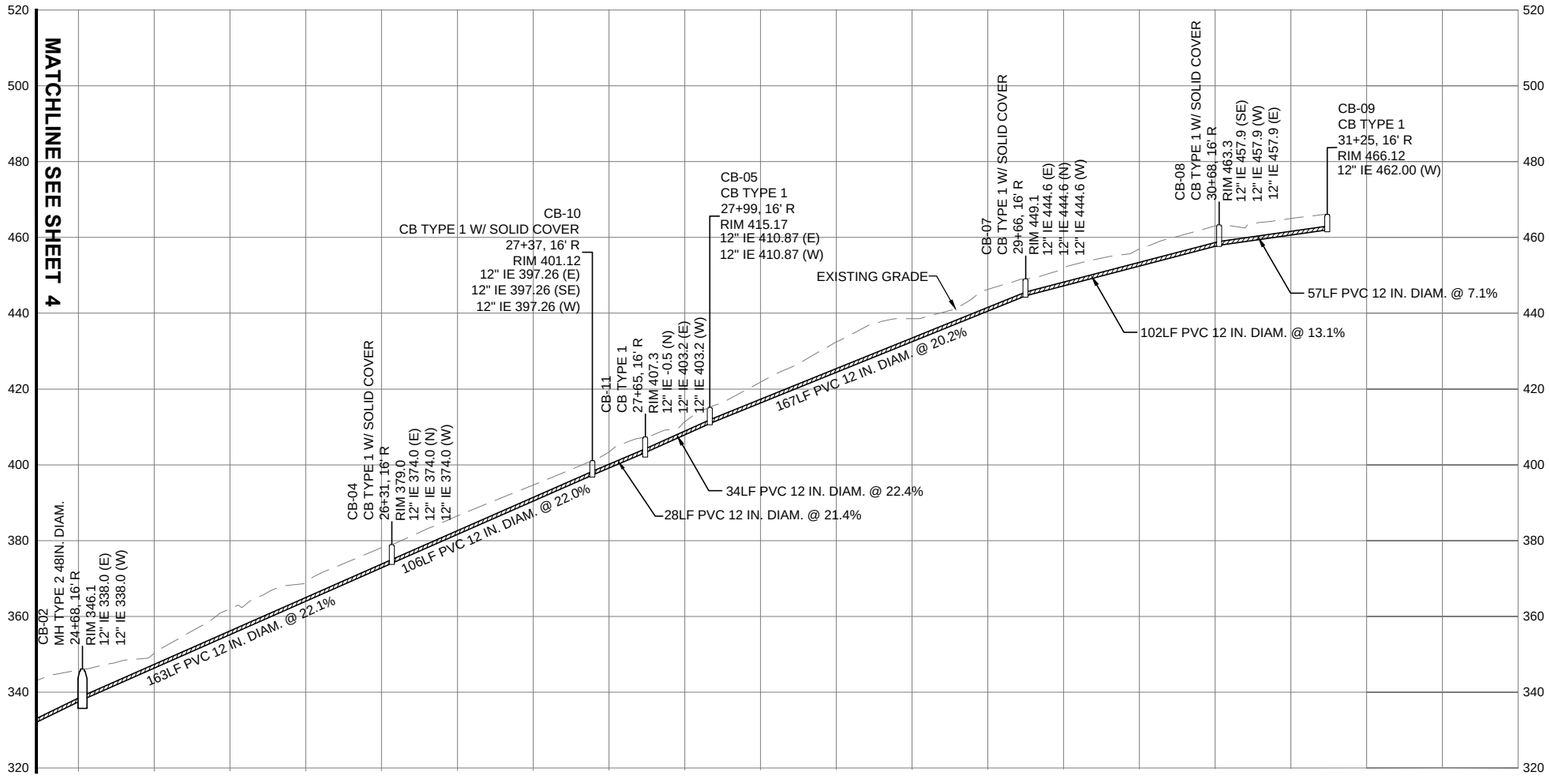
SEC. 32, TWP. 25, RGE. 6, W.M.

LEGEND:

- 25-FT CONTOUR (GIS)
- 5-FT CONTOUR (GIS)
- RIGHT-OF-WAY (GIS)
- ROAD CENTERLINE
- EXISTING PAVEMENT
- EXISTING SIDEWALK
- EXISTING SEWER MH
- EXISTING SEWER PIPE
- EXISTING STORM MH
- EXISTING STORM CB
- EXISTING STORM DRAIN PIPE
- PROPOSED MH TYPE 2
- PROPOSED CB TYPE 1
- PROPOSED WATER QUALITY TREATMENT 4-FT X 4-FT (SEE DETAILS SHEET 7)
- PROPOSED CONCRETE FLUME (SEE DETAILS SHEET 7)
- PROPOSED STORM DRAIN PIPE
- PROPOSED DITCH
- PROPOSED CURB AND GUTTER







SCALE BARS INDICATE SCALE OF FULL-SIZE (22 X 34 INCH) DRAWINGS. FOR REDUCED SIZE DRAWINGS ADJUST SCALE ACCORDINGLY.

PRELIMINARY PLANS – NOT FOR CONSTRUCTION

Call 2 Working Days Before You Dig
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LAURA RUPPERT — STATE OF WASHINGTON — 43848 — REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	BY	CKD.	REVISION

City of Sammamish Washington

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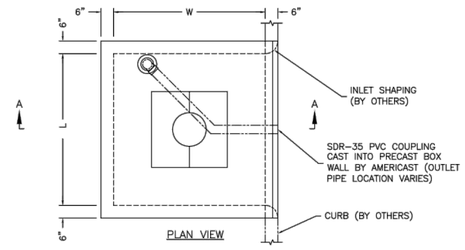
DESIGNED BY: RDP
DRAWN BY: MLP
CHECKED BY: LCR
DATE: DEC 2012

TAMARACK
STORMWATER IMPROVEMENTS
NE 4TH ST

10-110024
OCI PROJECT NO.

6 SHEET 7 OF

PLOTTING DATE: 4/22/2013 USER: Marie FILE NAME: O:\Projects\10-110024 Sammamish SW\CAD\Tamarack\Tamarack.dwg



DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
4 x 4	4'-0"	4'-0"	(1) 3x3	4" SDR-35 PVC
6 x 6	6'-0"	6'-0"	(1) 3x3	4" SDR-35 PVC

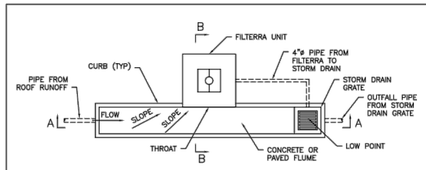
MODIFICATIONS OF DRAWINGS ARE ONLY PERMITTED BY WRITTEN AUTHORIZATION FROM FILTERRA

DRAWING AVAILABLE IN TIF FILE FORMAT.

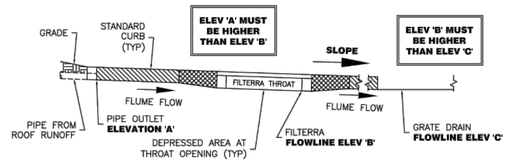
DATE: 12-09-09 DWG: WWA FTST-3

PRECAST FILTERRA® UNIT STANDARD CONFIGURATION WESTERN WASHINGTON

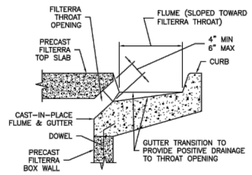
filterra® US PAT 6,277,274 AND 6,569,321



FLUME PLAN



FLUME CROSS SECTION A-A



FLUME SECTION B-B

MODIFICATIONS OF DRAWINGS ARE ONLY PERMITTED BY WRITTEN AUTHORIZATION FROM FILTERRA

DATE: 03-17-05 DWG: FTRDF-1

FILTERRA® EXAMPLE SCENARIOS ROOF DRAIN FLUME APPLICATION

filterra® US PAT 6,277,274 AND 6,569,321

LAURA RUPPERT STATE OF WASHINGTON 43848 REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY PLANS – NOT FOR CONSTRUCTION

SCALE BARS INDICATE SCALE OF FULL-SIZE (22 X 34 INCH) DRAWINGS. FOR REDUCED SIZE DRAWINGS ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	CKD.	REVISION

City of Sammamish Washington

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DESIGNED BY: RDP
DRAWN BY: MLP
CHECKED BY: LCR
DATE: DEC 2012

TAMARACK STORMWATER IMPROVEMENTS DETAILS

10-110024 OCI PROJECT NO.

7 SHEET 7 OF

PLOTTING DATE: 4/22/2013 USER: Marie FILE NAME: G:\Projects\10-110024 Sammamish SW\CAD\Tamarack\Tamarack.dwg

ATTACHMENT B

TAMARACK NEIGHBORHOOD DRAINAGE PROJECT COST ESTIMATE

Opinion (Estimate) of Probable Cost

			Project No. Sammamish Neighborhood Projects		**Date** December 21, 2012	
Project Name	Tamarack Neighborhood					
Location	NE 4th St and 209th Ave NE, Sammamish, WA					
Owner	City of Sammamish					
Estimated By:	Joe Wright		**Checked By:**	Laura Ruppert	**Approved By:**	L. Ruppert
Date:	December 20, 2012		**Date:**	12/21/12	**Date:**	April 2013
ITEM NO.	**SPEC SECTION**	**DESCRIPTION**	**QTY**	**UNIT**	**UNIT PRICE**	**TOTAL COST**
		Mobilization	1	LS	8%	$38,507.14
		Clearing and grubbing	0.1	ACRE	$8,500.00	$850.00
		Removing Asphalt Conc. Pavement	1,610	SY	$6.00	$9,658.00
		Ditch Excavation Incl. Haul	30	CY	$25.00	$740.74
		Cement Conc. Curb and Gutter	1,590	LF	$30.00	$47,700.00
		Schedule A Storm Sewer Pipe 12 in. Diam*	1,056	LF	$40.00	$42,240.00
		Schedule A Storm Sewer Pipe 18 in. Diam*	1,813	LF	$60.00	$108,780.00
		Schedule A Storm Sewer Pipe 24 in. Diam*	134	LF	$70.00	$9,380.00
		Pipe Anchor	6	Each	$3,000.00	$9,000.00
		Catch Basin Type 1	11	Each	$1,000.00	$11,000.00
		Catch Basin Type 2 48 In. Diam.	3	Each	$2,200.00	$6,600.00
		Connect to existing catch basin or manhole	24	Each	$620.00	$14,880.00
		Structure Excavation Class B Incl. Haul	1,690	CY	$9.00	$15,210.00
		Crushed surfacing base course	268	CY	$30.00	$8,048.33
		HMA For Pavement Repair Cl. 3/4 In. PG	642	TON	$150.00	$96,244.65
		Temporary Erosion and Sediment Control	1	EST	$6,000.00	$6,000.00
		Roadside Restoration	1	EST	$6,000.00	$6,000.00
		Project Temporary Traffic Control	1	EST	$6,000.00	$6,000.00
		Plugging Existing Pipe	1	Each	$500.00	$500.00
		Shoring or Extra Excavation Class B	15,015	SF	$0.50	$7,507.50
		Water Quality Structure (Filterra 4'x4')	5	Each	$15,000.00	$75,000.00
				Subtotal Project Cost		**$519,846.37**
				Contingency	**30%**	**$155,953.91**
				Tax	**10%**	**$64,201.03**
				Easement Acquisition		**$0.00**
				Engineering Design	**20%**	**$103,969.27**
				Permitting	**5%**	**$25,992.32**
Notes:				**Construction Management**	**20%**	**$103,969.27**
*Includes installation, materials, pipe zone bedding, trench backfill and CDF and SD testing				**TOTAL PROJECT COST**		**$973,932.16**
					TOTAL PROJECT COST (Rounded)	**$974,000.00**

ATTACHMENT C

HYDROLOGIC AND HYDRAULIC ANALYSIS

The Hydrologic and Hydraulic Analysis was provided by Windward Environmental. This attachment contains the following:

- Flows generated from MGSFlood
- Existing pipe sizing and capacity calculations
- Proposed pipe sizing and capacity calculations

100-Year Storm Event Flows				
	Tlingit Subdivision	**Private Road**	**209th Ave NE**	**NE 4th Street**
100-Year Flows (cfs)	19.223	10.735	9.358	6.189

Existing Pipes - Assuming Reusing CMP

			Cumulative Flow out (cfs)				n	0.022
			Tam7 Q	Tam5 Q	Tam 4	Tam 3	1.486/n	67.54545
			6.189	9.358	10.735	19.223		
Pipe	Diameter	Area(SF)						
12"	1	0.785	8.7%	19.8%	26.0%	83.5%		
18"	1.5	1.76625	1.00%	2.28%	3.0%	9.6%		
24"	2	3.14	0.21%	0.49%	0.6%	2.1%		
36"	3	7.065	0.02%	0.06%	0.1%	0.2%		

NE 4th street - 22.0%

Private stairs - 28.0%

Private road - 0.5%

NE 5th PL - 15.0%

206th ave NE - 5.0%

205th ave NE - 1.0%

Pipe diameter meets slopes of area

Slope will have to be adjusted or pipe size increased

Mannings Equation (for partially full pipe)

$q = Av = A * k_n/n*R^{2/3} * S^{1/2}$

q	CFS	flow	R	Ft	hydraulic radius = A/P
A	SF	cross sectional area	P	Ft	wetted perimeter
v	ft/sec	average velocity	n	mannings roughness	
k_n	1.486	for English units	$S^{1/2}$	sqrt of slope	

Proposed Pipes - Assuming Using HDPE

			Cumulative Flow out (cfs)				n	0.013
			Tam7 Q	Tam5 Q	Tam 4	Tam 3	1.486/n	114.3077
			6.189	9.358	10.735	19.223		
Pipe	Diameter	Area(SF)						
12"	1	0.785	3.0%	6.9%	9.1%	29.1%		
18"	1.5	1.76625	0.35%	0.79%	1.0%	3.4%		
24"	2	3.14	0.07%	0.17%	0.2%	0.7%		
36"	3	7.065	0.01%	0.02%	0.0%	0.1%		

NE 4th street - 22.0%

Private stairs - 28.0%

Private road - 0.5%

NE 5th PL - 15.0%

206th ave NE - 5.0%

205th ave NE - 1.0%

Pipe diameter meets slopes of area

Slope will have to be adjusted or pipe size increased

Mannings Equation (for partially full pipe)

$q = Av = A * k_n/n*R^{2/3} * S^{1/2}$

q	CFS	flow	R	Ft	hydraulic radius = A/P
A	SF	cross sectional area	P	Ft	wetted perimeter
v	ft/sec	average velocity	n	mannings roughness	
k_n	1.486	for English units	$S^{1/2}$	sqrt of slope	

ATTACHMENT D

FILTERRA® BIORETENTION SYSTEMS

CALCULATIONS COVER PAGE

REVISION 0 (11/9/2012)

PROJECT: Sammamish SW - Tamarack	**OCI JOB NO.:** 10-110024	**PLAN NO.:**	**PAGE 1 OF 5** Total Pages includes Attachments.
CLIENT: City of Sammamish	**DEPARTMENT/DISCIPLINE:**	**CALCULATION NO.**	
SUBJECT/TITLE:	WATER QUALITY STRUCTURE SPACING		

CALCULATION REV. NO.	ORIGINATOR	DISCIPLINE REVIEWER	TECHNICAL PEER REVIEWER (IF REQUIRED)	CONFIRMATION REQUIRED (Y/N) IF YES, INCLUDED ATTACHMENT II
0	M. Phelan	L. Ruppert	N/A	N
1				
2				
3				

CALCULATIONS OBJECTIVE

Determine size and spacing needed for Filterra boxes, based on PGIS.

CALCULATION METHODOLOGY/ LIST OF ASSUMPTIONS

Assumptions:

1. 20-foot pavement width + 16-foot parking = 36-foot PGIS (See Page 3)
2. Available Filterra sizes are 4x4 and 4x6 (See Pages 4 and 5)
3. Sized for Enhanced Treatment to account for sensitive Lake WQ treatment (See Page 4)
4. Road is crowned, and half the road width contributes to each Filterra system (See Page 3)

Following is the process used to size the boxes:

1. Determine manhole spacing.
2. Determine maximum spacing for Filterra systems
3. Determine the Filterra layout
4. Determine the cost

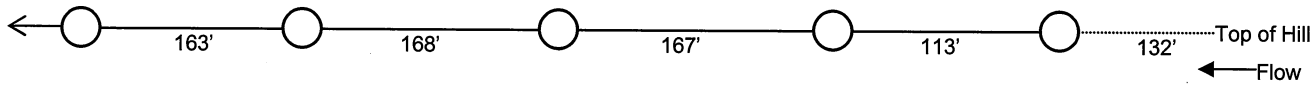
REFERENCES / INPUTS

Roadway Width

Roadway width from City of Sammamish Department of Public Works Standards, FIG01-05. Assumed parking but no sidewalks (See Page 3).

Manhole Spacing

From AutoCAD drawing. Total Distance is 774 feet.



Filterra Spacing

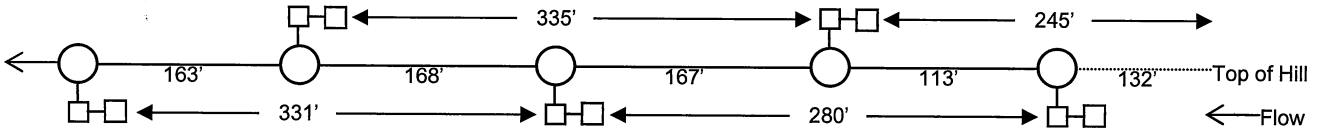
Maximum Spacing from Engineering Design Assistance Kit from Filterra Bioretention Systems, Table 1: WWHM Sizing for Basic Treatment – TSS, Oil/Grease and Phosphorous Treatment (See Page 4). Multiply spacing by two to account for half the road width.

Cost

Filterra Box costs from Filterra Bioretention Systems, Filterra Price List – Standard Unity, Pacific Northwest Region (See Page 5).

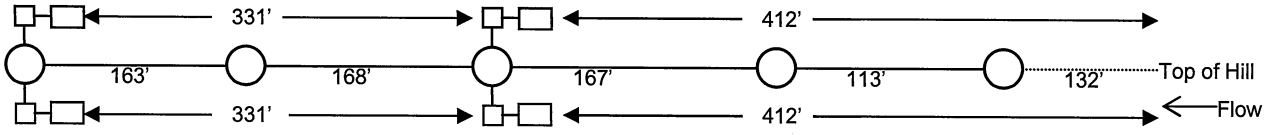
CONCLUSIONS

For 18-foot pavement width, the spacing for a 4x4 Enhanced Treatment Filterra Box is 339 feet. The below diagram shows the spacing with respect to the proposed manholes.



The total cost for five boxes, plus 50% for offloading, installation, and sales tax (See Page 5) is $62,250.

For 18-foot pavement width, the spacing for a 4x6 Enhanced Treatment Filterra Box is 509 feet. The below diagram shows the spacing with respect to the proposed manholes.



The total cost for four boxes, plus 50% for offloading, installation, and sales tax (See Page 5) is $56,100.

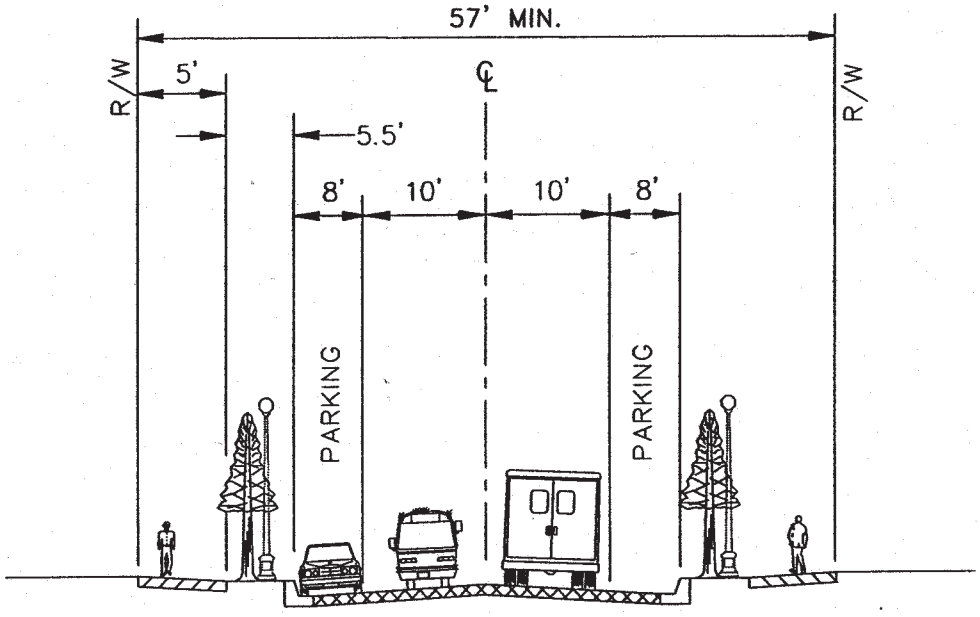
RECOMMENDATION

OCI recommends using the **4x4 Filterra Box** because it is unlikely that the runoff will sheet flow over the intersections, which it would need to do with the 4x6 boxes.

THE CALCULATIONS IS COMPLETED AND READY FOR DISCIPLINE REVIEW

Originator Marie Phelan 11/9/12

Signature/Date



ROADWAY SECTION
LOCAL ROAD
DETAIL

N.T.S.

BUNYAMIN BEN YAZICI
STATE OF WASHINGTON
26221
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES: 4/30/01

NOTES:

1. ADD 5' OF PAVEMENT WIDTH EACH SIDE AND 10' OF RIGHT-OF-WAY WIDTH WHEN BIKE LANES ARE REQUIRED.

2. ON-STREET PARKING MAY BE REDUCED WITH CITY ENGINEER'S APPROVAL FOR CUL-DE-SAC STREETS.

CITY OF SAMMAMISH
DEPARTMENT OF PUBLIC WORKS

ROADWAY SECTION
LOCAL ROAD

APPROVED BY
CITY ENGINEER _____ DATE _____

REV	DWN	CKD	DATE	FILE
	JM	SPS	MARCH-15-2000	FIG01-05

REV NO

filterra
Bioretention Systems

Table 2: WWHM Sizing for **Enhanced Treatment** - Dissolved Metals
Western Washington Region ONLY - v01a

Available Filterra® Box Sizes (feet)	Approximate Contributing Drainage Area (acres)	Maximum Spacing (18-ft Pave width)
4 x 4	0.140	339 LF
4 x 6 or 6 x 4	0.210	509 LF
4 x 8 or 8 x 4	0.275	
6 x 6	0.310	
6 x 8 or 8 x 6	0.415	
6 x10 or 10 x 6	0.520	
6 x 12 or 12 x 6	0.630	

Notes:

1. Sizing table intended for planning level use. The design engineer must use the latest version WWHM to calculate the appropriately sized facility.
2. Sizing table meets WA DOE 2005 Stormwater Manual's 91% annual stormwater volume filtered.
3. Sizing table based on WWHM3 parking/flat and the SeaTac rain gauge with a precipitation factor of 1.0. Other precipitation factors, geographic locations and site conditions will affect Filterra sizing.
4. Sand Filter (Filterra) parameters:
   - Filter material depth = 1.8 feet
   - Effective ponding depth = 0.75 feet
   - Zero slope(s) on the filter box
   - Riser height = 0.7 feet
   - Riser diameter = 100 inches
   - Filter Hydraulic Conductivity = 24.82 inches per hour
5. All boxes are a standard 3.5 feet depth (INV to TC).
6. A standard SDR-35 PVC pipe coupling is cast into the wall for easy connection to discharge drain.
7. Dimensions shown are internal. Please add 1' to each external (using 6" walls).
8. Valid for Enhanced Treatment regiments (Dissolved Zinc and Copper).
9. For sizing in other areas of Washington State please contact Filterra.

Filterra Price List – Standard Units

Pacific Northwest Region

Effective May 1, 2011

4 x 4 .....$8,300	**4 x 12 or 12 x 4.....$14,200**
4 x 6 or 6 x 4.....$9,350	**6 x 8 or 8 x 6.....$13,800**
4 x 8 or 8 x 4.....$10,050	**6 x 10 or 10 x 6.....$17,500**
3 x 8 or 8 x 3.....$10,900	**6 x 12 or 12 x 6.....$20,450**
6 x 6 Standard.....$10,400	**7 x 13 or 13 x 7.....$23,400**

Notes

1. Price includes: Concrete box & top, engineered media, suitable mulch, internal underdrain system & clean out, plant, standard tree grate and two maintenance visits in the first year of each Filterra unit (Maintenance agreement is between owner of Filterra® and Americast) . Delivery to site is included.
2. Modifications to standard products may incur an extra charge and prepayment prior to manufacture (note local tree grate standards).
3. Price does not include offloading, installation or sales taxes (where applicable).
4. The contractor is responsible for safe unloading, handling and installation and to determine if a crane is required. Refer to table of weights of components. Lifting Filterra® boxes **always** requires a spreader bar (not included).
5. The plant/tree and mulch (activation) will be installed by Americast only after the Filterra® units are installed and the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed).
6. The total unit price is due to Americast upon shipment or at 3 months after release for production, whichever is sooner. Activation, maintenance or any other services performed by Americast do not constitute a reason for delay of payment.
7. Filterra® is protected under U.S. Patents # 6,277,274, 6,569,321, 7,425,261, 7,625,485, 7,833,412 and D596,697.
8. This Price List supersedes all other Price Lists and is subject to change without notice.