HEARINGS EXAMINER MEETING AGENDA
Thursday, October 18, 2018, 5:00 PM
City Hall, 616 NE 4th Avenue

I. CALL TO ORDER

II. INTRODUCTION AND INSTRUCTIONS

III. HEARING ITEM

Valley View Estates Subdivision Preliminary Plat Application Public Hearing (File No. SUB18-02)
Presenter: Lauren Hollenbeck, Senior Planner

1-Application
2-Narrative
3-Preliminary Plans May 18, 2018
4-Updated Preliminary Development Plans June 25, 2018
5-GIS Packet with Vicinity Map
6-Notice of Development Sign
7-SEPA Checklist
8-300 Foot Assessors Map, Mailing List and Labels
9-Pre-Application Report
10-Breckenridge Trail
11-Stormwater Plan
12-Stormwater Report
13-Geotechnical Report
14-Revised Geotechnical Report
15-EEI Geotechnical Peer Review #1
16-EEI Geotechnical Peer Review #2
17-Traffic Study
18-Environmental Report
19-Tribal Certified Mailings
20-Notice of Application
21-Incompleteness Review Letter
22-Completeness Review Letter
23-City Review Letter
24-Notice of Public Hearing
25-MDNS Cover Letter SEPA18-15
26-MDNS Determination SEPA18-15
27-Wetland Determination Report October 18, 2007
28-Revised Preliminary Plat October 9, 2018
29-Valley View Estates Subdivision Staff Report SUB18-02
30-Kris Good Comment Letter
Index of Exhibits

IV. ADJOURNMENT

V. LAND USE DECISION

NOTE: The City of Camas welcomes and encourages the participation of all of its citizens in the public meeting process. A special effort will be made to ensure that persons with special needs have opportunities to participate. For more information, please call the City Clerk's Office at 360.817.1591.

Exhibit 1 SUB18-02

City of Camas WASHINGTON

Community Development Department | Planning
616 NE Fourth Avenue | Camas, WA 98607
(360) 817-1568
communitydevelopment@cityofcamas.us

General Application Form

Case Number:

Applicant Information

Applicant/Contact:: Sterling Design, Inc./Joel Stirling
Phone: (360) 759-1794

Address: 2208 E. Evergreen Blvd.
Street Address
Mail@SterlingDesign.biz
E-mail Address
Vancouver
City
WA
State
98661
ZIP Code

Property Information

Property Address: 20109 SE 40th Street
Street Address
125646-000 & 125635-000
County Assessor # / Parcel #
Camas
City
WA
State
98666
ZIP Code

Zoning District R-7.5
Site Size 9.26 acres

Description of Project

Brief description: Preliminary Subdivision application to subdivide 9.26 acres into 36 residential lots.

Are you requesting a consolidated review per CMC 18.55.020(B)? YES ☐ NO ☐

Permits Requested: ☐ Type I ☐ Type II ☒ Type III ☐ Type IV, BOA, Other

Property Owner or Contract Purchaser

Owner's Name: Firestone Stan
Last *First*
Phone: (360) 772-3445

Address: PO Box 61928
Street Address
Apartment/Unit #

E mail Address: Vancouver
City
WA
State
986666
Zip

Signature

I authorize the applicant to make this application. Further, I grant permission for city staff to conduct site inspections of the property.

Signature:
Date: 5/17/2018

Note: If multiple property owners are party to the application, an additional application form must be signed by each owner. If it is impractical to obtain a property owner signature, then a letter of authorization from the owner is required.

Date Submitted: 5/18/18
Pre-Application Date:

Staff:
Related Cases #
☐ **Electronic Copy Submitted**

Paid ✓ 5/18/18
$17,714.00 AB
Validation of Fees

Revised: 11/30/17

Exhibit 2 SUB18-02

Project Narrative:

The "Valley View Estates" Subdivision proposal is to subdivide two parcels of land, serial number(s): 125646-000 and 125635-00, located in the NE ¼ quarter of Section 8, Township 1 North, Range 3 East of the Willamette Meridian, Clark County, Washington into 36 single family residential lots utilizing the R-7.5 zone development standards with the Density Transfer design subsection. The site area is approximately 9.2 acres and currently has one (1) single family home on it. The single-family home will be removed as part of the development process. The property topography slopes moderately from the Northeastern property corner down to the Southwestern property corner and currently has field grass with black berry bushes.

The site is zoned R-7.5 and the comprehensive plan designation for the site is SFM. There are no sensitive lands located on the property and none were located within 100' from the property on adjacent properties as was field verified by Ecological Land Services, Inc.

CMC18.09.040 - Table 2 shows the Lot Requirements for properties within the R1-7.5 zoning district:

18.09.040 Table 2—Density and dimensions—Single-family residential zones.

Density and Dimensions for Single-family Residential Zones[1]

	R-5	R-6	R-7.5	R-10	R-12	R-15	R-20
A. Standard New Lots							
Maximum density (dwelling units/gross acre)	8.7	7.2	5.8	4.3	3.6	2.9	2.1
Average lot area (square feet)[5]	5,000	6,000	7,500	10,000	12,000	15,000	20,000
Minimum lot size (square feet)	4,000	4,800	6,000	8,000	9,600	12,000	16,000
Maximum lot size (square feet)[4]	6,000	7,200	9,000	12,000	14,400	18,000	24,000
Minimum lot width (feet)	50	60	70	80	90	100	100
Minimum lot depth (feet)	80	90	90	100	100	100	100
Maximum building lot coverage	45%	40%	40%	35%	30%	30%	30%
Maximum building height (feet)[3]	35	35	35	35	35	35	35
B. Density Transfer Lots[1]							
Maximum density (dwelling units/gross acre	8.7	7.2	5.8	4.3	3.6	2.9	2.1
Minimum lot size (square feet)	3,500	4,200	5,250	7,000	8,400	10,500	14,000
Maximum lot size (square feet)[4]	6,000	7,200	9,000	12,000	14,400	18,000	24,000

Minimum lot width (feet)[1]	40	50	60	60	70	80	90
Minimum lot depth (feet)[1]	80	80	80	90	90	100	100
Maximum building lot coverage	45%	40%	40%	40%	35%	35%	30%
Maximum building height (feet)[3]	35	35	35	35	35	35	35
C. Setbacks based on average lot sizes (not zone specific) [2]	Up to 4,999 sq. ft.	5,000 to 7,499 sq. ft.	7,500 to 9,999 sq. ft.	10,000 to 11,999 sq. ft.	12,000 to 14,999 sq. ft.	15,000 to 19,999 sq. ft.	20,000 or more sq. ft.
Minimum front yard (feet)	15	20	20	20	25	30	30
Minimum side yard and corner lot rear yard (feet)	5	5	5	5	10	15	15
Minimum side yard flanking a street (feet)	15	20	20	20	25	30	30
Minimum rear yard (feet)	20	25	25	25	30	35	35
Minimum lot frontage on a cul-de-sac or curve (feet)	25	30	30				

The proposed plat has been designed in accordance with CMC18.09.040 Table 2(B.) Density Transfer Lots, as allowed within CMC18.09.080(B.) due to the requirement for a Public Trail (T-21) to be extended through the Project.

The proposed lots all exceed the minimum requirements of the R-7.5 zone, utilizing CMC18.09.040 Table 2(B.). The minimum lot size is 5,900 sq.ft.; the maximum lot size is 9,000 sq.ft. and the average lot area is 7,087 sq.ft. The total property area is 9.2 acres and the maximum density allowed for the property at 5.8 units/acre is 53 lots.

The site is located to the north of the recently constructed "Breckenridge" subdivision near the intersection of SE 202nd Avenue with NW 18th Street. The project is bordered to the East by the existing "Knight Point At Prune Hill" subdivision, to the West by the existing "Winchester Hills Phase 1" subdivision, to the South by the "Breckenridge" subdivision and to the North by SE 40th Street, a public road.

During the preparation of the Type 3 Subdivision Application materials several site studies were performed on the property to assure that the project is feasible and the reports from these studies are included within the application packet. A site geotechnical study was performed by Rapid Soil Solutions, a traffic study was performed by H. Lee and Associates, a wetland determination was performed by Ecological Land Services, Inc. and an archaeological predetermination was performed by Archaeological Services of Clark County. As mentioned previously, all reports are included within the application packet.

CMC17.11.030.D (1 – 10):

Criteria for Preliminary Plat Approval. The hearings examiner decision on an application for preliminary plat approval shall be based on the following criteria:

1. The proposed subdivision is in conformance with the Camas comprehensive plan, parks and open space comprehensive plan, neighborhood traffic management plan, and any other city adopted plans;

The proposed Valley View Estates Subdivision is in substantial conformance with the Camas Comprehensive Plans, Parks and Open Space Comprehensive Plan, Neighborhood Traffic Management Plan, and all other City Adopted Plans.

2. Provisions have been made for water, storm drainage, erosion control and sanitary sewage disposal for the subdivision that are consistent with current standards and plans as adopted in the Camas Design Standard Manual;

Provisions have been made for water, storm drainage, erosion control and sanitary sewage disposal for the subdivision and they are consistent with the current standards and plans as adopted in the Camas Design Standard Manual.

3. Provisions have been made for road, utilities, street lighting, street trees and other improvements that are consistent with the six-year street plan, the Camas Design Standard Manual and other state adopted standards and plans;

Roads, Utilities, Street Lighting, Street Trees and other required project improvements are consistent with the six-year street plan, the Camas Design Standard Manual and other State Adopted Standards and Plans are included herein.

4. Provisions have been made for dedications, easements and reservations;

Dedications and easements are designed into the project as required.

5. The design, shape and orientation of the proposed lots are appropriate to the proposed use;

The design, shape and orientation of the proposed lots are appropriate to the proposed use.

6. The subdivision complies with the relevant requirements of the Camas land development and zoning codes, and all other relevant local regulations;

The subdivision complies with the relevant requirements of the Camas land development and zoning codes, and all other relevant local regulations.

7. Appropriate provisions are made to address all impacts identified by the transportation impact study;

There are no offsite improvements proposed as part of the project since none were identified as needed within the Transportation Impact Study.

8. Appropriate provisions for maintenance of commonly owned private facilities have been made;

All commonly owned private facilities will be owned and maintained by a Home Owners Association (HOA) that will be formed and put in place to assure perpetual ownership and maintenance of all private facilities within the project.

9. Appropriate provisions, in accordance with RCW 58.17.110, are made for:
a. The public health, safety, and general welfare and for such open spaces, drainage ways, streets, or roads, alleys or other public ways, transit stops, potable water supplies, sanitary wastes, parks and recreation, playgrounds, schools and school grounds and all other relevant facts, including sidewalks and other planning features that assure safe conditions at schools bus shelter/stops, and for students who walk to and from school, and
b. The public use and interest will be served by the platting of such subdivision and dedication;

Provisions are made for public health, safety, and general welfare for open spaces, drainage ways, streets, roads, potable water supplies, sanitary wastes, parks and recreations, including sidewalks and other planning features that assure safe conditions at school bus shelter/stops, and for students who walk to and from school. The public use and interest will be served by the platting of such subdivision and dedication.

10. The application and plans shall be consistent with the applicable regulations of the adopted comprehensive plans, shoreline master plan, state and local environmental acts and ordinances in accordance with RCW 36.70B.030.

The Valley View Estates Subdivision has been designed to be consistent with the applicable regulations of the comprehensive plans, shoreline master plan, state and local environmental acts and ordinances in accordance with RCW 36.70B.030.

A pre-application conference was held for the project on January 18, 2018 to review the proposed development and the report issued by the City of Camas is included herein. The specific issues discussed in the conference are addressed further on within this document.

STERLING DESIGN, INC. has prepared a Preliminary Plat for the project along with a Preliminary Utility Plan, Grading & Erosion Control Plan, Preliminary Transportation Plan, and a Preliminary Stormwater Plan with Technical Information Report demonstrating that the project is feasible. Water Quantity and Quality control for the new drainage from the required infrastructure and future home sites will be managed onsite within privately owned and maintained stormwater facilities that will be constructed at the time of infrastructure installation. As part of the recent infrastructure improvements that were installed with the "Breckenridge" subdivision, two (2) 18" storm conveyance systems were extended to the Southern property line of the Valley View Estates property. All stormwater from the project will be conveyed to these conveyance systems following water quality and water quantity control as required by City of Camas development code CMC14.02 and the SMMWW standards from Washington Department of Ecology.

The site currently has public road access from NW 18th Street on the Northern boundary and to SE 202nd Avenue from the South. There is a project that is being constructed to the south and west of the property that will be extending a Public Road to the southwest corner for extension. All roads accessing the property are a minimum of 20' wide paved roads and there are no offsite road improvements needed to serve the project. New Public Roads will be extended through the project to connect SE 202nd Avenue to SE 40th Street and to provide access the proposed single-family lots. Sight distance has been verified at all proposed intersections.

Public sanitary sewer facilities were extended to the property as part of the "Breckenridge" subdivision and each new lot will be provided via. a 4" sanitary sewer lateral that is connected into the Public Sanitary Sewer system owned and operated by the City of Camas.

Public water facilities are available on both the Northern and Southern property boundaries. Public water will be provided to each new lot via. a water service connection to the Public Water system owned and operated by City of Camas

There are fire hydrants near the property both on the Northern and Southern boundaries, however, new hydrants will be installed as required to meet the spacing requirements of the City of Camas Fire Marshall. Since the project is proposing to utilize a 28-foot-wide paved Public Road section for access to the future home sites, all new homes will utilize residential fire suppressant sprinkler systems.

All newly constructed homes located on the site will be required to pay park, school and traffic impact fees at the time of building permit issuance. These fees are collected to ensure that adequate facilities are available to serve new growth and development; promote orderly growth and development by requiring that new development pay a proportionate share of the cost of new established procedures and criteria so that specific developments do not pay arbitrary fees or duplicate fees for the same impact.

The development of this site into 36 single family home sites that meet the dimensional and area requirements of the Density Transfer Section of the R-7.5 zone, will aid in meeting the zoning and comprehensive plan goals for the area. The development of this site will improve public road and utility access to the area. The full build out of this development will provide housing consistent with the goals of the Growth Management Act and will provide housing that is compatible with the existing housing types located in the vicinity.

Specific Items as addressed in the Pre-Application Conference Report:

Planning:

(1.) The required application fee has been paid for the project application.

(2.) A SEPA Checklist has been prepared for the project and is included herein.

(3.) Land Use Application materials have been prepared utilizing the requirements found in the City of Camas Development Code along with the specific comments from the Pre-Application Conference Report.

(4.) A Vicinity Map Showing the Location of the Site is included herein.

(5.) There are a few small scraggly trees scattered on the property but no Significant Trees are located on the property as defined in CMC 18.31.080.

(6.) Existing conditions are shown within the Preliminary Development Plans.

(7.) A Preliminary Grading Plan is included within the Preliminary Development Plans.

(8.) A Preliminary Stormwater Plan and Report are included within the Application Materials.

(9.) A Geotechnical Report is included within the Land Use Application Materials.

(10.) A Clark County Assessor's Map of Properties within 300 feet is included.

(11.) Mailing Labels as required by CMC 18.55.110 are provided.

(12.) A Traffic Study is included within the Land Use Application Materials.

(13.) All Open Spaces and Tract's will be owned and maintained by the HOA.

(14.) The required Development Sign has been ordered for installation.

(15.) 3 Copies and an Electronic Copy of the Land Use Application is provided.

Preliminary Plat Review

(1.) The T-21 Trail will be set aside within a tract as required for Density Transfer.

(2.) A 10-foot-wide Landscape Tract has been placed along the northerly edge of Lot(s) 1 - 4 as required to address "double frontage" Lot(s).

(3.) All Lot(s) will accommodate a minimum 40' x 40' Building Envelope. Building Envelopes are shown for all Lot(s) but only the smallest Lot(s) show the 40' x 40' Footprint.

(4.) All Lot Frontages on a curve are a minimum of 30 feet.

(5.) All Lot areas have been adjusted as required by the Pre-application Conference Report.

(6.) As required, eight (8) "off street" parking spaces are provided as shown.

(7.) A Circulation Plan is included within the Land Use Application Materials as required.

(8.) Future Retaining Walls are shown on the Preliminary Grading Plan as required.

Engineering:

(1.) Construction Plans will be prepared by a licensed Washington State Engineer.

(2.) Plan review and inspection fees will be paid at the time of Final Construction Plan Submittal.

(3.) Construction of project infrastructure will be completed per CMC 17.19.020.

(4.) Final Platting will be completed as required by City of Camas Development Code.

(5.) All existing wells and septic systems will be abandoned as required.

(6.) Street improvements to NW 18th Street are designed to the ST5 Standard, including a center turn lane.

(7.) Street rights-of-way meet the criteria of CMC 17.19.040(B.), Table 17.19.040-2(C.).

(8.) Sidewalk and fencing along NW 18th meets the Camas Design Standards.

(9.) All improvements will blend with the Camas School District PBL Project at the time of construction. It is anticipated that both projects will construct the NW 18th Road improvements during the summer of 2018.

(10.) As stated in number 8, sidewalk and fencing along NW 18th meets the Camas Design Standards. It is impossible to have both a sidewalk and a multi-mobile access in the same location.

(11.) Tracts for home access meet the Minimum Private Street Standards.

(12.) A Traffic Study is included within the Land Use Application Materials.

(13.) This is no longer applicable now that all lots access from the internal street network.

(14.) The proposed intersection with NW 18th Street is designed to meet the intersection spacing standards and is 333 feet from the intersection to the west.

(15.) NW 18th Street is designed with a center turn lane instead of a raised median which will allow for left turn movements into the proposed Valley View Estates Development.

(16.) Uniform fencing and landscaping will be installed along NW 18th.

(17.) ADA compliant street crossings will be installed as required.

(18.) A right deceleration lane is not needed based on the Traffic Study.

(19.) Traffic signs, street names, pavement markings and street lighting will be installed as required by City of Camas Standards.

(20.) A utility plan will be provided as required prior to approval of the infrastructure construction drawings.

(21.) A road connection is being provided to the southwesterly corner of the project to connect to the Vancouver Riverview Gateway Subarea.

(22.) Streets will be named to reflect Camas addresses.

(23.) Stormwater Management is in accordance with the Western Washington and City of Camas Stormwater Design Standards Manual.

(24.) Stormwater facilities will be located and landscaped as required.

(25.) Stormwater facilities are designed as required by City of Camas standards.

(26.) Stormwater facilities will be Privately Owned and Maintained by the future HOA.

(27.) All contributing stormwater will be collected and conveyed through the project as required. Flow calculations will be provided to assure that flow rates following installation of the stormwater facilities will be equal to, or less then, pre-developed flow rates.

(28.) Public water system will be extended through the project.

(29.) Public sanitary sewer system will be extended through the project.

(30.) The existing 8" STEF sanitary sewer system will be utilized.

(31.) A sewer basin analysis will be completed prior to approval of the infrastructure construction drawings.

(32.) Community mailboxes will be coordinated with the Postmaster and City of Camas prior to installation.

(33.) Garbage and recycling containers will be placed at the public right-of-way.

Building Division
All Building Division Comments will be addressed at the time of home construction

Fire Department
All Fire Department Comments are addressed within the Land Use Application Materials or will be completed with the future home construction.

Applications submitted for this project:

- **Subdivision Type III**
- **SEPA Checklist**
- **Archeological review**
- **Critical area review**
- **Fire department review**

Please review the enclosed data and contact us as soon as possible if you have any questions or need any additional data.

Thank you for your assistance,

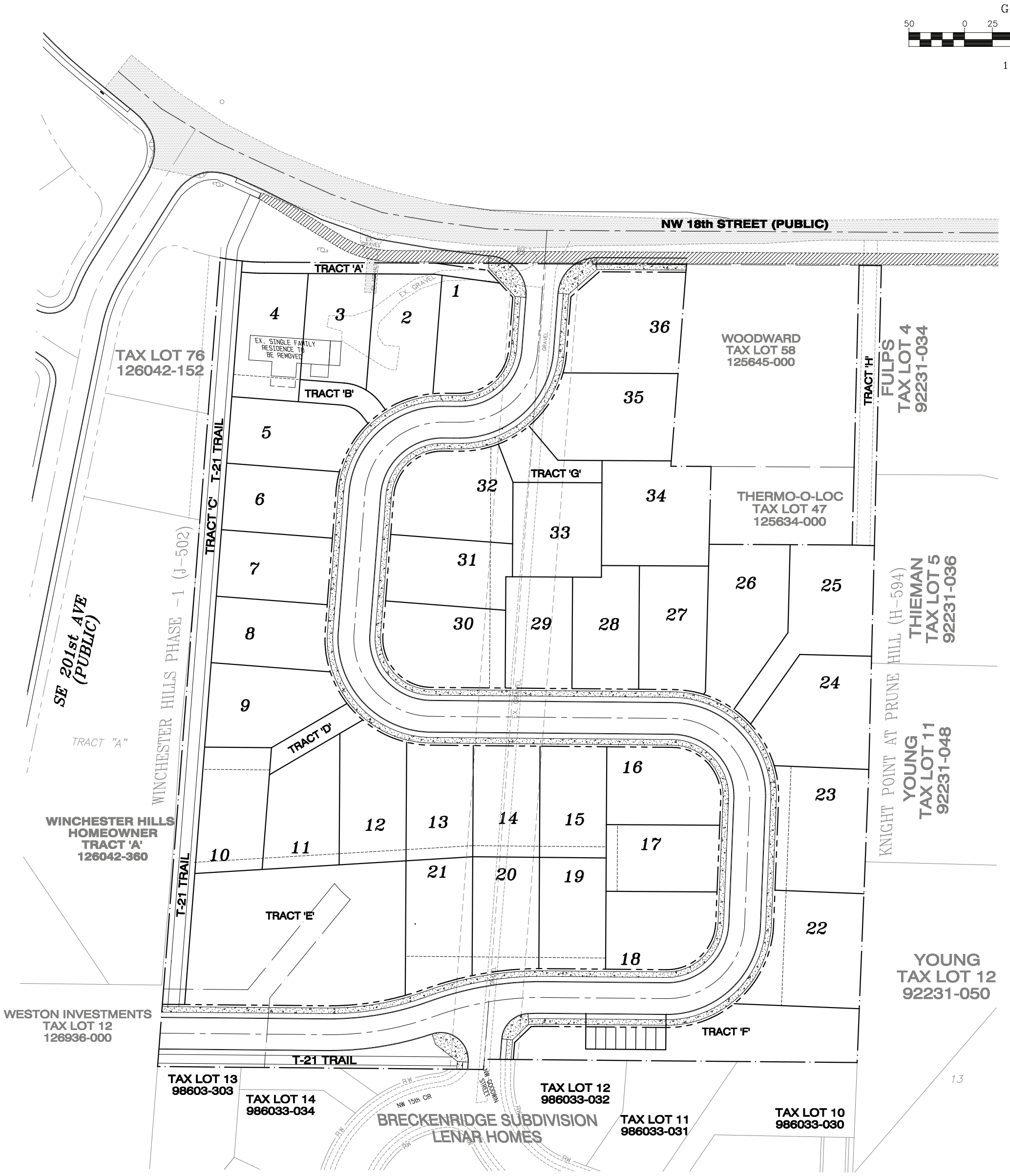
Joel G. Stirling, P.E.
STERLING DESIGN, INC.

Exhibit 3 SUB 18-02

VALLEY VIEW ESTATES

A Preliminary Subdivision
within in a portion of the
NE 1/4 of Sec. 8,
T1N., R3E., W.M.
Clark County, Washington

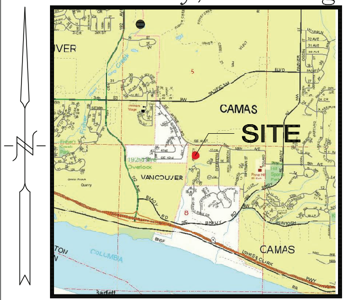
GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.



LEGEND

- CURB & SIDWALK
- PROPOSED EASEMENT
- PROPOSED LOT LINE
- EXISTING RIGHT-OF-WAY
- PROPOSED SANITARY SEWER LINE
- PROPOSED STORM SEWER LINE
- PROPOSED PERFORATED STORM LINE
- PROPOSED ROADWAY CENTERLINE
- E E EXISTING ELECTRIC
- T T EXISTING TELEPHONE LOCATE PAINT
- W W EXISTING WATER LOCATE PAINT
- EXISTING EDGE OF PAVEMENT/GRAVEL
- S S EXISTING SANITARY SEWER LINE
- ST ST EXISTING STORM LINE
- × × EXISTING FENCE
- 286 EXISTING GROUND CONTOUR
- 286 PROPOSED GROUND CONTOUR (1')
- ← DIRECTION OF STORMWATER FLOW
- EROSION CONTROL SILT FENCE
- INLET PROTECTION
- ● PROPOSED SANITARY CLEANOUT
- PROPOSED FIRE HYDRANT
- STD 1" WATER METER SERVICE
- ● PROPOSED MANHOLE
- ⬢ PROPOSED DRYWELL
- PROPOSED CATCH BASIN
- PROPOSED COMBINATION CURB INLET
- ☒ PROPOSED STORMFILTER
- 2S. EXISTING POWER POLE WITH NUMBER AND DIRECTION OF OVERHEAD LINES
- EXISTING GUY ANCHOR
- TP EXISTING TELEPHONE PEDESTAL
- ST EXISTING STORM DRAIN MANHOLE
- CB EXISTING CATCH BASIN
- ADA EXISTING ADA RAMP
- E EXISTING ELECTRICAL SERVICE BOX
- S EXISTING SANITARY MANHOLE
- ○CO EXISTING SANITARY CLEANOUT
- EXISTING FIRE HYDRANT
- EXISTING WATER SERVICE
- WV EXISTING WATER VALVE
- PROPOSED STREET TREES 30' O.C.
- PROPOSED STREET LIGHT 70' SPACING

STREET TREES AND STREET LIGHTING WILL BE PROVIDED AS REQUIRED BY THE CITY OF CAMAS CODE.



VICINITY MAP (NTS)

SHEET INDEX

COVER SHEET	1
PROPOSED DEVELOPMENT PLAN	2
PRELIMINARY TOPOGRAPHIC & BOUNDARY SURVEY	3
PRELIMINARY GRADING PLAN	4
PRELIMINARY EROSION CONTROL PLAN	5
PRELIMINARY STORMWATER MANAGEMENT PLAN	6
PRELIMINARY TRANSPORTATION PLAN	7
PRELIMINARY UTILITY PLAN	8
PRELIMINARY LANDSCAPE & LIGHTING PLAN	9

SITE DATA:

- TAX LOT(S): 59 & 48
- SERIAL NUMBER(S): 125646–000 & 125635–000
- SITE ADDRESS: 20109 SE 40th STREET
- AREA: 9.26 ACRES
- ZONING: R–7.5
- COMPREHENSIVE PLAN: UL

CITY OF CAMAS PRE-APPLICATION NUMBER: PA18-09

DESIGN & DEVELOPMENT TEAM

PROPERTY OWNER:
STAN FIRESTONE
PO BOX 61928
VANCOUVER WA, 98666
(360) 695–9484
stan@firestonepacificfoods.com

CIVIL ENGINEER/ LAND USE PLANNING:
STERLING DESIGN, INC.
JOEL STIRLING, PE
2208 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 759–1794
FAX: (360) 759–4983
EMAIL: joel@sterling–design.biz

SURVEYOR:
MINISTER & GLAESER SURVEYING, INC.
2200 E. EVERGREEN BLVD.
VANCOUVER WA, 98661
PHONE: (360) 694–3313
FAX: (360) 694–8410

BENCH MARK:
W.S.D.O.T. MONUMENT "LACAMAS" ID NO. 5789
A BRASS DISK IN CONCRETE LOCATED ON THE WESTERLY SIDEWALK OF N.E. 192nd AVE APPROXIMATELY 500 FEET NORTH OF THE INTERSECTION OF N.E. 192nd AVE AND S.E. 34th STREET. ELEVATION = 250.85', CITY OF CAMAS DATUM

NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424–5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694–3313
SOIL TYPE(s): Hcb, PoB & PoD
HYDROLOGIC GROUP: C
AASHTO CLASSIFICATION: A – 4
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816–3689
DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA
APPROX. SURFACE ELEV.: 385'–468'
SITE AREA: 9.26 ACRES
FILENAME 286/:Preliminary.pro

PREPARED BY:
STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759–1794
FAX (360) 759–4983
mail@sterlingdesign.biz

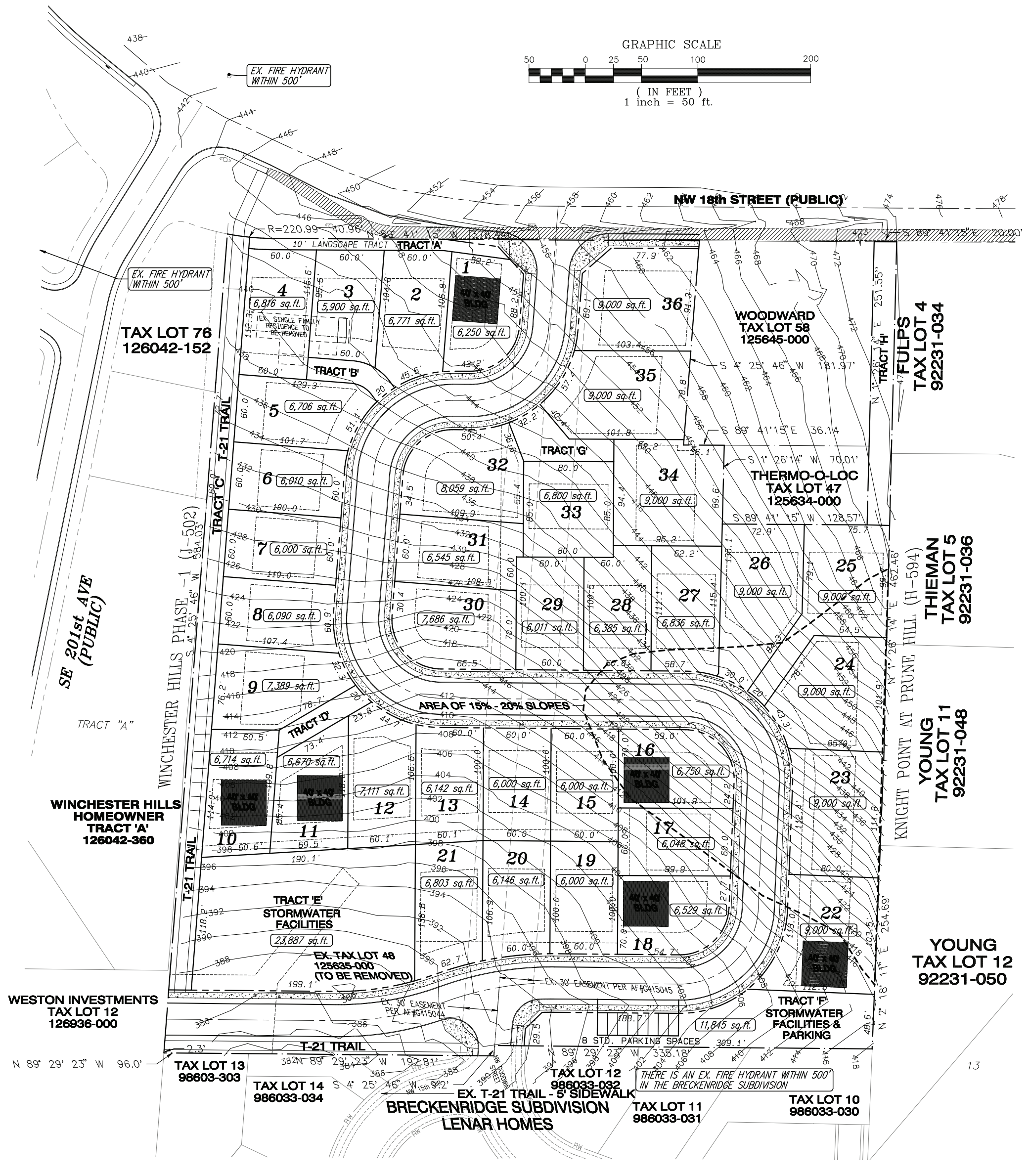
STERLING DESIGN, INC.

Sheet Description: COVER SHEET

Project: VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/ Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 1 of 9 Sheet(s)



PROPERTY BOUNDARY LEGAL DESCRIPTION(s)

TAX LOT 48 (ASSESSORS PARCEL NUMBER 125635-000):

That parcel of land located in a portion of the Joel Knight D.L.C. No. 41 and in a portion of the Northwest Quarter of the Northeast Quarter and the Northeast Quarter of the Northwest Quarter of Section 8, Township 1 North, Range 3 East, Willamette Meridian, City of Camas, Clark County, Washington, described as follows;

BEGINNING at the Northwest corner of the Plat of "Breckenridge" as recorded in Book 311 of Plats, at Page 715, Clark County, Washington, plat records;

Thence South 89°29'23" East, along the North line of said Plat of "Breckenridge" for a distance of 95.97 feet;

Thence leaving said North line, North 04°25'46" East, parallel with the West line of the Joel Knight D.L.C. No. 41, for a distance of 62.70 feet;

Thence North 39°16'12" East, for a distance of 114.49 feet to the beginning of a 96.00 foot radius non-tangent curve to the left;

Thence along the arc of a 96.00 foot radius non-tangent curve to the right, for an arc distance of 20.15 feet, through a central angle of 12°01'29", the radius of which bears North 39°16'12" East, the long chord of which bears North 44°43'03" West, for a chord distance of 20.11 feet;

Thence South 39°16'12" West, for a distance of 123.30 feet;

Thence North 89°29'23" West, parallel with the North line of said Plat of "Breckenridge", for a distance of 75.68 feet to the West line of the Joel Knight D.L.C. No. 41;

Thence South 04°25'46" West, along said West line, for a distance of 70.00 feet to the POINT OF BEGINNING;

CONTAINING: 9,000 square feet of land, more or less.

TAX LOT 59 (ASSESSORS PARCEL NUMBER 125646-000):

That parcel of land located in a portion of the Joel Knight D.L.C. No. 41 and in a portion of the Northwest Quarter of the Northeast Quarter and the Northeast Quarter of the Northwest Quarter of Section 8, Township 1 North, Range 3 East, Willamette Meridian, City of Camas, Clark County, Washington, described as follows;

BEGINNING at the Northeast corner of the Plat of "Breckenridge" as recorded in Book 311 of Plats, at Page 715, Clark County, Washington, plat records;

Thence North 89°29'23" West, along the North line of said Plat of "Breckenridge", for a distance of 335.14 feet;

Thence continuing along said North line, South 04°25'46" West, for a distance of 9.20 feet;

Thence continuing along said North line, North 89°29'23" West, for a distance of 197.07 feet;

Thence leaving said North line, North 04°25'46" East, for a distance of 62.70 feet;

Thence North 39°16'12" East, for a distance of 114.49 feet to the beginning of a 96.00 foot radius non-tangent curve to the right;

Thence along the arc of a 96.00 foot radius non-tangent curve to the right, for an arc distance of 20.15 feet, through a central angle of 12°01'29", the radius of which bears North 39°16'12" East, the long chord of which bears North 44°43'03" West, for a chord distance of 20.11 feet;

Thence South 39°16'12" West, for a distance of 123.30 feet;

Thence North 89°29'23" West, for a distance of 75.68 feet to the West line of the Joel Knight D.L.C. No. 41;

Thence North 04°25'46" East, along the West line of said Joel Knight D.L.C. No. 41, for a distance of 659.58 feet to the South Right of Way line of SE 40th Street and the beginning of a 220.99 foot radius non-tangent curve to the left;

Thence leaving said West line, along said South Right of Way line, along the arc of a 220.99 foot radius non-tangent curve to the left, for an arc distance of 40.96 feet, through a central angle of 10°37'07", the radius of which bears North 10°55'53" East, the long chord of which bears South 84°22'41" East, for a chord distance of 40.90 feet;

Thence continuing along said South Right of Way line, South 89°41'15" East, for a distance of 378.44 feet to the Northwest corner of Tax Lot 58, as described and recorded under Clark County, Washington, Auditor's File Number #4919758 D;

Thence leaving said South Right of Way line, South 04°25'46" West, along the West line of said Tax Lot 58, for a distance of 181.97 feet to the Southwest corner thereof;

Thence leaving said West line, South 89°41'15" East, along the South line of said Tax Lot 58, for a distance of 36.14 feet to the Northwest corner of Tax Lot 47 as described and recorded under Clark County, Washington, Auditor's File Number #5108393 D;

Thence leaving said South line, South 01°26'14" West, along the West line of said Tax Lot 47, for a distance of 70.01 feet to the Southwest corner thereof;

Thence leaving said West line, South 89°41'15" East, along the South line of said Tax Lot 47, for a distance of 128.57 feet to the Southeas

PROPOSED DEVELOPMENT PLAN:

TOTAL LOTS: 36
MINIMUM LOT AREA: 5,900 sq.ft.
MAXIMUM LOT AREA: 9,000 sq.ft.
AVERAGE LOT AREA: 7,087 sq.ft.

TRACT PURPOSE	AREA	OWNED & MAINTAINED
TRACT 'A' - LANDSCAPE	2,268 sf	HOA
TRACT 'B' - ACCESS & UTILITY	1,541 sf	HOA
TRACT 'C' - RECREATIONAL OPEN SPACE	13,438 sf	CITY
TRACT 'D' - ACCESS & UTILITY	1,752 sf	HOA
TRACT 'E' - STORM FACILITY	23,887 sf	HOA
TRACT 'F' - STORM FACILITY	10,405 sf	HOA
TRACT 'G' - ACCESS & UTILITY	2,630 sf	HOA
TRACT 'H' - ACCESS & UTILITY	5,034 sf	HOA

TABLE 18.09.040

MINIMUM SETBACKS:	
FRONT:	20'
SIDE STREET:	20'
SIDE INTERIOR:	5'
REAR:	25'
MAX. LOT COVERAGE:	40%
MAX. BLDG. HEIGHT:	35'

LAND INVENTORY

TOTAL SITE AREA:	9.26 ACRES
TOTAL DEVELOPED ACREAGE:	7.29 ACRES
TOTAL LOT AREA:	5.85 ACRES
TOTAL INFRASTRUCTURE ACREAGE:	2.79 ACRES
TOTAL TRACT AREA(MINUS STORM TRACTS):	0.61 ACRES
TOTAL ACREAGE OF CRITICAL AREAS:	NONE
TOTAL ACREAGE OF REC. OPENSPACE	0.31 ACRES

ALL PROPOSED BUILDING ENVELOPES ARE LARGE ENOUGH TO FIT A 40 FOOT x 40 FOOT BUILDING FOOT PRINT.

NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424-5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313
SOIL TYPE(s): Hcb, PoB & PoD
HYDROLOGIC GROUP: C
AASHTO CLASSIFICATION: A - 4
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689
DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA
APPROX. SURFACE ELEV.: 385'-468'
SITE AREA: 9.26 ACRES
FILENAME 286/:Preliminary.pro

PREPARED BY:
STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

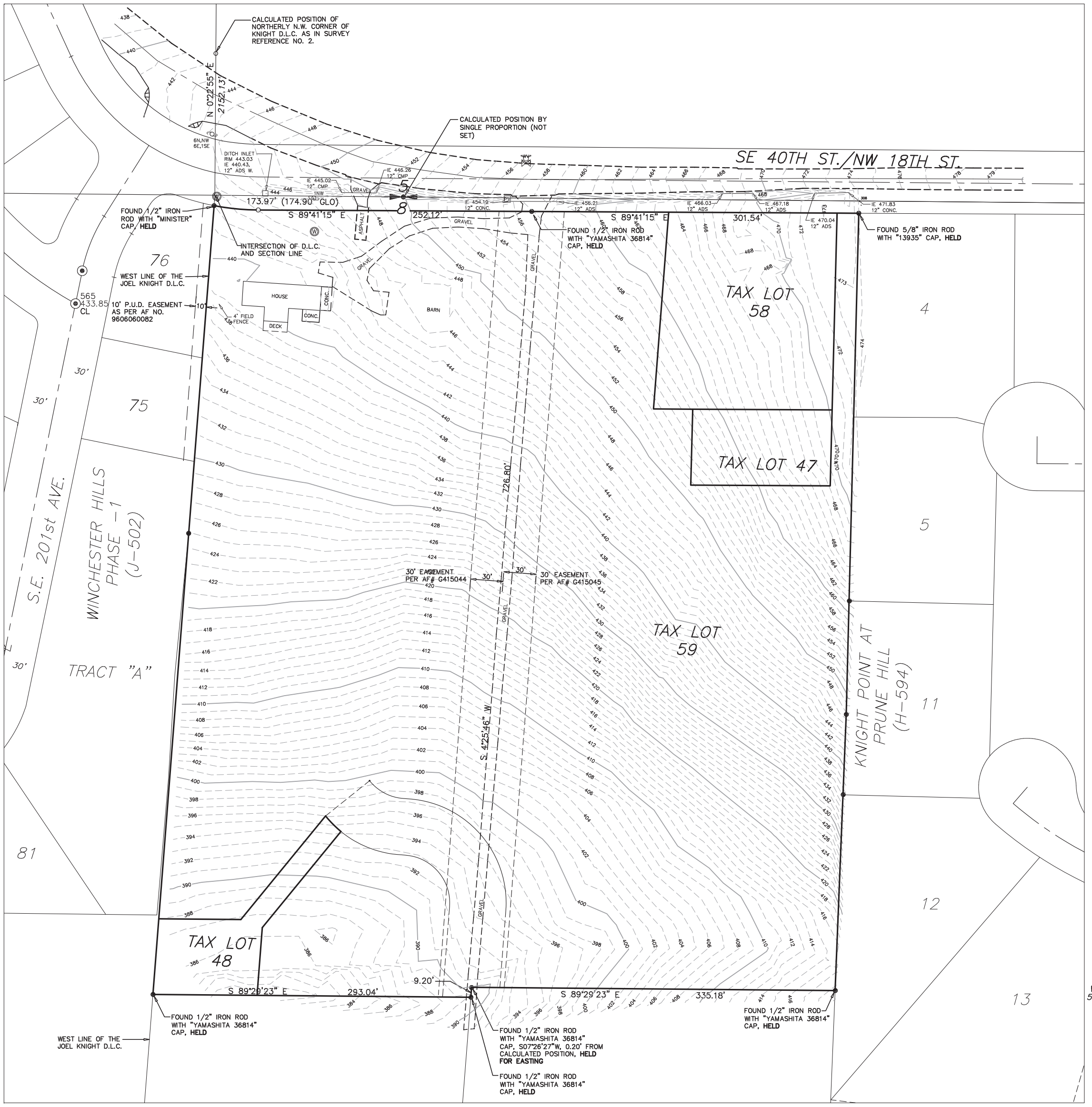
STERLING DESIGN, INC.

Sheet Description:
PROPOSED DEVELOPMENT PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
38524
06/25/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: JUNE 2018
Sheet 2 of 9 Sheet(s)



TOPOGRAPHIC SURVEY

OF
A PORTION OF THE JOEL KNIGHT D.L.C.
IN THE NW 1/4 OF THE NE 1/4,
THE SW 1/4 OF THE NE 1/4,
THE NE 1/4 OF THE NW 1/4
AND THE SE 1/4 OF THE NW 1/4
SECTION 8
T. 1 N., R. 3 E., W.M.
CLARK COUNTY, WASHINGTON

JOB NO.: 04-413 DATA COLLECT: 10-11-04, 10-12-04

DRAWING DATE: 04-27-18

LEGEND:

●	INDICATES FOUND MONUMENT AS NOTED
PV	INDICATES TELEPHONE VAULT
	INDICATES FIRE HYDRANT
WV ⋈	INDICATES WATER VALVE
□	INDICATES CATCH BASIN
Ⓦ	INDICATES WELL
Ⓢ	INDICATES SANITARY MANHOLE
– – – – – –	INDICATES EASEMENT LINE
———	INDICATES ADJACENT LOT LINE
———	INDICATES BACK OF CURB LINE
—— —— ——	INDICATES CALCULATED RIGHT-OF-WAY LINE
—— · —— · ——	INDICATES CENTERLINE OF CREEK
– – – – – –	INDICATES EDGE OF GRAVEL
– – – – – –	INDICATES EDGE OF PAVEMENT
—X—X—X—	INDICATES FENCE LINE
—G—G—G—G—	INDICATES GAS LINE LOCATE
—T—T—T—T—	INDICATES TELEPHONE LINE LOCATE
—W—W—W—W—	INDICATES WATER LINE LOCATE
———	INDICATES 10 FOOT INTERVAL CONTOUR
– – – – – –	INDICATES 1 FOOT INTERVAL CONTOUR

N

BASIS OF BEARING:
NAD 83/91, WASHINGTON STATE
PLANE COORDINATE SYSTEM,
SOUTH ZONE, US SURVEY FEET
CONVERGENCE ANGLE: -01°25'40"
COMBINED SCALE FACTOR: 1.0000041831

50 25 0 50 75 100
SCALE 1 INCH = 50 FEET

BENCH MARK:

W.S.D.O.T. MONUMENT "LACAMAS" ID NO. 5789
A BRASS DISK IN CONCRETE LOCATED ON THE WESTERLY
SIDEWALK OF N.E. 192ND AVE APPROXIMATELY 500 FEET
NORTH OF THE INTERSECTION OF N.E. 192ND AVE AND S.E.
34TH STREET. ELEVATION = 250.85, CITY OF CAMAS DATUM

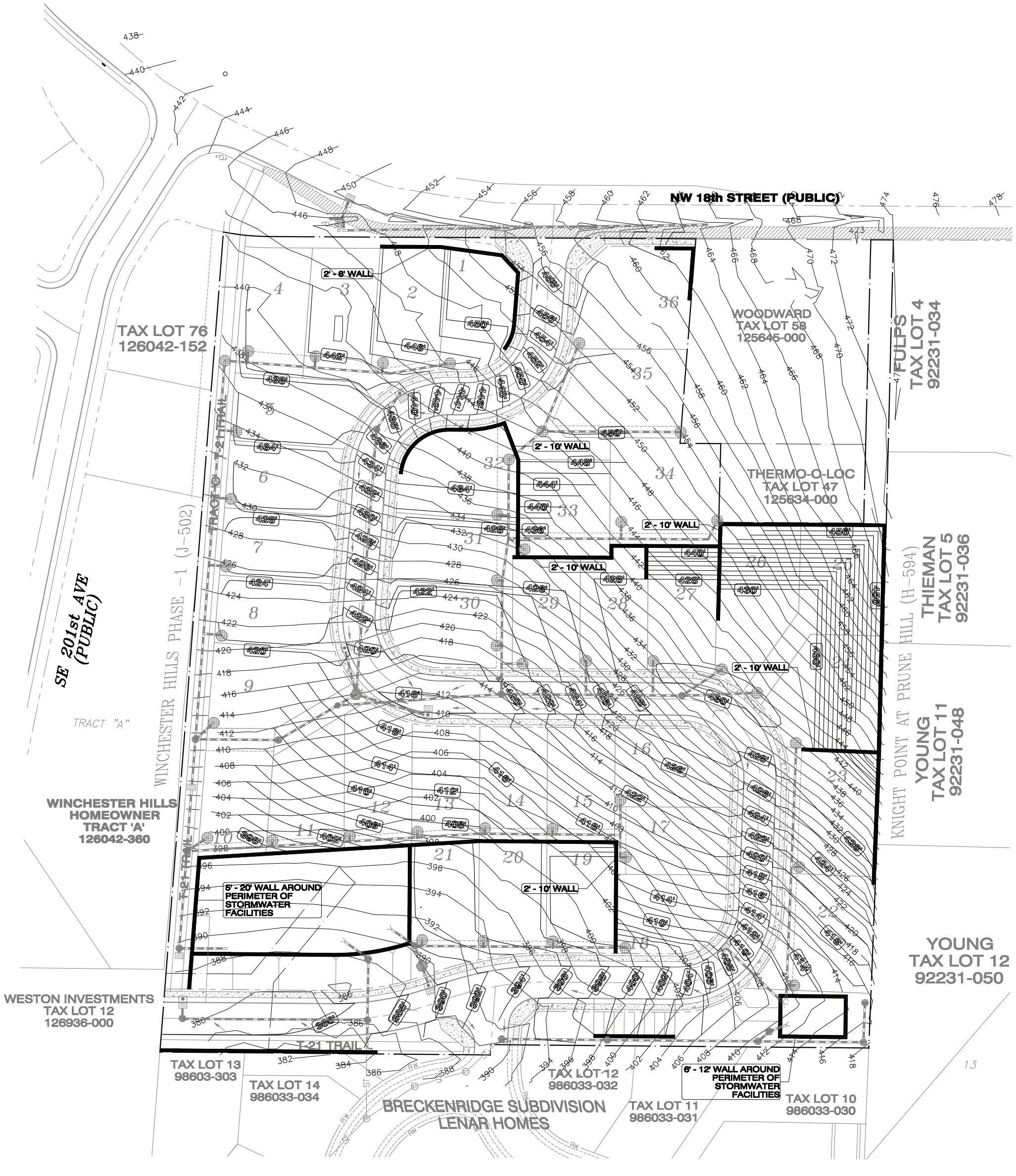
NOTE:

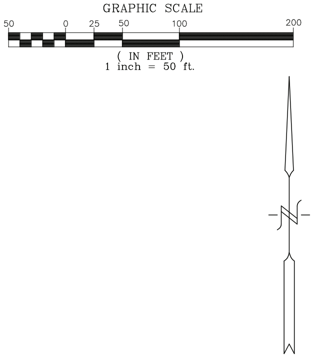
A UTILITY LOCATE WAS CALLED FOR ON 10-01-04 UNDER TICKET NUMBER 4323876. THE UNDERGROUND UTILITIES AS SHOWN ON THIS TOPOGRAPHIC MAP ARE AS MARKED AT THE TIME OF THIS SURVEY. UNDERGROUND UTILITY LOCATIONS SHOWN ARE APPROXIMATE ONLY. UNDERGROUND CONNECTIONS ARE SHOWN AS STRAIGHT LINES BETWEEN SURFACE LOCATIONS BUT MAY CONTAIN BENDS OR CURVES NOT SHOWN. SOME UNDERGROUND LOCATIONS HEREON MAY HAVE BEEN TAKEN FROM PUBLIC RECORDS. M.G.S. ASSUMES NO LIABILITY FOR THE ACCURACY OF PUBLIC RECORDS.

DANIEL ADOLPH RENTON

MINISTER-GLAESER
SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694-3313

DRAWING FILE: 04413T.DWG DRAWN BY: KPF PROJECT MGR: KPF





NOTE:

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SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313

SOIL TYPE(s): Hcb, PoB & PoD
HYDROLOGIC GROUP: C
AASHTO CLASSIFICATION: A - 4

SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689
DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA
APPROX. SURFACE ELEV.: 385'-468'

SITE AREA: 9.26 ACRES
FILENAME 286/:Preliminary.pro

PREPARED BY:

STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

STERLING DESIGN, INC.

Sheet Description:

PRELIMINARY GRADING PLAN

Project:

VALLEY VIEW ESTATES
SUBDIVISION

JOEL GREGORY STIRLING
38524

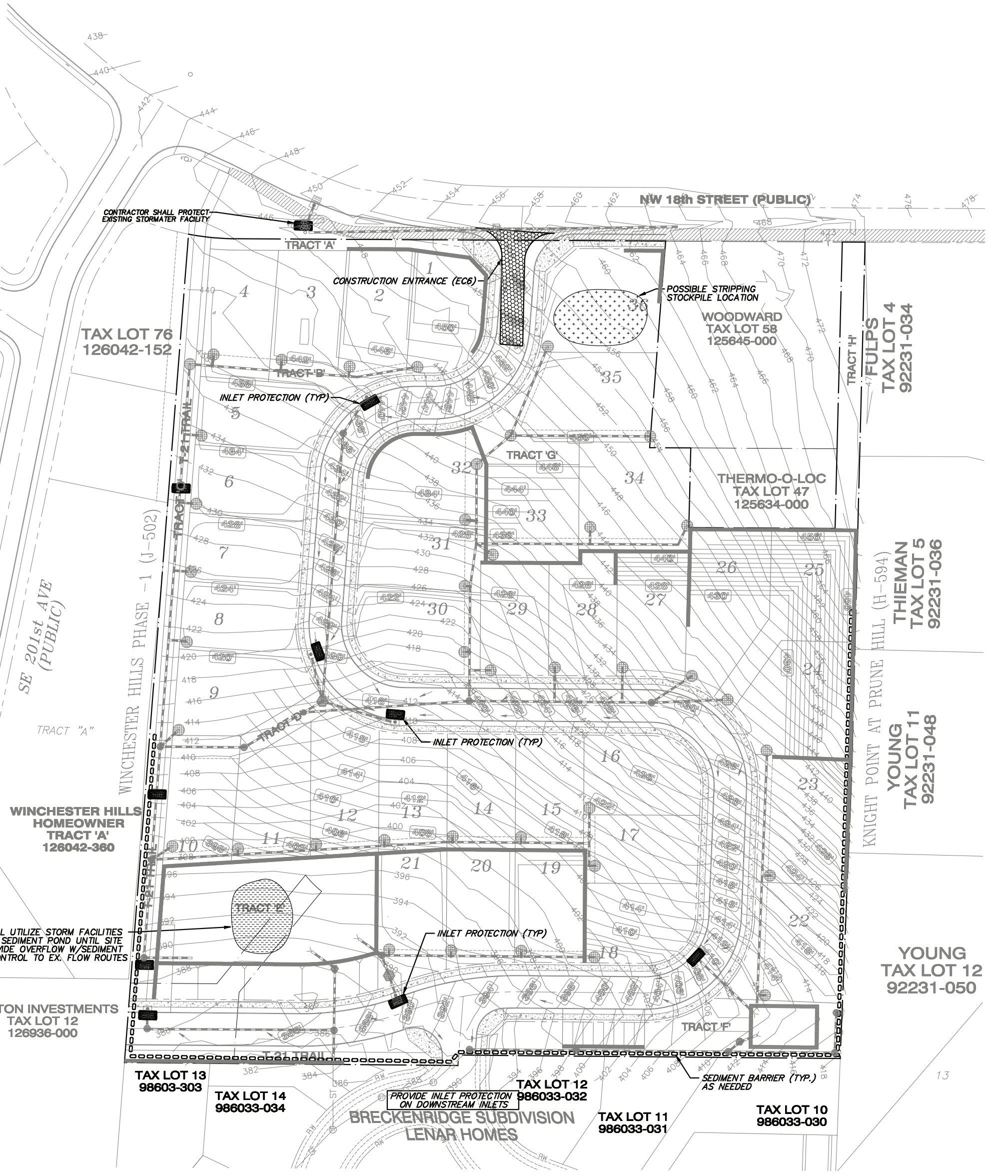
05/18/18

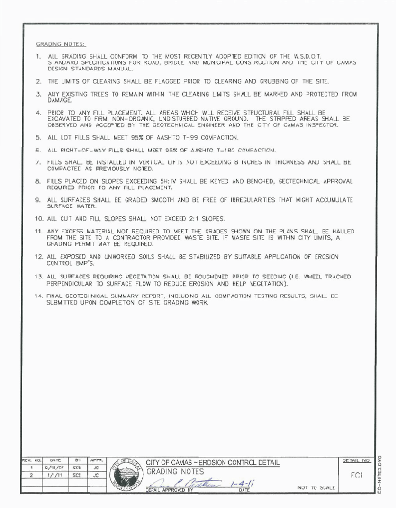
Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 4 of 9 Sheet(s)

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.





GRADING NOTES:

1. ALL GRADING SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION AND THE CITY OF CAMAS DESIGN STANDARDS MANUAL.
2. THE LIMITS OF CLEARING SHALL BE FLAGGED PRIOR TO CLEARING AND GRUBBING OF THE SITE.
3. ANY EXISTING TREES TO REMAIN WITHIN THE CLEARING LIMITS SHALL BE MARKED AND PROTECTED FROM DAMAGE.
4. PRIOR TO ANY FILL PLACEMENT, ALL AREAS WHICH WILL RECEIVE STRUCTURAL FILL SHALL BE EXCAVATED TO FIRM NON-ORGANIC, UNDISTURBED NATIVE GROUND. THE STRIPPED AREAS SHALL BE OBSERVED AND ACCEPTED BY THE GEOTECHNICAL ENGINEER AND THE CITY OF CAMAS INSPECTOR.
5. ALL LOT FILLS SHALL MEET 95% OF AASHTO T-99 COMPACTION.
6. ALL RIGHT-OF-WAY FILLS SHALL MEET 95% OF AASHTO T-180 COMPACTION.
7. FILLS SHALL BE INSTALLED IN VERTICAL LIFTS NOT EXCEEDING 8 INCHES IN THICKNESS AND SHALL BE COMPACTED AS PREVIOUSLY NOTED.
8. FILLS PLACED ON SLOPES EXCEEDING 5H:1V SHALL BE KEYED AND BENCHED, GEOTECHNICAL APPROVAL REQUIRED PRIOR TO ANY FILL PLACEMENT.
9. ALL SURFACES SHALL BE GRADED SMOOTH AND BE FREE OF IRREGULARITIES THAT MIGHT ACCUMULATE SURFACE WATER.
10. ALL CUT AND FILL SLOPES SHALL NOT EXCEED 2:1 SLOPES.
11. ANY EXCESS MATERIAL NOT REQUIRED TO MEET THE GRADES SHOWN ON THE PLANS SHALL BE HAULED FROM THE SITE TO A CONTRACTOR PROVIDED WASTE SITE. IF WASTE SITE IS WITHIN CITY LIMITS, A GRADING PERMIT MAY BE REQUIRED.
12. ALL EXPOSED AND UNWORKED SOILS SHALL BE STABILIZED BY SUITABLE APPLICATION OF EROSION CONTROL BMP'S.
13. ALL SURFACES REQUIRING VEGETATION SHALL BE ROUGHENED PRIOR TO SEEDING (I.E. WHEEL TRACKED PERPENDICULAR TO SURFACE FLOW TO REDUCE EROSION AND HELP VEGETATION).
14. FINAL GEOTECHNICAL SUMMARY REPORT, INCLUDING ALL COMPACTION TESTING RESULTS, SHALL BE SUBMITTED UPON COMPLETION OF SITE GRADING WORK.

REV. NO.	DATE	BY	APPR.
1	9/13/07	SCB	JC
2	1/7/11	SCB	JC

CITY OF CAMAS ~ EROSION CONTROL DETAIL
GRADING NOTES
DETAIL APPROVED BY 1-4-11 DATE
NOT TO SCALE
DETAIL NO. EC1
EC-NOTES.DWG

NOTE:
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SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313

SOIL TYPE(s): Hcb, PoB & PoD
HYDROLOGIC GROUP: C
AASHTO CLASSIFICATION: A - 4

SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689
DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA
APPROX. SURFACE ELEV.: 385'-468'

SITE AREA: 9.26 ACRES
FILENAME: 286/:Preliminary.pro

PREPARED BY:

STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY EROSION CONTROL PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

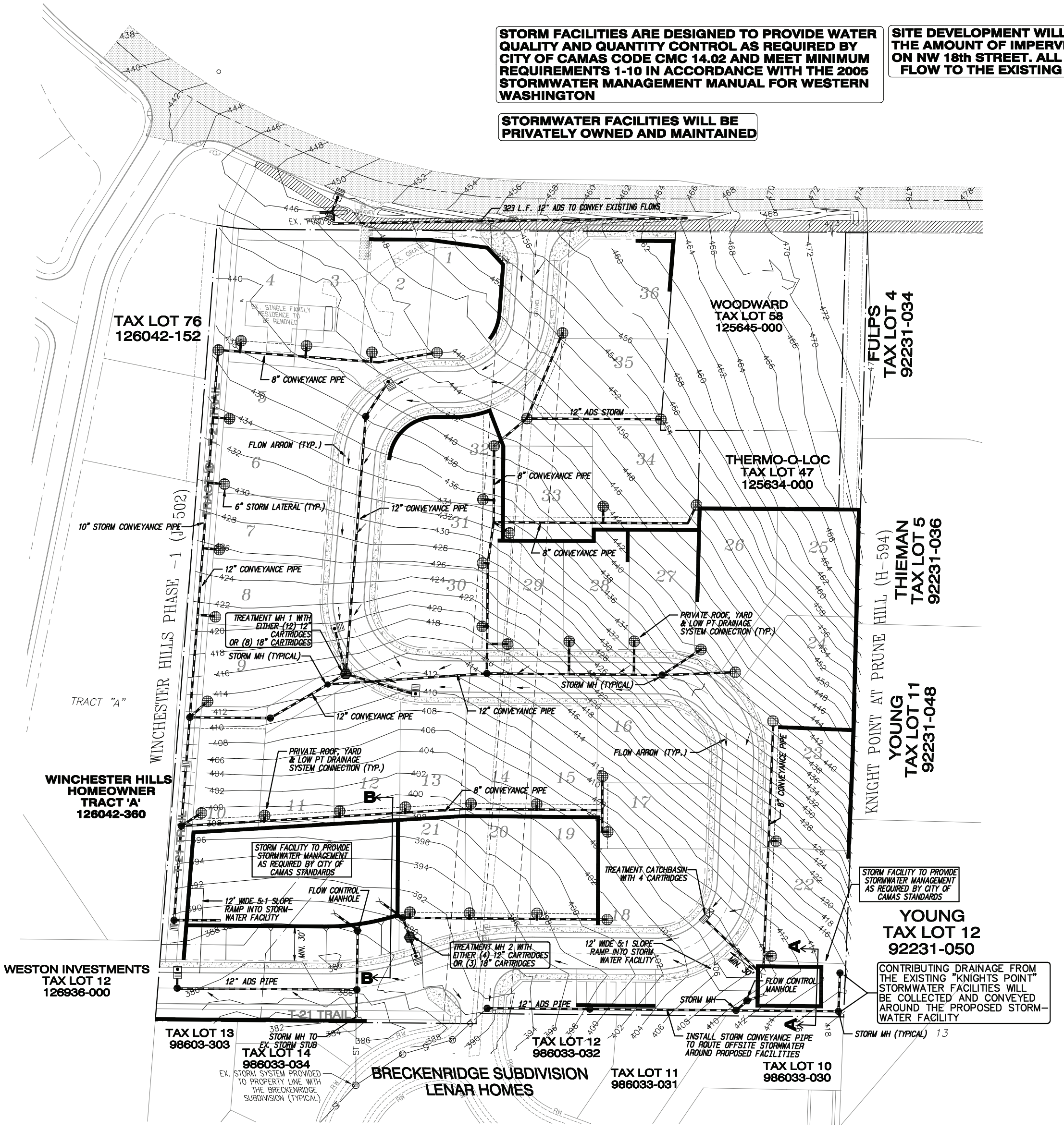
JOEL GREGORY STIRLING
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn: JGS/BC
Drawing Date: MAY 2018
Sheet 5 of 9 Sheet(s)

STORM FACILITIES ARE DESIGNED TO PROVIDE WATER QUALITY AND QUANTITY CONTROL AS REQUIRED BY CITY OF CAMAS CODE CMC 14.02 AND MEET MINIMUM REQUIREMENTS 1-10 IN ACCORDANCE WITH THE 2005 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

SITE DEVELOPMENT WILL NOT INCREASE THE AMOUNT OF IMPERVIOUS SURFACES ON NW 18th STREET. ALL DRAINAGE WILL FLOW TO THE EXISTING FLOW ROUTES

STORMWATER FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED



GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

STORM CONSTRUCTION NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF ON AN APPROVED SITE.

2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.

3. TRENCH COMPACTION SHALL BE PER THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD TO USE TO ACHIEVE THE REQUIRED COMPACTION. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.

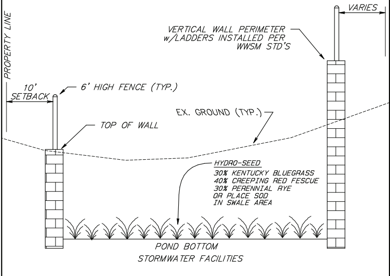
4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

5. ALL STORM PIPE SHALL BE PVC OR N-12 WITH DOUBLE BELLED COUPLINGS WITH O-RING TYPE GASKETS OR APPROVED EQUAL.

6. ALL STORM PIPE LATERALS TO BE A MINIMUM 10 INCHES DIAMETER WITH A MINIMUM SLOPE OF S=0.0100 UNLESS SPECIFIED OTHERWISE IN THE PLANS.

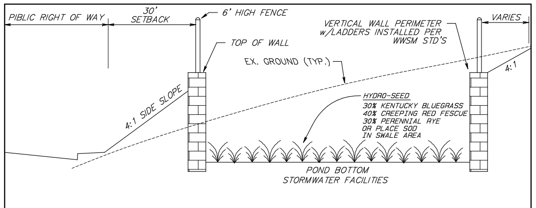
7. ALL MANHOLES LOCATED IN UNIMPROVED EASEMENTS AND RIGHT OF WAYS SHALL BE PROVIDED WITH TAMPER PROOF LIDS AND SHALL BE SET 6 INCHES ABOVE FINISHED GRADE.

8. VIDEO INSPECTION TAPES AND REPORTS MAY BE REQUIRED AT THE CITY'S DISCRETION. MANDREL TESTING MAY BE REQUIRED AT THE CITY'S DISCRETION.



STORMWATER FACILITIES SECTION A-A

(Not to Scale)



STORMWATER FACILITIES SECTION B-B

(Not to Scale)

NOTE:

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SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313		
SOIL TYPE(s): Hcb, PoB & PoD	HYDROLOGIC GROUP: C	AASHTO CLASSIFICATION: A - 4
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689		DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA	APPROX. SURFACE ELEV.: 385'-468'	
SITE AREA: 9.26 ACRES	FILENAME 286/:Preliminary.pro	

PREPARED BY:

STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

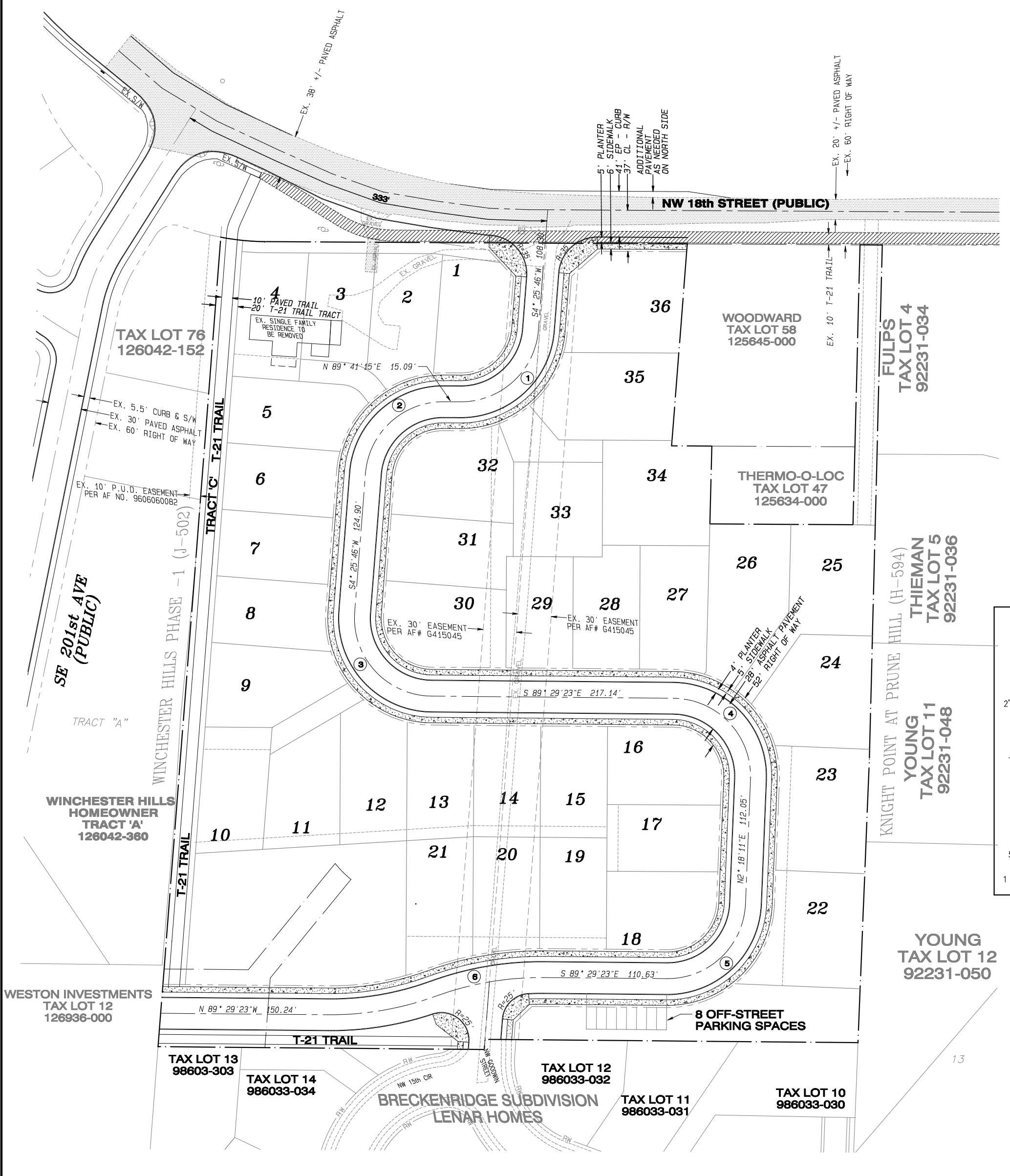
STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY STORMWATER MANAGEMENT PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
05/18/18

Scale:	AS SHOWN
Project Number:	286
Design/ Drawn	JGS/BC
Drawing Date:	MAY 2018
Sheet 6 of 9 Sheet(s)	



STREET CONSTRUCTION NOTES:

1. ENGINEERED FILL SHALL BE PLACED AND COMPACTED IN ACCORDANCE WITH THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T STANDARD SPECIFICATIONS SECTION 2-03.3(14). FOR FILL AREAS WITHIN ROADWAYS, METHOD C OF (14)C SHALL BE USED. FOR FILL AREAS OUTSIDE OF ROADWAYS METHOD B SHALL BE USED. ALL FILL PLACED SHALL BE VERIFIED BY GEOTECHNICAL TESTING. TEST RESULTS SHALL BE FORWARDED TO THE CITY OF CAMAS PROJECT ENGINEER.

2. MATERIALS IN SOFT SPOTS WITHIN THE ROADWAY SHALL BE REMOVED TO THE DEPTH REQUIRED TO PROVIDE A FIRM FOUNDATION AND SHALL BE BACKFILLED WITH 1-1/2 INCH MINUS CRUSHED ROCK.

3. ALL SUBGRADE TO BE PROOF ROLLED AND APPROVED BY THE CITY INSPECTOR OR BY A GEOTECHNICAL ENGINEER WITH CONSENT OF THE CITY ENGINEER. SUBGRADE FILLS ARE TO BE TESTED USING THE A.A.S.H.T.O. T-180 TEST METHOD.

4. ALL TRENCH LINES, FILL AREAS AND BASE COURSE LOCATED IN THE RIGHT-OF-WAY SHALL BE APPROVED GRANULAR MATERIAL AND SHALL MEET 95% OF A.A.S.H.T.O. T-180 COMPACTION. TRENCH LINES LOCATED WITHIN AN EXISTING ROADWAY SHALL BE PLATED OR TOPPED WITH COLD MIX. GRANULAR BACKFILL OVERNIGHT IS NOT ALLOWED. PLATES SHALL HAVE COLD MIX AROUND ALL EDGES.

5. THE CONTRACTOR SHALL NOTIFY THE CITY INSPECTOR A MINIMUM OF 24 HOURS PRIOR TO SUBGRADE PROOF ROLL OR GRADE CHECK INSPECTIONS.

6. THE AGGREGATE ROAD BASE SHALL BE COMPACTED IN ACCORDANCE WITH THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 4-04.3. THE CONTRACTOR SHALL SUBMIT TEST RESULTS TO THE ENGINEER AND CITY INSPECTOR. MAXIMUM DENSITY (95%) AS DETERMINED BY A.A.S.H.T.O. T-180 TEST METHOD.

7. ASPHALT CONCRETE PAVEMENT MIX SHALL BE DESIGNED FROM A MIX FORMULA APPROVED BY W.S.D.O.T. FOR MATERIAL USED. CONTRACTOR TO PROVIDE THE CITY WITH CERTIFICATE OF COMPLIANCE FROM THE ASPHALT PAVEMENT PLANT, UNLESS OTHERWISE INDICATED.

8. THE ASPHALT CONCRETE PAVEMENT MIX SHALL BE COMPACTED IN ACCORDANCE WITH THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 5-04.3(10). CONTRACTOR SHALL SUBMIT TEST RESULTS TO THE ENGINEER AND THE CITY INSPECTOR.

9. ALL STORM SYSTEM IMPROVEMENTS AND STORMWATER DETENTION AND TREATMENT FACILITIES SHALL BE COMPLETED AND PROPERLY FUNCTIONING PRIOR TO ANY PAVING.

10. HALF STREET IMPROVEMENTS SHALL INCLUDE AN ANALYSIS OF THE EXISTING STRUCTURAL SECTION OUT TO CENTERLINE. IF FOUND TO BE SUBSTANDARD, THE DEVELOPER SHALL BE REQUIRED TO PROVIDE AS ADEQUATE STRUCTURAL SECTION SECTION TO CENTERLINE. THIS MAY CONSIST OF A STRUCTURAL OVERLAY OR A COMPLETE STREET RECONSTRUCTION AS DETERMINED BY A GEOTECHNICAL ANALYSIS AND AS APPROVED BY THE CITY ENGINEER.

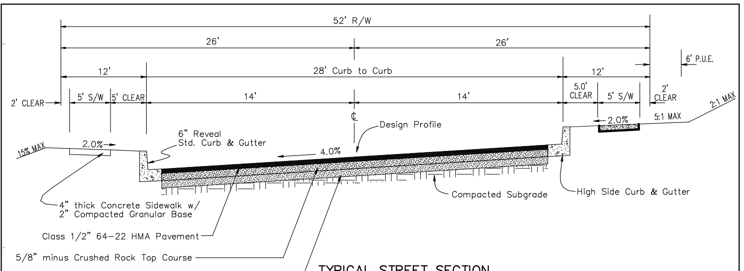
GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

CENTERLINE CURVE DATA

①	R=70.00ft CH=95.38ft A=104.93ft T=65.14ft EX=25.62ft Δ=85° 52' 59"	④	R=70.00ft CH=100.53ft A=112.15ft T=72.23ft EX=30.58ft Δ=91° 47' 34"
②	R=70.00ft CH=95.38ft A=104.93ft T=65.14ft EX=25.62ft Δ=85° 52' 59"	⑥	R=70.00ft CH=97.43ft A=107.77ft T=67.84ft EX=27.48ft Δ=88° 12' 26"
③	R=70.00ft CH=102.32ft A=114.74ft T=74.96ft EX=32.56ft Δ=93° 55' 09"	⑦	R=275.00ft CH=94.17ft A=94.64ft T=47.79ft EX=4.12ft Δ=19° 43' 02"



TYPICAL STREET SECTION
(No Scale)

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SITE INFORMATION

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SOIL TYPE(s): Hcb, PoB & PoD HYDROLOGIC GROUP: C AASHTO CLASSIFICATION: A - 4	
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689	DATE: MARCH 2014
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SITE AREA: 9.26 ACRES	FILENAME 286/:Preliminary.pro

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FAX (360) 759-4983
mail@sterlingdesign.biz

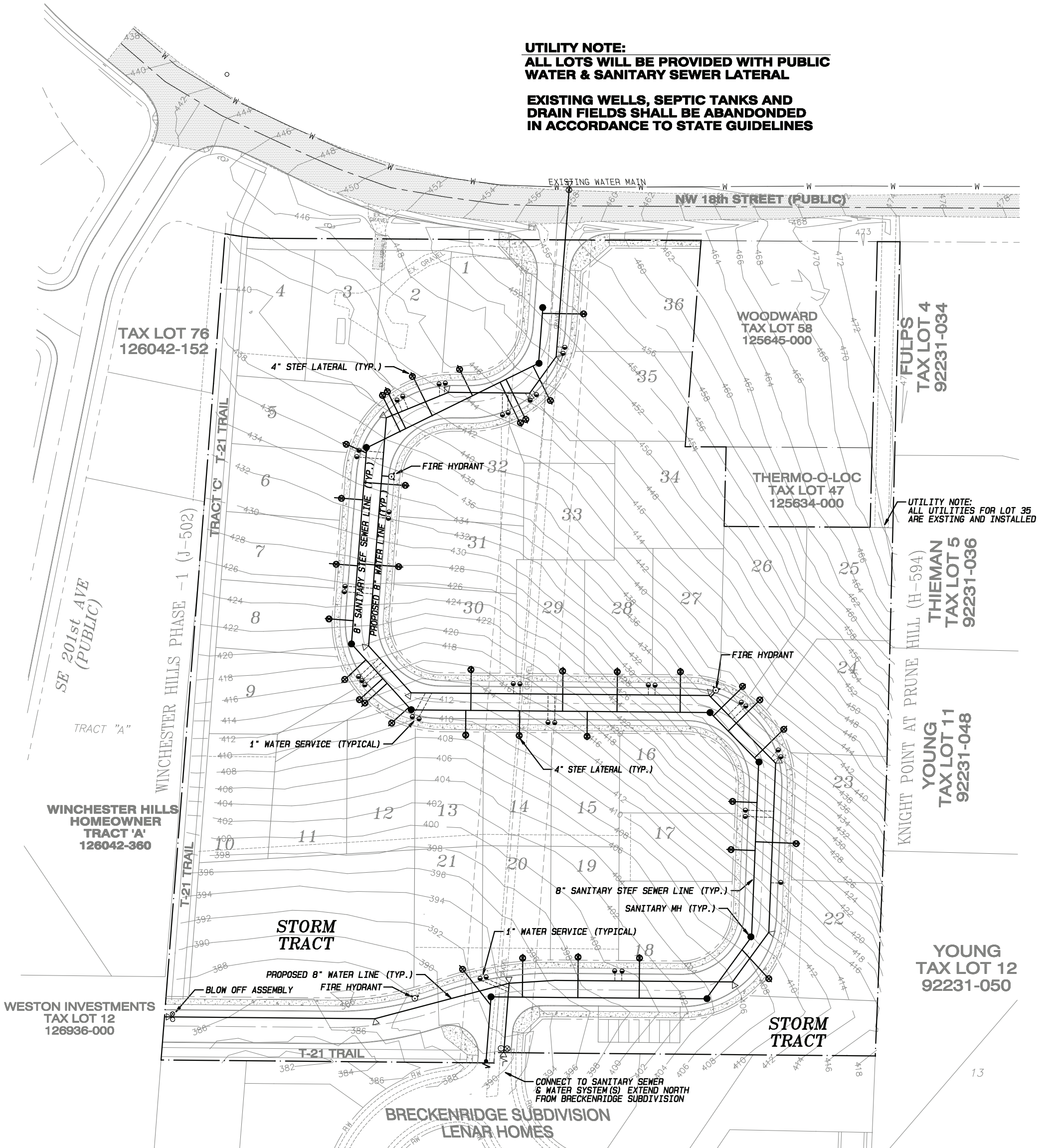
STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY TRANSPORATION PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

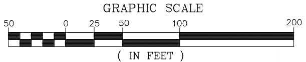
JOEL GREGORY STIRLING
05/18/18

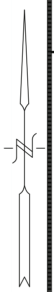
Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 7 of 9 Sheet(s)

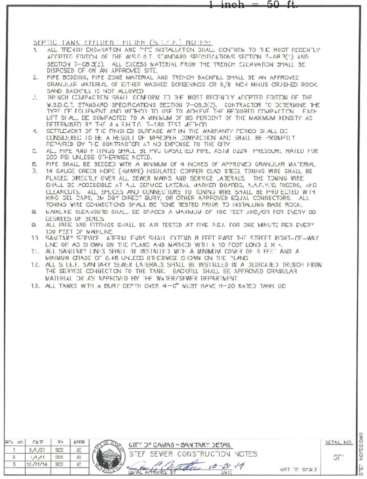


UTILITY NOTE:
ALL LOTS WILL BE PROVIDED WITH PUBLIC
WATER & SANITARY SEWER LATERAL

EXISTING WELLS, SEPTIC TANKS AND
DRAIN FIELDS SHALL BE ABANDONDED
IN ACCORDANCE TO STATE GUIDELINES





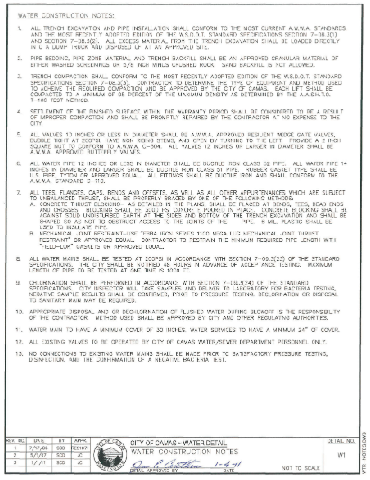


SEPTIC TANK EFFLUENT FILTER (S.T.E.F.) NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF ON AN APPROVED SITE.
2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.
3. TRENCH COMPACTION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITON OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD TO USE TO ACHIEVE THE REQUIRED COMPACTION. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.
4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.
5. ALL PIPE AND FITTINGS SHALL BE PVC GASKETED PIPE, ASTM D2241 PRESSURE RATED FOR 200 PSI UNLESS OTHERWISE NOTED.
6. PIPE SHALL BE BEDDED WITH A MINIMUM OF 4 INCHES OF APPROVED GRANULAR MATERIAL.
7. 14 GAUGE GREEN HDPE (HMWPE) INSULATED COPPER CLAD STEEL TONING WIRE SHALL BE PLACED DIRECTLY OVER ALL SEWER MAINS AND SERVICE LATERALS. THE TONING WIRE SHALL BE ACCESSIBLE AT ALL SERVICE LATERAL MARKER BOARDS, A.A.R.V.'S, RISERS, AND CLEANOUTS. ALL SPLICES AND CONNECTIONS TO TONING WIRE SHALL BE PROTECTED WITH KING GEL CAPS, 3M DBY DIRECT BURY, OR OTHER APPROVED EQUAL CONNECTORS. ALL TONING WIRE CONNECTIONS SHALL BE TONE TESTED PRIOR TO INSTALLING BASE ROCK.
8. MAINLINE CLEANOUTS SHALL BE SPACED A MAXIMUM OF 400 FEET AND/OR FOR EVERY 90 DEGREES OF BENDS.
9. ALL PIPE AND FITTINGS SHALL BE AIR TESTED AT FIVE P.S.I. FOR ONE MINUTE PER EVERY 100 FEET OF MAINLINE.
10. SANITARY SERVICE LATERAL ENDS SHALL EXTEND 8 FEET PAST THE STREET RIGHT-OF-WAY LINE OR AS SHOWN ON THE PLANS AND MARKED WITH A 10 FOOT LONG 2 X 4.
11. ALL SANITARY LINES SHALL BE INSTALLED WITH A MINIMUM COVER OF 6 FEET AND A MINIMUM GRADE OF 0.4% UNLESS OTHERWISE SHOWN ON THE PLANS.
12. ALL S.T.E.F. SANITARY SEWER LATERALS SHALL BE INSTALLED IN A DEDICATED TRENCH FROM THE SERVICE CONNECTION TO THE TANK. BACKFILL SHALL BE APPROVED GRANULAR MATERIAL OR AS APPROVED BY THE WATER/SEWER DEPARTMENT.
13. ALL TANKS WITH A BURY DEPTH OVER 4'-0" MUST HAVE H-20 RATED TANK LID

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC
3	10/21/14	SCD	JC

CITY OF CAMAS ~ SANITARY DETAIL
STEF SEWER CONSTRUCTION NOTES
10-21-14
DETAIL APPROVED BY DATE
NOT TO SCALE
DETAIL NO. SF1
STEF NOTES.DWG



WATER CONSTRUCTION NOTES:

1. ALL TRENCH EXCAVATON AND PIPE INSTALLATION SHALL CONFORM TO THE MOST CURRENT A.W.W.A. STANDARDS AND THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE LOADED DIRECTLY IN TO A DUMP TRUCK AND DISPOSED OF AT AN APPROVED SITE.
2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.
3. TRENCH COMPACTION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD USED TO ACHEIVE THE REQUIRED COMPACTION AND BE APPROVED BY THE CITY OF CAMAS. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.
4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.
5. ALL VALVES 10 INCHES OR LESS IN DIAMETER SHALL BE A.W.W.A. APPROVED RESILIENT WEDGE GATE VALVES, BUBBLE TIGHT AT 200PSI, HAVE NON RISING STEMS, AND OPEN BY TURNING TO THE LEFT. PROVIDE A 2 INCH SQUARE NUT TO CONFORM TO A.W.W.A. C-504. ALL VALVES 12 INCHES OR LARGER IN DIAMETER SHALL BE A.W.W.A. APPROVED BUTTERFLY VALVES.
6. ALL WATER PIPE 12 INCHES OR LESS IN DIAMETER SHALL BE DUCTILE IRON CLASS 52 PIPE. ALL WATER PIPE 14 INCHES IN DIAMETER AND LARGER SHALL BE DUCTILE IRON CLASS 51 PIPE. RUBBER GASKET TYPE SHALL BE U.S. PIPE, TYTON OR APPROVED EQUAL. ALL FITTINGS SHALL BE DUCTILE IRON AND SHALL CONFORM TO THE A.W.W.A. STANDARD C-110.
7. ALL TEES, FLANGES, CAPS, BENDS AND OFFSETS, AS WELL AS ALL OTHER APPURTENANCES WHICH ARE SUBJECT TO UNBALANCED THRUST, SHALL BE PROPERLY BRACED BY ONE OF THE FOLLOWING METHODS:
   - A. CONCRETE THRUST BLOCKING– AS DETAILED IN THE PLANS, SHALL BE PLACED AT BENDS, TEES, DEAD ENDS AND CROSSES. BLOCKING SHALL BE 3000 PSI CONCRETE POURED IN PLACE. CONCRETE BLOCKING SHALL BE AGAINST SOLID UNDISTURBED EARTH AT THE SIDES AND BOTTOM OF THE TRENCH EXCAVATION AND SHALL BE SHAPED SO AS NOT TO OBSTRUCT ACCESS TO THE JOINTS OF THE PIPE. 6 MIL. PLASTIC SHALL BE USED TO INSULATE PIPE.
   - B. MECHANICAL JOINT RESTRAINT–USE 'EBBA IRON SERIES 1100 MEGA LUG MECHANICAL JOINT THRUST RESTRAINT' OR APPROVED EQUAL. CONTRACTOR TO RESTRAIN THE MINIMUM REQUIRED PIPE LENGTH WITH "FIELD-LOK" GASKETS OR APPROVED EQUAL.
8. ALL WATER MAINS SHALL BE TESTED AT 200PSI IN ACCORDANCE WITH SECTION 7-09.3(23) OF THE STANDARD SPECIFICATIONS. THE CITY SHALL BE NOTIFIED 48 HOURS IN ADVANCE OF ACCEPTANCE TESTING. MAXIMUM LENGTH OF PIPE TO BE TESTED AT ONE TIME IS 1000 FT.
9. CHLORINATION SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 7-09.3(24) OF THE STANDARD SPECIFICATIONS. CITY INSPECTOR WILL TAKE SAMPLES AND DELIVER TO LABORATORY FOR BACTERIA TESTING. NEGATIVE SAMPLE RESULTS SHALL BE CONFIRMED, PRIOR TO PRESSURE TESTING. DECHLORINATION OR DISPOSAL TO SANITARY MAIN MAY BE REQUIRED.
10. APPROPRIATE DISPOSAL AND OR DECHLORINATION OF FLUSHED WATER DURING BLOWOFF IS THE RESPONSIBILITY OF THE CONTRACTOR. METHOD USED SHALL BE APPROVED BY CITY AND OTHER REGULATING AUTHORITIES.
11. WATER MAIN TO HAVE A MINIMUM COVER OF 30 INCHES. WATER SERVICES TO HAVE A MINIMUM 24" OF COVER.
12. ALL EXISTING VALVES TO BE OPERATED BY CITY OF CAMAS WATER/SEWER DEPARTMENT PERSONNEL ONLY.
13. NO CONNECTIONS TO EXISTING WATER MAINS SHALL BE MADE PRIOR TO SATISFACTORY PRESSURE TESTING, DISINFECTION, AND THE CONFIRMATION OF A NEGATIVE BACTERIA TEST.

REV. NO.	DATE	BY	APPR.
1	7/17/06	SCD	FES1071
2	5/1/07	SCD	JC
3	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL
WATER CONSTRUCTION NOTES
1-4-11
DETAIL APPROVED BY DATE
NOT TO SCALE
DETAIL NO. W1
WTR NOTES.DWG

NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424-5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313	
SOIL TYPE(s): Hcb, PoB & PoD HYDROLOGIC GROUP: C AASHTO CLASSIFICATION: A - 4	
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689 DATE: MARCH 2014	
SITE LOCATION: CLARK COUNTY, WA	APPROX. SURFACE ELEV.: 385'-468'
SITE AREA: 9.26 ACRES	FILENAME 286/:Preliminary.pro

PREPARED BY:
STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

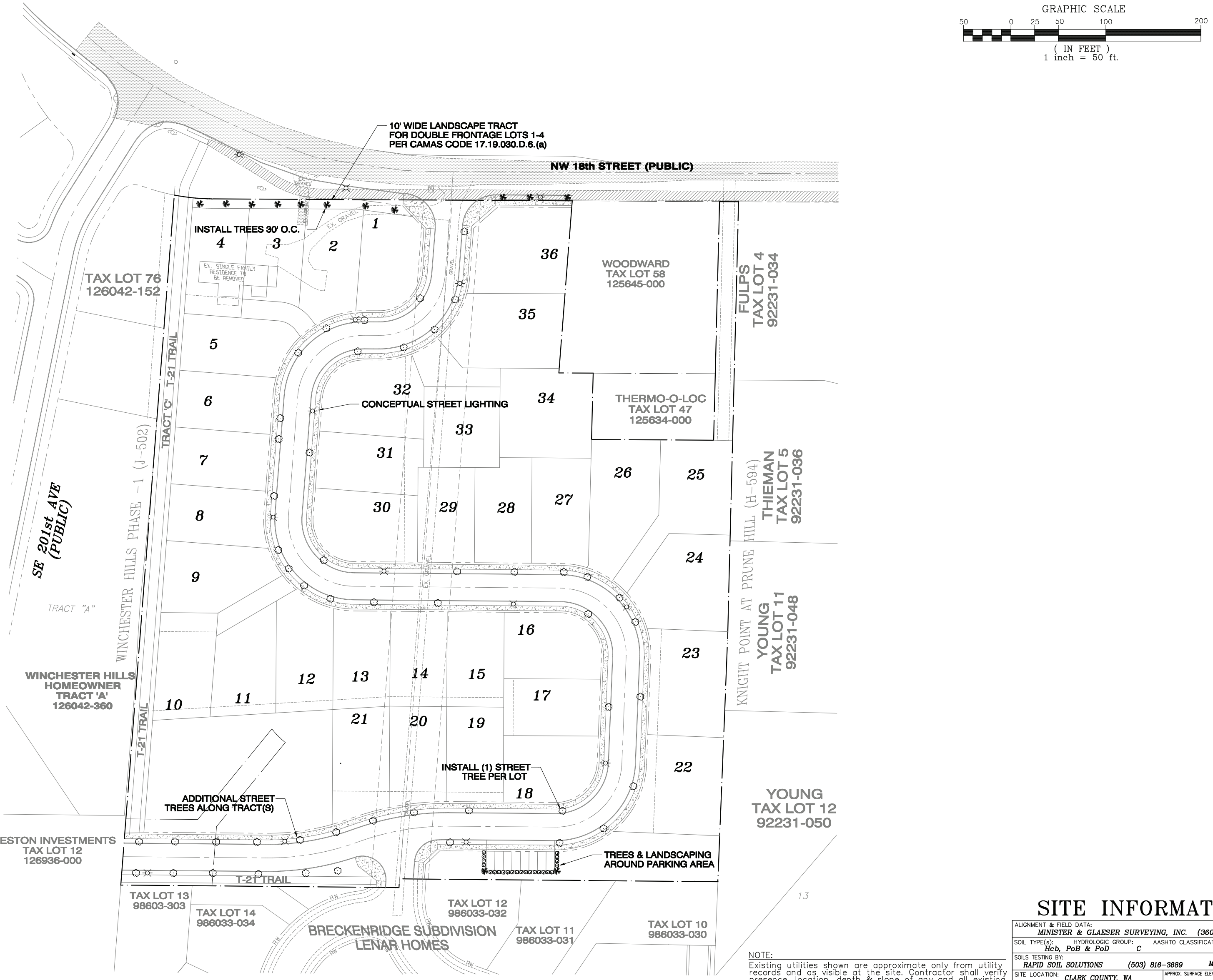
STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY UTILITY PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
36524
05/18/18

Scale:	AS SHOWN
Project Number:	286
Design/ Drawn	JGS/BC
Drawing Date:	MAY 2018
Sheet	8 of 9 Sheet(s)



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mail@sterlingdesign.biz

STERLING DESIGN, INC.

Sheet Description:
PRELIMARY
LANDSCAPE & LIGHTING
PLAN

Project:
VALLEY VIEW ESTATES
SUBDIVISION

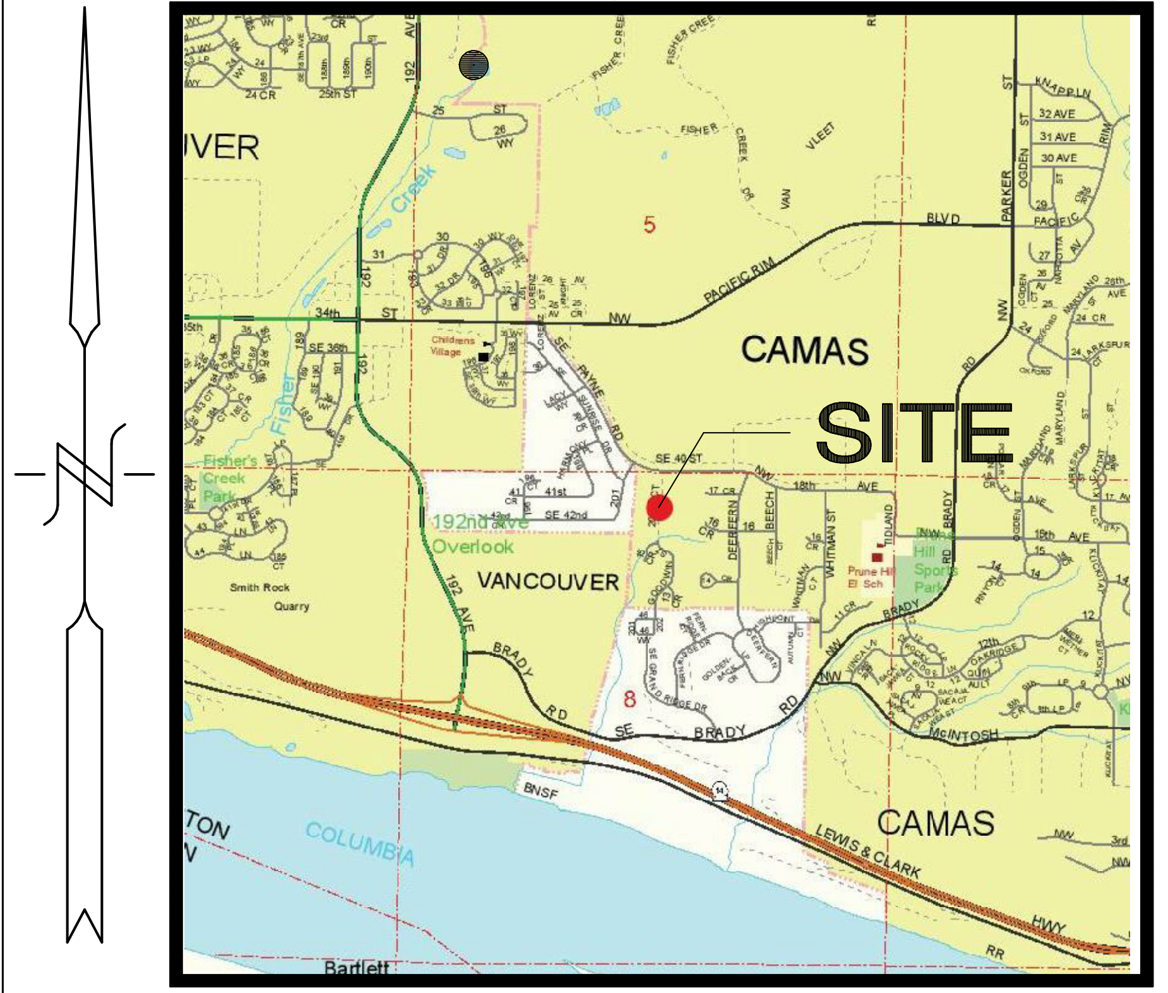
JOEL GREGORY STIRLING
36524
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 9 of 9 Sheet(s)

Exhibit 4 SUB18-02

VALLEY VIEW ESTATES

A Preliminary Subdivision
within in a portion of the
NE 1/4 of Sec. 8,
T1N., R3E., W.M.
Clark County, Washington



VICINITY MAP (NTS)

LEGEND

▨	CURB & SIDWALK
- - - - -	PROPOSED EASEMENT
———	PROPOSED LOT LINE
——— — — ——— — —	EXISTING RIGHT-OF-WAY
━━━	PROPOSED SANITARY SEWER LINE
▬▭▬▭	PROPOSED STORM SEWER LINE
———	PROPOSED PERFORATED STORM LINE
——— — ——— -	PROPOSED ROADWAY CENTERLINE
—E——E—	EXISTING ELECTRIC
—T——T—	EXISTING TELEPHONE LOCATE PAINT
—W——W—	EXISTING WATER LOCATE PAINT
- - - - -	EXISTING EDGE OF PAVEMENT/GRAVEL
—S——S—	EXISTING SANITARY SEWER LINE
—ST——ST—	EXISTING STORM LINE
—×——×—	EXISTING FENCE
—286—	EXISTING GROUND CONTOUR
—286—	PROPOSED GROUND CONTOUR (1')
←	DIRECTION OF STORMWATER FLOW
▭▭▭▭▭	EROSION CONTROL SILT FENCE
▨	INLET PROTECTION
●	PROPOSED SANITARY CLEANOUT
⊙	PROPOSED FIRE HYDRANT
⊖	STD 1" WATER METER SERVICE
●	PROPOSED MANHOLE
⬢	PROPOSED DRYWELL
▤	PROPOSED CATCH BASIN
▤	PROPOSED COMBINATION CURB INLET
⊠	PROPOSED STORMFILTER
2S.	EXISTING POWER POLE WITH NUMBER AND DIRECTION OF OVERHEAD LINES
↙	EXISTING GUY ANCHOR
TP	EXISTING TELEPHONE PEDESTAL
ST	EXISTING STORM DRAIN MANHOLE
CB ☐	EXISTING CATCH BASIN
ADA	EXISTING ADA RAMP
E	EXISTING ELECTRICAL SERVICE BOX
S	EXISTING SANITARY MANHOLE
○CO	EXISTING SANITARY CLEANOUT
✲	EXISTING FIRE HYDRANT
	EXISTING WATER SERVICE
WV ⋈	EXISTING WATER VALVE
✿	PROPOSED STREET TREES 30' O.C.
☼	PROPOSED STREET LIGHT 70' SPACING

STREET TREES AND STREET LIGHTING
WILL BE PROVIDED AS REQUIRED BY
THE CITY OF CAMAS CODE.

SHEET INDEX

COVER SHEET	1
PROPOSED DEVELOPMENT PLAN	2
PRELIMINARY TOPOGRAPHIC & BOUNDARY SURVEY	3
PRELIMINARY GRADING PLAN	4
PRELIMINARY EROSION CONTROL PLAN	5
PRELIMINARY STORMWATER MANAGEMENT PLAN	6
PRELIMINARY TRANSPORTATION PLAN	7
PRELIMINARY UTILITY PLAN	8
PRELIMINARY LANDSCAPE & LIGHTING PLAN	9

SITE DATA:

- TAX LOT(S): 59 & 48
- SERIAL NUMBER(S): 125646-000 & 125635-000
- SITE ADDRESS: 20109 SE 40th STREET
- AREA: 9.26 ACRES
- ZONING: R-7.5
- COMPREHENSIVE PLAN: UL

CITY OF CAMAS PRE-APPLICATION NUMBER: PA18-09

DESIGN & DEVELOPMENT TEAM

PROPERTY OWNER:
STAN FIRESTONE
PO BOX 61928
VANCOUVER WA, 98666
(360) 695-9484
stan@firestonepacificfoods.com

CIVIL ENGINEER/ LAND USE PLANNING:
STERLING DESIGN, INC.
JOEL STIRLING, PE
2208 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 759-1794
FAX: (360) 759-4983
EMAIL: joel@sterling-design.biz

SURVEYOR:
MINISTER & GLAESER SURVEYING, INC.
2200 E. EVERGREEN BLVD.
VANCOUVER WA, 98661
PHONE: (360) 694-3313
FAX: (360) 694-8410

BENCH MARK:
W.S.D.O.T. MONUMENT "LACAMAS" ID NO. 5789
A BRASS DISK IN CONCRETE LOCATED ON THE WESTERLY SIDEWALK OF N.E. 192nd AVE APPROXIMATELY 500 FEET NORTH OF THE INTERSECTION OF N.E. 192nd AVE AND S.E. 34th STREET. ELEVATION = 250.85', CITY OF CAMAS DATUM

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SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689		DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA	APPROX. SURFACE ELEV.: 385'-468'	
SITE AREA: 9.26 ACRES	FILENAME 286/:Preliminary.pro	

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STERLING DESIGN, INC.

Sheet Description: COVER SHEET

Project: VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
36524
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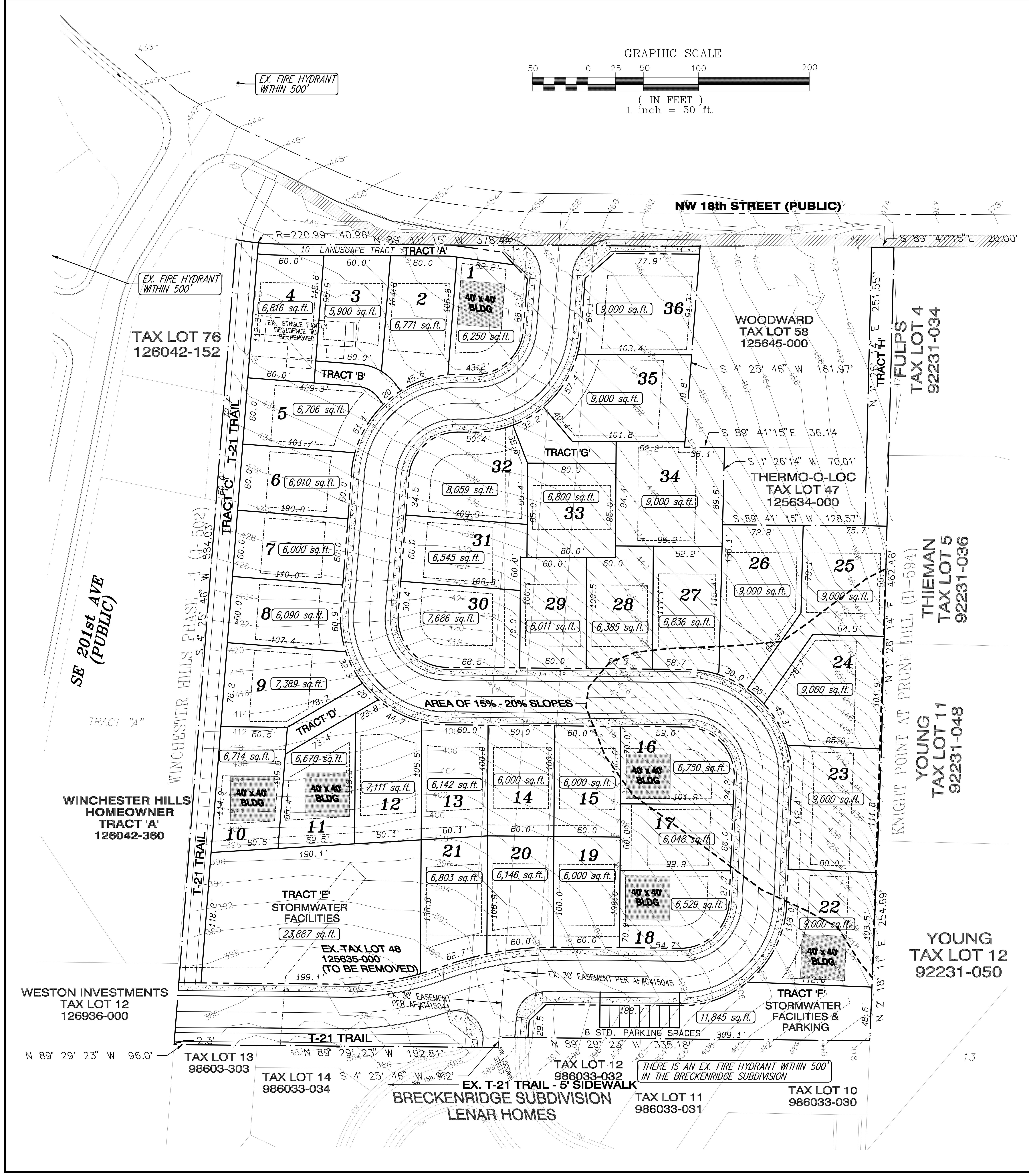

PROPERTY BOUNDARY LEGAL DESCRIPTION(s)

TAX LOT 48 (ASSESSORS PARCEL NUMBER 125635-000):

That parcel of land located in a portion of the Joel Knight D.L.C. No. 41 and in a portion of the Northwest Quarter of the Northeast Quarter and the Northeast Quarter of the Northwest Quarter of Section 8, Township 1 North, Range 3 East, Willamette Meridian, City of Camas, Clark County, Washington, described as follows;

BEGINNING at the Northwest corner of the Plat of "Breckenridge" as recorded in Book 311 of Plats, at Page 715, Clark County, Washington, plat records;

Thence South 89°29'23" East, along the North line of said Plat of "Breckenridge" for a distance of 95.97 feet;

Thence leaving said North line, North 04°25'46" East, parallel with the West line of the Joel Knight D.L.C. No. 41, for a distance of 62.70 feet;

Thence North 39°16'12" East, for a distance of 114.49 feet to the beginning of a 96.00 foot radius non-tangent curve to the left;

Thence along the arc of a 96.00 foot radius non-tangent curve to the right, for an arc distance of 20.15 feet, through a central angle of 12°01'29", the radius of which bears North 39°16'12" East, the long chord of which bears North 44°43'03" West, for a chord distance of 20.11 feet;

Thence South 39°16'12" West, for a distance of 123.30 feet;

Thence North 89°29'23" West, parallel with the North line of said Plat of "Breckenridge", for a distance of 75.68 feet to the West line of the Joel Knight D.L.C. No. 41;

Thence South 04°25'46" West, along said West line, for a distance of 70.00 feet to the POINT OF BEGINNING;

CONTAINING: 9,000 square feet of land, more or less.

TAX LOT 59 (ASSESSORS PARCEL NUMBER 125646-000):

That parcel of land located in a portion of the Joel Knight D.L.C. No. 41 and in a portion of the Northwest Quarter of the Northeast Quarter and the Northeast Quarter of the Northwest Quarter of Section 8, Township 1 North, Range 3 East, Willamette Meridian, City of Camas, Clark County, Washington, described as follows;

BEGINNING at the Northeast corner of the Plat of "Breckenridge" as recorded in Book 311 of Plats, at Page 715, Clark County, Washington, plat records;

Thence North 89°29'23" West, along the North line of said Plat of "Breckenridge", for a distance of 335.14 feet;

Thence continuing along said North line, South 04°25'46" West, for a distance of 9.20 feet;

Thence continuing along said North line, North 89°29'23" West, for a distance of 197.07 feet;

Thence leaving said North line, North 04°25'46" East, for a distance of 62.70 feet;

Thence North 39°16'12" East, for a distance of 114.49 feet to the beginning of a 96.00 foot radius non-tangent curve to the right;

Thence along the arc of a 96.00 foot radius non-tangent curve to the right, for an arc distance of 20.15 feet, through a central angle of 12°01'29", the radius of which bears North 39°16'12" East, the long chord of which bears North 44°43'03" West, for a chord distance of 20.11 feet;

Thence South 39°16'12" West, for a distance of 123.30 feet;

Thence North 89°29'23" West, for a distance of 75.68 feet to the West line of the Joel Knight D.L.C. No. 41;

Thence North 04°25'46" East, along the West line of said Joel Knight D.L.C. No. 41, for a distance of 659.58 feet to the South Right of Way line of SE 40th Street and the beginning of a 220.99 foot radius non-tangent curve to the left;

Thence leaving said West line, along said South Right of Way line, along the arc of a 220.99 foot radius non-tangent curve to the left, for an arc distance of 40.96 feet, through a central angle of 10°37'07", the radius of which bears North 10°55'53" East, the long chord of which bears South 84°22'41" East, for a chord distance of 40.90 feet;

Thence continuing along said South Right of Way line, South 89°41'15" East, for a distance of 378.44 feet to the Northwest corner of Tax Lot 58, as described and recorded under Clark County, Washington, Auditor's File Number #4919758 D;

Thence leaving said South Right of Way line, South 04°25'46" West, along the West line of said Tax Lot 58, for a distance of 181.97 feet to the Southwest corner thereof;

Thence leaving said West line, South 89°41'15" East, along the South line of said Tax Lot 58, for a distance of 36.14 feet to the Northwest corner of Tax Lot 47 as described and recorded under Clark County, Washington, Auditor's File Number #5108393 D;

Thence leaving said South line, South 01°26'14" West, along the West line of said Tax Lot 47, for a distance of 70.01 feet to the Southwest corner thereof;

Thence leaving said West line, South 89°41'15" East, along the South line of said Tax Lot 47, for a distance of 128.57 feet to the Southeas

PROPOSED DEVELOPMENT PLAN:

TOTAL LOTS: 36
MINIMUM LOT AREA: 5,900 sq.ft.
MAXIMUM LOT AREA: 9,000 sq.ft.
AVERAGE LOT AREA: 7,087 sq.ft.

TRACT PURPOSE	AREA	OWNED & MAINTAINED
TRACT 'A' - LANDSCAPE	2,268 sf	HOA
TRACT 'B' - ACCESS & UTILITY	1,541 sf	HOA
TRACT 'C' - RECREATIONAL OPEN SPACE	13,438 sf	CITY
TRACT 'D' - ACCESS & UTILITY	1,752 sf	HOA
TRACT 'E' - STORM FACILITY	23,887 sf	HOA
TRACT 'F' - STORM FACILITY	10,405 sf	HOA
TRACT 'G' - ACCESS & UTILITY	2,630 sf	HOA
TRACT 'H' - ACCESS & UTILITY	5,034 sf	HOA

LAND INVENTORY

TOTAL SITE AREA:	9.26 ACRES
TOTAL DEVELOPED ACREAGE:	7.29 ACRES
TOTAL LOT AREA:	5.85 ACRES
TOTAL INFRASTRUCTURE ACREAGE:	2.79 ACRES
TOTAL TRACT AREA(MINUS STORM TRACTS):	0.61 ACRES
TOTAL ACREAGE OF CRITICAL AREAS:	NONE
TOTAL ACREAGE OF REC. OPENSPACE	0.31 ACRES

TABLE 18.09.040

MINIMUM SETBACKS:	
FRONT:	20'
SIDE STREET:	20'
SIDE INTERIOR:	5'
REAR:	25'
MAX. LOT COVERAGE:	40%
MAX. BLDG. HEIGHT:	35'

ALL PROPOSED BUILDING ENVELOPES ARE LARGE ENOUGH TO FIT A 40 FOOT x 40 FOOT BUILDING FOOT PRINT.

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SITE LOCATION: CLARK COUNTY, WA	APPROX. SURFACE ELEV.: 385'-468'
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STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
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mail@sterlingdesign.biz

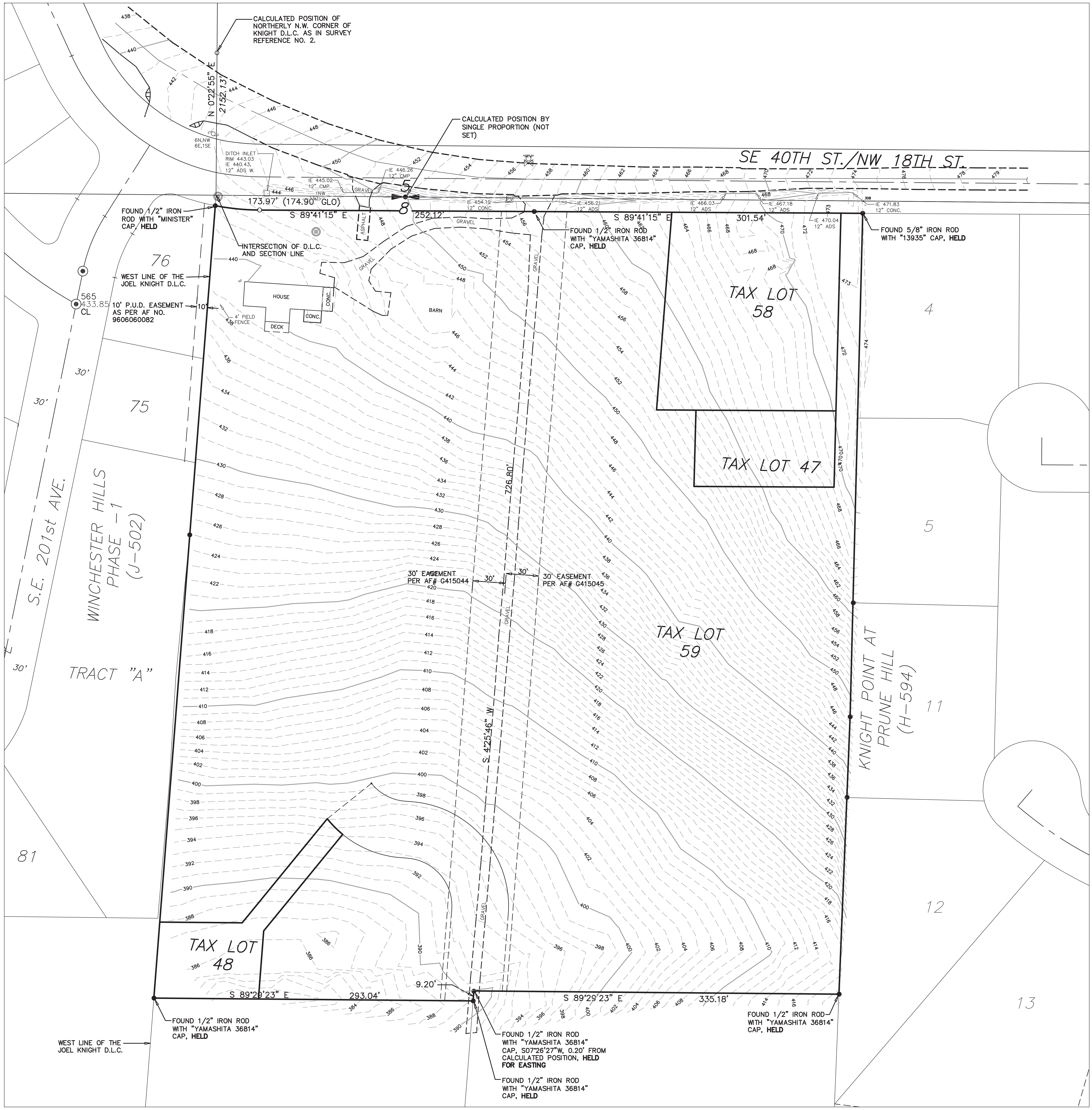
STERLING DESIGN, INC.

Sheet Description:
PROPOSED DEVELOPMENT PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
36524
06/25/18

Scale:	AS SHOWN
Project Number:	286
Design/ Drawn	JGS/BC
Drawing Date:	JUNE 2018
Sheet	2 of 9 Sheet(s)



TOPOGRAPHIC SURVEY

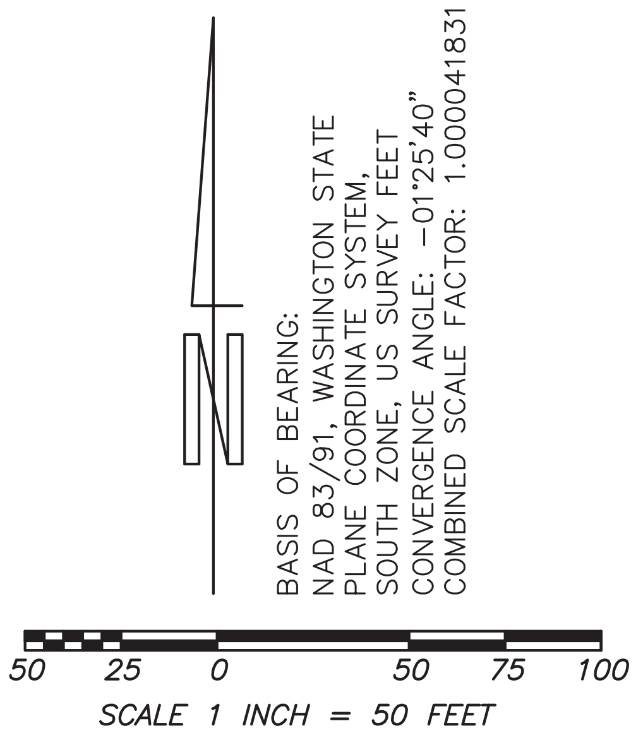
OF
A PORTION OF THE JOEL KNIGHT D.L.C.
IN THE NW 1/4 OF THE NE 1/4,
THE SW 1/4 OF THE NE 1/4,
THE NE 1/4 OF THE NW 1/4
AND THE SE 1/4 OF THE NW 1/4
SECTION 8
T. 1 N., R. 3 E., W.M.
CLARK COUNTY, WASHINGTON

JOB NO.: 04-413
DATA COLLECT: 10-11-04, 10-12-04

DRAWING DATE: 04-27-18

LEGEND:

●	INDICATES FOUND MONUMENT AS NOTED
PV	INDICATES TELEPHONE VAULT
	INDICATES FIRE HYDRANT
WV ⋈	INDICATES WATER VALVE
□	INDICATES CATCH BASIN
Ⓦ	INDICATES WELL
Ⓢ	INDICATES SANITARY MANHOLE
– – – –	INDICATES EASEMENT LINE
——	INDICATES ADJACENT LOT LINE
━━	INDICATES BACK OF CURB LINE
— — —	INDICATES CALCULATED RIGHT-OF-WAY LINE
— · — · —	INDICATES CENTERLINE OF CREEK
– – – –	INDICATES EDGE OF GRAVEL
━ ━ ━ ━	INDICATES EDGE OF PAVEMENT
—X—X—X—	INDICATES FENCE LINE
—G—G—G—G—	INDICATES GAS LINE LOCATE
—T—T—T—T—	INDICATES TELEPHONE LINE LOCATE
—W—W—W—W—	INDICATES WATER LINE LOCATE
——	INDICATES 10 FOOT INTERVAL CONTOUR
- - - -	INDICATES 1 FOOT INTERVAL CONTOUR



BASIS OF BEARING:
NAD 83/91, WASHINGTON STATE
PLANE COORDINATE SYSTEM,
SOUTH ZONE, US SURVEY FEET
CONVERGENCE ANGLE: -01°25'40"
COMBINED SCALE FACTOR: 1.000041831

SCALE 1 INCH = 50 FEET

BENCH MARK:

W.S.D.O.T. MONUMENT "LACAMAS" ID NO. 5789
A BRASS DISK IN CONCRETE LOCATED ON THE WESTERLY SIDEWALK OF N.E. 192ND AVE APPROXIMATELY 500 FEET NORTH OF THE INTERSECTION OF N.E. 192ND AVE AND S.E. 34TH STREET. ELEVATION = 250.85, CITY OF CAMAS DATUM

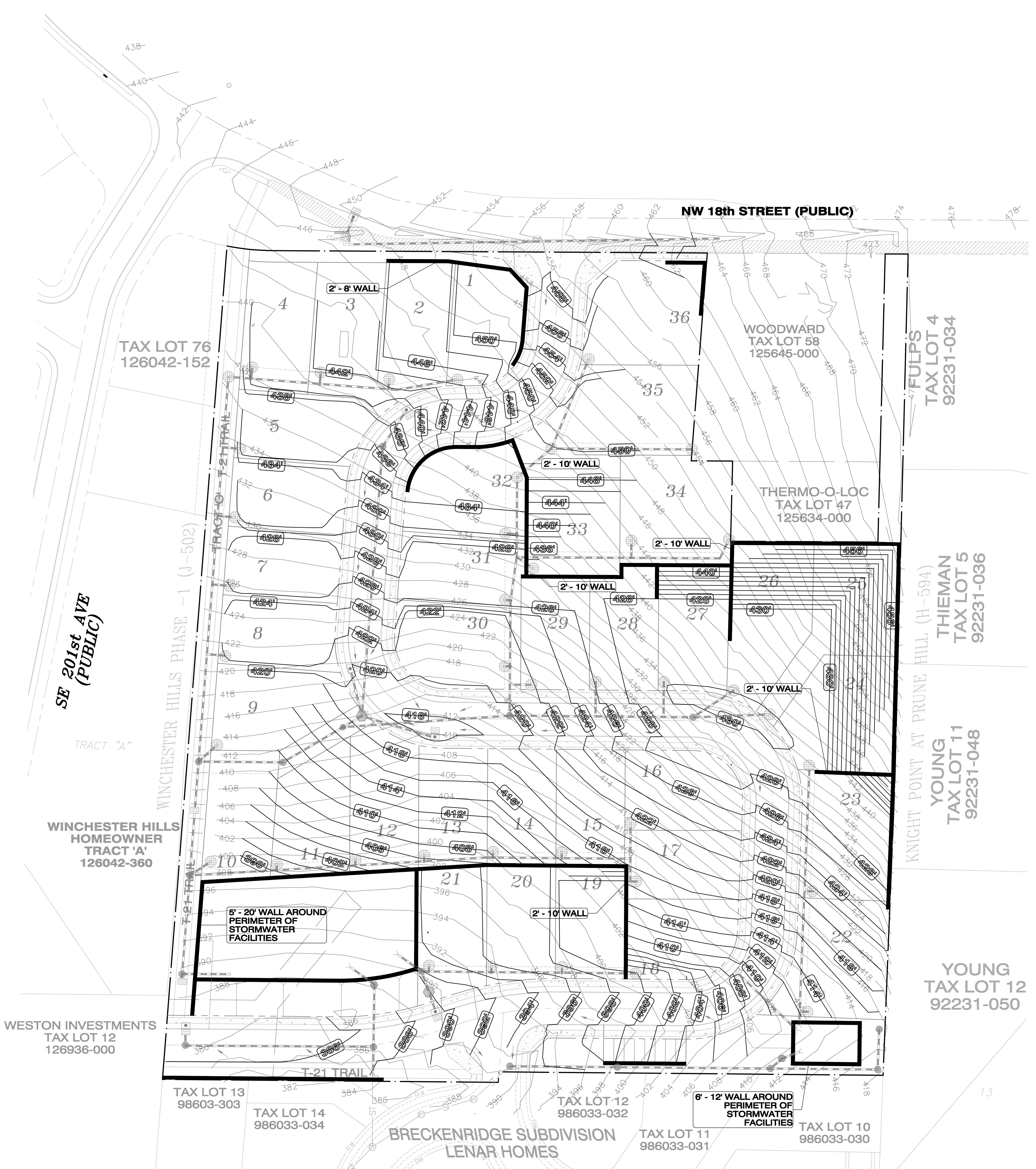
NOTE:

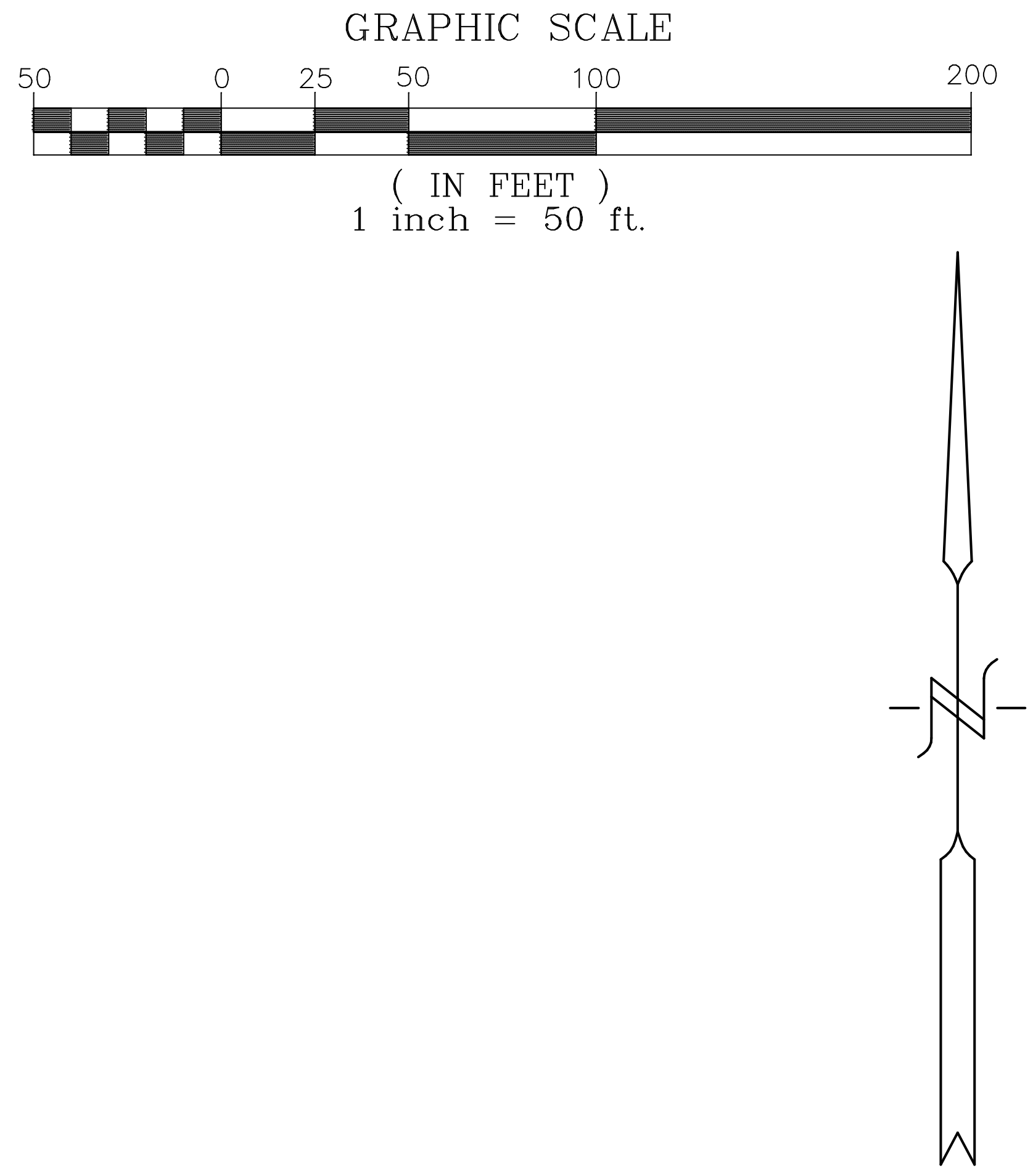
A UTILITY LOCATE WAS CALLED FOR ON 10-01-04 UNDER TICKET NUMBER 4323876. THE UNDERGROUND UTILITIES AS SHOWN ON THIS TOPOGRAPHIC MAP ARE AS MARKED AT THE TIME OF THIS SURVEY. UNDERGROUND UTILITY LOCATIONS SHOWN ARE APPROXIMATE ONLY. UNDERGROUND CONNECTIONS ARE SHOWN AS STRAIGHT LINES BETWEEN SURFACE LOCATIONS BUT MAY CONTAIN BENDS OR CURVES NOT SHOWN. SOME UNDERGROUND LOCATIONS HEREON MAY HAVE BEEN TAKEN FROM PUBLIC RECORDS. M.G.S. ASSUMES NO LIABILITY FOR THE ACCURACY OF PUBLIC RECORDS.

DANIEL ADOLPH RENTON
37535

MINISTER-GLAESER
SURVEYING INC.
2200 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 694-3313

DRAWING FILE: 04413T.DWG DRAWN BY: KPF PROJECT MGR: KPF





NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424-5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313	
SOIL TYPE(s): Hcb, PoB & PoD; HYDROLOGIC GROUP: C; AASHTO CLASSIFICATION: A - 4	
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689; DATE: MARCH 2014	
SITE LOCATION: CLARK COUNTY, WA	APPROX. SURFACE ELEV.: 385'-468'
SITE AREA: 9.26 ACRES	FILENAME 286/:Preliminary.pro

PREPARED BY:

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STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY GRADING PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION

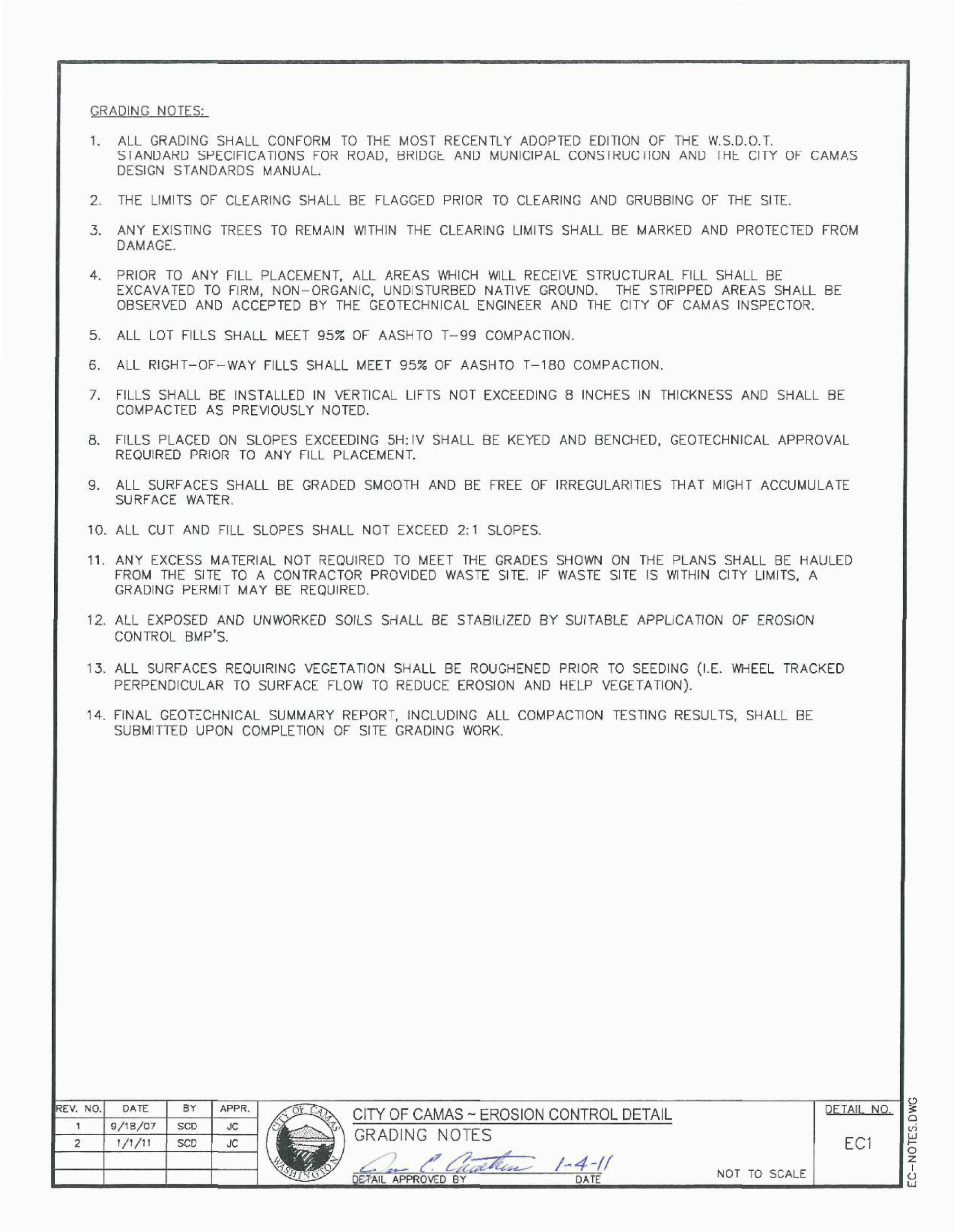
JOEL GREGORY STIRLING
36524
05/18/18

Scale:	AS SHOWN
Project Number:	286
Design/ Drawn	JGS/BC
Drawing Date:	MAY 2018
Sheet 4 of 9 Sheet(s)	

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.



GRADING NOTES:

1. ALL GRADING SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION AND THE CITY OF CAMAS DESIGN STANDARDS MANUAL.
2. THE LIMITS OF CLEARING SHALL BE FLAGGED PRIOR TO CLEARING AND GRUBBING OF THE SITE.
3. ANY EXISTING TREES TO REMAIN WITHIN THE CLEARING LIMITS SHALL BE MARKED AND PROTECTED FROM DAMAGE.
4. PRIOR TO ANY FILL PLACEMENT, ALL AREAS WHICH WILL RECEIVE STRUCTURAL FILL SHALL BE EXCAVATED TO FIRM, NON-ORGANIC, UNDISTURBED NATIVE GROUND. THE STRIPPED AREAS SHALL BE OBSERVED AND ACCEPTED BY THE GEOTECHNICAL ENGINEER AND THE CITY OF CAMAS INSPECTOR.
5. ALL LOT FILLS SHALL MEET 95% OF AASHTO T-99 COMPACTION.
6. ALL RIGHT-OF-WAY FILLS SHALL MEET 95% OF AASHTO T-180 COMPACTION.
7. FILLS SHALL BE INSTALLED IN VERTICAL LIFTS NOT EXCEEDING 8 INCHES IN THICKNESS AND SHALL BE COMPACTED AS PREVIOUSLY NOTED.
8. FILLS PLACED ON SLOPES EXCEEDING 5H:IV SHALL BE KEYED AND BENCHED, GEOTECHNICAL APPROVAL REQUIRED PRIOR TO ANY FILL PLACEMENT.
9. ALL SURFACES SHALL BE GRADED SMOOTH AND BE FREE OF IRREGULARITIES THAT MIGHT ACCUMULATE SURFACE WATER.
10. ALL CUT AND FILL SLOPES SHALL NOT EXCEED 2:1 SLOPES.
11. ANY EXCESS MATERIAL NOT REQUIRED TO MEET THE GRADES SHOWN ON THE PLANS SHALL BE HAULED FROM THE SITE TO A CONTRACTOR PROVIDED WASTE SITE. IF WASTE SITE IS WITHIN CITY LIMITS, A GRADING PERMIT MAY BE REQUIRED.
12. ALL EXPOSED AND UNWORKED SOILS SHALL BE STABILIZED BY SUITABLE APPLICATION OF EROSION CONTROL BMP'S.
13. ALL SURFACES REQUIRING VEGETATION SHALL BE ROUGHENED PRIOR TO SEEDING (I.E. WHEEL TRACKED PERPENDICULAR TO SURFACE FLOW TO REDUCE EROSION AND HELP VEGETATION).
14. FINAL GEOTECHNICAL SUMMARY REPORT, INCLUDING ALL COMPACTION TESTING RESULTS, SHALL BE SUBMITTED UPON COMPLETION OF SITE GRADING WORK.

REV. NO.	DATE	BY	APPR.
1	9/18/07	SCD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ EROSION CONTROL DETAIL
GRADING NOTES

DETAIL APPROVED BY 1-4-11 DATE

NOT TO SCALE

DETAIL NO. EC1

EC-NOTES.DWG

NOTE:
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SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313

SOIL TYPE(s): Hcb, PoB & PoD
HYDROLOGIC GROUP: C
AASHTO CLASSIFICATION: A - 4

SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689
DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA
APPROX. SURFACE ELEV.: 385'-468'

SITE AREA: 9.26 ACRES
FILENAME 286/:Preliminary.pro

PREPARED BY:

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STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY
EROSION CONTROL PLAN

Project:
VALLEY VIEW ESTATES
SUBDIVISION

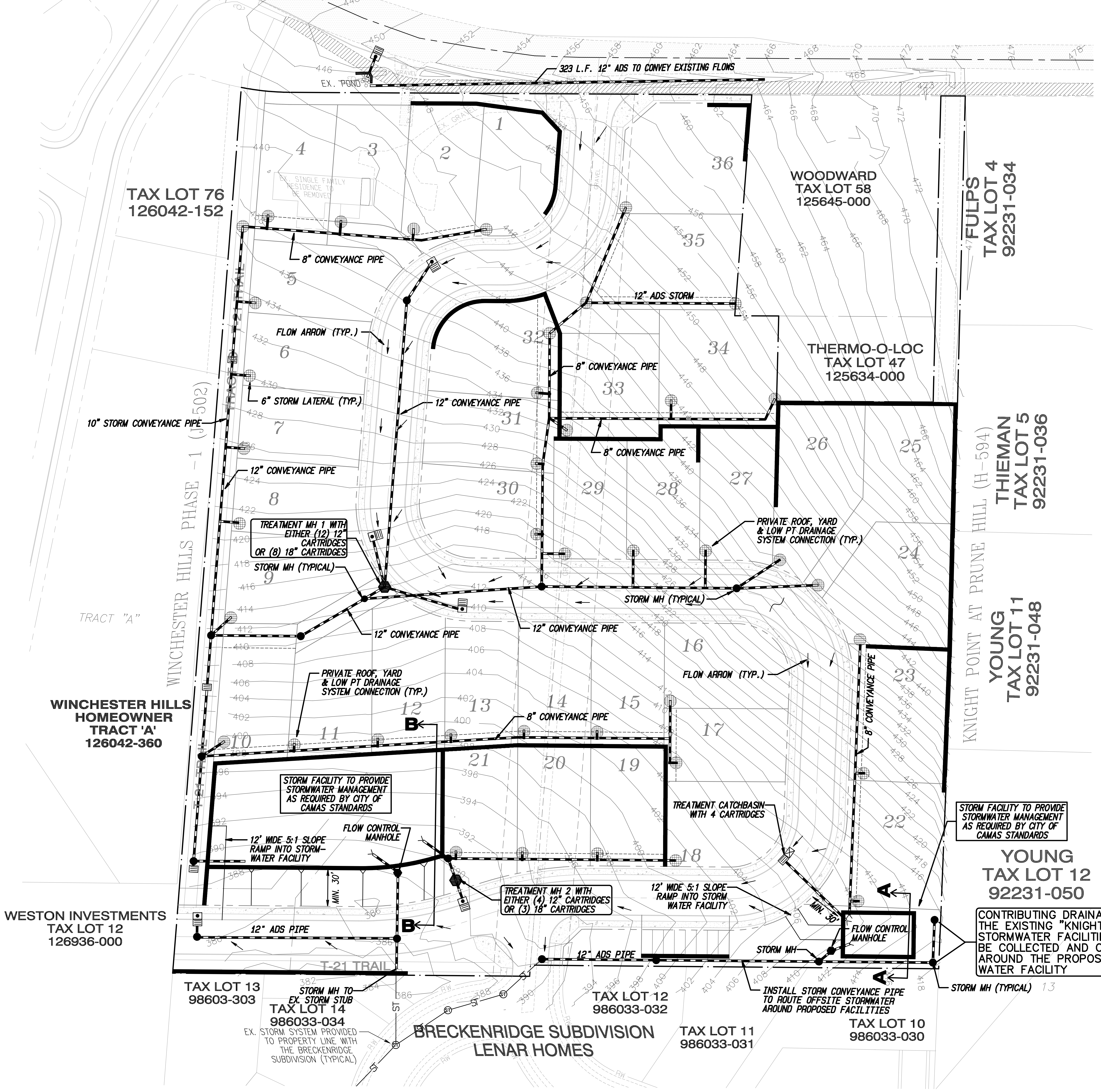
JOEL GREGORY STIRLING 36324
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 5 of 9 Sheet(s)

STORM FACILITIES ARE DESIGNED TO PROVIDE WATER QUALITY AND QUANTITY CONTROL AS REQUIRED BY CITY OF CAMAS CODE CMC 14.02 AND MEET MINIMUM REQUIREMENTS 1-10 IN ACCORDANCE WITH THE 2005 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

SITE DEVELOPMENT WILL NOT INCREASE THE AMOUNT OF IMPERVIOUS SURFACES ON NW 18th STREET. ALL DRAINAGE WILL FLOW TO THE EXISTING FLOW ROUTES

STORMWATER FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED



GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

STORM CONSTRUCTION NOTES:

1.ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF ON AN APPROVED SITE.

2.PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.

3.TRENCH COMPACTION SHALL BE PER THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD TO USE TO ACHIEVE THE REQUIRED COMPACTION. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.

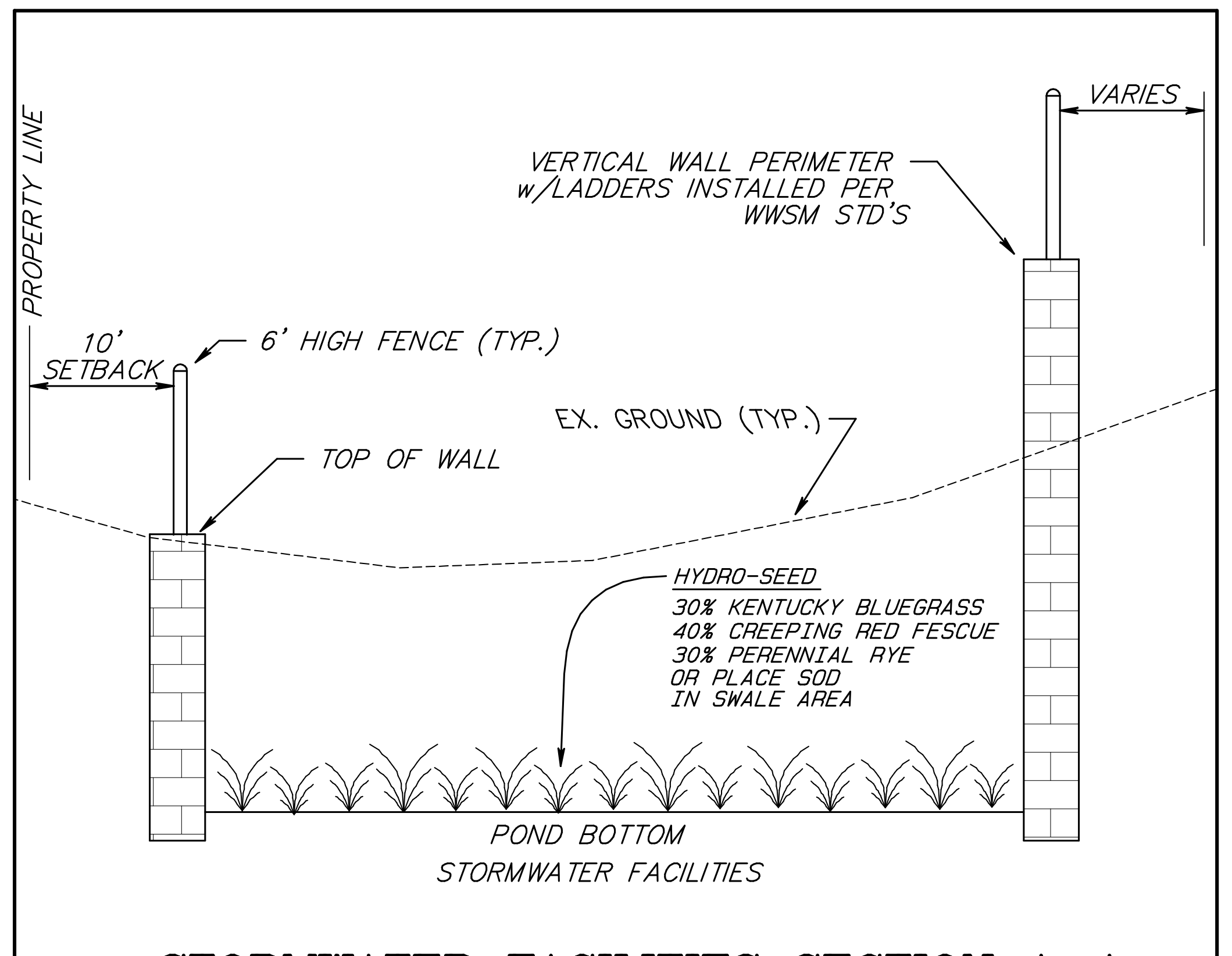
4.SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

5.ALL STORM PIPE SHALL BE PVC OR N-12 WITH DOUBLE BELLED COUPLINGS WITH O-RING TYPE GASKETS OR APPROVED EQUAL.

6.ALL STORM PIPE LATERALS TO BE A MINIMUM 10 INCHES DIAMETER WITH A MINIMUM SLOPE OF S=0.0100 UNLESS SPECIFIED OTHERWISE IN THE PLANS.

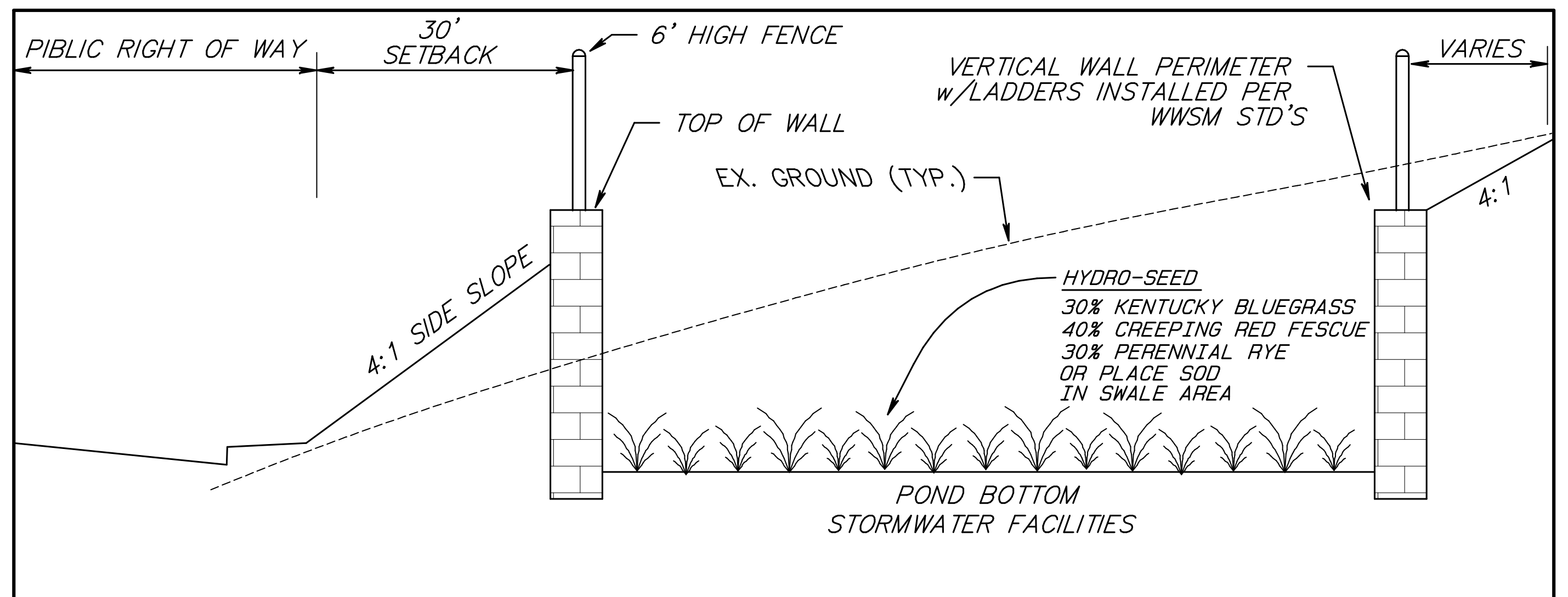
7.ALL MANHOLES LOCATED IN UNIMPROVED EASEMENTS AND RIGHT OF WAYS SHALL BE PROVIDED WITH TAMPER PROOF LIDS AND SHALL BE SET 6 INCHES ABOVE FINISHED GRADE.

8.VIDEO INSPECTION TAPES AND REPORTS MAY BE REQUIRED AT THE CITY'S DISCRETION. MANDREL TESTING MAY BE REQUIRED AT THE CITY'S DISCRETION.



STORMWATER FACILITIES SECTION A-A

(Not to Scale)



STORMWATER FACILITIES SECTION B-B

(Not to Scale)

NOTE:
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SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313	
SOIL TYPE(s): Hcb, PoB & PoD — HYDROLOGIC GROUP: C — AASHTO CLASSIFICATION: A - 4	
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689	DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA	APPROX. SURFACE ELEV.: 385'-468'
SITE AREA: 9.26 ACRES	FILENAME 286/:Preliminary.pro

JOEL GREGORY STERLING
36524
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 6 of 9 Sheet(s)

PREPARED BY:
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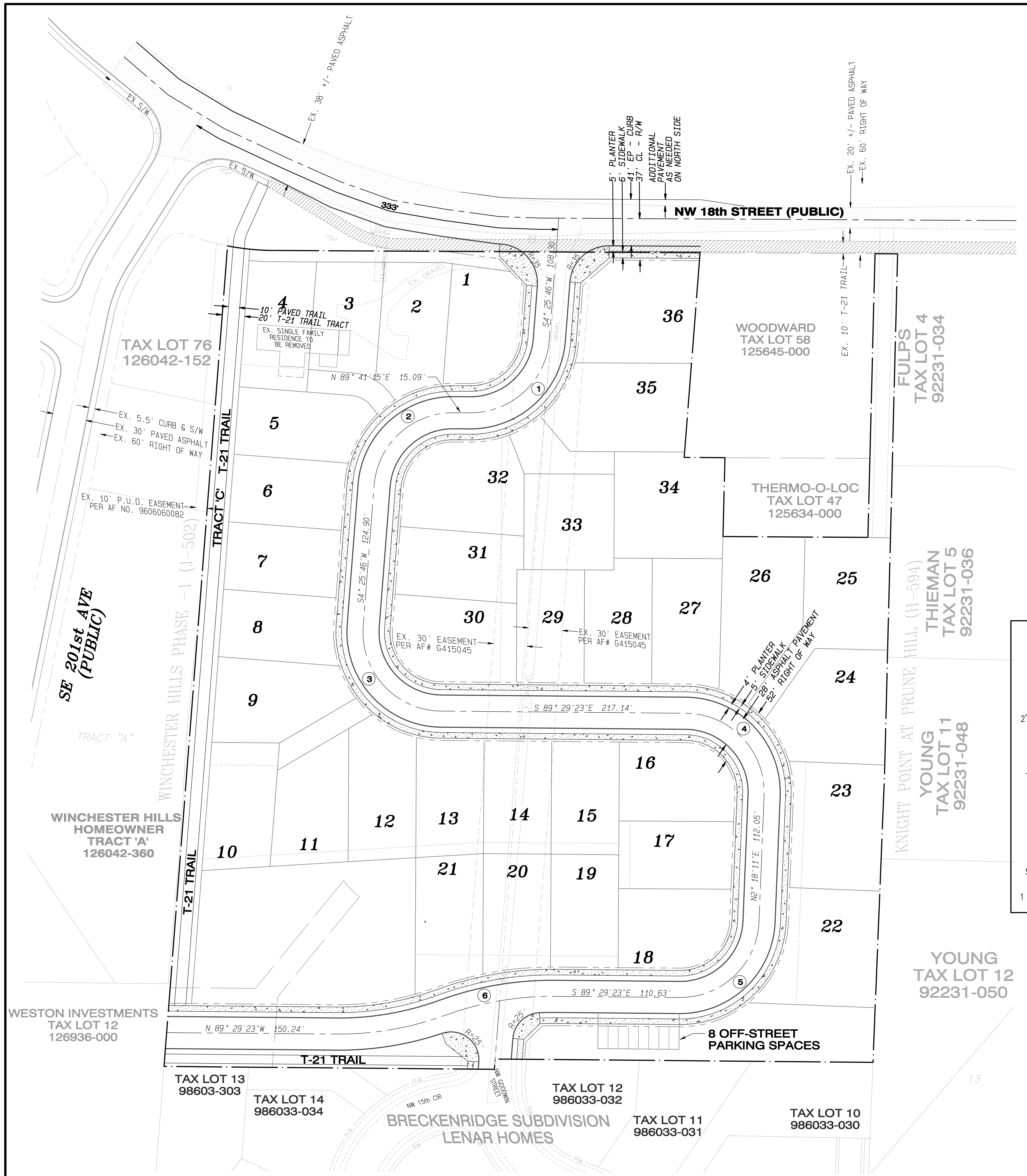
STERLING DESIGN, INC.

Sheet Description:
PRELIMINARY STORMWATER MANAGEMENT PLAN

Project:
VALLEY VIEW ESTATES SUBDIVISION



STREET CONSTRUCTION NOTES:

1. ENGINEERED FILL SHALL BE PLACED AND COMPACTED IN ACCORDANCE WITH THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T STANDARD SPECIFICATIONS SECTION 2-03.3(14). FOR FILL AREAS WITHIN ROADWAYS, METHOD C OF (14)C SHALL BE USED. FOR FILL AREAS OUTSIDE OF ROADWAYS METHOD B SHALL BE USED. ALL FILL PLACED SHALL BE VERIFIED BY GEOTECHNICAL TESTING. TEST RESULTS SHALL BE FORWARDED TO THE CITY OF CAMAS PROJECT ENGINEER.

2. MATERIALS IN SOFT SPOTS WITHIN THE ROADWAY SHALL BE REMOVED TO THE DEPTH REQUIRED TO PROVIDE A FIRM FOUNDATION AND SHALL BE BACKFILLED WITH 1-1/2 INCH MINUS CRUSHED ROCK.

3. ALL SUBGRADE TO BE PROOF ROLLED AND APPROVED BY THE CITY INSPECTOR OR BY A GEOTECHNICAL ENGINEER WITH CONSENT OF THE CITY ENGINEER. SUBGRADE FILLS ARE TO BE TESTED USING THE A.A.S.H.T.O. T-180 TEST METHOD.

4. ALL TRENCH LINES, FILL AREAS AND BASE COURSE LOCATED IN THE RIGHT-OF-WAY SHALL BE APPROVED GRANULAR MATERIAL AND SHALL MEET 95% OF A.A.S.H.T.O. T-180 COMPACTION. TRENCH LINES LOCATED WITHIN AN EXISTING ROADWAY SHALL BE PLATED OR TOPPED WITH COLD MIX. GRANULAR BACKFILL OVERNIGHT IS NOT ALLOWED. PLATES SHALL HAVE COLD MIX AROUND ALL EDGES.

5. THE CONTRACTOR SHALL NOTIFY THE CITY INSPECTOR A MINIMUM OF 24 HOURS PRIOR TO SUBGRADE PROOF ROLL OR GRADE CHECK INSPECTIONS.

6. THE AGGREGATE ROAD BASE SHALL BE COMPACTED IN ACCORDANCE WITH THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 4-04.3. THE CONTRACTOR SHALL SUBMIT TEST RESULTS TO THE ENGINEER AND CITY INSPECTOR. MAXIMUM DENSITY (95%) AS DETERMINED BY A.A.S.H.T.O. T-180 TEST METHOD.

7. ASPHALT CONCRETE PAVEMENT MIX SHALL BE DESIGNED FROM A MIX FORMULA APPROVED BY W.S.D.O.T. FOR MATERIAL USED. CONTRACTOR TO PROVIDE THE CITY WITH CERTIFICATE OF COMPLIANCE FROM THE ASPHALT PAVEMENT PLANT, UNLESS OTHERWISE INDICATED.

8. THE ASPHALT CONCRETE PAVEMENT MIX SHALL BE COMPACTED IN ACCORDANCE WITH THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 5-04.3(10). CONTRACTOR SHALL SUBMIT TEST RESULTS TO THE ENGINEER AND THE CITY INSPECTOR.

9. ALL STORM SYSTEM IMPROVEMENTS AND STORMWATER DETENTION AND TREATMENT FACILITIES SHALL BE COMPLETED AND PROPERLY FUNCTIONING PRIOR TO ANY PAVING.

10. HALF STREET IMPROVEMENTS SHALL INCLUDE AN ANALYSIS OF THE EXISTING STRUCTURAL SECTION OUT TO CENTERLINE. IF FOUND TO BE SUBSTANDARD, THE DEVELOPER SHALL BE REQUIRED TO PROVIDE AS ADEQUATE STRUCTURAL SECTION SECTION TO CENTERLINE. THIS MAY CONSIST OF A STRUCTURAL OVERLAY OR A COMPLETE STREET RECONSTRUCTION AS DETERMINED BY A GEOTECHNICAL ANALYSIS AND AS APPROVED BY THE CITY ENGINEER.

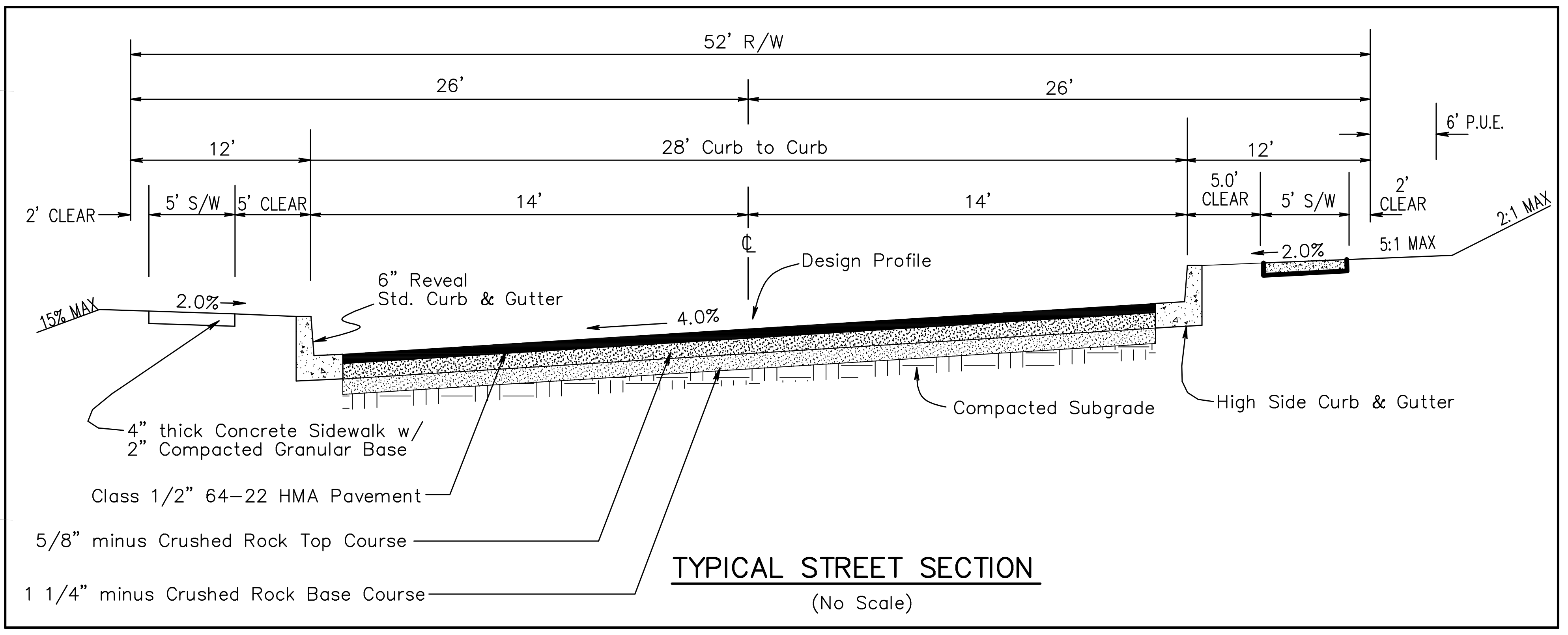
GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

CENTERLINE CURVE DATA

①	R=70.00ft CH=95.38ft A=104.93ft T=65.14ft EX=25.62ft Δ=85° 52' 59"	④	R=70.00ft CH=100.53ft A=112.15ft T=72.23ft EX=30.58ft Δ=91° 47' 34"
②	R=70.00ft CH=95.38ft A=104.93ft T=65.14ft EX=25.62ft Δ=85° 52' 59"	⑥	R=70.00ft CH=97.43ft A=107.77ft T=67.84ft EX=27.48ft Δ=88° 12' 26"
③	R=70.00ft CH=102.32ft A=114.74ft T=74.96ft EX=32.56ft Δ=93° 55' 09"	⑦	R=275.00ft CH=94.17ft A=94.64ft T=47.79ft EX=4.12ft Δ=19° 43' 02"



TYPICAL STREET SECTION

(No Scale)

NOTE:

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SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313

SOIL TYPE(s): Hcb, PoB & PoD HYDROLOGIC GROUP: C AASHTO CLASSIFICATION: A - 4

SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689 DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA APPROX. SURFACE ELEV.: 385'-468'

SITE AREA: 9.26 ACRES FILENAME 286/:Preliminary.pro

PREPARED BY:

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STERLING DESIGN, INC.

Sheet Description:

PRELIMINARY TRANSPORATION PLAN

Project:

VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STERLING
36524
05/18/18

Scale: AS SHOWN

Project Number: 286

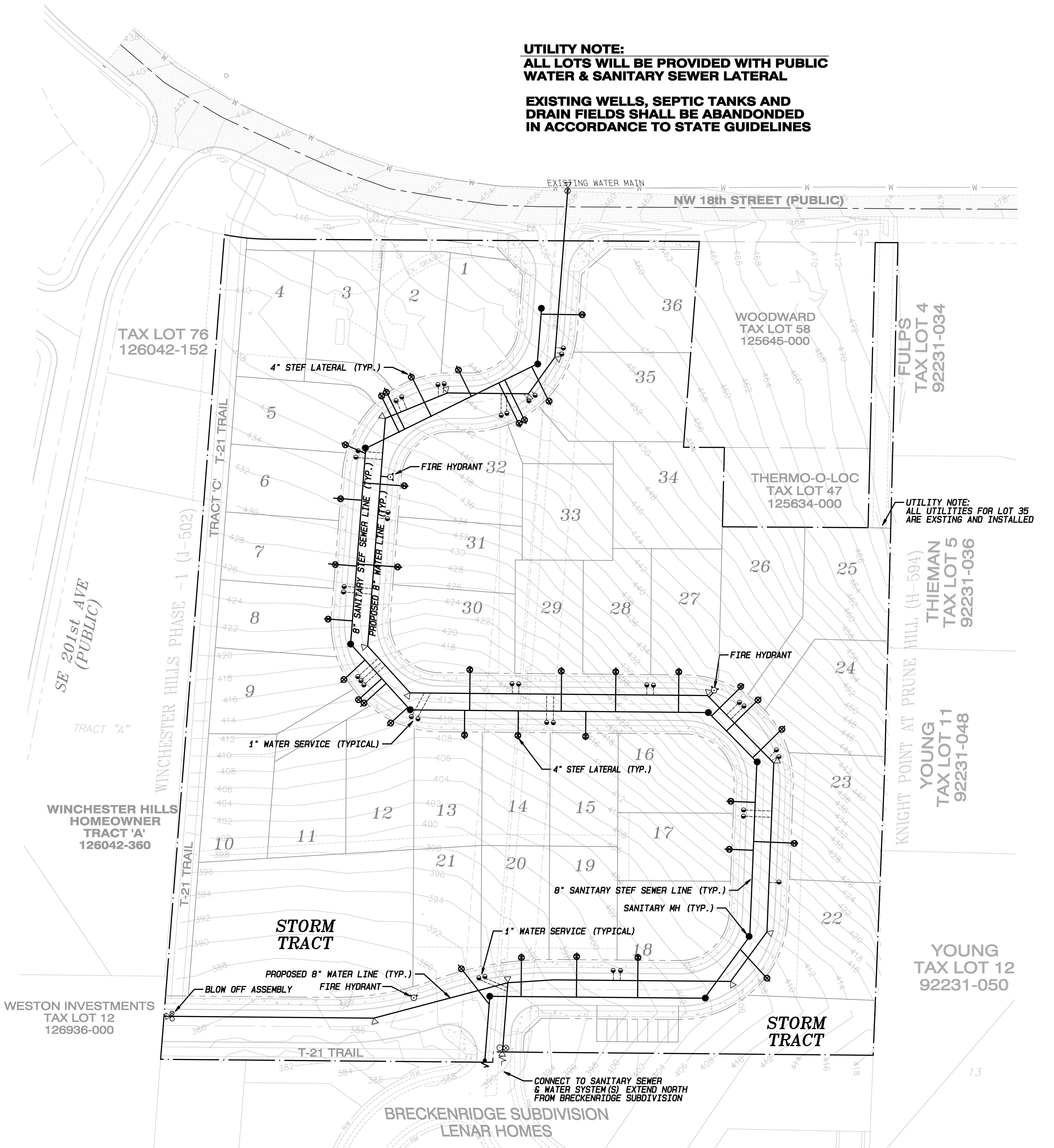
Design/Drawn JGS/BC

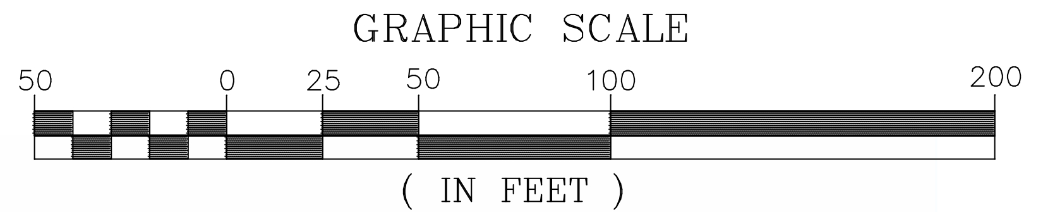
Drawing Date: MAY 2018

Sheet 7 of 9 Sheet(s)

UTILITY NOTE:
ALL LOTS WILL BE PROVIDED WITH PUBLIC WATER & SANITARY SEWER LATERAL

EXISTING WELLS, SEPTIC TANKS AND DRAIN FIELDS SHALL BE ABANDONDED IN ACCORDANCE TO STATE GUIDELINES





SEPTIC TANK EFFLUENT FILTER (S.T.E.F.) NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7–08.3(1) AND SECTION 7–08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF ON AN APPROVED SITE.
2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.
3. TRENCH COMPACTION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7–08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD TO USE TO ACHIEVE THE REQUIRED COMPACTION. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T–180 TEST METHOD.
4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.
5. ALL PIPE AND FITTINGS SHALL BE PVC GASKETED PIPE, ASTM D2241 PRESSURE RATED FOR 200 PSI UNLESS OTHERWISE NOTED.
6. PIPE SHALL BE BEDDED WITH A MINIMUM OF 4 INCHES OF APPROVED GRANULAR MATERIAL.
7. 14 GAUGE GREEN HDPE (HMWPE) INSULATED COPPER CLAD STEEL TONING WIRE SHALL BE PLACED DIRECTLY OVER ALL SEWER MAINS AND SERVICE LATERALS. THE TONING WIRE SHALL BE ACCESSIBLE AT ALL SERVICE LATERAL MARKER BOARDS, A.A.R.V.'S, RISERS, AND CLEANOUTS. ALL SPLICES AND CONNECTIONS TO TONING WIRE SHALL BE PROTECTED WITH KING GEL CAPS, 3M DBY DIRECT BURY, OR OTHER APPROVED EQUAL CONNECTORS. ALL TONING WIRE CONNECTIONS SHALL BE TONE TESTED PRIOR TO INSTALLING BASE ROCK.
8. MAINLINE CLEANOUTS SHALL BE SPACED A MAXIMUM OF 400 FEET AND/OR FOR EVERY 90 DEGREES OF BENDS.
9. ALL PIPE AND FITTINGS SHALL BE AIR TESTED AT FIVE P.S.I. FOR ONE MINUTE PER EVERY 100 FEET OF MAINLINE.
10. SANITARY SERVICE LATERAL ENDS SHALL EXTEND 8 FEET PAST THE STREET RIGHT–OF–WAY LINE OR AS SHOWN ON THE PLANS AND MARKED WITH A 10 FOOT LONG 2 X 4.
11. ALL SANITARY LINES SHALL BE INSTALLED WITH A MINIMUM COVER OF 6 FEET AND A MINIMUM GRADE OF 0.4% UNLESS OTHERWISE SHOWN ON THE PLANS.
12. ALL S.T.E.F. SANITARY SEWER LATERALS SHALL BE INSTALLED IN A DEDICATED TRENCH FROM THE SERVICE CONNECTION TO THE TANK. BACKFILL SHALL BE APPROVED GRANULAR MATERIAL OR AS APPROVED BY THE WATER/SEWER DEPARTMENT.
13. ALL TANKS WITH A BURY DEPTH OVER 4'–0" MUST HAVE H–20 RATED TANK LID

REV. NO.	DATE	BY	APPR.
1	5/1/07	SCD	JC
2	1/1/11	SCD	JC
3	10/21/14	SCD	JC

CITY OF CAMAS ~ SANITARY DETAIL
STEF SEWER CONSTRUCTION NOTES
10-21-14
DETAIL APPROVED BY DATE
NOT TO SCALE
DETAIL NO. SF1
STEF–NOTES.DWG

WATER CONSTRUCTION NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST CURRENT A.W.W.A. STANDARDS, AND THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7–08.3(1) AND SECTION 7–08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE LOADED DIRECTLY INTO A DUMP TRUCK AND DISPOSED OF AT AN APPROVED SITE.

2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.

3. TRENCH COMPACTION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7–08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD USED TO ACHEIVE THE REQUIRED COMPACTION AND BE APPROVED BY THE CITY OF CAMAS. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T–180 TEST METHOD.

4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

5. ALL VALVES 10 INCHES OR LESS IN DIAMETER SHALL BE A.W.W.A. APPROVED RESILIENT WEDGE GATE VALVES, BUBBLE TIGHT AT 200PSI, HAVE NON RISING STEMS, AND OPEN BY TURNING TO THE LEFT. PROVIDE A 2 INCH SQUARE NUT TO CONFORM TO A.W.W.A. C–504. ALL VALVES 12 INCHES OR LARGER IN DIAMETER SHALL BE A.W.W.A. APPROVED BUTTERFLY VALVES.

6. ALL WATER PIPE 12 INCHES OR LESS IN DIAMETER SHALL BE DUCTILE IRON CLASS 52 PIPE. ALL WATER PIPE 14 INCHES IN DIAMETER AND LARGER SHALL BE DUCTILE IRON CLASS 51 PIPE. RUBBER GASKET TYPE SHALL BE U.S. PIPE, TYTON OR APPROVED EQUAL. ALL FITTINGS SHALL BE DUCTILE IRON AND SHALL CONFORM TO THE A.W.W.A. STANDARD C–110.

7. ALL TEES, FLANGES, CAPS, BENDS AND OFFSETS, AS WELL AS ALL OTHER APPURTENANCES WHICH ARE SUBJECT TO UNBALANCED THRUST, SHALL BE PROPERLY BRACED BY ONE OF THE FOLLOWING METHODS:
   - A. CONCRETE THRUST BLOCKING– AS DETAILED IN THE PLANS, SHALL BE PLACED AT BENDS, TEES, DEAD ENDS AND CROSSES. BLOCKING SHALL BE 3000 PSI CONCRETE POURED IN PLACE. CONCRETE BLOCKING SHALL BE AGAINST SOLID UNDISTURBED EARTH AT THE SIDES AND BOTTOM OF THE TRENCH EXCAVATION AND SHALL BE SHAPED SO AS NOT TO OBSTRUCT ACCESS TO THE JOINTS OF THE PIPE. 6 MIL. PLASTIC SHALL BE USED TO INSULATE PIPE.
   - B. MECHANICAL JOINT RESTRAINT–USE "EBBA IRON SERIES 1100 MEGA LUG MECHANICAL JOINT THRUST RESTRAINT" OR APPROVED EQUAL. CONTRACTOR TO RESTRAIN THE MINIMUM REQUIRED PIPE LENGTH WITH "FIELD–LOK" GASKETS OR APPROVED EQUAL.

8. ALL WATER MAINS SHALL BE TESTED AT 200PSI IN ACCORDANCE WITH SECTION 7–09.3(23) OF THE STANDARD SPECIFICATIONS. THE CITY SHALL BE NOTIFIED 48 HOURS IN ADVANCE OF ACCEPTANCE TESTING. MAXIMUM LENGTH OF PIPE TO BE TESTED AT ONE TIME IS 1000 FT.

9. CHLORINATION SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 7–09.3(24) OF THE STANDARD SPECIFICATIONS. CITY INSPECTOR WILL TAKE SAMPLES AND DELIVER TO LABORATORY FOR BACTERIA TESTING, NEGATIVE SAMPLE RESULTS SHALL BE CONFIRMED, PRIOR TO PRESSURE TESTING. DECLORINATION OR DISPOSAL TO SANITARY MAIN MAY BE REQUIRED.

10. APPROPRIATE DISPOSAL AND OR DECHLORINATION OF FLUSHED WATER DURING BLOWOFF IS THE RESPONSIBILITY OF THE CONTRACTOR. METHOD USED SHALL BE APPROVED BY CITY AND OTHER REGULATING AUTHORITIES.

11. WATER MAIN TO HAVE A MINIMUM COVER OF 30 INCHES. WATER SERVICES TO HAVE A MINIMUM 24" OF COVER.

12. ALL EXISTING VALVES TO BE OPERATED BY CITY OF CAMAS WATER/SEWER DEPARTMENT PERSONNEL ONLY.

13. NO CONNECTIONS TO EXISTING WATER MAINS SHALL BE MADE PRIOR TO SATISFACTORY PRESSURE TESTING, DISINFECTION, AND THE CONFIRMATION OF A NEGATIVE BACTERIA TEST.

REV. NO.	DATE	BY	APPR.
1	7/17/06	SCD	RES1071
2	5/1/07	SCD	JC
3	1/1/11	SCD	JC

CITY OF CAMAS ~ WATER DETAIL
WATER CONSTRUCTION NOTES
1-4-11
DETAIL APPROVED BY DATE
NOT TO SCALE
DETAIL NO. W1
WTR–NOTES.DWG

NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424–5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694–3313
SOIL TYPE(s): Hcb, PoB & PoD
HYDROLOGIC GROUP: C
AASHTO CLASSIFICATION: A – 4
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816–3689
DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA
APPROX. SURFACE ELEV.: 385'–468'
SITE AREA: 9.26 ACRES
FILENAME 286/:Preliminary.pro

PREPARED BY:
STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759–1794
FAX (360) 759–4983
mail@sterlingdesign.biz

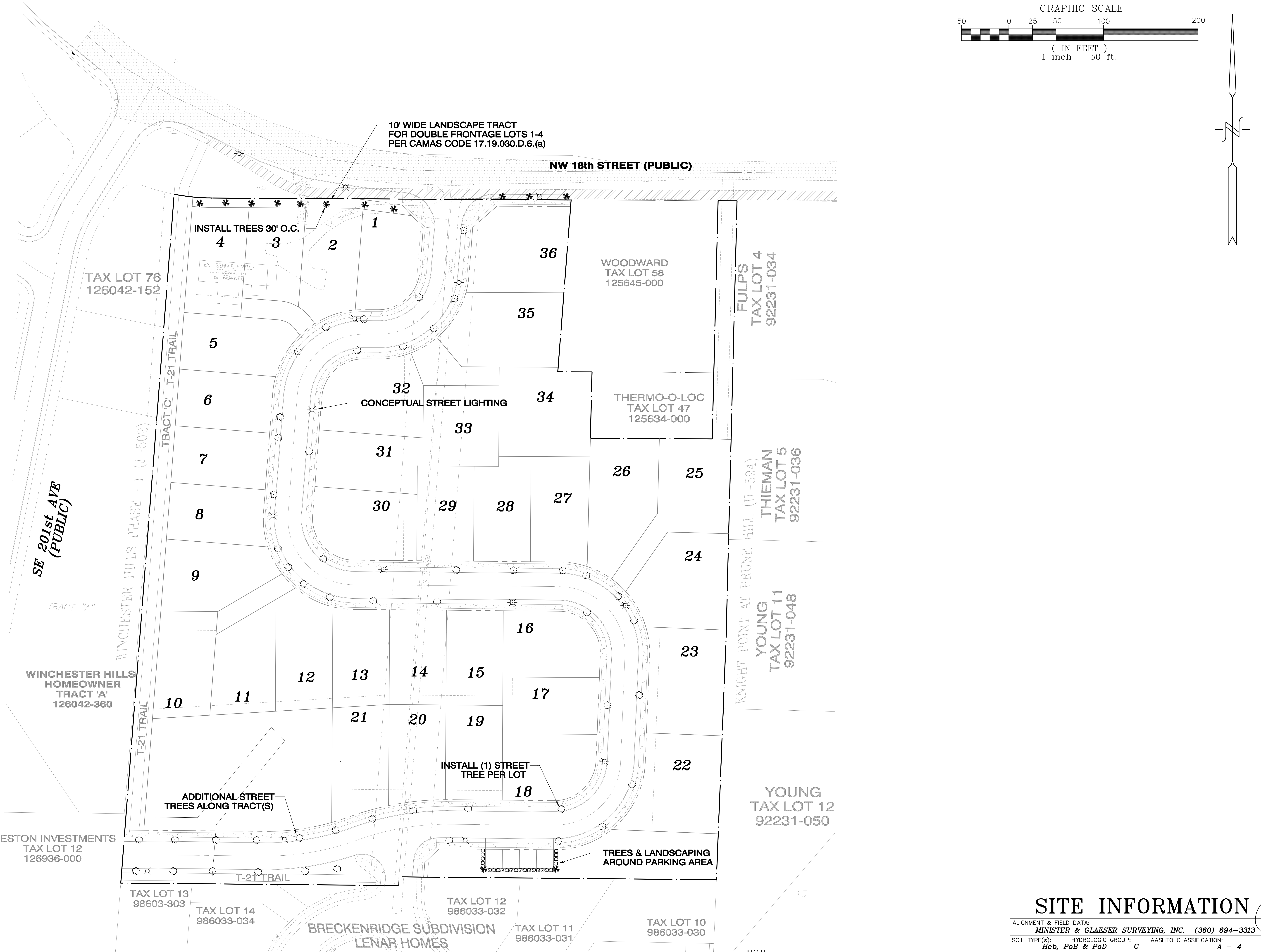
STERLING DESIGN, INC.

Sheet Description: PRELIMINARY UTILITY PLAN

Project: VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
36524
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 8 of 9 Sheet(s)



NOTE:
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VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
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STERLING DESIGN, INC.

Sheet Description:
PRELIMARY
LANDSCAPE & LIGHTING
PLAN

Project:
VALLEY VIEW ESTATES
SUBDIVISION

JOEL GREGORY STIRLING
36524
05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: MAY 2018
Sheet 9 of 9 Sheet(s)

Exhibit 5 SUB18-02

DEVELOPER'S PACKET

Produced By:

Clark County Geographic Information System (GIS)

For:

Sterling Design, Inc.

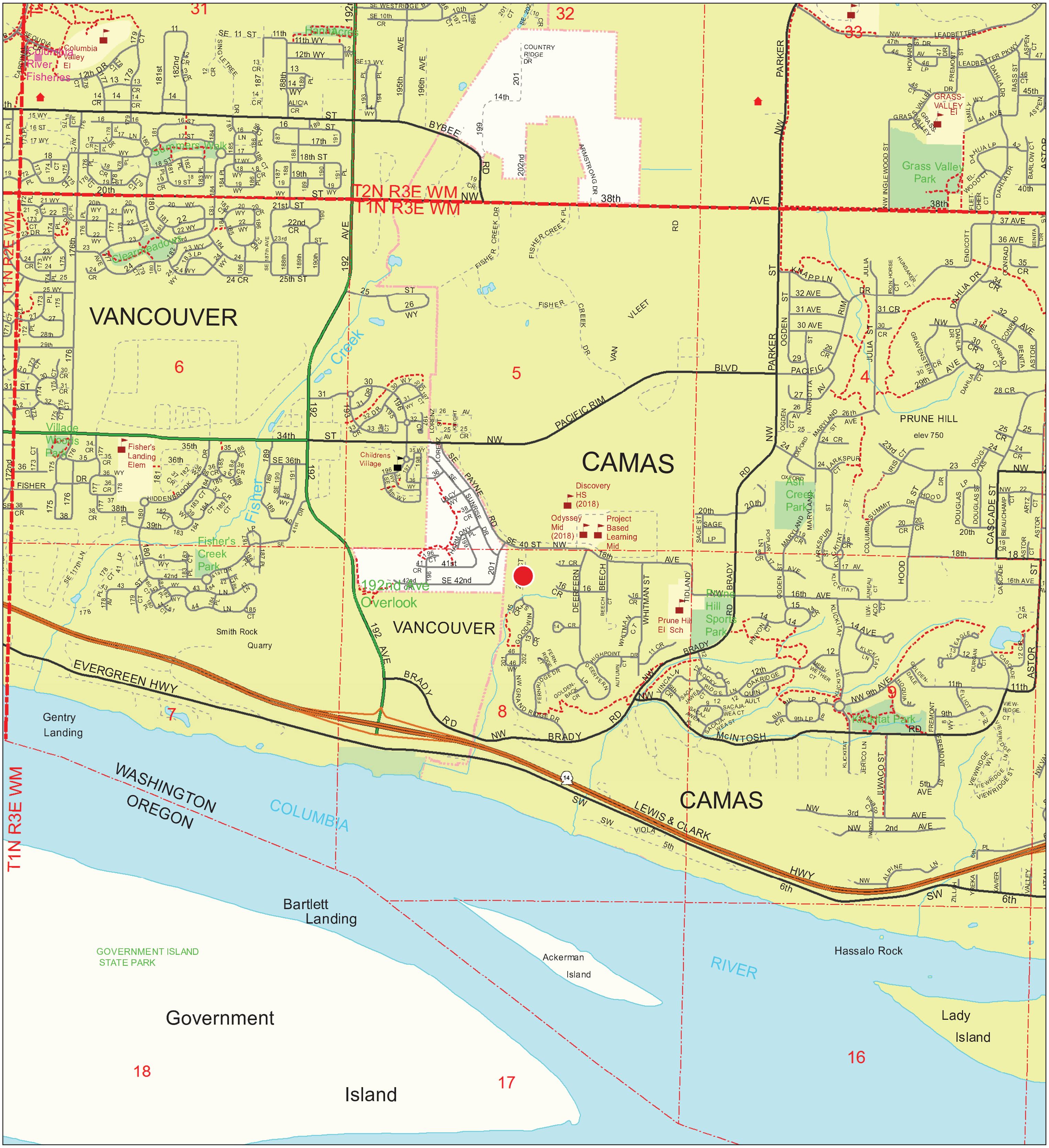
Subject Property Account Number(s):

125635000
125646000

PDF # 196986

Printed: March 26, 2018
Expires: March 26, 2019

Table of Contents

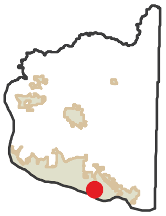


General Location

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Printed on: March 26, 2018

CLARK COUNTY, WASHINGTON
Geographic Information System



● Location of Subject Property(s)

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Property Information Fact Sheet

Mailing Information:
Account No.: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666
Assessed Parcel Size: 9.26 Ac
Property Type: Multiple Property Types

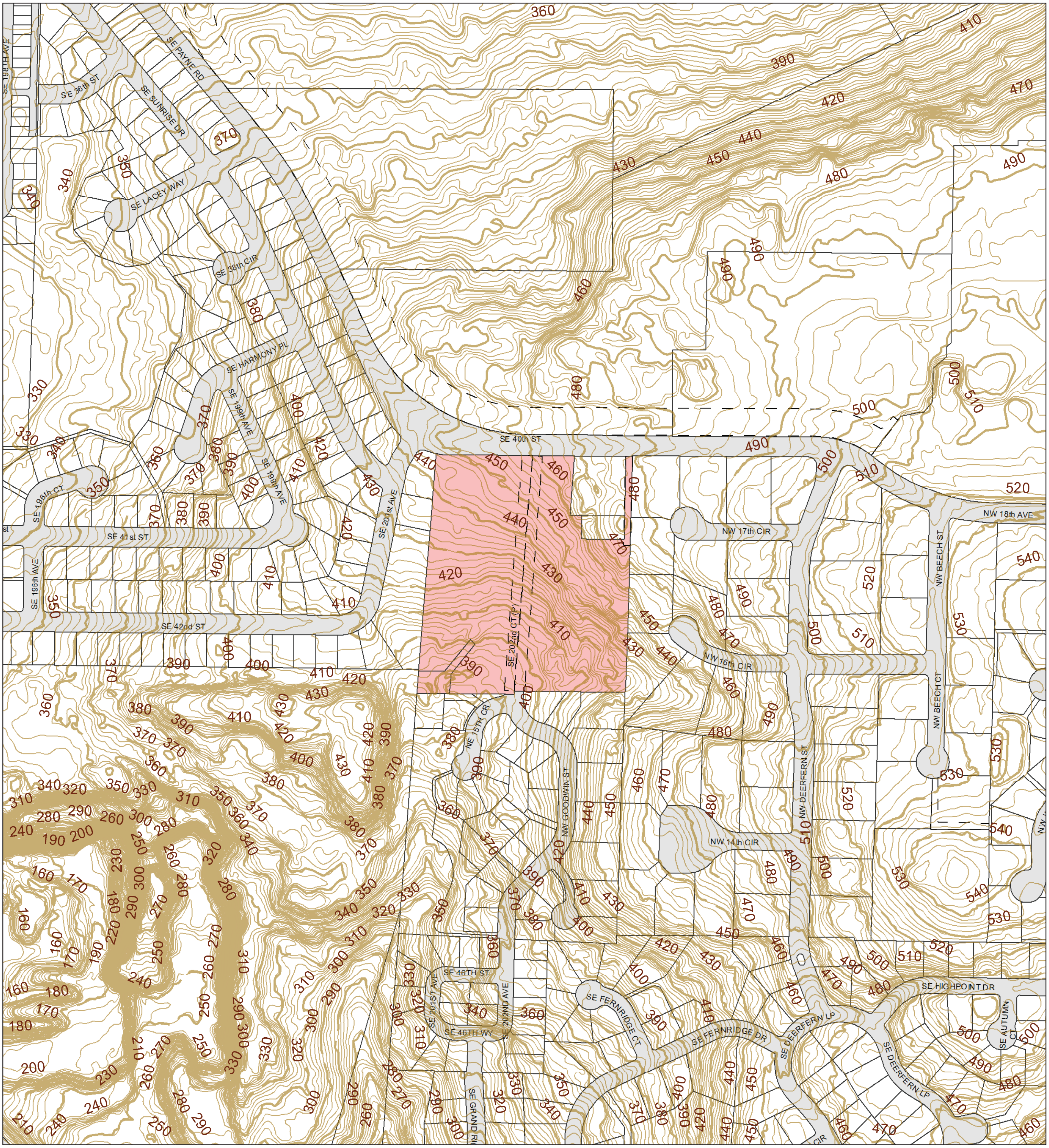
PARCEL LOCATION FINDINGS:

Quarter Section(s): NW 1/4,S08,T1N,R3E,
NE 1/4,S08,T1N,R3E
Municipal Jurisdiction: Camas
Urban Growth Area: Camas
Zoning: R-7.5
Zoning Overlay: No Mapping Indicators
Comprehensive Plan Designation: SFM
Trans. Impact Fee Area: Camas: Current,
Camas UGA: End Date Dec. 31, 2016
Park Impact Fee District: No Mapping Indicators
Neighborhood Association: No Mapping Indicators

School District: Camas
Elementary School: Prune Hill
Junior High School: Skyridge Middle
Senior High School: Camas
Fire District: Camas Washougal FD
Sewer District: Camas
Water District: Camas
Wildland: No Mapping Indicators
Trans. Analysis Zone: 396
Trans. Management Zone: 192nd_Ave_from_Brady_to_SE_1st_ST
Historic Sites: No Mapping Indicators

ENVIRONMENTAL CONSTRAINTS:

Soil Type(s): HcB, 17.8% of parcel
PoB, 29.0%
PoD, 31.6%
PoE, 21.6%
Hydric Soils: Non-Hydric, 100.0% of parcel
Flood Zone Designation: Outside Flood Area
Liquefaction Susceptibility: Bedrock
NEHRP: B
Slope: 0 - 5 percent, 4.8% of parcel
10 - 15 percent, 35.3%
15 - 25 percent, 22.6%
25 - 40 percent, 0.6%
5 - 10 percent, 36.8%
Slopes > 25% + 100 ft buffer: No Mapping Indicators
Unstable Slopes + 100 ft buffer: No Mapping Indicators
200 ft Shoreline buffer: No Mapping Indicators
Special Wellhead Protection Area: No Mapping Indicators
Habitat Conservation: Riparian Priority Habitat
Archeological Predictive: Low-Moderate, 19.6% of parcel
Moderate, 60.5%
Moderate-High, 20.0%
Archeological Site Buffers: No Mapping Indicators



CLARK COUNTY, WASHINGTON
Geographic Information System

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Feet

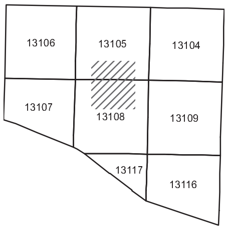
Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

Elevation Contours

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

- 🟥 Subject Property(s)
- ⬜ Public Road
- - - - Transportation or Major Utility Easement
- ━ 10' Elevation Contours
- ─ 2' Elevation Contours

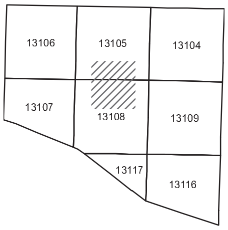
Printed on: March 26, 2018



2016 Aerial Photography

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666



Geographic Information System

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Feet

▭ Subject Property(s)

CLARK COUNTY, WASHINGTON

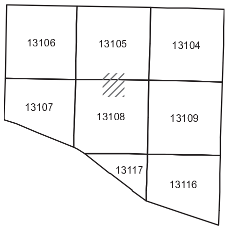
Geographic Information System

0 100 200
Feet

2016 Aerial Photography with Elevation Contours

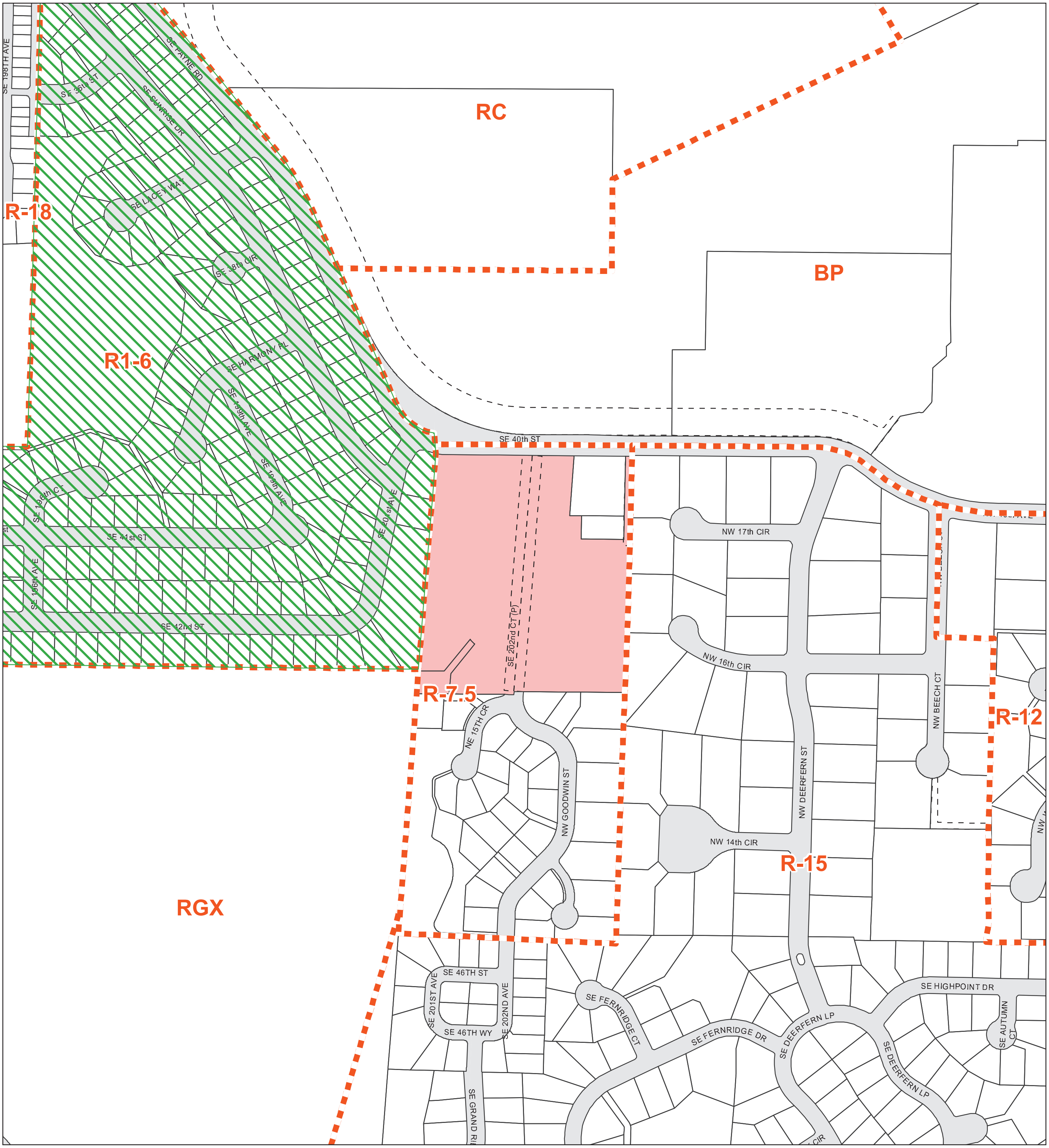
Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Printed on: March 26, 2018



▭ Subject Property(s)

— 2' Elevation Contours



CLARK COUNTY, WASHINGTON

Geographic Information System

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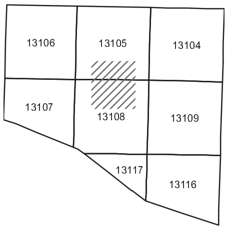
0 200 400
Feet

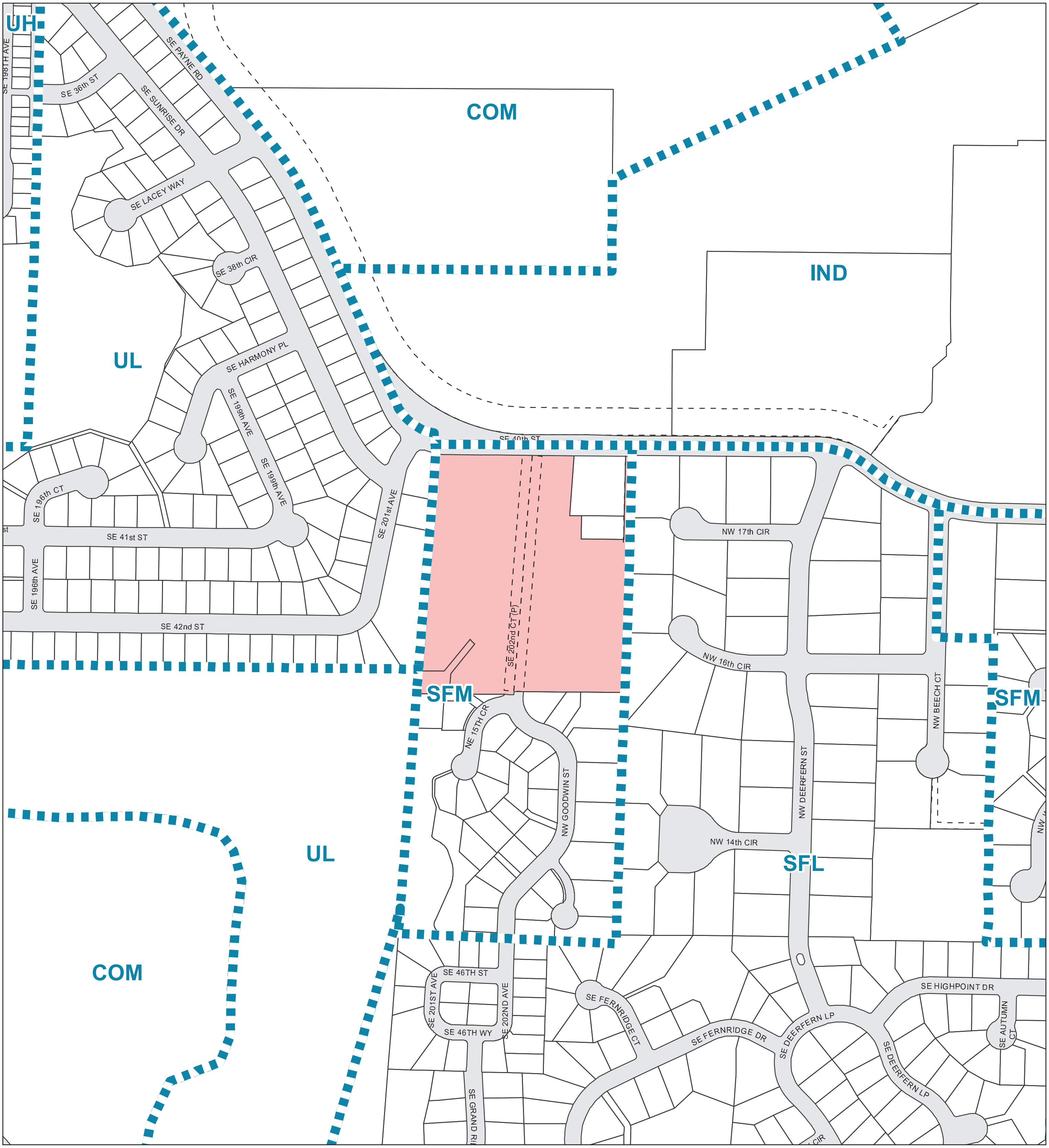
Zoning Designations

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Printed on: March 26, 2018



🟥 Subject Property(s)	▨ Urban Holding - 10 (UH-10)
⬜ Public Road	▨ Urban Holding - 20 (UH-20)
- - - Transportation or Major Utility Easement	▨ Urban Holding - 40 (UH-40)
▪▪▪ Zoning Boundary	▨ Surface Mining Overlay District



Printed on: March 26, 2018

Comprehensive Plan Designations

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Geographic Information System

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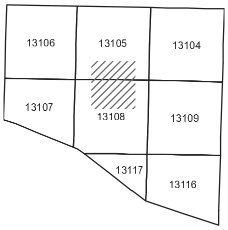
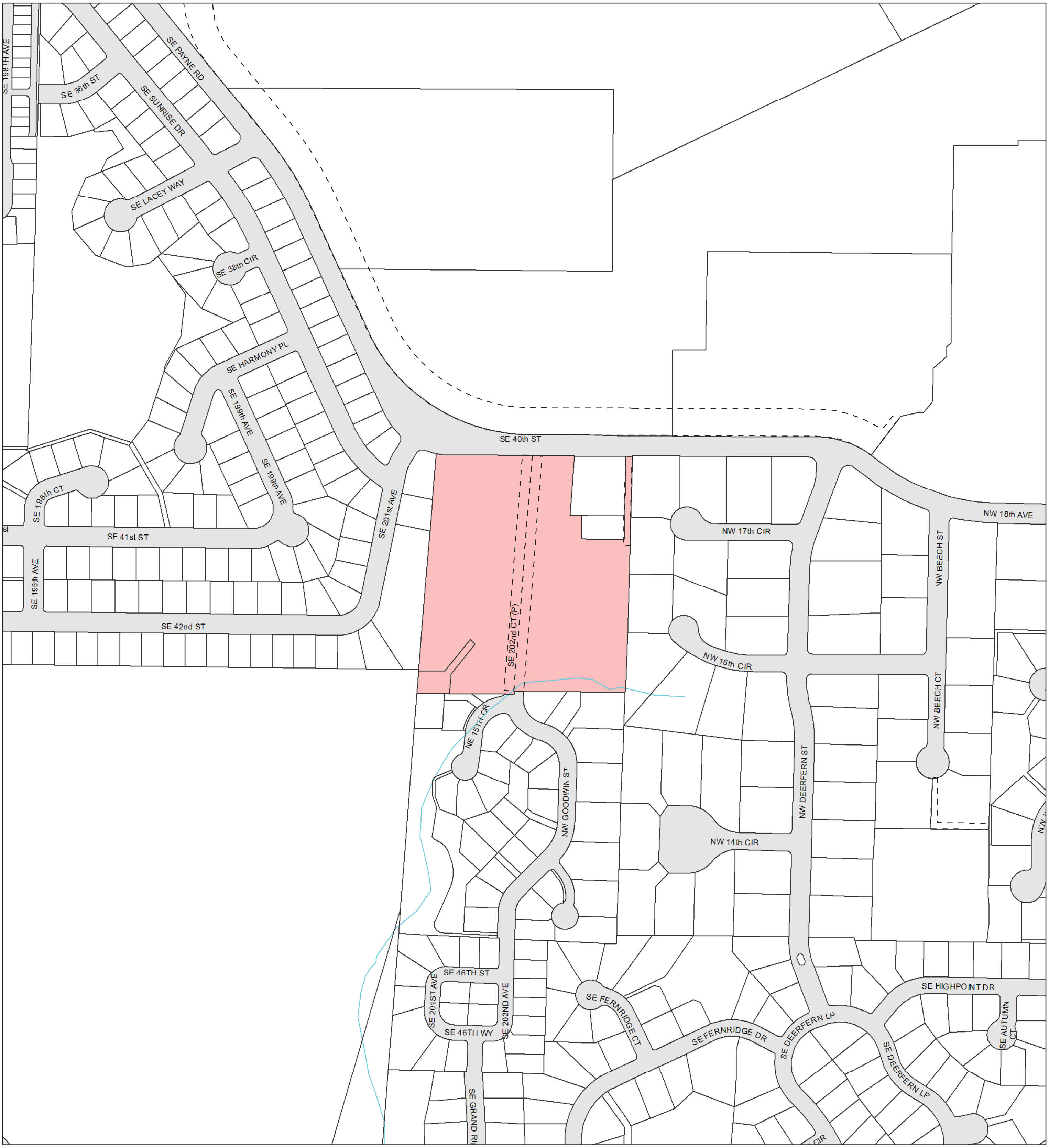
Feet



- 🟥 Subject Property(s)
- ▨ Public Road
- - - - Transportation or Major Utility Easement
- ▪▪ Comprehensive Plan Boundary
- ▨ Urban Reserve
- ▨ Industrial Reserve
- ▨ Railroad Industrial Reserve
- ▨ Mining
- ▥ Rural Center Mixed Use
- ▨ Columbia River Gorge Scenic Area



CLARK COUNTY, WASHINGTON

Geographic Information System

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Feet

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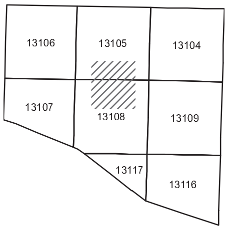
Arterials, C-Tran Bus Routes, Parks & Trails

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

🟥	Subject Property(s)	▭	Principal Arterial	▪▪▪▪	Rural Minor Collector
▭	Public Road	▭	Minor Arterial	▬	State Route
- - -	Transportation or Major Utility Easement	▭	Collector	▬	Other
🟩	Parks	▬	Rural Major Collector	❘❘❘❘❘	Proposed Arterial
-------	Trail			▬	Scenic Highway
▬ ▬ ▬	C-Tran Route				



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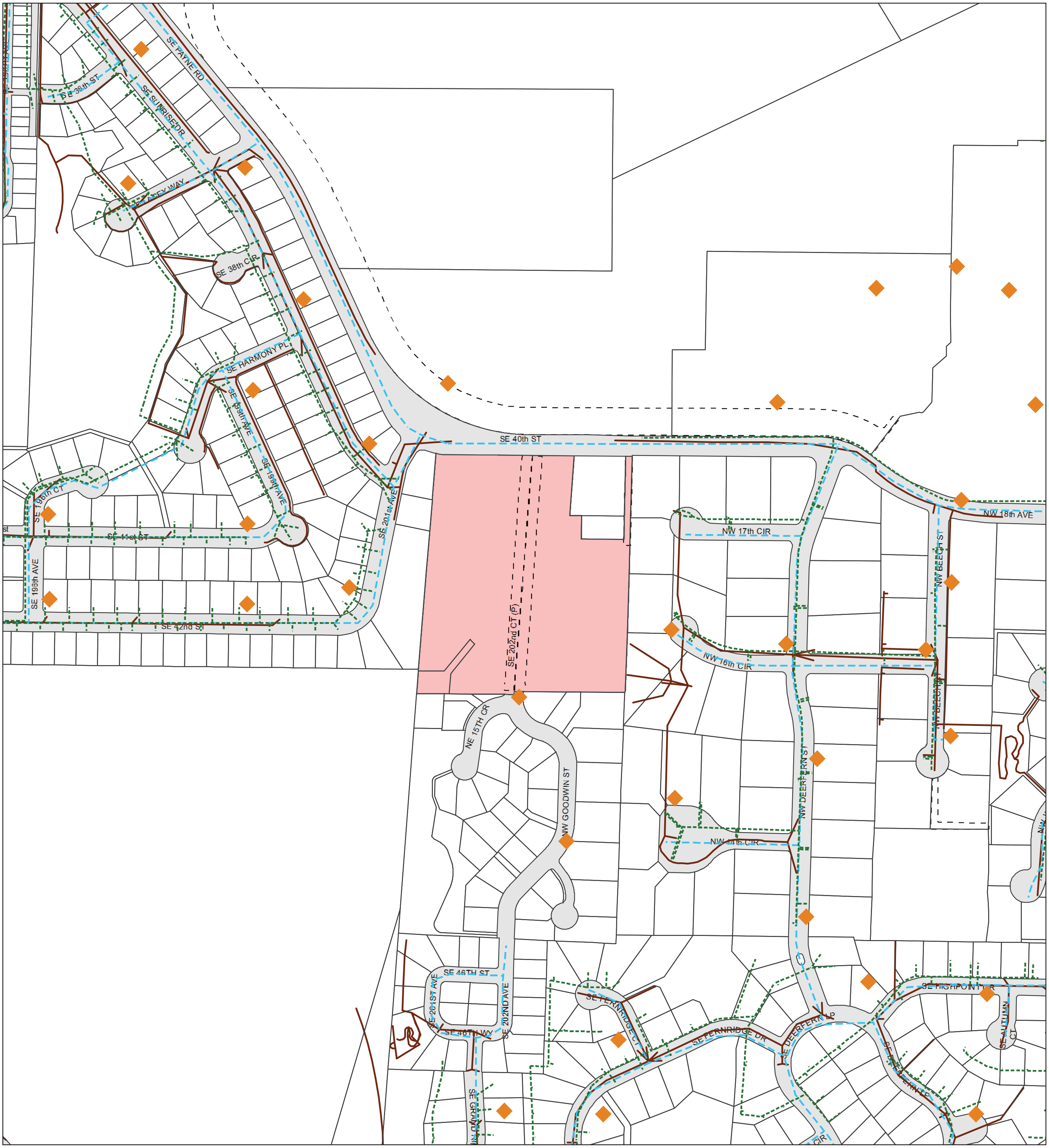

CLARK COUNTY, WASHINGTON
Geographic Information System

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Feet

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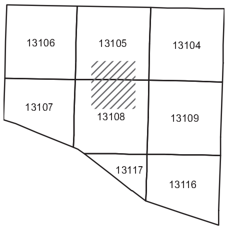
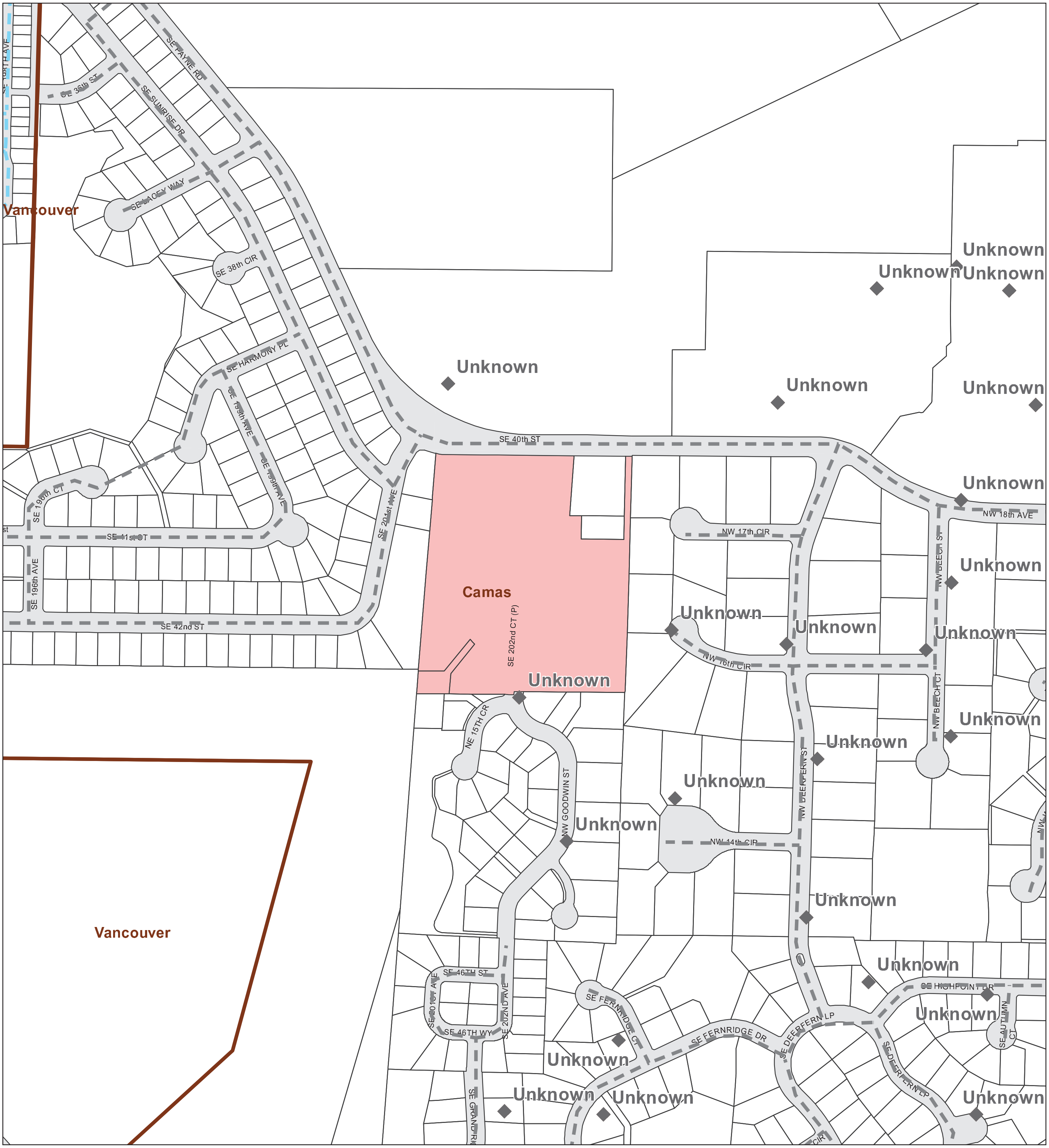
Water, Sewer, and Storm Systems

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

▨ Subject Property(s)
▨ Public Road
- - - Transportation or Major Utility Easement
- - - Water Lines
----- Sewer Lines
— Storm Water Lines
🟥 1-year Wellhead ZOC
🟧 5-year Wellhead ZOC
🟨 10-year Wellhead ZOC
◆ Hydrants





Water Systems

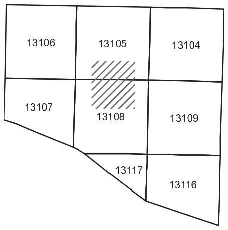
Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Geographic Information System

0 200 400
Feet

🟥 Subject Property(s)
⬜ Public Road
▭ Water District Boundary
– – Unknown Size Water Line
– – < 10" Water Line
– – 10-20" Water Line
– – > 20" Water Line
◆ No Flow Data Hydrant
◆ 0 - 499 GPM at 20 PSI
◆ 500 - 999 GPM at 20 PSI
◆ > 1000 - 1749 GPM at 20 PSI
◆ > 1750 GPM at 20 PSI
◆ Hydrant > 500' from parcel(s)



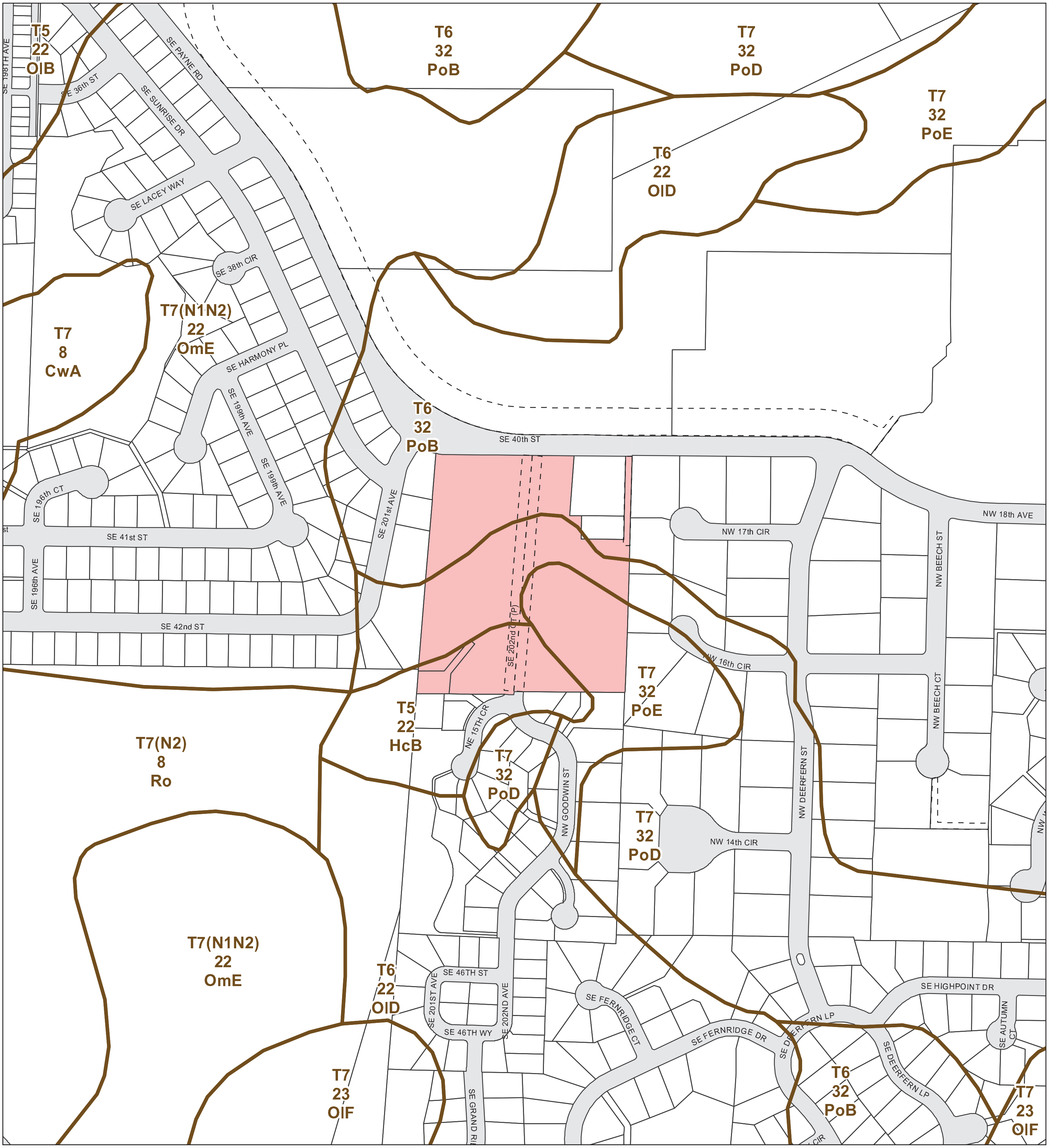
Hydrant Fire Flow Details

Account No.: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Water District(s)	Hydrant Data Update	Project Site Provider
Camas (There is currently no hydrant data for this district.)		
Vancouver	January 1, 2017	Adjacent District

HYDRANT INFORMATION:

Hydrant ID	Hydrant Owner	Main Diameter	Flow at 20 PSI	Test Date	Distance to site
Unknown	Unknown	0.0"	No Data	None	18 ft
Unknown	Unknown	0.0"	No Data	None	134 ft
Unknown	Unknown	0.0"	No Data	None	214 ft
Unknown	Unknown	0.0"	No Data	None	355 ft
Unknown	Unknown	0.0"	No Data	None	452 ft
Unknown	Unknown	0.0"	No Data	None	470 ft
Unknown	Unknown	0.0"	No Data	None	484 ft



Soil Types

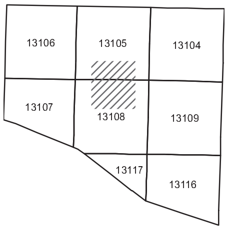
Printed on: March 26, 2018

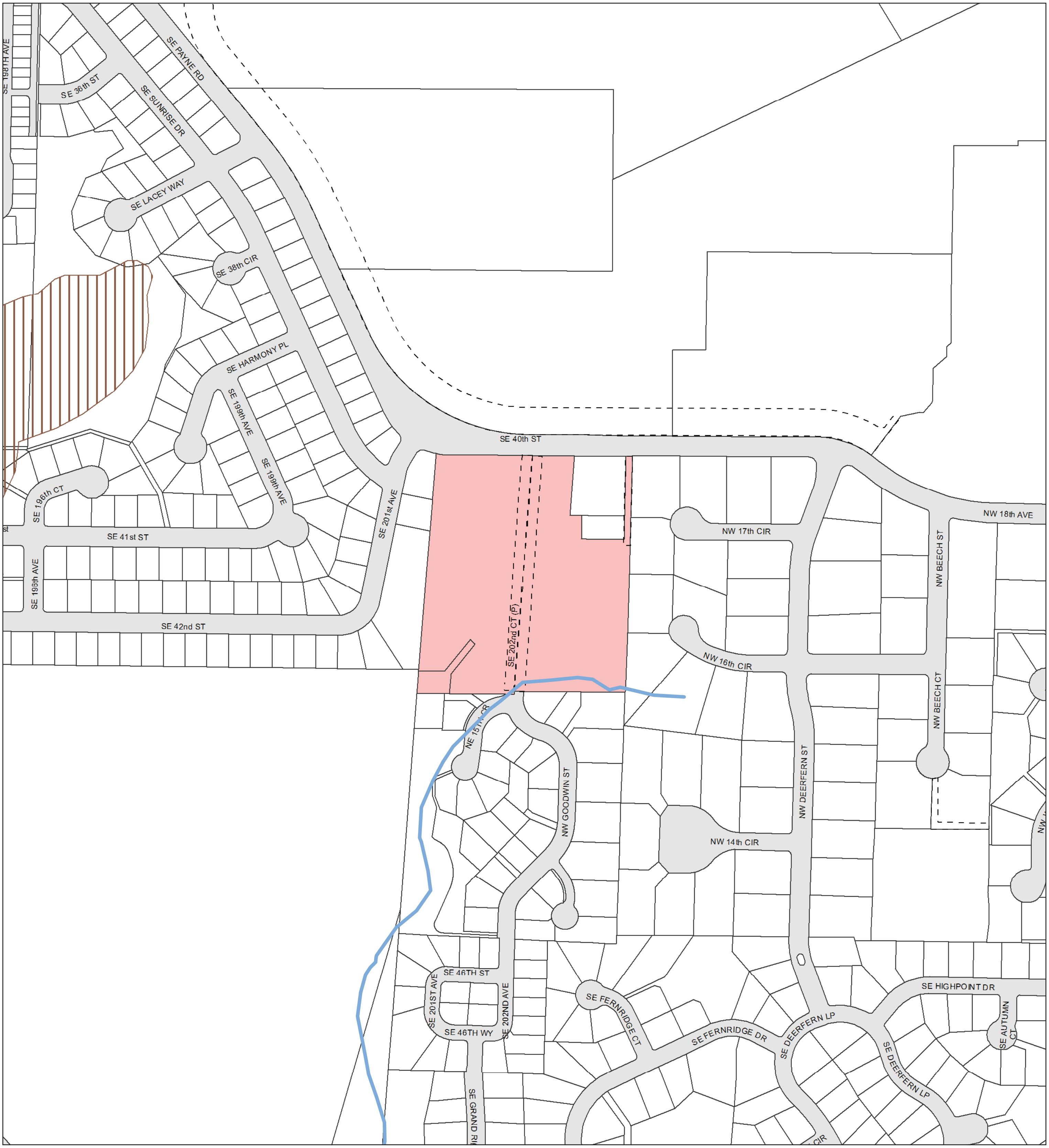
Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Clark County, Washington
Geographic Information System

0 200 400
Feet

🟥 Subject Property(s)
▨ Public Road
- - - Transportation or Major Utility Easement
▭ Soil Type Boundary





Environmental Constraints I

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

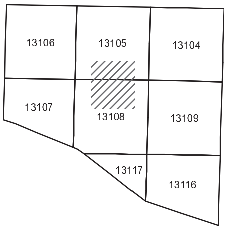
CLARK COUNTY, WASHINGTON
Geographic Information System

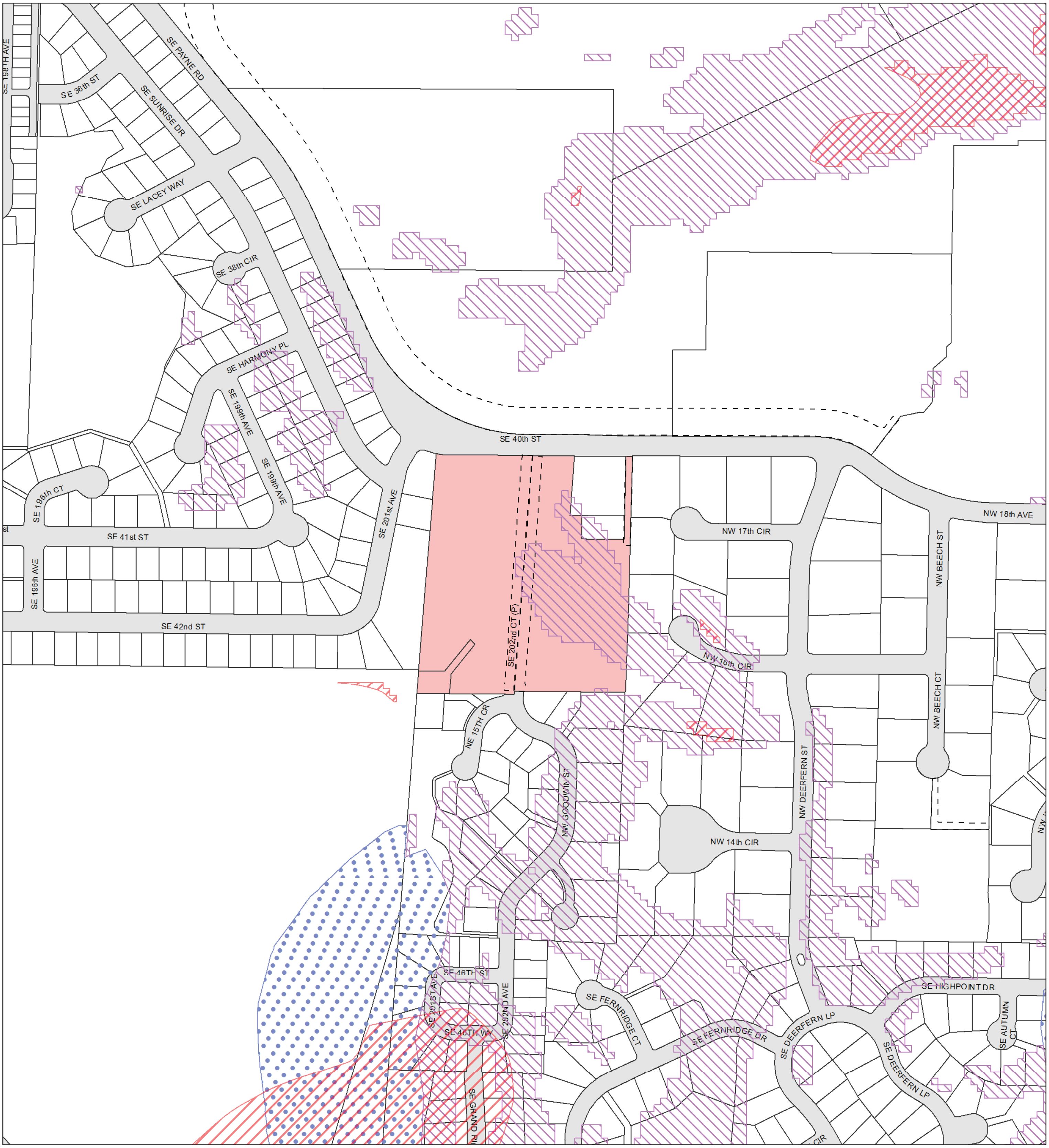
N

0 200 400
Feet

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

🟥 Subject Property(s)	▦ CARA Category 1
▭ Public Road	🟪 100 year Floodplains
- - - Transportation or Major Utility Easement	⋯ Floodway
▥ Hydric Soils	⌐¬ Shorelines
▨ Wetland Inventory	― Stream
▨ Non-Riparian Habitat or Species Area	





Environmental Constraints II

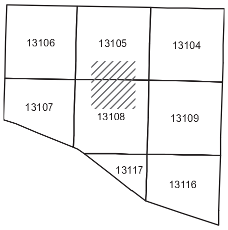
Printed on: March 26, 2018

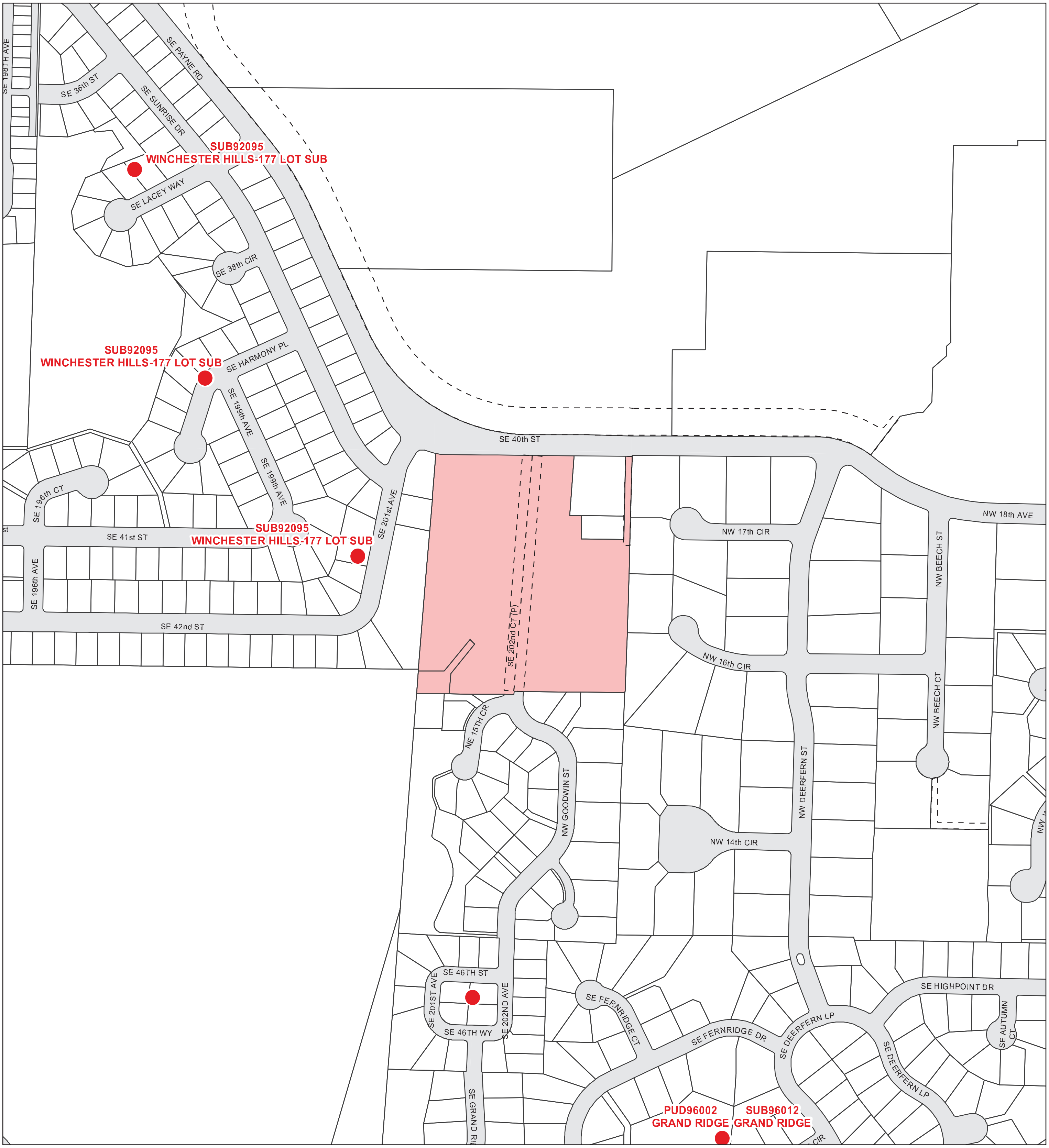
Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

Geographic Information System

0 200 400
Feet

- 🟥 Subject Property(s)
- ⬜ Public Road
- - - - Transportation or Major Utility Easement
- ▨ Slopes > 15%
- ⁘ Potentially Unstable Slope
- ⁘ Historic or Active Landslide
- ▨ Severe Erosion Hazard Areas
- ★ CCHR Historic Site
- 🟧 NRHP Historic Site
- ▲ INV Historic Site

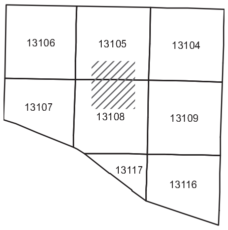




Adjacent Development

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

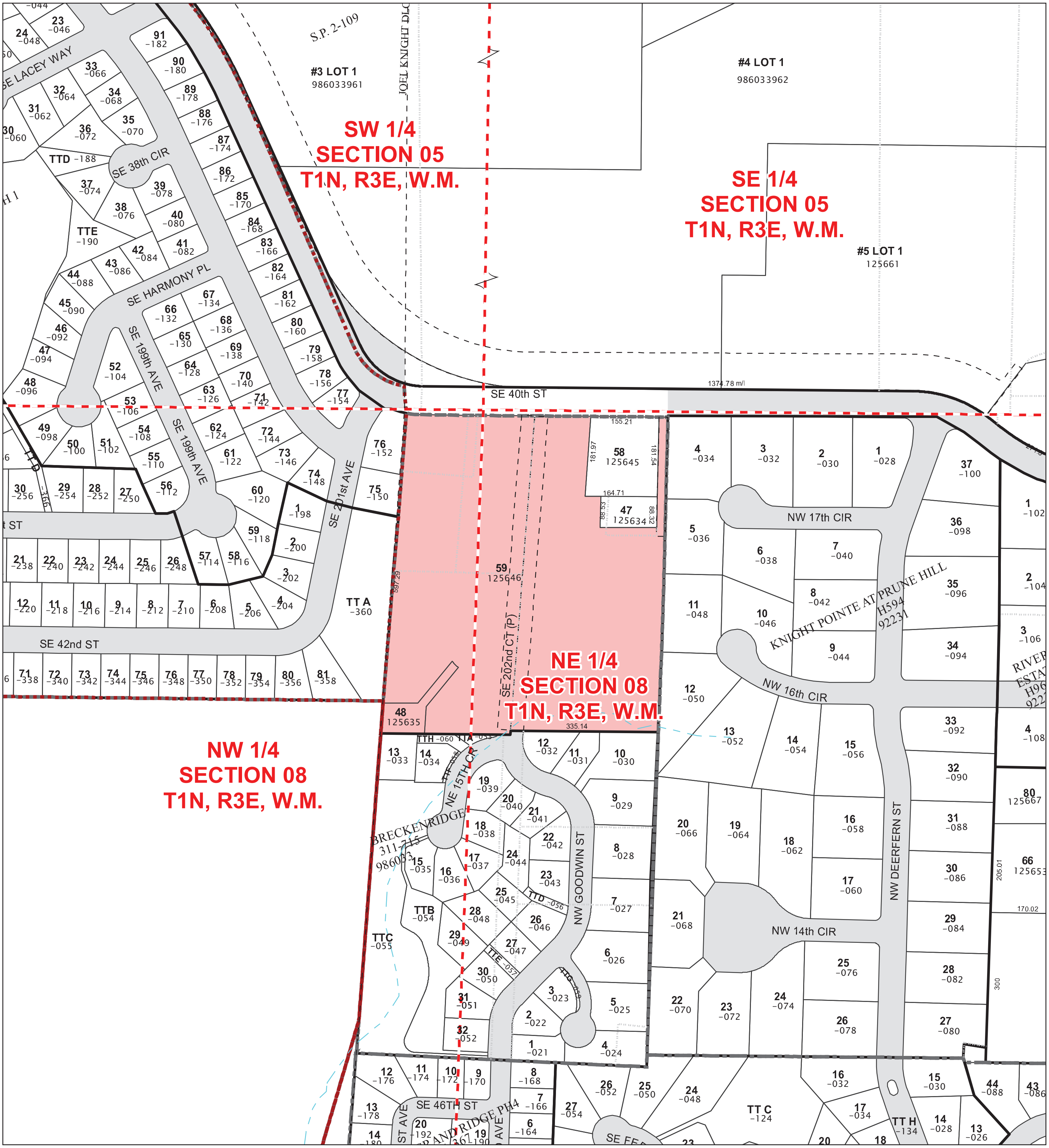


CLARK COUNTY, WASHINGTON
Geographic Information System

0 200 400
Feet

N

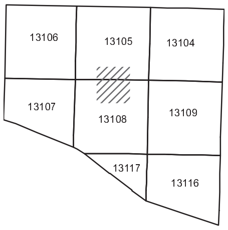
- 🟥 Subject Property(s)
- ⬜ Public Road
- - - - Transportation or Major Utility Easement
- ● Adjacent Development



Quarter Section Parcels

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666



Clark County, Washington
Geographic Information System

0 150 300
Feet

▭ Subdivision Lines	🟥 Subject Property(s)
▭ Donation Land Claim	▭ Road Right of Way - Actual Road May not Exist
▭ Section Quarters	- - - Transportation or Major Utility Easement
▭ City Boundaries	

Exhibit 6 SUB18-02

Notice of Proposed Development

Valley View Estates Subdivision

The Applicant is on file with the City of Camas for a review of a subdivision and SEPA to establish a residential subdivision. For information regarding this project contact:

Applicant Contact:
Joel Stirling
360-759-1794

City Contact:
Lauren Hollenbeck
360-817-7253

Public Hearing Schedule:

Hearing Date/Time: 10/18/18

Hearing Location: CITY HALL
5PM

Exhibit 7 SUB18-02

WAC 197-11-960 Environmental checklist.

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable: **Valley View Estates Subdivision**

2. Name of applicant: **STERLING DESIGN, INC.**
3. Address and phone number of applicant and contact person:

2208 E. Evergreen Blvd.
Vancouver, WA 98661
contact: Joel Stirling

4. Date checklist prepared: **05-17-18**
5. Agency requesting checklist: **City of Camas**
6. Proposed timing or schedule (including phasing, if applicable):

Construction in the Summer of 2019

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

No

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. **A Wetland Pre-determination was prepared for the property by Ecological Land Services, Inc. No wetlands were found on the property and no adjacent wetland buffers extend onto the property.**

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. **No.**

10. List any government approvals or permits that will be needed for your proposal, if known.

Subdivision Approval for Plat Recording and infrastructure installation construction plans will be approved by the City of Camas for the project.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

The Valley View Estates Subdivision is a proposal to subdivide approximately 9.26 acres of property zoned for residential development within the City of Camas R-7.5 zoning district. The property will be divided into a total of thirty two (36) new single family residential building lots. One (1) existing single family home will be removed during the subdivision infrastructure installation process.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The property address is 20109 SE 40th, Camas, WA 98607 and is located the NW 1/4 of Section 8, T1N., R3E

B. ENVIRONMENTAL ELEMENTS

1. **Earth**

a. General description of the site (circle one): Flat, rolling, [✓ **hilly**], steep slopes, mountainous, other ......

b. What is the steepest slope on the site (approximate percent slope)? **15%**

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland. **Soil types on site are mapped as Hesson Clay Loam (HcB) & Powell Silt Loam(s) (PoB) & (PoD). It is unknown if the property was ever used for agriculture.**

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. **Unknown. A geotechnical study has been completed on the property and development is feasible.**

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill. **The property will be graded as needed for roads, single family building sites, utility installation and stormwater management facilities. It is likely that up to 30,000 cu.yds. of earth will be graded, moved, cut and filled. All grading activities will be monitored by a geotechnical engineer licensed in the State of Washington and certified to be constructed as needed for future infrastructure installation.**

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Yes, prior to construction a grading and erosion control plan will be approved by the City of Camas and will be implemented during the construction process to limit the potential erosion on the project.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? **50%**

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Approval of a grading and erosion control plan by the City of Camas.

a. **Air**

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Construction vehicles will emit exhaust during the construction phase of the project and will likely create dust during dry periods. Following home construction the completed project will have typical single family home emissions from all 36 single family homes.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

None

3. **Water**

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

No

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

N/A

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

N/A

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No other then natural infiltration of stormwater that will occur within the yard areas of the future home sites and limited natural infiltration of stormwater within the stormwater facilities.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve. **None**

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Stormwater runoff from the single family homes and the new streets will be collected and conveyed to stormwater management facilities for both water quality and quantity control as required by the City of Camas and the Washington State Department of Ecology. Stormwater facilities have been designed utilizing the Western Washington Hydrology Manual and discharge from the facilities will flow south to the natural drainage routes. There is a seasonal drainage corridor located approximately 220 L.F. South of the project which will convey the controlled stormwater south where it eventually flows into the Columbia River.

2) Could waste materials enter ground or surface waters? If so, generally describe.

No. The proposed stormwater management facilities are designed to limit the potential for waste materials from the single-family residences and the public road surfaces to leave the property. Stormwater facilities will be maintained regularly as needed.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Stormwater management facilities will be installed with the project and maintained in perpetuity with the completed homes.

4. **Plants**

a. Check or circle types of vegetation found on the site:

——— deciduous tree: alder, maple, aspen, **other**
——— evergreen tree: **fir,** cedar, pine, other
——— **shrubs**
——— **grass**
——— **pasture**
——— crop or grain
——— wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
——— water plants: water lily, eelgrass, milfoil, other
——— other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

All existing vegetation will likely be removed during the grading and infrastructure installation processes but any existing vegetation that can be retained will be utilized for erosion control measures.

c. List threatened or endangered species known to be on or near the site.

None known

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: **None planned however existing vegetation will be left as much as possible during grading and infrastructure installation for erosion control.**

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, **songbirds**, other:
mammals: **deer**, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other:

b. List any threatened or endangered species known to be on or near the site. **None known**

c. Is the site part of a migration route? If so, explain.

It is likely that birds migrate within the vicinity of the property, as they do throughout the City of Camas region, however the site is not being utilized as a destination or nesting site for migrating birds.

d. Proposed measures to preserve or enhance wildlife, if any: **None**

6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Completed single family homes will utilize electricity and natural gas for the typical energy needs of single family homes.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

All single family homes will obtain building permits from the City of Camas prior to construction and will be designed to comply with all required energy codes.

7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe. **No. Project is for single family homes.**

1) Describe special emergency services that might be required.

None, project will only need typical emergency services required for single family homes.

2) Proposed measures to reduce or control environmental health hazards, if any:

All single family homes will be connected to City of Camas water and sanitary sewer systems.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

There are public roads that serve the proposed project which generate traffic noises. There is an adjacent property to the West that is currently being developed for single family housing. During construction of the single family homes and road infrastructure there will be noise from construction equipment.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

During construction of the project infrastructure and single family homes there will be noise from construction. Following home build out there will be typical single family home noises which include but are not limited to traffic.

3) Proposed measures to reduce or control noise impacts, if any:

None

8. **Land and shoreline use**

a. What is the current use of the site and adjacent properties? **The site currently has one (1) single-family home on it with a large area of underdeveloped property.**

b. Has the site been used for agriculture? If so, describe. **It is unknown if the property has ever been used for agriculture but it is not likely due to the slope of the property.**

c. Describe any structures on the site.

There is one (1) single family home on the property.

d. Will any structures be demolished? If so, what?

Yes, the single family home will be removed.

e. What is the current zoning classification of the site?

City of Camas zoning district R-7.5

f. What is the current comprehensive plan designation of the site?

SFM

g. If applicable, what is the current shoreline master program designation of the site?

N/A

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

No

i. Approximately how many people would reside or work in the completed project?

Thirty six (36) Single family homes will be constructed within the project. Based on the 2010 Census of the City of Camas the average household size was 2.91 therefore a total of approximately 104.76 people will reside within the completed project.

j. Approximately how many people would the completed project displace?

One (1) single family home will be destroyed as part of the project which will displace one (1) household of 2.91 people.

k. Proposed measures to avoid or reduce displacement impacts, if any: **None**

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any: **Approval through the City of Camas review and approval processes.**

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Thirty six (36) middle income homes will be constructed within the completed project.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

One (1) middle income home will be removed during the project construction.

c. Proposed measures to reduce or control housing impacts, if any: **None**

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed? **City of Camas Building Code limits structures to 35' in height**

b. What views in the immediate vicinity would be altered or obstructed? **None**

c. Proposed measures to reduce or control aesthetic impacts, if any: **None**

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur? **Street lights and vehicle lights at night along with lighting typically associated with single family uses.**

b. Could light or glare from the finished project be a safety hazard or interfere with views? **No**

EVALUATION FOR
AGENCY USE ONLY

c. What existing off-site sources of light or glare may affect your proposal? **Other single family homes & public streets.**

d. Proposed measures to reduce or control light and glare impacts, if any: **None**

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?
City of Camas public walking trails.

b. Would the proposed project displace any existing recreational uses? If so, describe.
No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any: **The project will continue a public trail through the project .**

13. **Historic and cultural preservation**

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe. **No**

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site. **None**

c. Proposed measures to reduce or control impacts, if any: **An archaeological pre-determination was completed at the property and a recommendation of "no further work needed" was sent to the Washington State Department of Archaeology and Historic Preservation (DAHP). DAHP concurred that no further work is needed at the property.**

14. **Transportation**

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.
Interstate 5, NE 192nd Avenue, SE Payne Road, SE 40th Street, SE 34th Street, SE 202nd Avenue and Brady Road all can be utilized to access the property.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop? **No. Over 500 feet away.**

c. How many parking spaces would the completed project have? How many would the project eliminate? **N/A - single family homes will provide a minimum of 2 parking spaces per single family residence.**

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private). **Yes, new public roads will be constructed within the proposed project to provide access to the new single family home sites. NW 18th Street, a public road, will also be improved with additional pavement, curb and sidewalk along the projects northern boundary.**

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe. **No, single family residential development**

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur. **The project is expected to generate 333 new daily trips, 26 new A.M. peak hour and 35 new P.M. peak hour trips.**

g. Proposed measures to reduce or control transportation impacts, if any: **Construction of new roads within the development and construction of improvements to NW 18th Street along the project northern boundary.**

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

Yes, Thirty five (35) new single family households will require additional public services.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Impact fees are assessed to the project to help offset immediate impacts on public services and long term taxes from the future home owner's will continue to support the impacts on public services.

16. **Utilities**

a. Circle utilities currently available at the site: [✓ **electricity**], [✓ **natural gas**], [✓ **water**], [✓ **refuse service**], [✓ **telephone**], [✓ **sanitary sewer**], septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed. **City of Camas Public Sanitary Sewer and Water will be extended to each new single family home for service, NW Natural Gas will provide natural gas, Clark Public Utilities will provide electricity and franchise utilities will be provided as available within the area.**

C. SIGNATURE

Under the penalty of perjury, the above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: ....

Name of signee: Joel G. Stirling, PE

Position and Agency/Organization: Owner & Lead Professional Engineer/**STERLING DESIGN, INC.**

Date Submitted: 06/24/2018

TO BE COMPLETED BY APPLICANT

EVALUATION FOR
AGENCY USE ONLY

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

Proposed measures to avoid or reduce such increases are:

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

3. How would the proposal be likely to deplete energy or natural resources?

Proposed measures to protect or conserve energy and natural resources are:

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

Proposed measures to protect such resources or to avoid or reduce impacts are:

TO BE COMPLETED BY APPLICANT

EVALUATION FOR
AGENCY USE ONLY

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

Proposed measures to avoid or reduce shoreline and land use impacts are:

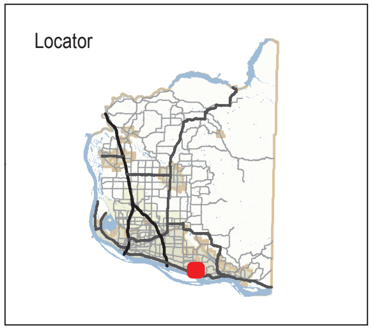
6. How would the proposal be likely to increase demands on transportation or public services and utilities?

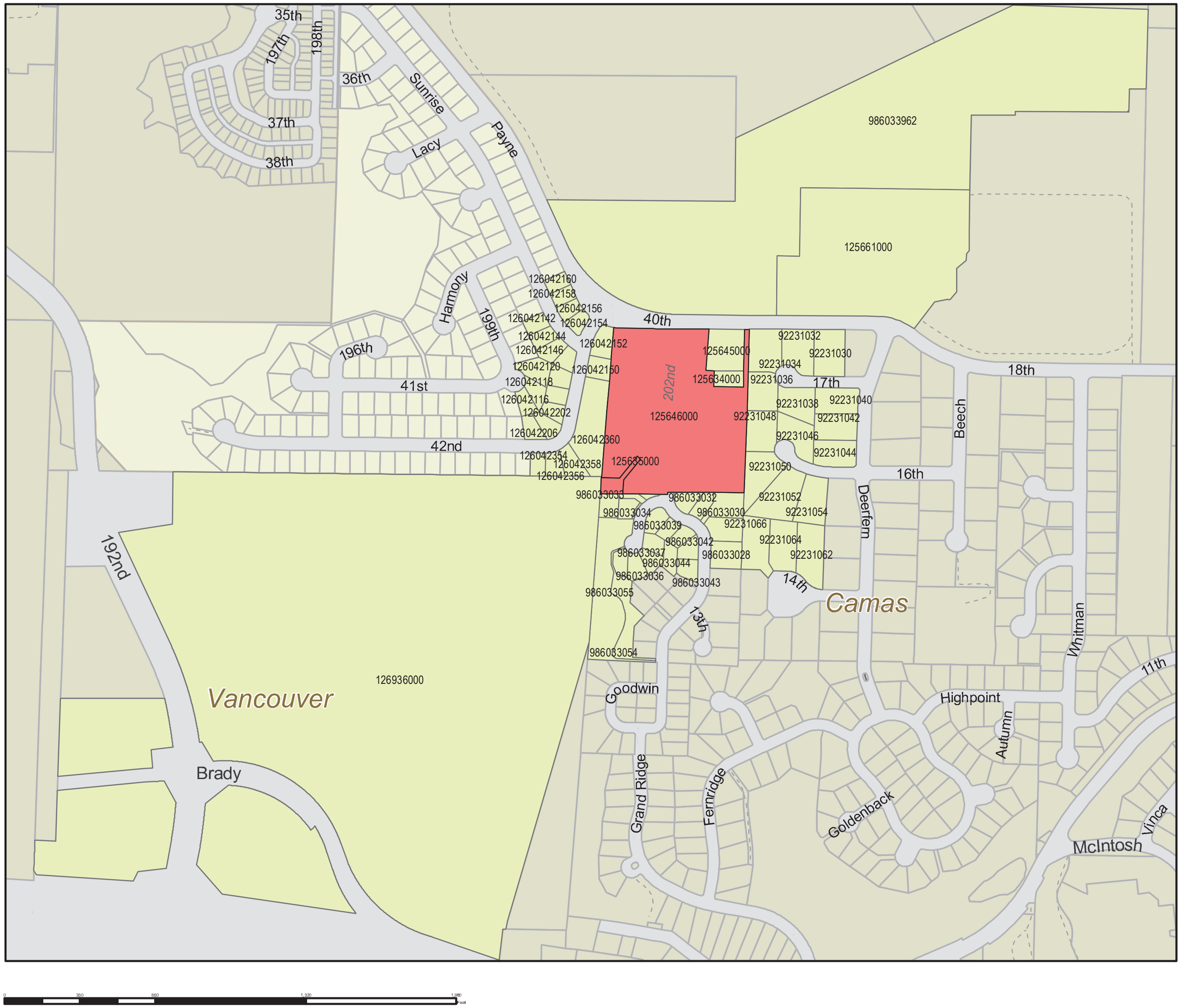
Proposed measures to reduce or respond to such demand(s) are:

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

Exhibit 8 SUB18-02

PID(s): 125635000,125646000 , 300 Foot Buffer





Legend

🟥 Subject Property

🟩 Buffer Selection

☐ Parcels

🟦 Water Body

🟫 Incorporated

🟨 Urban Growth Area

☐ Unincorporated

Scale: 1:8,262

NOTE: This data is compiled from many sources and scales. Clark county makes this information available as a service, and accepts no responsibility for any inaccuracy, actual or implied.

GIS Order Number: 196987

Printed: 3/26/2018

Path: c:\usr_proj\xxOrdID196987_751054\xx_114870\MailingListPacket.mxd

Owner Name	Mailing Address
AHSAN MUHAMMAD & AHSAN FAIZA	2424 NW IRIS CT, CAMAS, WA, 98607
ANDERSON MICHAEL B	20011 SE 42ND ST, CAMAS, WA, 98607
BAZZAZ ALA & BAZZAZ FATMA	20017 SE 42ND ST, CAMAS, WA, 98607
CAMAS SCHOOL DISTRICT #117	841 NE 22ND AVE, CAMAS, WA, 98607
CARLSMITH DAVID SUTTON & SAULNIER VIRGINIE JEANNE	5415 NW 15TH CIR, CAMAS, WA, 98607
CHERNICHENKO VIKTOR & CHERNICHENKO VERA	4008 SE SUNRISE DRIVE, CAMAS, WA, 98607
COLUMBIA PALISADES CORP	2154 NE BROADWAY STE 200, PORTLAND, OR, 97232
COPELAND KERRY & COPELAND JACQUELINE	4039 SE 199TH AVE, CAMAS, WA, 98607
CRUZ AMOR DELA & CRUZ JOHANN	1425 NW GOODWIN ST, CAMAS, WA, 98607
DEAN NATHAN DANIEL	4001 SE SUNRISE DR, CAMAS, WA, 98607
DITTIRCH KENNETH C & DITTIRCH CAROLE	5144 NW 16TH CIR, CAMAS, WA, 98607
ELLIS JASON DANIEL & ELLIS JULIE JENNIFER	5360 NW 18TH AVE, CAMAS, WA, 98607
FEIK JOHN & FEIK MARILYN	5201 NW 17TH CIR, CAMAS, WA, 98607
FIRESTONE STAN	PO BOX 61928, VANCOUVER, WA, 98666
FISHER JARED S	20002 SE 42ND ST, CAMAS, WA, 98607
FUJIHARA PATRICIA SARAI KAIULANI & FUJIHARA BROOKS JR	5450 NW 15TH CR, CAMAS, WA, 98607
GIL KEVIN J & GIL TARA L	5215 NW 16TH CIR, CAMAS, WA, 98607
GONZALEX MIGUEL ANGEL & TRUJILLO MELINDA ELIZABETH	4005 SE SUNRISE DR, CAMAS, WA, 98607
GOOD DONALD E	4025 SE 201ST AVE, CAMAS, WA, 98607
GREAVES WESLEY C & GREAVES CYNTHIA L	1424 NW GOODWIN ST, CAMAS, WA, 98607
GREEN GAIL TRUSTEE	2927 SE VILLAGE LP #314, VANCOUVER, WA, 98683
GRIFFITH BRIAN PAUL & GRIFFITH SHELLY ANNE	4037 SE 199TH AVE, CAMAS, WA, 98607
HAMADEH SHAFIQ & HAMADEH ZHANNA	1319 NW GOODWIN ST, CAMAS, WA, 98607
HELMS JANET	124 CAMBRIA WALK, ALEXANDRIA, VA, 22304
HYLAND CURTIS S & HYLAND BRANDI F	5411 NE 15TH CIR, CAMAS, WA, 98607
JACKSON RICHARD T & JACKSON CHERYL ANN	1430 NW GOODWIN ST, CAMAS, WA, 98607
JAMISON WILLIAM C	4009 SE SUNRISE DR, CAMAS, WA, 98607
JOHNSON KRISTI L	4016 SE SUNRISE DR, CAMAS, WA, 98607
KLEINMAN GRETCHEN H	5213 NW 17TH CIR, CAMAS, WA, 98607
KOTKA GREGORY L & KOTKA JULIA M	1324 NW GOODWIN ST, CAMAS, WA, 98607
LARSON DAVID & LARSON GAIL	4120 SE 201ST AVE, CAMAS, WA, 98607
LENNAR NORTHWEST INC	11807 NE 99TH ST SUITE #1170, VANCOUVER, WA, 98682
MASONER JOHN W	4035 SE 199TH AVE, CAMAS, WA, 98607
MCCALLUM SEAN P TRUSTEE	5121 NW 17TH CIR, CAMAS, WA, 98607
MCCONNELL MARK & MCCONNELL JOEL	5440 NW 15TH CIR, CAMAS, WA, 98607
MIAN AFNAN A	4024 SE SUNRISE DR, CAMAS, WA, 98607
PIEN GENE C & PIFER-PIEN LESLIE TRUSTEES	5206 NW 16TH CIR, CAMAS, WA, 98607
PILEGGI SANTINA & PILEGGI NATHANIEL	1415 NW GOODWIN ST, CAMAS, WA, 98607
PULLEN REBECCA G	4015 SE SUNRISE DR, CAMAS, WA, 98607
PUSHKARIC SCOTT & PUSHKARIC STEPHANIE	5430 NW 15th Cir, Camas, WA, 98607
RADY DORIAN & RADY MARIE	1312 NW GOODWIN ST, CAMAS, WA, 98607
RALSTON RICHARD ANTHONY & GODFREY KELLY MARIE	5420 NW 15TH CIR, CAMAS, WA, 98607
ROSEBRAUGH FRED E & ROSEBRAUGH MARILYN	1601 NW DEERFERN ST, CAMAS, WA, 98607
SAARINEN SEPPO & SAARINEN EVA TRUSTEES	5215 NW 14TH CIRCLE, CAMAS, WA, 98607
SALTI OSAMA & ALYA SIREEN ABU	1325 NW GOODWIN ST, CAMAS, WA, 98607
SHIRA ERIC & SHIRA SHAYE	1416 NW GOODWIN ST, CAMAS, WA, 98607
SIKKEMA MARK EDWARD & SIKKEMA LISA MARIE	5120 NW 17TH CIR, CAMAS, WA, 98607
SMITH SANDRA J	4106 SE 201ST AVE, CAMAS, WA, 98607
THIEMAN LARRY & THIEMAN ARLENE ETAL	5216 NW 17TH CIR, CAMAS, WA, 98607
TSAI JAMES WEN & TSAI RINA HENDRAWAN	1421 NW GOODWIN ST, CAMAS, WA, 98607
WALES KAREN A & WALES BILLY R	1420 NW GOODWIN ST, CAMAS, WA, 98607
WILCOX AARON S & WILCOX AUBREY L	5209 NW 14TH CIR, CAMAS, WA, 98607
WINCHESTER HILLS HOMEOWNERS	16320 NE 77TH CIR, VANCOUVER, WA, 98682
WONG BENTAL H & WONG REBEKAH A	5204 NW 17TH CIR, CAMAS, WA, 98607

Owner Name	Mailing Address
WOODWARD JOHN R & YEE ELAINE M	5354 NW 18TH AVE, CAMAS, WA, 98607
WRIGHT MICHAEL B & MOORE-WRIGHT ASHLEY	5230 NW 16TH CIR, CAMAS, WA, 98607
YABLONSKIY VASILIY & YABLONSKIYA LYUDMILA	703 SE 201ST AVE, CAMAS, WA, 98607
YAN MAN PUI & YAN SUET HA ETAL	4112 SE 201ST AVE, CAMAS, WA, 98607
YING RICHARD & YING GLORIA	1635 NW DEERFERN ST, CAMAS, WA, 98607
YOUNG DAWNRAY H & YOUNG KITTY M	5220 NW 16TH CIR, CAMAS, WA, 98607
ZATTA SANDRA L	3839 LAKE KATIE WAY, SACRAMENTO, CA, 95834

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Employee Signature

Employee Name Bob Pool

AHSAN MUHAMMAD & AHSAN FAIZA
2424 NW IRIS CT
CAMAS, WA 98607

ANDERSON MICHAEL B
20011 SE 42ND ST
CAMAS, WA 98607

BAZZAZ ALA & BAZZAZ FATMA
20017 SE 42ND ST
CAMAS, WA 98607

CAMAS SCHOOL DISTRICT #117
841 NE 22ND AVE
CAMAS, WA 98607

CARLSMITH DAVID SUTTON & SAULNIER
5415 NW 15TH CIR
CAMAS, WA 98607

CHERNICHENKO VIKTOR & CHERNICHENKO
4008 SE SUNRISE DRIVE
CAMAS, WA 98607

COLUMBIA PALISADES CORP
2154 NE BROADWAY STE 200
PORTLAND, OR 97232

COPELAND KERRY & COPELAND JACQUELINE
4039 SE 199TH AVE
CAMAS, WA 98607

CRUZ AMOR DELA & CRUZ JOHANN
1425 NW GOODWIN ST
CAMAS, WA 98607

DEAN NATHAN DANIEL
4001 SE SUNRISE DR
CAMAS, WA 98607

DITTIRCH KENNETH C & DITTIRCH CAROLE
5144 NW 16TH CIR
CAMAS, WA 98607

ELLIS JASON DANIEL & ELLIS JULIE JENNIFER
5360 NW 18TH AVE
CAMAS, WA 98607

FEIK JOHN & FEIK MARILYN
5201 NW 17TH CIR
CAMAS, WA 98607

FIRESTONE STAN
PO BOX 61928
VANCOUVER, WA 98666

FISHER JARED S
20002 SE 42ND ST
CAMAS, WA 98607

FUJIHARA PATRICIA SARAI KAIULANI &
5450 NW 15TH CR
CAMAS, WA 98607

GIL KEVIN J & GIL TARA L
5215 NW 16TH CIR
CAMAS, WA 98607

GONZALEX MIGUEL ANGEL & TRUJILLO
4005 SE SUNRISE DR
CAMAS, WA 98607

GOOD DONALD E
4025 SE 201ST AVE
CAMAS, WA 98607

GREAVES WESLEY C & GREAVES CYNTHIA L
1424 NW GOODWIN ST
CAMAS, WA 98607

GREEN GAIL TRUSTEE
2927 SE VILLAGE LP #314
VANCOUVER, WA 98683

GRIFFITH BRIAN PAUL & GRIFFITH SHELLY
4037 SE 199TH AVE
CAMAS, WA 98607

HAMADEH SHAFIQ & HAMADEH ZHANNA
1319 NW GOODWIN ST
CAMAS, WA 98607

HELMS JANET
124 CAMBRIA WALK
ALEXANDRIA, VA 22304

HYLAND CURTIS S & HYLAND BRANDI F
5411 NE 15TH CIR
CAMAS, WA 98607

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CAMAS, WA 98607

JAMISON WILLIAM C
4009 SE SUNRISE DR
CAMAS, WA 98607

JOHNSON KRISTI L
4016 SE SUNRISE DR
CAMAS, WA 98607

KLEINMAN GRETCHEN H
5213 NW 17TH CIR
CAMAS, WA 98607

KOTKA GREGORY L & KOTKA JULIA M
1324 NW GOODWIN ST
CAMAS, WA 98607

LARSON DAVID & LARSON GAIL
4120 SE 201ST AVE
CAMAS, WA 98607

LENNAR NORTHWEST INC
11807 NE 99TH ST SUITE #1170
VANCOUVER, WA 98682

MASONER JOHN W
4035 SE 199TH AVE
CAMAS, WA 98607

MCCALLUM SEAN P TRUSTEE
5121 NW 17TH CIR
CAMAS, WA 98607

MCCONNELL MARK & MCCONNELL JOEL
5440 NW 15TH CIR
CAMAS, WA 98607

MIAN AFNAN A
4024 SE SUNRISE DR
CAMAS, WA 98607

PIEN GENE C & PIFER-PIEN LESLIE TRUSTEES
5206 NW 16TH CIR
CAMAS, WA 98607

PILEGGI SANTINA & PILEGGI NATHANIEL
1415 NW GOODWIN ST
CAMAS, WA 98607

PULLEN REBECCA G
4015 SE SUNRISE DR
CAMAS, WA 98607

PUSHKARIC SCOTT & PUSHKARIC STEPHANIE
5430 NW 15th Cir
Camas, WA 98607

RADY DORIAN & RADY MARIE
1312 NW GOODWIN ST
CAMAS, WA 98607

RALSTON RICHARD ANTHONY & GODFREY
5420 NW 15TH CIR
CAMAS, WA 98607

ROSEBRAUGH FRED E & ROSEBRAUGH
1601 NW DEERFERN ST
CAMAS, WA 98607

SAARINEN SEPPO & SAARINEN EVA TRUSTEES
5215 NW 14TH CIRCLE
CAMAS, WA 98607

SALTI OSAMA & ALYA SIREEN ABU
1325 NW GOODWIN ST
CAMAS, WA 98607

SHIRA ERIC & SHIRA SHAYE
1416 NW GOODWIN ST
CAMAS, WA 98607

SIKKEMA MARK EDWARD & SIKKEMA LISA
5120 NW 17TH CIR
CAMAS, WA 98607

SMITH SANDRA J
4106 SE 201ST AVE
CAMAS, WA 98607

THIEMAN LARRY & THIEMAN ARLENE ETAL
5216 NW 17TH CIR
CAMAS, WA 98607

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ZATTA SANDRA L
3839 LAKE KATIE WAY
SACRAMENTO, CA 95834

Exhibit 9 SUB18-02

Pre-Application Meeting
Valley View Estates Subdivision
20109 SE 40th Street
#125646-000 & 125635-000
File PA18-09

Thursday, January 18, 2018
3:30pm, Council Chambers
616 NE Fourth Avenue, Camas, WA 98607

Applicant / Contact:	**Applicant**: Sterling Design, Inc. Joel Stirling 2208 E Evergreen Blvd Vancouver WA 98661 Ph: (360)759-1794 Email: joel@sterling-design.biz	**Contact:** Same
Representing City of Camas:	Lauren Hollenbeck, Senior Planner Randy Miller, Fire Marshal Norm Wurzer, Engineer I Bob Cunningham, Building Official	
Location:	20109 SE 40th Street Tax Account: 125646-000 and 125635-000	
Zoning:	R-7.5	
Project Description:	Applicant is proposing to subdivide 9.26 acres into 36 single family residential lots within the R-7.5 zone.	

NOTICE: Notwithstanding any representation by City staff at a pre-application conference, staff is not authorized to waive any requirement of the City Code. Any omission or failure by staff to recite to an applicant all relevant applicable code requirements shall not constitute a waiver by the City of any standard or requirement. [CMC 18.55.060 (C)] This pre-application conference shall be valid for a period of 180 days from the date it is held. If no application is filed within 180 days of the conference or meeting, the applicant must schedule and attend another conference before the City will accept a permit application. [CMC 18.55.060 (D)] Any changes to the code or other applicable laws, which take effect between the pre-application conference and submittal of an application, shall be applicable. [CMC 18.55.060 (D)]. **A link to the Camas Municipal Code (CMC) can be found on the City of Camas website, http://www.cityofcamas.us/ on the main page under "Business and Development".**

PLANNING DIVISION LAUREN HOLLENBECK (360) 817-7253

An application for a subdivision is considered a Type III permit. Applicable codes for preliminary plat development include Title 16 Environment, Title 17 Land Development, and Title 18 Zoning of the Camas Municipal Code ("CMC"), which can be found on the city website. Please note it remains the applicant's responsibility to review the CMC and address all applicable provisions. The following pre-application notes are based on the application materials and site plan submitted to the City on December 22, 2017:

Application Requirements

Your proposal will need to comply with the general application requirements per **CMC Section 18.55.110** in addition to the specific application requirements outlined in **CMC Section 17.11.030.B** for a preliminary subdivision plat. The following is an excerpt from the requirements of CMC Section17.11.030.B (see code section for full text):

1. A completed city application form(s) and required fee(s);

Fees will be based on the adopted fees at the time of application submittal. The current fees include the following:

1.	Preliminary Plat	$6,400+$225 per lot
2.	SEPA	$721.00
3.	Critical Areas Review	$690.00 (per type)
4.	Archeological Review	$122.00
5.	Fire Department Review	$314.00
6.	Building Permit and Plan Review	based on the valuation of the project
7.	Engineering Review	3% of estimated construction costs

2. A completed and signed SEPA checklist;
3. Complete applications for other required land use proposals applicable to the proposal;
4. A vicinity map showing location of the site;
5. A survey of existing significant trees as required under CMC Section 18.31.080;
6. All existing conditions shall be delineated on the site plan;
7. A preliminary grading plan as slopes are greater than ten percent;
8. Preliminary stormwater plan and report;
9. A geotechnical report consistent with CMC Chapter 16.59 as development is proposed on slopes greater than ten percent
10. A copy of the Clark County assessor's map which show the location of each property within 300 feet of the subdivision;
11. One set of mailing labels for all property owners as provided in CMC Section 18.55.110;
12. A traffic study
13. A narrative addressing ownership and maintenance of open spaces, stormwater facilities, public trails and critical areas, and the applicable approval criteria (CMC Section 17.11.030.D) and standards of the Camas Municipal Code. It should also address any proposed building conditions or restrictions.
14. A development sign must be posted on site per CMC Section 18.55.110.H (1-5).
15. Necessary drawings- three sets and an electronic copy (send as a PDF by email or on a disc). All documents and reports submitted as separate pdf copies.

Preliminary Plat Review

The following comments are based on the site plan materials submitted with this Pre Application:

1. Density Transfer is acceptable if the T-24 trail is set aside in a tract per CMC 18.09.060.C.
2. Lots 1 and 4 are double frontage lots and shall comply with CMC 17.19.030.D.6 (a-c). Also refer to CMC Figure 17.19-1.
3. Per CMC 17.19.030.D.3, the 40x40 building envelopes should be shown on the plat. Lot 9 may not meet the 60-foot wide lot width as the front of the building envelope is measured at lot width.
4. Per CMC 18.09.040 Table 2, the minimum lot frontage on a curve shall be 30-feet. Verify if Lot 12 meets this requirement.
5. Lots 22-26 and lots 34-36 exceed the maximum lot size requirement of 9,000 square feet and should be revised.
6. Per CMC 17.19.040.B.1.c, if the average lot size is less than 7,500 square feet, one additional off-street parking space is required for every 5 units and shall be located within a common tract.

7. Per CMC 17.19.040.B.10.a, a Circulation plan is required at application that includes the subject site and properties within six hundred feet showing topography, critical areas and existing and proposed streets, trails, etc.
8. There is likelihood that retaining walls will be necessary as part of this development. Include the location and height of the retaining walls on the grading plan. Also, the elevation plans with an overlay of lot layout should be included with the submittal.

Trails

The applicant shall include provisions for the T-21 trail consistent with the current City of Camas Parks, Recreation and Open Space plan. Do not remove significant trees for the location of T-21 trail. Approval is required with the Parks Ad Hoc Committee; contact Jerry Acheson with the Parks Department at 834-7092 to schedule a meeting.

Tree retention

Per CMC Section 18.31.080, a tree survey is required for development; not for lands to be retained as undeveloped open space. CMC 18.31.080.B requires preservation of significant trees and integrate them into the land use design per CMC 17.19.030.A.2. Significant trees are defined as evergreen trees 8" dbh, and deciduous, other than red alder or cottonwood, 12" dbh. In addition to the tree survey, an arborist report prepared by a qualified biologist shall also be submitted.

SEPA

Your proposal is not categorically exempt from the requirements of the State Environmental Policy Act (SEPA) per CMC Section 16.07.020.A.1 as the proposed subdivision is more than ten residential units.

Critical Areas Review

Per city mapping and Clark County GIS, steep slopes and streams are identified within the property. Further, wetlands have been identified with the Breckenridge development to the south. Per CMC Section 16.51.130, a critical areas report prepared by a qualified professional is required if a proposed development is within or adjacent to a critical area. The general requirements for a critical areas report is found in CMC Section 16.51.140. The City's code contains additional requirements for each type of critical area:

1) Wetlands are addressed in CMC Section 16.53.030. If impacts to critical areas (or wetland) are anticipated, then an analysis of alternative designs must be included as a demonstration of the effort to avoid impacts per CMC Section 16.53.050.D.
2) Geologically Hazardous Areas are addressed in CMC Section 16.59.060 and 16.59.070. Based on the steep slopes on site, the location of some of the lots shown on the preliminary plat may not be feasible.
3) Fish and Wildlife Habitat Conservation Areas are addressed in CMC Section 16.61.020. If impacts to critical areas (or streams) are anticipated, then the applicant shall demonstrate that an effort has been made to avoid impacts per CMC Section 16.51.170.

Archeological Review

The site is located in an area of high probability for the presence of archaeological objects. As such, an archeological predetermination will be required as per CMC Section 16.31.070.A.

ENGINEERING DIVISION NORM WURZER (360) 817-7235

General Requirements:

1. Construction plans shall be prepared by a licensed Washington State engineer in accordance with City of Camas standards.
2. A 3% plan review and inspection fee will be required. The fee will be based on an engineer's estimate or construction bid. The fee is due prior to approved construction drawings being released by the City.

3. Per CMC 17.19.020 –This includes but is not limited to: *Every developer shall be required to grade and pave streets and alleys, install curbs and gutters, sidewalks, monuments, sanitary and storm sewers, water mains, fire hydrants, street lights and street name signs, underground transmission lines, provide and install centralized mail delivery boxes as determined by the U.S. Postal Service, together with all appurtenances in accordance with specifications and standards in the Camas Design Standard Manual, the six-year street plan, and other state and local adopted standards and plans as may be applicable.*
4. Regulations for installation of public improvements, improvement agreements, bonding, final platting and final acceptance can be found at CMC 17.21.
5. Existing wells and septic tanks and septic drain fields shall be abandoned in accordance with state and county guide lines per CMC 17.19.020 (A3).

Streets:

6. Street improvements to NW 18th need to meet the requirements of Camas Street Design ST5 or an approved equivalent.
7. Street rights-of-way shall meet the criteria of CMC 17.19.040(B), Table 17.19.040-2(C).
8. Sidewalk and fencing along NW 18th shall meet the Camas Design Standards.
9. Applicant to coordinate road improvements to NW 18th with the Camas School District PBL project.
10. Applicant to maintain multi-mobile access on the south side of NW 18th.
11. Tracts for home access shall meet the requirements of Table 17.19.040-1 Minimum Private Street Standards and/or CMC 17.19.030D5 regarding Flag Lots, as applicable.
12. A traffic study will be required for this project in accordance with the City's adopted Traffic Impact Study Guidelines. The study shall include speed surveys, traffic counts, site distance evaluation, AM and PM peak volumes, trip distribution and assignment, signal warrants, turn pocket analysis, with and without project analysis for the current year and build out year. Evaluation of additional off-site intersections will be required once trip generation and distribution information is determined. Contact the City Engineer for trip distribution acceptance and the identification of specific study intersections.
13. Tract "G" will require access from the interior of the development. (Direct access from Tract "G" to NW 18th will be eliminated). Per Resolution 976 and 1260 no new residential accesses are permitted on Arterial/Collectors. Lots 58&47 were granted temporary direct access to the collector (18th) as they were otherwise land locked to public access.
14. NW 18th is designated as a collector street as such, minimum intersection access spacing of 330' is required,
15. A left turn lane intersection will be required allowing a left turn lane pocket into the proposed Valley View Estates development. *Left turn lanes required per "General Guidelines for Geometry of Roadway" listed in the City of Camas' Design Standard Manual.*
16. Uniform fencing and landscaping is required along NW 18th.
17. ADA compliant pedestrian ramps and ADA compliant street crossings are required. To provide ADA compliant pedestrian ramps and street crossings careful evaluation of street profile grades and intersection site grading will be required.
18. A right deceleration lane for NW 18th may be required based on the traffic study.
19. The applicant will be responsible for all traffic control signs, street name signs, pavement markings and street lighting per CMC 17.19.030 (I) (J).
20. The applicant will be responsible for the design and submittal of the utility plan showing the locations for underground power, telephone, gas, CATV, street lights and associated accessories.
21. The applicant will be required to comply with Vancouver's Riverview Gateway Subarea Plan that shows a roadway connection from Fisher/WSDOT Quarries to the southwest corner of the subject property. This includes but is not limited to street alignment with Columbia Palisades.
22. Streets to be named to reflect Camas addresses.

Stormwater:

23. Per CMC 14.02 stormwater treatment and runoff control, if triggered (5,000 SF of impervious surface), shall be designed in accordance with the latest Stormwater Management Manual for Western Washington and the City of Camas Stormwater Design Standards Manual.
24. Stormwater facilities shall be located and landscaped per CMC 17.19.030 (F6) and CMC 17.19.040 (C3a).
25. Stormwater facilities shall meet the requirements of Chapter 4.05 in Camas Stormwater manual. This includes but is not limited to; 10' from neighboring property lines, 50-feet from slopes 15 percent or greater unless the design meets additional requirements described in Chapter 4.05.
26. Maintenance of the storm water facilities will be the responsibility of the HOA per CMC 17.19.040 (C3).
27. The Technical Storm Water Report shall address the water conveyance from the Knights Point Subdivision and control of the downstream impacts.

Water:

28. There is a 12" DI water line available in NW 18th and an 8" DI waterline on the south side of the site on NW Goodwin. This water system will be required to be tied into NW 18th (north side), NW Goodwin (south side) and to be extended to the southwest side (for Vancouver). This site most likely will require a Pressure Relief Valve system.

Sanitary Sewer:

29. The sanitary design is required to be based on a STEF system unless otherwise approved by the City of Camas's Utility Manager.
30. There is an available 8" diameter STEF line in NW Goodwin Street that flows to the Grand Ridge sanitary pump station.
31. A sewer basin analysis will be required for the Grand Ridge Sanitary Pump Station to confirm there is adequate capacity for this proposed development.

Additional:

32. It is recommended that the applicant resolve placement of the community mailboxes with the Postmaster and the City of Camas prior to design submittal.
33. Garbage and recycling containers shall be placed at the public right-of-way.

Fees

All fees are subject to change and are paid at time of building permit issuance.

For each single family detached residential structure, the 2018 impact fees and SDC's will be as follows:

• Transportation TIF	$ 3,233.00 (South)
• School impact fee	$ 5,371.00 (Camas)
• ¾" Water Meter SDC	$ 4,778.00 (South)
• Water Connection fee	$ 380.00
• Sewer SDC	$ 2,493.00 (South)
• Parks/O.S.	$ 2,290.00
• Fire Impact Fees	$ 0.20/SF

BUILDING DIVISION **BOB CUNNINGHAM (360) 817-1568**

1. A plan showing proposed development, proposed streets, lot lay out, lot numbers minus all the side notes. If possible overlay the Camas address grid on the proposed development. The Camas address grid is available on the Clark County GIS web Site.
2. Existing structures need an asbestos survey and demolition permit.
3. Decommissioning of septic tanks and drainfields through Clark County Department of Health
4. The structures will be reviewed under the most current building codes as adopted by The State of Washington.

5. The structural drawings and calculations shall be prepared and stamped by a Professional Engineer licensed by the State of Washington.
6. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal shall conform to Sections R403.1.7.1 through R403.1.7.4. A geotechnical reports may be required
7. Geotechnical engineer's report required
8. The required fire distance between buildings and property line shall be in accordance with the International Building Codes.
9. The required fire suppression system shall be in accordance with IBC and other applicable codes standards and shall be reviewed by the Camas Fire Marshal's office.
10. Storm sewer disposal and connections shall identified on the approved plans.
11. All lots shall be provided a storm drain lateral at the lowest practical location.
12. Storm water from adjacent properties and existing developments should be taken into consideration.
13. System Development Charges and Impact fees shall be assessed prior to permits
14. An approved monument sign for posting addresses shall be provided at all Flag lots, the monument sign, location and design a shall be noted on the Plat.
15. Impact fees and System Development charges shall be applicable

FIRE DEPARTMENT RANDY MILLER (360) 834-6191

1. Low Flow Life Safety Residential Fire Sprinklers (NFPA 13D) required in all new dwellings
2. The distance from a required fire hydrant may be doubled when Low Flow Life Safety Residential Fire Sprinklers are installed throughout a fully sprinklered subdivision. CMC 17.19.040.C.4.a.
3. Establishing Hydrant Flow Tests per NFPA 24 (National Fire Protection Association) utilizing a Washington State Licensed Fire Sprinkler Contractor may be waived when Low Flow Life Safety Residential Fire Sprinklers are installed throughout a fully sprinklered subdivision. 17.15.030.D.C
4. An approved address sign, in accordance with the Camas Municipal Code, must be posted for each residence where the flag lot leaves the public road or access tract. This sign shall be of permanence in its design/installation and shall be approved prior to installation. Contact the FMO for approval. CMC 17.19.030.D.5.d
5. Underground oil tank removal requires a permit with the fire marshal's office following IFC (International Fire Code) 3404.2.14
6. Any existing structures that are scheduled to be torn down may be considered for fire department training. Contact the FMO for further information.
7. Any blasting that may be needed for this location is required to follow the CMC Blasting Code and requires a permit with the fire marshal's office. CMC 15.40
8. Currently there is a reduction in the fire Impact Fee of .20 cents per square foot are when Low Flow Life Safety Residential Fire Sprinklers are installed.
9. Private Streets require a plan for access obstruction per CMC, 17.19.040.A.9
10. Street signs to include the 100 block designation on the sign.
11. Witnessed Hydrant Flushing required contact the FMO to schedule.
12. Underground oil/fuel tank removal requires a permit with the fire marshal's office following IFC (International Fire Code) 3404.2.14
13. Water line size installation from the meter into the house shall be determined with the fire sprinkler contractor and not the underground or plumbing contractor.

Exhibit 10 SUB18-02

BK 311 Pg 715

BRECKENRIDGE

A SUBDIVISION IN THE NE 1/4 AND THE NW
1/4 OF SEC. 8, T1N, R3E, W.M.,
CITY OF CAMAS,
CLARK COUNTY, WASHINGTON
DECEMBER 2013

CITY OF CAMAS MAYOR

APPROVED BY:

1-30-14

MAYOR, CITY OF CAMAS DATE:

COUNTY ASSESSOR

THIS PLAT MEETS THE REQUIREMENTS OF R.C.W. NO. 58.17.170, LAWS OF WASHINGTON, 1981, TO BE KNOWN AS:

BRECKENRIDGE

SUBDIVISION PLAT NO. __________ IN THE COUNTY OF CLARK, STATE OF WASHINGTON

Peter Van Nortwick by Joe Utterback

COUNTY ASSESSOR DATE:

COUNTY AUDITOR

FILED FOR RECORD THIS 30th DAY OF Jan, 2014

IN BOOK 311 OF PLATS AT PAGE 715 AT THE REQUEST OF

LENNAR NORTHWEST, INC.

AUDITOR'S FILE NO.: 5048596

ATTESTED TO: Greg Kimsey by

COUNTY AUDITOR

COMMUNITY DEVELOPMENT DEPT.

APPROVED BY:

1-29-14

CITY OF CAMAS COMMUNITY DEV. DIRECTOR OR DESIGNEE DATE:

City Engineer

FIRE DEPARTMENT

APPROVED BY:

1/28/14

CITY OF CAMAS FIRE CHIEF OR DESIGNEE DATE:

PUBLIC WORKS DEPARTMENT

CERTIFICATION THAT THE DEVELOPER HAS COMPLIED WITH THE FOLLOWING:

A. ALL IMPROVEMENTS HAVE BEEN INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THIS TITLE AND WITH THE PRELIMINARY PLAT APPROVAL.

B. ALL IMPROVEMENTS MEET CURRENT PUBLIC WORKS DRAWING STANDARDS FOR ROAD, UTILITY AND DRAINAGE CONSTRUCTION PLANS.

C. ORIGINAL AND REPRODUCIBLE MYLAR OR ELECTRONIC RECORDS IN A FORMAT APPROVED BY THE PUBLIC WORKS DIRECTOR OR DESIGNEE AND CERTIFIED BY THE DESIGNING ENGINEER AS BEING "AS CONSTRUCTED" HAVE BEEN SUBMITTED FOR CITY RECORDS.

APPROVED BY: 1/29/14

CITY OF CAMAS PUBLIC WORKS DIRECTOR OR DESIGNEE DATE:

CITY FINANCE DIRECTOR

THERE ARE NO DELINQUENT SPECIAL ASSESSMENTS. ALL SPECIAL ASSESSMENTS ON ANY OF THE PROPERTY THAT IS DEDICATED AS STREETS, ALLEYS OR FOR OTHER PUBLIC USE HAVE BEEN PAID IN FULL

APPROVED BY: 1/28/14

CITY OF CAMAS FINANCE DIRECTOR DATE:

BRUCE D. TOWLE 17686 1/23/14

LAND SURVEYOR'S CERTIFICATION

ON THE BASIS OF MY KNOWLEDGE, INFORMATION AND BELIEF, I CERTIFY TO THE CITY OF CAMAS THAT AS A RESULT OF A SURVEY MADE ON THE GROUND TO THE NORMAL STANDARD OF CARE OF PROFESSIONAL LAND SURVEYORS PRACTICING IN CLARK COUNTY, I FIND THAT THIS PLAT, AS SHOWN, IS A TRUE RETURN FROM THE FIELD AND THAT THE DELINEATION IS CORRECT.

BRUCE D. TOWLE – PROFESSIONAL LAND SURVEYOR NO. 17686

LINE TABLE

LINE	BEARING	DISTANCE
L1	S 54°32'27" E	6.61'
L2	S 85°34'41" E	19.40'
L3	S 54°32'27" E	10.95'
L4	S 54°32'27" E	20.62'
L5	N 70°14'09" E	12.17'
L6	S 89°30'36" E	8.25'
L7	S 54°37'58" E	7.09'
L8	S 89°30'36" E	7.08'
L9	N 01°45'36" E	8.00'
L10	N 01°45'36" E	8.00'
L11	N 78°51'09" E	8.54'
L12	N 59°43'31" W	10.12'
L13	S 39°00'01" E	9.49'
L14	N 02°25'20" E	7.21'
L15	N 43°05'33" W	35.83'
L16	N 34°55'06" E	4.01'
L17	S 35°56'35" E	36.08'
L18	N 34°55'06" E	2.08'
L19	S 34°55'06" W	5.30'
L20	S 56°05'23" E	78.77'
L21	S 56°05'23" E	60.01'
L22	S 88°10'52" E	12.50'
L23	S 88°10'52" E	17.50'
L24	S 88°10'52" E	7.50'
L25	S 88°10'52" E	12.50'
L26	N 01°49'08" E	12.50'
L27	N 01°49'08" E	12.50'
L28	N 01°49'08" E	40.00'
L29	N 01°49'08" E	80.72'

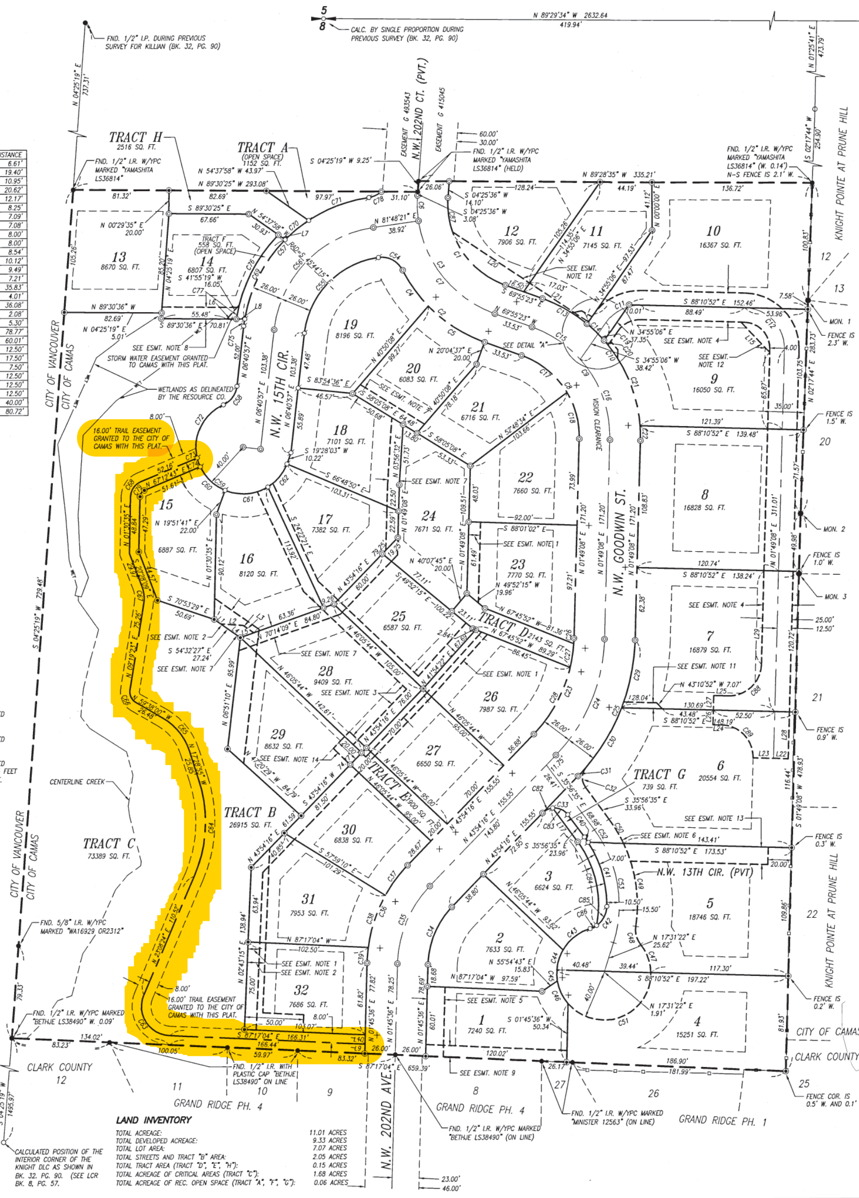
MONUMENT NOTES

MON. 1: FND. 5/8" I.R. W/YPC MARKED 13935. N-S FENCE IS EAST 0.2'.

MON. 2: FND. 5/8" I.R. W/YPC MARKED 13935 IN N-S FENCE LINE.

MON. 3: FND. 5/8" I.R. W/YPC MARKED 13935 IN N-S FENCE LINE SOUTH 1.85 FEET FROM SET I.R. AND 0.05' EAST OF LINE.

BUILDING SETBACKS	SINGLE-FAMILY LOTS 1-3, 11-12, 15-32	SINGLE-FAMILY LOTS 4-10	SINGLE-FAMILY LOTS 13, 14
MINIMUM LOT WIDTH	60'	60'	60'
MINIMUM LOT DEPTH	80'	80'	80'
MAXIMUM BUILDING HEIGHT	35'	35'	35'
MAXIMUM BUILDING COVERAGE	40%	40%	40%
MINIMUM SETBACKS			
FRONT YARD (INCLUDES 6' PUBLIC UTILITY EASEMENT)	20'	30'	18'
SIDE YARD	5'	15'	5'
REAR YARD	25'	35'	20'
CORNER LOTS			
CORNER LOT FRONT YARD	20'	30'	
CORNER LOT STREET SIDE YARD	20'	20'	
CORNER LOT REAR & SIDE YARD	5'	5'	



LAND INVENTORY

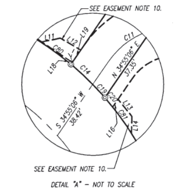
TOTAL ACREAGE:	11.01 ACRES
TOTAL DEVELOPED ACREAGE:	9.33 ACRES
TOTAL LOT AREA:	7.07 ACRES
TOTAL STREETS AND TRACT "B" AREA:	2.05 ACRES
TOTAL TRACT AREA (TRACT "D", "E", "H"):	0.15 ACRES
TOTAL ACREAGE OF CRITICAL AREAS (TRACT "C"):	1.68 ACRES
TOTAL ACREAGE OF REC. OPEN SPACE (TRACT "A", "F", "G"):	0.06 ACRES

CURVE TABLE

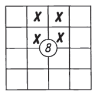
CURVE	DELTA ANGLE	RADIUS	ARC LENGTH
C1	74°20'59"	74.00'	96.03'
C2	43°23'44"	126.00'	95.43'
C3	74°20'59"	100.00'	129.76'
C4	17°11'38"	126.00'	37.81'
C5	26°12'05"	126.00'	57.62'
C6	12°34'36"	100.00'	21.95'
C7	61°46'23"	100.00'	107.81'
C8	71°44'31"	74.00'	92.66'
C9	71°44'31"	100.00'	125.21'
C10	71°44'31"	126.00'	157.77'
C11	56°54'02"	35.00'	34.76'
C12	90°00'00"	35.00'	54.98'
C13	19°58'08"	126.00'	43.91'
C14	05°44'32"	126.00'	12.63'
C15	28°35'13"	100.00'	49.89'
C16	43°09'18"	100.00'	75.32'
C17	39°26'17"	74.00'	50.94'
C18	32°18'14"	74.00'	41.72'
C19	03°29'43"	126.00'	7.69'
C20	02°21'37"	126.00'	5.19'
C21	34°22'43"	126.00'	75.60'
C22	05°47'48"	126.00'	12.75'
C23	42°05'08"	124.00'	91.08'
C24	42°05'08"	150.00'	110.18'
C25	42°05'08"	176.00'	129.28'
C26	02°12'06"	124.00'	4.76'
C27	09°30'47"	124.00'	20.59'
C28	30°22'15"	124.00'	65.73'
C29	19°21'25"	176.00'	59.46'
C30	19°22'28"	176.00'	59.51'
C31	03°21'15"	176.00'	10.30'
C32	76°29'37"	14.00'	18.69'
C33	100°09'09"	14.00'	24.47'
C34	42°08'40"	74.00'	54.43'
C35	42°08'40"	100.00'	73.56'
C36	42°08'40"	126.00'	92.68'
C37	14°41'40"	126.00'	32.31'
C38	21°26'40"	126.00'	47.16'
C39	06°00'20"	126.00'	13.21'
C40	03°16'56"	98.42'	5.64'
C41	33°47'57"	98.42'	58.06'
C42	72°13'52"	20.00'	25.21'
C43	43°00'09"	40.00'	30.02'
C44	25°54'31"	40.00'	18.09'
C45	13°28'46"	40.00'	9.41'
C46	31°16'42"	40.00'	21.84'
C47	37°21'35"	40.00'	26.08'
C48	46°55'35"	20.00'	16.38'
C49	33°31'51"	124.42'	72.81'
C50	11°09'30"	124.42'	24.23'
C51	140°31'16"	40.00'	98.10'
C52	06°59'44"	108.92'	13.30'
C53	46°28'14"	108.92'	88.34'
C54	71°19'08"	20.00'	24.89'

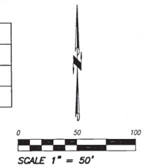
CURVE TABLE (CONT.)

CURVE	DELTA ANGLE	RADIUS	ARC LENGTH
C55	75°28'16"	74.00'	97.47'
C56	75°07'24"	100.00'	131.11'
C57	75°07'24"	126.00'	165.20'
C58	58°53'28"	20.00'	20.56'
C59	224°27'37"	40.00'	156.70'
C60	42°32'39"	40.00'	29.70'
C61	54°18'45"	40.00'	37.92'
C62	37°25'50"	40.00'	26.13'
C63	110°25'28"	25.00'	48.18'
C64	40°37'19"	120.00'	85.08'
C65	42°09'05"	50.00'	36.78'
C66	68°57'23"	10.00'	12.04'
C67	29°47'33"	30.00'	15.60'
C68	65°42'07"	14.00'	16.05'
C69	35°16'40"	126.00'	77.58'
C70	11°48'24"	126.00'	25.96'
C71	25°14'18"	126.00'	55.50'
C72	66°44'43"	40.00'	46.60'
C73	11°55'20"	40.00'	8.32'
C74	11°30'20"	40.00'	8.03'
C75	02°48'03"	126.00'	6.16'
C76	29°58'14"	133.00'	69.57'
C77	05°17'08"	133.00'	12.27'
C78	34°16'37"	20.00'	11.96'
C79	65°42'07"	6.00'	6.88'
C80	07°17'27"	126.00'	16.03'
C81	06°16'57"	126.00'	13.82'
C82	40°09'09"	14.00'	9.81'
C83	60°00'00"	14.00'	14.66'
C84	47°22'48"	91.42'	75.60'
C85	54°48'18"	20.00'	19.13'
C86	17°25'33"	20.00'	6.08'
C87	74.00'	29.91'	29.71'
C88	27.50'	43.20'	38.89'
C89	27.50'	43.20'	38.89'



DETAIL "A" – NOT TO SCALE





SCALE 1" = 50'

BASIS OF BEARINGS

ASSUMED BASED ON WASHINGTON STATE COORDINATE SYSTEM (SOUTH ZONE) FROM GPS MEASUREMENTS.

LEGEND

- ⦿ SET 1/2" X 24" IRON ROD W/PLASTIC CAP (OLSON ENG PLS 17686) DURING THIS SURVEY
- ◎ 1/2" X 24" IRON ROD W/PLASTIC CAP (OLSON ENG PLS 17686) TO BE SET AFTER RECORDING OF PLAT
- ◕ SET 1/2" X 24" IRON ROD W/PLASTIC CAP (OLSON ENG PLS 17686) DURING PREVIOUS SURVEY
- ● FOUND MONUMENT AS DESCRIBED IN FEBRUARY 2006 UNLESS OTHERWISE NOTED
- + BRASS SCREW WITH WASHER (OLSON ENG PLS 17686) TO BE SET AFTER RECORDING OF THE PLAT IN CURB ON A PROJECTION OF THE LOT LINE (GOOD FOR LINE ONLY – NOT DISTANCE)
- ø BRASS SCREW WITH WASHER (OLSON ENG PLS 17686) TO BE SET AFTER RECORDING OF THE PLAT
- – – – – SETBACK LINE
- ━ ━ ━ EASEMENT LINE
- W/YPC WITH YELLOW PLASTIC CAP
- ——□— FENCE

PROCEDURE

FIELD TRAVERSES WERE PERFORMED WITH A LEICA TC-1610 (1") AND ADJUSTED BY COMPASS RULE. THE FIELD TRAVERSES MET THE MINIMUM STANDARDS FOR SURVEYS AS DESIGNATED IN WAC 332-130-090.

DEED REFERENCES

GRANTOR: TEN TALENTS INVESTMENTS 6, LLC
GRANTEE: LENNAR NORTHWEST, INC.
A.F. #: 4991793
DATE: 07/11/2013

SURVEY REFERENCES

GRAND RIDGE PHASE 1 (310/590 RECORDED 10/23/98
GRAND RIDGE PHASE 4 (311/367) RECORDED 03/30/06
KNIGHT POINTE AT PRUNE HILL (H/594) RECORDED 11/29/90
SURVEY BY MACKAY & SPOSITO (26/193) RECORDED 05/30/90
SURVEY BY MACKAY & SPOSITO (51/2) RECORDED 03/06/03
SURVEY BY MINISTER-GLAESER SURVEYING (57/61) RECORDED 02/20/07

CITY OF CAMAS REQUIRED NOTES

1) A HOMEOWNER'S ASSOCIATION (H.O.A.) WILL BE REQUIRED FOR THIS DEVELOPMENT. COPIES OF THE CC&R'S SHALL BE SUBMITTED AND ON FILE WITH THE CITY OF CAMAS.

2) NO FURTHER SHORT PLATTING OR SUBDIVIDING WILL BE PERMITTED ONCE THE FINAL PLAT HAS BEEN RECORDED.

3) A FINAL OCCUPANCY PERMIT WILL NOT BE ISSUED BY THE BUILDING DEPARTMENT UNTIL ALL SUBDIVISION IMPROVEMENTS ARE COMPLETED AND ACCEPTED BY THE CITY.

4) THE LOTS IN THIS SUBDIVISION ARE SUBJECT TO TRAFFIC IMPACT FEES, SCHOOL IMPACT FEES AND PARK/OPEN SPACE IMPACT FEES. EACH NEW DWELLING WILL BE SUBJECT TO THE PAYMENT OF APPROPRIATE IMPACT FEES AT THE TIME OF BUILDING PERMIT ISSUANCE.

5) THIS PLAT IS LOCATED NEAR A DESIGNATED MINERAL RESOURCE LAND (AN ACTIVE ROCK QUARRY TO THE WEST OF THIS SUBDIVISION) ON WHICH A VARIETY OF COMMERCIAL ACTIVITIES MAY OCCUR THAT MAY NOT BE COMPATIBLE WITH RESIDENTIAL DEVELOPMENT FOR CERTAIN PERIODS OF LIMITED DURATION. POTENTIAL DISCOMFORTS OR INCONVENIENCES MAY INCLUDE, BUT ARE NOT LIMITED TO: NOISE, BLASTING, ODORS, FUMES, DUST OR OPERATION OF MACHINERY DURING ANY TWENTY-FOUR (24) HOUR PERIOD.

6) IN THE EVENT THAT THE EXISTING HOME AT LOT 6 IS DEMOLISHED OR NEW DEVELOPMENT IS REQUESTED ON THIS LOT, ANY NEW DEVELOPMENT SHALL PROVIDE A MINIMUM 35-FOOT REAR YARD, 30-FOOT FRONT YARD AND A 15-FOOT SIDE YARD SETBACKS PER CMC 18.09.040, TABLE 2.C.

7) TRACT "C" IS SET ASIDE OPEN SPACE AND SHALL REMAIN IN ITS NATURAL STATE, UNLESS OTHERWISE APPROVED BY THE CITY. NO ACTIVITY MAY OCCUR IN THIS TRACT WITHOUT A CRITICAL AREA REPORT AND APPROVAL FROM THE DIRECTOR OF COMMUNITY DEVELOPMENT UNLESS OTHERWISE PERMITTED PURSUANT TO CMC 16.50.120. THESE TRACTS SHALL BE OWNED AND MAINTAINED BY THE HOA OF THIS DEVELOPMENT.

8) A PUBLIC TRAIL IS LOCATED WITHIN THIS DEVELOPMENT AND A PUBLIC EASEMENT FOR THE RECREATIONAL USE OF THIS TRAIL IS GRANTED WITH THIS PLAT.

9) THE PRELIMINARY PLAT IDENTIFIES CERTAIN TREES TO BE PRESERVED ON THE SITE. GRADING, CONSTRUCTION AND OTHER EARTH DISTURBING ACTIVITIES, OTHER THAN NORMAL LANDSCAPING, ARE PROHIBITED WITHIN THE DRIP LINE OF THESE TREES WITHOUT PRIOR WRITTEN PERMISSION FROM THE CITY. THE PRESERVED TREES SHALL NOT BE REMOVED WITHOUT PRIOR WRITTEN PERMISSION FROM THE CITY.

10) RESIDENTS OF LOTS 4 THROUGH 10 MUST TRANSPORT THEIR SOLID WASTE AND RECYCLING CONTAINERS TO N.W. GOODWIN STREET FOR PICKUP BY THE SERVICE PROVIDER. SERVICE PROVIDER VEHICLES WILL NOT ACCESS THE ALLEY SERVING THE EAST OF THESE LOTS.

11) ANY STAIRS PROVIDED BETWEEN THE PROPOSED LOTS AND ABUTTING STREETS SHALL BE MAINTAINED IN A SAFE, UNOBSTRUCTED AND ACCESSIBLE MANNER AS NECESSARY TO ACCOMMODATE EMERGENCY ACCESS AND PROVIDE A MINIMUM 5-FOOT WIDTH AND RISE/RUN MEETING IBC STANDARDS. LOCKING GATES OR OTHER OBSTRUCTIONS ARE PROHIBITED.

12) VISION CLEARANCE SHALL BE MAINTAINED ON ALL CORNER LOTS. NO VEHICLE, FENCE, WALL, HEDGE OR OTHER OBSTRUCTIVE STRUCTURE OR PLANTING SHALL IMPEDE VISIBILITY BETWEEN A HEIGHT OF 36 INCHES.

TRACT NOTES

TRACT A IS S SET ASIDE AS OPEN SPACE AND IS TO BE OWNED AND MAINTAINED BY THE HOA OF THIS DEVELOPMENT.

TRACT B IS A STORM WATER TREATMENT FACILITY AND SHALL BE OWNED AND MAINTAINED BY THE HOA OF THIS DEVELOPMENT. AN INSPECTION AND MAINTENANCE EASEMENT IS GRANTED TO THE CITY OF CAMAS WITH THIS PLAT.

TRACT C IS SET ASIDE AS OPEN SPACE AND IS TO BE OWNED AND MAINTAINED BY THE HOA OF THIS DEVELOPMENT.

TRACT D IS A UTILITY EASEMENT TO BE OWNED AND MAINTAINED BY THE HOA. IT IS ALSO AN ACCESS EASEMENT FOR LOTS 24 AND 25.

TRACT E IS A UTILITY EASEMENT TO BE OWNED AND MAINTAINED BY THE HOA. IT IS ALSO AN ACCESS EASEMENT FOR LOTS 28 AND 29.

TRACT F IS A PUBLIC AND PRIVATE UTILITY EASEMENT AND OPEN SPACE AREA TO BE OWNED AND MAINTAINED BY THE HOA OF THIS DEVELOPMENT.

TRACT G IS AN OPEN SPACE AREA TO BE OWNED AND MAINTAINED BY THE HOA OF THIS DEVELOPMENT.

TRACT H IS A UTILITY EASEMENT TO BE OWNED AND MAINTAINED BY THE HOA. IT IS ALSO AN ACCESS EASEMENT FOR LOTS 13 AND 14.

PUBLIC UTILITY AND SIDEWALK EASEMENT

AN EASEMENT IS HEREBY RESERVED UNDER AND UPON THE EXTERIOR SIX (6) FEET AT THE FRONT BOUNDARY LINES OF ALL LOTS AND TRACTS ADJACENT TO PUBLIC AND PRIVATE (NW 13TH CIR.) STREETS FOR THE PURPOSE OF INSTALLING, CONSTRUCTING, RENEWING, OPERATING AND MAINTAINING OF ELECTRIC, TELEPHONE, TV, CABLE, WATER, SANITARY SEWER, AND OTHER UTILITIES AS NOTED. ALSO SAID EASEMENT IS HEREBY RESERVED OVER A (4) FOUR FOOT WIDE PARCEL OF PROPERTY IN LOTS 7, 8 AND 9. THE EAST LINE OF SAID STRIP IS THE WEST LINE OF THE 25' PRIVATE EASEMENT THAT IS DESCRIBED IN NOTE 4 ON THIS PLAT. ALSO SAID EASEMENT IS RESERVED OVER A (4) FOUR FOOT WIDE PARCEL OF PROPERTY IN LOTS 10 AND 11. THE SOUTH LINE OF SAID STRIP IS THE NORTH LINE OF SAID 25' EASEMENT.

ALSO, A SIDEWALK EASEMENT IS RESERVED, AS NECESSARY TO COMPLY WITH ADA SLOPE REQUIREMENTS, UPON THE EXTERIOR SIX (6) FEET ALONG THE FRONT BOUNDARY LINES OF ALL LOTS AND TRACTS ADJACENT TO THE PUBLIC STREETS.

ALSO AN EASEMENT IS HEREBY RESERVED UPON THE EXTERIOR 1.50 FEET AT THE FRONT BOUNDARY LINES OF ALL LOTS AND TRACTS ADJACENT TO PUBLIC AND PRIVATE (NW 13TH CIR.) STREETS FOR SIDEWALKS.

EASEMENT NOTES

1. 10.00 FOOT PRIVATE STORM SEWER EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION AND LOTS 22-23 AND 26-32 WITH THIS PLAT. MAINTENANCE WILL BE THE RESPONSIBILITY OF LOTS 22-23 AND 26-32.

2. 15.00 FOOT RETAINING WALL EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION WITH THIS PLAT.

3. 15.00 FOOT SANITARY SEWER EASEMENT GRANTED TO THE CITY OF CAMAS WITH THIS PLAT.

4. 25.00 FOOT PRIVATE ROAD AND UTILITY EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION AND LOTS 6-10 WITH THIS PLAT. MAINTENANCE WILL BE THE RESPONSIBILITY OF THE HOMEOWNERS ASSOCIATION.

5. 15.00 FOOT ENTRY MONUMENT AND LANDSCAPING EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION WITH THIS PLAT. THE HOMEOWNERS ASSOCIATION WILL BE RESPONSIBLE FOR MAINTENANCE OF IMPROVEMENTS.

6. PRIVATE ROAD AND UTILITY EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION AND LOTS 1-5 WITH THIS PLAT. MAINTENANCE WILL BE THE RESPONSIBILITY OF THE HOMEOWNERS ASSOCIATION.

7. 10.00 FOOT PRIVATE STORM SEWER EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION AND LOTS 16, 19, 20, 21, 24, 25, 28 AND 29 WITH THIS PLAT. MAINTENANCE WILL BE THE RESPONSIBILITY OF LOTS 16, 19, 20, 21, 24, 25, 28 AND 29.

8. 10.00 FOOT PRIVATE STORM SEWER EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION AND LOTS 13 AND 14 WITH THIS PLAT. MAINTENANCE WILL BE THE RESPONSIBILITY OF LOTS 13 AND 14.

9. 10.00 FOOT PRIVATE STORM SEWER EASEMENT GRANTED TO THE HOMEOWNERS ASSOCIATION AND LOTS 1 AND 4 WITH THIS PLAT. MAINTENANCE WILL BE THE RESPONSIBILITY OF LOTS 1 AND 4.

10. SIDEWALK EASEMENT GRANTED TO THE CITY OF CAMAS WITH THIS PLAT.

11. 5.00 FOOT PRIVATE WATER LINE EASEMENT GRANTED TO LOT 6 WITH THIS PLAT.

12. VISION CLEARANCE EASEMENT GRANTED TO THE CITY OF CAMAS AND THE HOMEOWNERS ASSOCIATION WITH THIS PLAT.

13. 15.00 FOOT PRIVATE WALL EASEMENT GRANTED TO LOT 6 WITH THIS PLAT.

14. A 20.00' X 20.00' PRIVATE ACCESS AND UTILITY EASEMENT GRANTED TO LOTS 28 AND 29 WITH THIS PLAT.

JOB# 7630.02.02

J:\DATA\7000\7600\7630\7630\SURVEY\7630.S.FPLAT.DWG

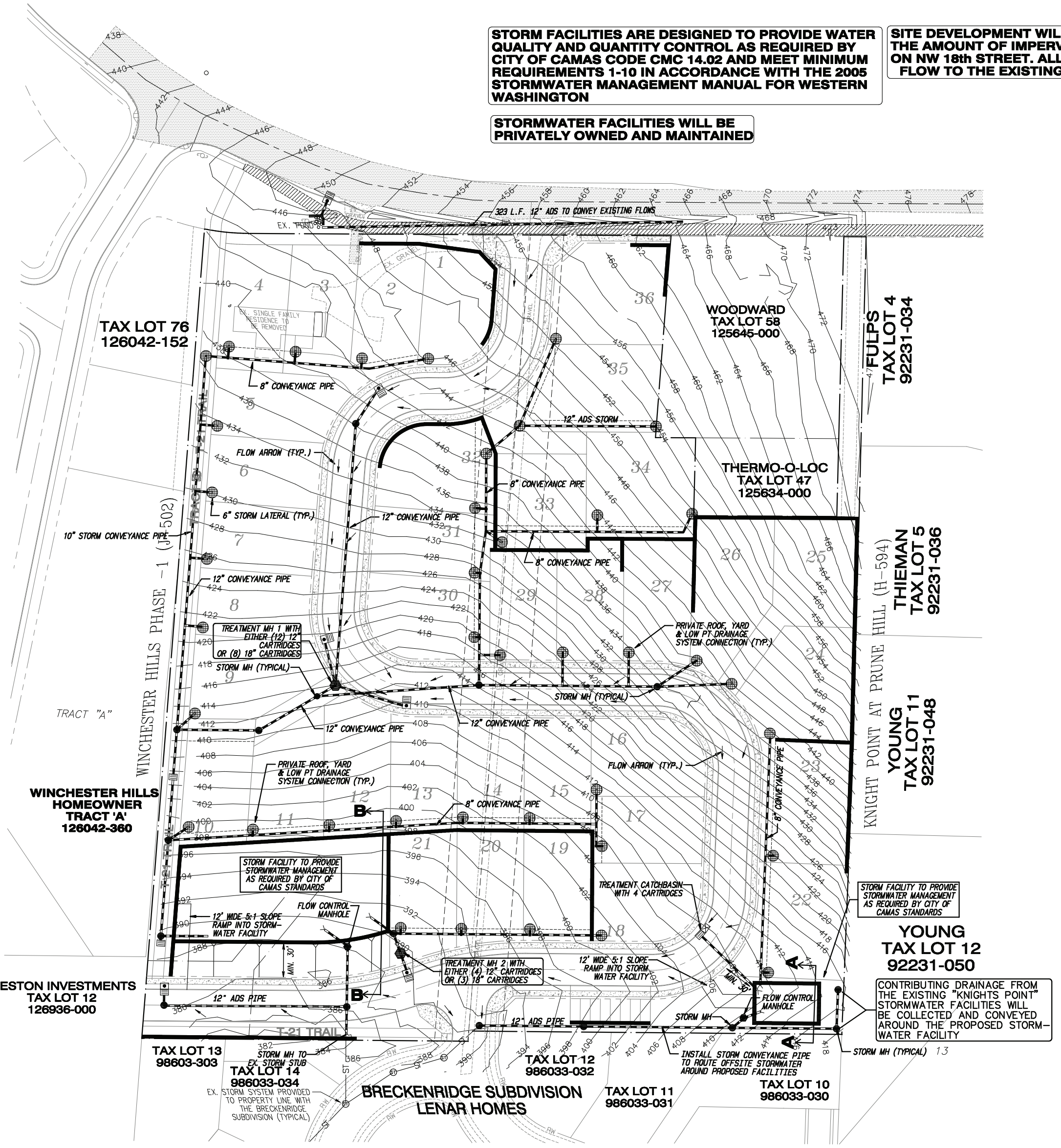
OLSON ENGINEERING INC.
LAND SURVEYORS
ENGINEERS
1-360-695-1385
1-503-289-9936
1111 BROADWAY, VANCOUVER, WA 98660

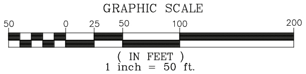
Exhibit 11 SUB18-02

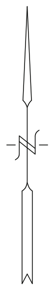
STORM FACILITIES ARE DESIGNED TO PROVIDE WATER QUALITY AND QUANTITY CONTROL AS REQUIRED BY CITY OF CAMAS CODE CMC 14.02 AND MEET MINIMUM REQUIREMENTS 1-10 IN ACCORDANCE WITH THE 2005 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

SITE DEVELOPMENT WILL NOT INCREASE THE AMOUNT OF IMPERVIOUS SURFACES ON NW 18th STREET. ALL DRAINAGE WILL FLOW TO THE EXISTING FLOW ROUTES

STORMWATER FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED







STORM CONSTRUCTION NOTES:

1.ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF ON AN APPROVED SITE.

2.PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.

3.TRENCH COMPACTION SHALL BE PER THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD TO USE TO ACHIEVE THE REQUIRED COMPACTION. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.

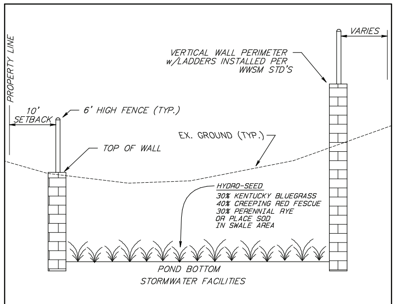
4.SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

5.ALL STORM PIPE SHALL BE PVC OR N-12 WITH DOUBLE BELLED COUPLINGS WITH O-RING TYPE GASKETS OR APPROVED EQUAL.

6.ALL STORM PIPE LATERALS TO BE A MINIMUM 10 INCHES DIAMETER WITH A MINIMUM SLOPE OF S=0.0100 UNLESS SPECIFIED OTHERWISE IN THE PLANS.

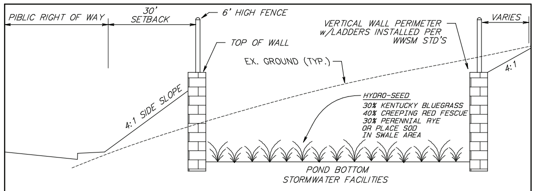
7.ALL MANHOLES LOCATED IN UNIMPROVED EASEMENTS AND RIGHT OF WAYS SHALL BE PROVIDED WITH TAMPER PROOF LIDS AND SHALL BE SET 6 INCHES ABOVE FINISHED GRADE.

8.VIDEO INSPECTION TAPES AND REPORTS MAY BE REQUIRED AT THE CITY'S DISCRETION. MANDREL TESTING MAY BE REQUIRED AT THE CITY'S DISCRETION.



STORMWATER FACILITIES SECTION A-A

(Not to Scale)



STORMWATER FACILITIES SECTION B-B

(Not to Scale)

NOTE:

Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424-5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313

SOIL TYPE(s):	HYDROLOGIC GROUP:	AASHTO CLASSIFICATION:
Hcb, PoB & PoD	C	A - 4

SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689

DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA

APPROX. SURFACE ELEV.: 385'-468'

SITE AREA: 9.26 ACRES

FILENAME 286/:Preliminary.pro

PREPARED BY:

STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

STERLING DESIGN, INC.

Sheet Description: PRELIMINARY STORMWATER MANAGEMENT PLAN

Project: VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING 36524

05/18/18

Scale: AS SHOWN

Project Number: 286

Design/Drawn JGS/BC

Drawing Date: MAY 2018

Sheet 6 of 9 Sheet(s)

Exhibit 12 SUB18-02

JOB # 286

STERLING DESIGN, INC.

2208 E. Evergreen Blvd., Vancouver, WA 98661
Ph: (360) 759-1794 Fx: (360) 759-4983
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PRELIMINARY TECHNICAL INFORMATION REPORT

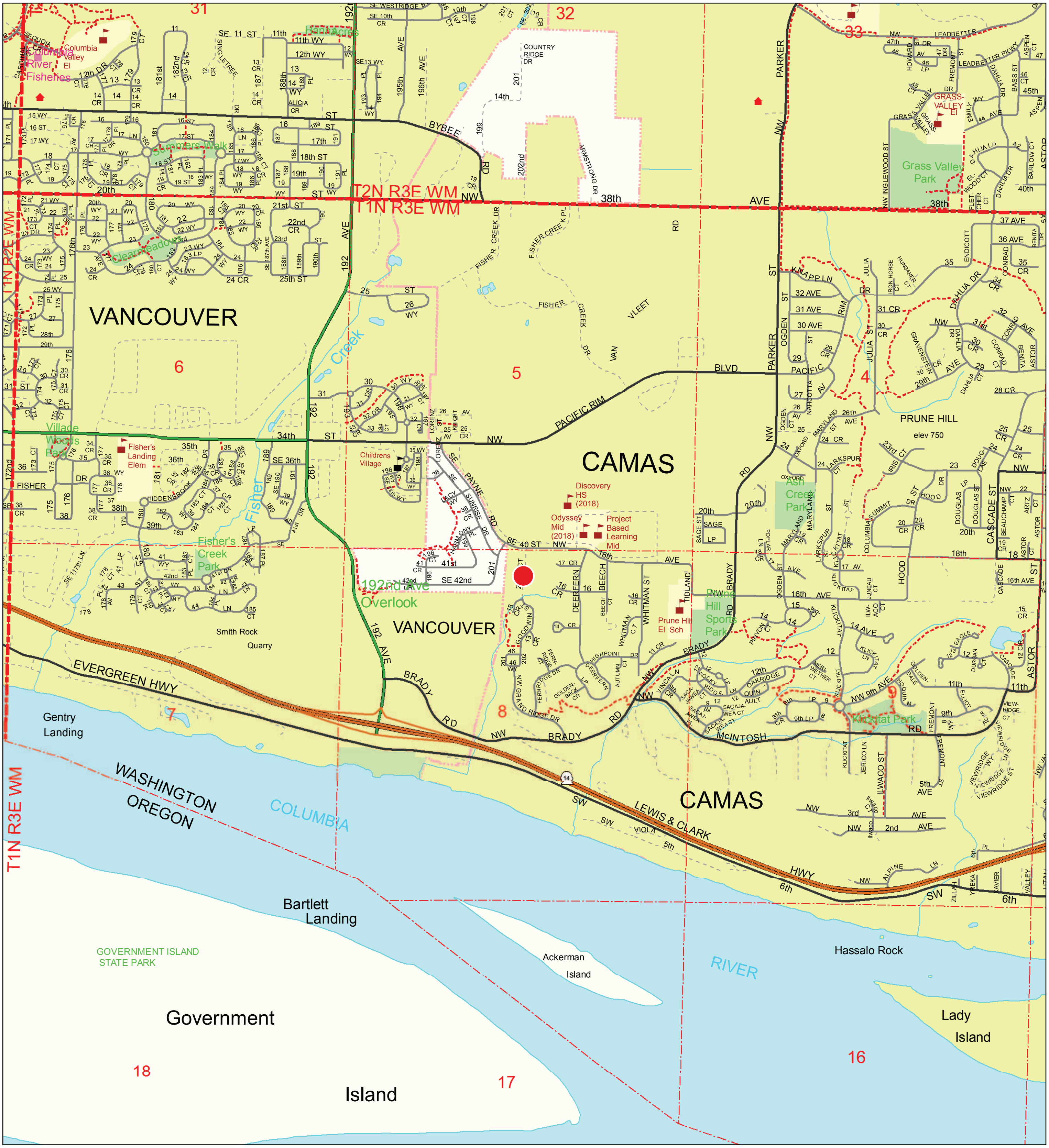
Valley View Estates Subdivision

June 2018

Prepared by: Joel G. Stirling, P.E.

JOEL GREGORY STIRLING
36324

6/25/18



CLARK COUNTY, WASHINGTON

Geographic Information System

0 1,000 2,000
Feet

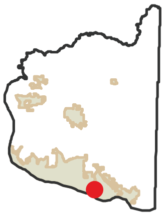
Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

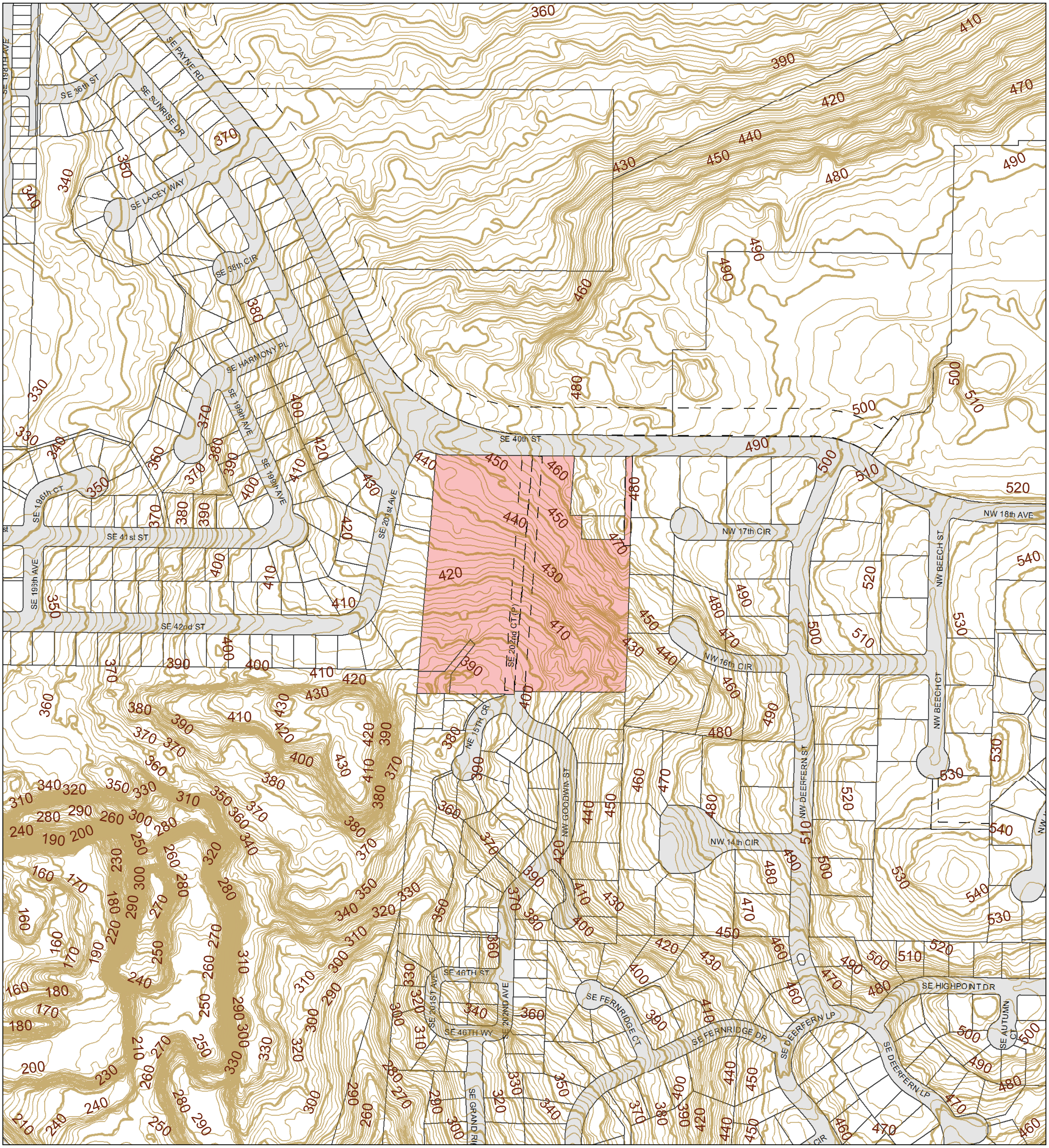
General Location

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

● Location of Subject Property(s)





CLARK COUNTY, WASHINGTON

Geographic Information System

0 200 400
Feet

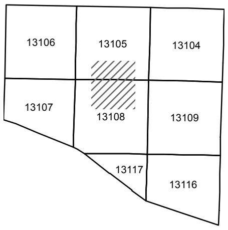
Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

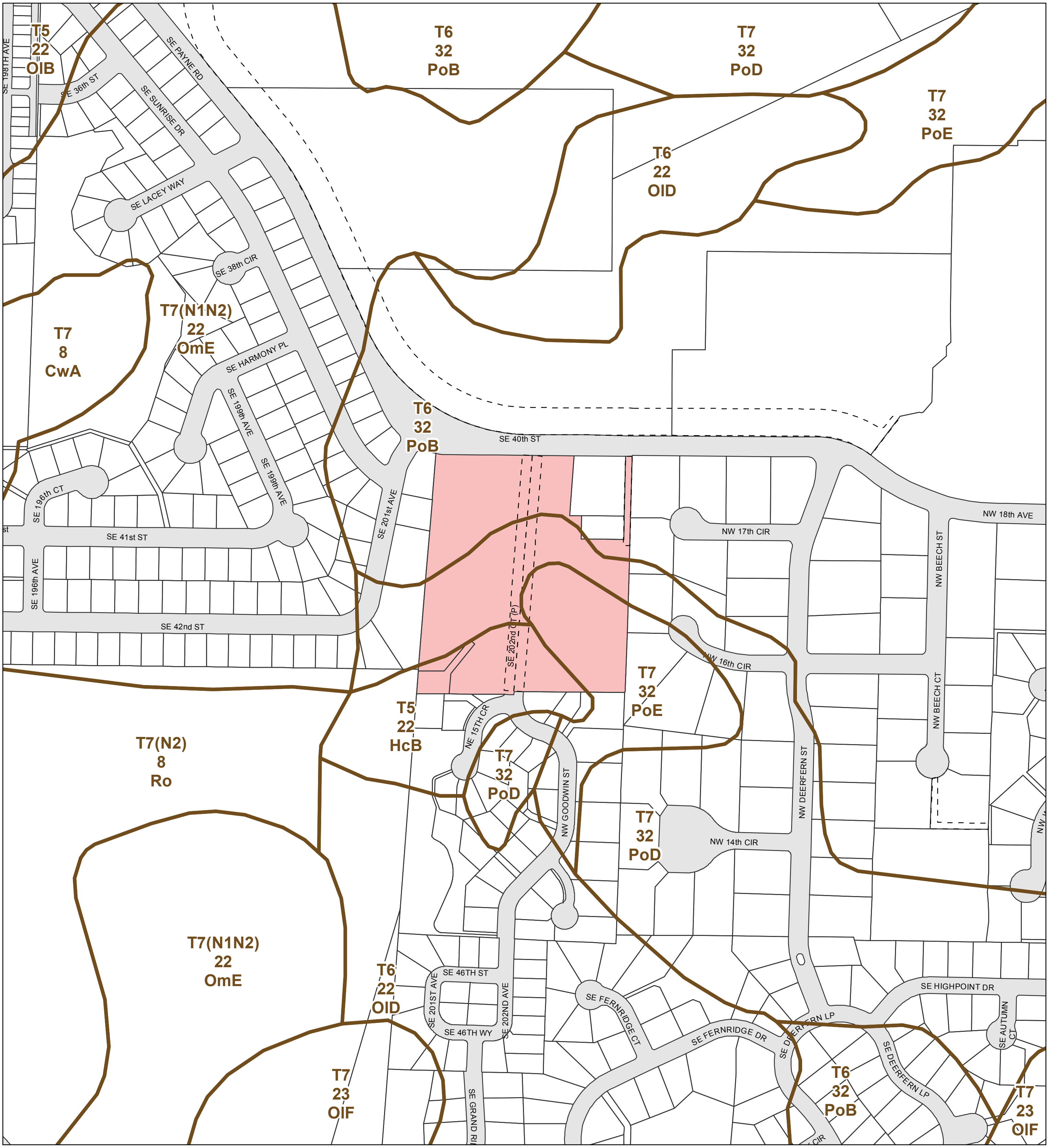
Elevation Contours

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666

🟥 Subject Property(s)
▨ Public Road
- - - Transportation or Major Utility Easement
— 10' Elevation Contours
— 2' Elevation Contours

Printed on: March 26, 2018

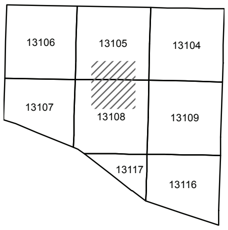




Soil Types

Printed on: March 26, 2018

Account: 125635000, 125646000
Owner: FIRESTONE STAN
Address: PO BOX 61928
C/S/Z: VANCOUVER, WA 98666



CLARK COUNTY, WASHINGTON
Geographic Information System

N

0 200 400
Feet

▨ Subject Property(s)
▨ Public Road
- - - Transportation or Major Utility Easement
☐ Soil Type Boundary

Information shown on this map was collected from several sources. Clark County accepts no responsibility for any inaccuracies that may be present.

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Stormwater Management Manual for Western Washington dated 2014.
City of Camas Municipal Code as amended prior to March, 2014

Valley View Estates Subdivision

Section A – Project Overview

The “Valley View Estates” Subdivision proposal is to develop one existing 9.26 acre parcel of land into 36 single family building lots within the R-7.5 zoning district. The site is located at 20109 SE 40th Street in Camas, Washington; known as tax lots 59 & 48, serial number 125646-000 & 125635-000, and is located in the Northwest quarter of Section 8, Township 1 North, Range 3 East of the Willamette Meridian, Clark County, Washington.

The site topography is hilly and rolls from a gradual to a moderate slope from the Northeast corner down to the Southwest property line. Natural drainage flows from the property to a field inlet and public storm system, installed with the recently constructed "Brecken Ridge" Subdivision, which conveys it through the project to an unnamed wetland and natural seasonal drainage way to the south. There is some potential for contributing drainage from two (2) parcels of land along the Northeastern portion of the project and this area has been considered in the design of the stormwater management systems. The entire site has one (1) single family home on it with the remaining portion of the property covered with field grasses, blackberry bushes and a few undernourished trees. All existing man-made stormwater systems on the site are shown within the proposed development plans.

The existing subdivision, "Knight Point at Prune Hill", is located along the Eastern property line of the proposed Valley View Estates project which discharges stormwater from its stormwater management facilities at the Southeastern portion of the proposed project. The drainage from those facilities has been conveyed overland within a 12" ADS pipe system, to the Southern property line, for many years. As part of the proposed Valley View Estates improvements, a permanent stormwater conveyance system will be constructed to connect to the stormwater conveyance system from the Knight Point at Prune Hill stormwater management facilities, to route the drainage around the proposed stormwater management systems that will be constructed as part of the Valley View Estates Subdivision.

Construction of the Valley View Estates Subdivision will consist of grading approximately 8 acres of the site for construction of utilities, a public trail, public roads, stormwater facilities and grading building pads for the future single family home sites. The design of the stormwater management system was influenced primarily by the property topography and the location of the public storm system connection that was installed with the Breckenridge Subdivision to collect the stormwater drainage from the project. Quality control is required for this project and will be met through the use of multiple Cartridge Treatment Structures that are sized to meet the standards of the WWHM and the City of Camas stormwater management standards. Stormwater flow rates and durations will be controlled using two (2) detention ponds located along the Southern property line of the project.

Section B – Minimum Requirements

The Valley View Estates Subdivision proposal contains only one threshold discharge area (TDA) and is subject to minimum requirements 1 – 9. As required by CMC 14.02, the property is defined as follows: **Pre-developed Condition** - The native vegetation and soils that existed at a site prior to the influence of Euro-American settlement. The pre-developed condition shall be assumed to be a forested land cover unless reasonable, historic information is provided that indicates the site was prairie prior to settlement. The property currently contains a single family home and a large area of private gravel road which is not being considered within the stormwater management pre-developed flow calculations.

Section C – Soils Evaluation

The "Soil Survey of Clark County, Washington" printed by the United States Department of Agriculture Soil Conservation Service (SCS), in cooperation with Washington Agriculture Experiment Station maps the soils on site as Hesson clay loam (HcB), and Powell silt loam (PoB & PoD). Both soils are listed within Soils Group (SG) 3 for WWHM calculation purposes and are also categorized as AASHO A-4 soils. Infiltration rates of 0.06-0.20 inches per hour are typical for these soil types. Although infiltration is not being considered for the primary quantity control management system, it is recognized that there is a small amount of natural infiltration that will occur throughout the project which makes the proposed stormwater management system conservative.

Section D – Source Control

The development activity includes landscaping and lawn/vegetation and maintenance of stormwater drainage and treatment systems. Source control will be the responsibility of each of the new property owners within the subdivision.

Section E – Onsite Stormwater Management BMPs

There are no specific applicable onsite stormwater management BMPs that apply to the proposed site improvements. All site runoff will be treated as required using multiple Treatment Cartridge Systems designed to provide water quality control to meet the minimum stormwater quality control requirements of the SWWMM and the City of Camas. All flows from the developed project will be detained to pre-European-development runoff durations, and released to the pre-developed flow paths.

Section F – Runoff Treatment and Design

Basic stormwater treatment is required for this project and will be met through the use of Stormwater Treatment Cartridge system(s) designed in compliance with City of Camas Municipal Code. Initial installation cost and the expenses associated with long-term maintenance are expected to be typical of developments of this size. There are no pollution-generating pervious surfaces (PGPS) on this project

The proposed Stormwater Treatment Cartridge System(s) have been designed according to the latest Stormwater Management Manual for Western Washington. The treatment cartridge system(s) are sized to treat at least 91% of all runoff based on the Water Quality flows calculated by the WWHM computer program.

The stormwater management facilities are design to collect and treat all proposed improvements and also include providing stormwater water quality and quantity control for the two (2) existing single-family home sites that are located at the Northeastern corner of the property. NW 18th Street is located along the Northern property line and will be improved with approximately 8' of additional pavement and a 6' wide sidewalk. The road transitions to a shed section that drains all stormwater along the Valley View Estates project to the north, making it impossible to pick up and manage. To mitigate for the small area of drainage that is able to be collected and managed onsite, the two (2) homes and driveways that are outside the project boundaries have been included within the stormwater management facilities rather then conveying the unmanaged stormwater from these offsite improvements around the proposed stormwater facilities. Another factor that is considered with this proposed area exchange is that the City of Camas is currently in the process of installing a public trail connection along NW 18th Street along the project frontage. This drainage will also flow to the North and is not be considered within the Valley View Estates stormwater management facilities which makes the proposed stormwater mitigation measures even more conservative.

Section G – Flow Control Analysis and Design

Stormwater flow rates and durations will be controlled using two (2) detention pond(s) located along the southern portion of the project. The stormwater flow control analysis was done using WWHM2012 to match developed flow rate durations to pre-developed flow rate durations for all flows between ½ the 2-year discharge rate and up to the 50-year discharge rate as required by City of Camas Municipal Code. The detention pond control structures were sized utilizing the WWHM2012 computer analysis program and will be located within each of the detention ponds. The detention ponds will have vertical walls located on all sides of the facilities as allowed by Volume III section 3.2 - Side Slopes from the 2014 SMMWW (also included herein). The section recommends that 25% of detention ponds be vegetated slope, however, gives the option to have 100% of the perimeter as vertical walls as long as:

> **(a) they are constructed of reinforced concrete per Section 3.2.3, Material;**
> **(b) a fence is provided along the top of the wall;**
> **(c) the entire pond perimeter may be retaining walls, ...**
> **(d) the design is stamped by a licensed engineer with structural expertise. If the entire pond is to be retaining walls, ladders should be provided on the walls for safety reasons.**

The detention pond walls will be designed by a licensed engineer with structural expertise and ladders will be provided on all sides of the detention pond as required. All retaining walls will comply with CMC18.17.060. A 5:1 maintenance access ramp is also proposed for access into the pond facilities and fencing with a locked access gate will also be provided on each facility.

Section H – Flow Control System Plan

See Engineering Plans.

Section I – Wetlands Protection

There are no wetlands on the property or immediately adjacent to the property.

Section J – Other Permits

Coverage under the Washington State NPDES Construction Stormwater General Permit will be obtained prior to construction.

Section K – Conveyance System Analysis and Design

See Engineering Plans for entire conveyance system design. The project is located on a property with considerable slope therefore all conveyance systems will convey the predicted 100 year flows to the proposed stormwater management facilities.

Section L – Offsite Analysis

As required by Camas Municipal Code, a representative of STERLING DESIGN, INC. visited the site and followed the downstream flow route to a point in the receiving water more than ¼ of a mile from the site in order to analyze existing conditions and potential impacts of this development activity. This analysis looked for indications of excessive sedimentation, stream bank erosion, polluted discharges to ground water contributing to recharge zones, violations of water quality standards, and spills and discharges of priority pollutants as well as for potential impacts to public health and safety and private or public facilities downstream. All storm water from the site will connect to a public stormwater system that was recently installed with the Breckenridge Subdivision. The conveyance system from the Breckenridge Subdivision conveys the stormwater to a discharge point approximately 400' South of the Valley View Estates Southern property boundary. From there stormwater continues to flow south within a well vegetated natural drainage ravine along the Western boundary of the Grand Ridge Phase(s) 4 and 1. Stormwater flows from the proposed Valley View Estates Subdivision will continue to follow historical flow routes and will not be rerouted to another drainage basin. The designed stormwater system mimics the pre-developed condition by detaining to pre-development flow rates and discharging to the pre-development flow path. This project will not have a significant adverse impact on the downstream and/or upstream drainage system.

Section M – Groundwater Monitoring Program

Ground water monitoring is not a requirement for single family residential developments and it is unlikely that there is any threat to ground water from the proposed Valley View Estates project.

Section N – Maintenance and Operations Manual

Stormwater facilities will be privately owned and maintained per City of Camas Stormwater code CMC 14.02 and pages 7-24 and 7-25 of 2014 Stormwater Management Manual for Western Washington, Volume V.

Appendix I: Hydrology Calculations

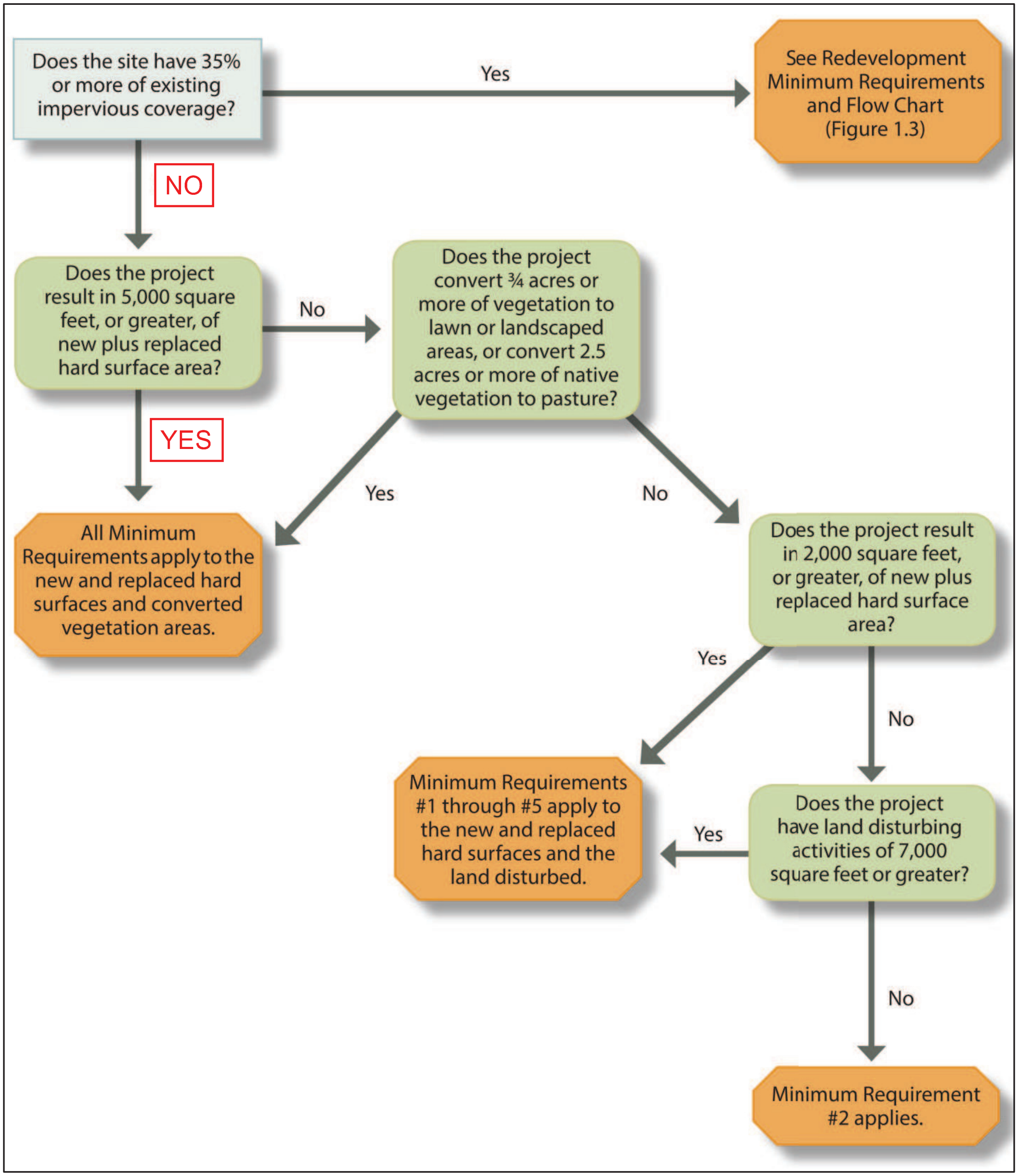
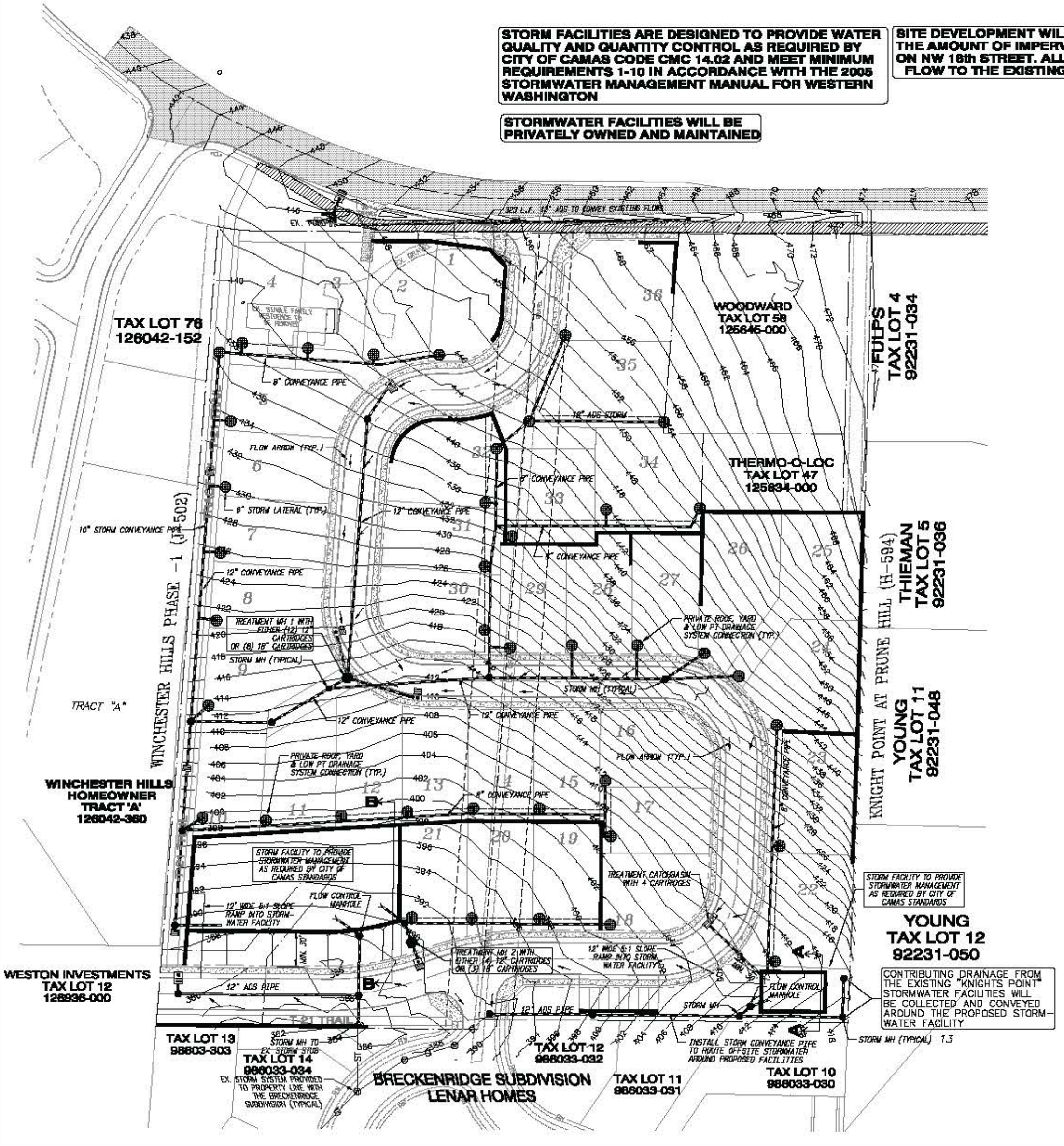


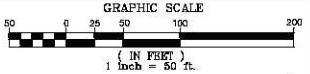
Figure 1.2: New Development Flow Chart

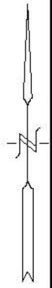
STORM FACILITIES ARE DESIGNED TO PROVIDE WATER QUALITY AND QUANTITY CONTROL AS REQUIRED BY CITY OF CAMAS CODE CMC 14.02 AND MEET MINIMUM REQUIREMENTS 1-10 IN ACCORDANCE WITH THE 2005 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

SITE DEVELOPMENT WILL NOT INCREASE THE AMOUNT OF IMPERVIOUS SURFACES ON NW 16th STREET. ALL DRAINAGE WILL FLOW TO THE EXISTING FLOW ROUTES

STORMWATER FACILITIES WILL BE PRIVATELY OWNED AND MAINTAINED







STORM CONSTRUCTION NOTES:

1. ALL TRENCH EXCAVATION AND PIPE INSTALLATION SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T. STANDARD SPECIFICATIONS SECTION 7-08.3(1) AND SECTION 7-08.3(2). ALL EXCESS MATERIAL FROM THE TRENCH EXCAVATION SHALL BE DISPOSED OF ON AN APPROVED SITE.

2. PIPE BEDDING, PIPE ZONE MATERIAL AND TRENCH BACKFILL SHALL BE AN APPROVED GRANULAR MATERIAL OF EITHER WASHED SCREENINGS OR 5/8 INCH MINUS CRUSHED ROCK. SAND BACKFILL IS NOT ALLOWED.

3. TRENCH COMPACTION SHALL BE PER THE MOST RECENTLY ADOPTED EDITION OF THE W.S.D.O.T STANDARD SPECIFICATIONS SECTION 7-08.3(3). CONTRACTOR TO DETERMINE THE TYPE OF EQUIPMENT AND METHOD TO USE TO ACHIEVE THE REQUIRED COMPACTION. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY THE A.A.S.H.T.O. T-180 TEST METHOD.

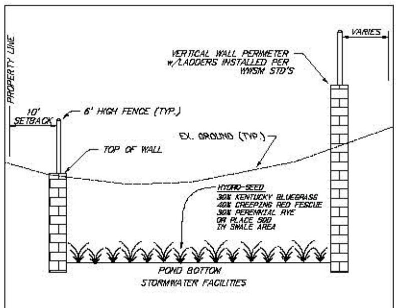
4. SETTLEMENT OF THE FINISHED SURFACE WITHIN THE WARRANTY PERIOD SHALL BE CONSIDERED TO BE A RESULT OF IMPROPER COMPACTION AND SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR AT NO EXPENSE TO THE CITY.

5. ALL STORM PIPE SHALL BE PVC OR N-12 WITH DOUBLE BELLED COUPLINGS WITH O-RING TYPE GASKETS OR APPROVED EQUAL.

6. ALL STORM PIPE LATERALS TO BE A MINIMUM 10 INCHES DIAMETER WITH A MINIMUM SLOPE OF S=0.0100 UNLESS SPECIFIED OTHERWISE IN THE PLANS.

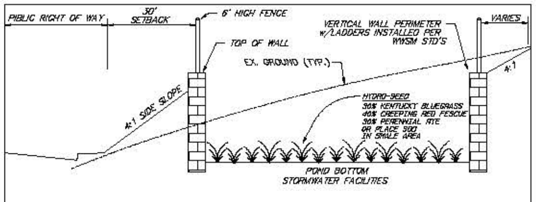
7. ALL MANHOLES LOCATED IN UNIMPROVED EASEMENTS AND RIGHT OF WAYS SHALL BE PROVIDED WITH TAMPER PROOF LIDS AND SHALL BE SET 6 INCHES ABOVE FINISHED GRADE.

8. VIDEO INSPECTION TAPES AND REPORTS MAY BE REQUIRED AT THE CITY'S DISCRETION. MANDREL TESTING MAY BE REQUIRED AT THE CITY'S DISCRETION.



STORMWATER FACILITIES SECTION A–A

(Not to Scale)



STORMWATER FACILITIES SECTION B–B

(Not to Scale)

NOTE:

Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424–5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694–3313

SOIL TYPE(s): HcB, PoB & PoD HYDROLOGIC GROUP: C AASHTO CLASSIFICATION: A – 4

SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 616–3686 DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA APPROX. SURFACE ELEV.: 385'-466'

SITE AREA: 9.26 ACRES FILENAME: 286/:Preliminary.pro

PREPARED BY:

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2205 N.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

STERLING DESIGN, INC.

Sheet Description:

PRELIMINARY STORMWATER MANAGEMENT PLAN

Project:

VALLEY VIEW ESTATES SUBDIVISION

05/18/18

Scale: AS SHOWN

Project Number: 286

Design/Drawn JGS/BC

Drawing Date: MAY 2018

Sheet 6 of 9 Sheet(s)

Hydrologic Soil Groups for Soils in Clark County

U.S. Department of Agriculture
Soil Conservation Service

WATER FEATURES

Survey Area: CLARK COUNTY, WASHINGTON

Map Symbol	Soil Name	Hydrologic Group	Clark County WWHM Soils Group
BpB	BEAR PRARIE	B	2
BpC	BEAR PRARIE	B	2
CnB	CINEBAR	B	2
CnD	CINEBAR	B	2
CnE	CINEBAR	B	2
CnG	CINEBAR	B	2
CrE	CINEBAR	B	2
CrG	CINEBAR	B	2
CsF	CISPUS	B	2
CtA	CLOQUATO	B	2
CvA	COVE	D	4
CwA	COVE	D	4
DoB	DOLLAR	C	3
Fn	FILL LAND	In-situ	N/A
GeB	GEE	C	4
GeD	GEE	C	4
GeE	GEE	C	4
GeF	GEE	C	4
GuB	GUMBOOT	D	4
HcB *	HESSON *	C *	3 *
HcD	HELLSON	C	3
HcE	HESSON	C	3
HcF	HESSON	C	3
HgB	HESSON	C	3
HgD	HESSON	C	3
HhE	HESSON	C	3
HIA	HILLSBORO	B	2
HIB	HILLSBORO	B	2

Map Symbol	Soil Name	Hydrologic Group	Clark County WWHM Soils Group
NbA	NEWBERG	B	2
NbB	NEWBERG	B	2
OdB	ODNE	D	4
OeD	OLEQUA	B	3
OeE	OLEQUA	B	3
OeF	OLEQUA	B	3
OhD	OLEQUA VARIANT	C	4
OhF	OLEQUA VARIANT	C	4
OIB	OLYMPIC	B	3
OID	OLYMPIC	B	3
OIE	OLYMPIC	B	3
OIF	OLYMPIC	B	3
OmE	OLYMPIC	B	3
OmF	OLYMPIC	B	3
OpC	OLYMPIC VARIANT	C	3
OpE	OLYMPIC VARIANT	C	3
OpG	OLYMPIC VARIANT	C	3
OrC	OLYMPIC VARIANT	C	3
PhB	PILCHUCK	C	2
PoB *	POWELL *	C *	3 *
PoD *	POWELL *	C *	3 *
PoE	POWELL	C	3
PuA	PUYALLUP	B	2
Ra	RIVERWASH	D	N/A
Rc	RIVERWASH	D	N/A
Rk	ROCK LAND	D	N/A
Ro	ROUGH BROKEN LAND	A	1
SaC	SALKUM	B	2
SIB	SARA	D	4
SID	SARA	D	4
SIF	SARA	D	4
SmA	SAUVIE	B	3
SmB	SAUVIE	B	3
SnA	SAUVIE	D	3
SpB	SAUVIE	B	3

TABLE 7.—*Estimated physical and chemical properties of the soils*—Continued

Soil series and map symbols	Depth from surface	Classification			Percentage passing sieve—			* Permeability	Available water capacity	Reaction
		Dominant USDA texture	Unified	AASHO	No. 4 (4.76 mm.)[1]	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
	Inches							*Inches per hour*	*Inches per inch of soil*	*pH*
Minniece: MnA, MnD.	0–48	Silty clay and clay	CH	A–7	90–95	85–95	65–75	<0. 06	0. 06–0. 08	6. 1–7. 8
	48	Basalt bedrock.								
MoA.	0–12	Silt loam	ML	A–4	100	95–100	65–75	0. 63–2. 0	0. 19–0. 21	6. 1–6. 5
	12–22	Silty clay	CH	A–7	95–100	95–100	80–90	0. 06–0. 2	0. 12–0. 14	6. 1–6. 5
	22–60	Very gravelly clay loam (weakly cemented).	GC	A–2	35–50	30–50	20–35	<0. 06	0. 03–0. 05	5. 6–6. 5
Mossyrock: MsB.	0–23	Silt loam	OL or OH	A–5	95–100	95–100	50–60	0. 63–2. 0	0. 19–0. 21	6. 1–6. 5
	23–60	Silt loam	ML	A–5	100	95–100	55–65	0. 63–2. 0	0. 19–0. 21	6. 6–7. 3
	60–74	Loam	ML	A–4	100	95–100	70–80	0. 63–2. 0	0. 16–0. 18	6. 1–7. 3
Newberg: NbA, NbB.	0–7	Silt loam	ML	A–4	--------	100	70–80	0. 63–2. 0	0. 19–0. 21	5. 6–6. 5
	7–52	Fine sandy loam and sandy loam.	SM or ML	A–4	--------	100	40–55	2. 0–6. 3	0. 13–0. 15	6. 1–7. 3
	52–72	Sand	SM	A–1	--------	100	5–15	0. 63–20. 0	0. 05–0. 07	6. 6–7. 3
Odne: OdB.	0–50	Silt loam, silty clay loam, clay loam, and loam.	CL	A–4 or A–6	--------	100	75–85	<0. 06	0. 10–0. 12	5. 0–6. 5
Olequa: OeD, OeE, OeF.	0–17	Silt loam	ML	A–7	--------	100	75–85	0. 63–2. 0	0. 19–0. 21	6. 1–6. 5
	17–90	Heavy silt loam and silty clay loam.	CL	A–7	--------	100	80–90	0. 2–0. 63	0. 19–0. 21	4. 5–6. 5
OhD, OhF.	0–32	Silty clay loam	CL	A–7	95–100	90–95	85–95	0. 2–0. 63	0. 19–0. 21	5. 1–6. 0
	32–82	Silty clay and clay	CH	A–7	95–100	90–95	85–95	<0. 06	0. 06–0. 08	5. 1–6. 5
Olympic: OIB, OID, OIE, OIF, OmE, OmF.	0–44	Clay loam and silty clay loam.	ML or CL	A–7	90–100	90–100	75–85	0. 2–0. 63	0. 19–0. 21	5. 1–6. 0
	44–59	Gravelly clay loam.	GC	A–4	75–90	70–85	35–50	0. 2–0. 63	0. 10–0. 12	4. 5–5. 5
	59	Fractured basalt.								
OpC, OpE, OpG, OrC.	0–30	Heavy clay loam and heavy silty clay loam.	ML or CL	A–7	90–95	90–95	75–85	0. 2–0. 63	0. 19–0. 21	5. 1–6. 0
	30	Fractured basalt.								
Pilchuck: PhB.	0–60	Fine sand	SM	A–3	95–100	90–100	5–10	6. 3–20. 0	0. 05–0. 07	6. 1–7. 3
*Powell: PoB, PoD, PoE.	0–23	Silt loam	ML	A–4	--------	100	80–90	0. 63–0. 20	0. 18–0. 20	5. 1–6. 0
	23–63	Slit loam (fragipan).	ML	A–4	--------	100	80–90	0. 06–0. 20*	0. 06–0. 08	5. 1–6. 0
Puyallup: PuA.	0–27	Stratified fine sandy loam, loam, and loamy sand.	SM	A–4	100	95–100	35–50	2. 0–6. 3	0. 10–0. 12	5. 6–6. 5
	27–60	Gravelly sand	SP or SW	A–1	70–90	65–85	0–5	6. 3–20. 0	0. 04–0. 06	6. 6–7. 3
Riverwash, sandy: Ra.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Riverwash, cobbly: Rc.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Rock land: Rk.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Rough broken land: Ro.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)

See footnotes at end of table.

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Valley View Estates
Site Name:	Valley View Estates
Site Address:	20109 SE 40TH ST
City:	Camas
Report Date:	4/26/2018
Gage:	Lacamas
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	1.300
Version Date:	2017/07/05
Version:	4.2.13

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Forest, Steep	9.8
Pervious Total	9.8
Impervious Land Use	acre
ROADS STEEP	0.2
Impervious Total	0.2
Basin Total	10

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Mod	2.2
Pervious Total	2.2
Impervious Land Use	acre
ROOF TOPS FLAT	1
DRIVEWAYS FLAT	0.5
Impervious Total	1.5
Basin Total	3.7

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Basin 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	1
Impervious Total	1
Basin Total	1

Element Flows To:

Surface	Interflow	Groundwater
Flow Splitter 1	Flow Splitter 1	

Basin 3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Mod	1.9
Pervious Total	1.9
Impervious Land Use	acre
ROOF TOPS FLAT	0.9
DRIVEWAYS FLAT	0.4
Impervious Total	1.3
Basin Total	3.2

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Basin 4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.2
Impervious Total	0.2
Basin Total	0.2

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Basin 5

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.3
Impervious Total	0.3
Basin Total	0.3

Element Flows To:

Surface	Interflow	Groundwater
Flow Splitter 2	Flow Splitter 2	

Basin 6

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Steep	0.4
Pervious Total	0.4
Impervious Land Use	acre
ROOF TOPS FLAT	0.2
DRIVEWAYS FLAT	0.1
Impervious Total	0.3
Basin Total	0.7

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 2	Trapezoidal Pond 2	

Basin 7

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS STEEP	0.3
Impervious Total	0.3
Basin Total	0.3

Element Flows To:

Surface	Interflow	Groundwater
Flow Splitter 3	Flow Splitter 3	

Basin 8

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Flat	0.07
Pervious Total	0.07
Impervious Land Use	acre
PARKING FLAT	0.03
Impervious Total	0.03
Basin Total	0.1

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 2	Trapezoidal Pond 2	

Basin 9

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Flat	0.3
Pervious Total	0.3
Impervious Land Use	acre
ROADS FLAT	0.2
Impervious Total	0.2
Basin Total	0.5

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements

Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length:	180.00 ft.	
Bottom Width:	90.00 ft.	
Depth:	7 ft.	
Volume at riser head:	2.0537 acre-feet.	
Infiltration On		
Infiltration rate:	0.5	
Infiltration safety factor:	0.5	
Total Volume Infiltrated (ac-ft.):		739.733
Total Volume Through Riser (ac-ft.):		459.106
Total Volume Through Facility (ac-ft.):		1198.839
Percent Infiltrated:		61.7
Total Precip Applied to Facility:		84.997
Total Evap From Facility:		15.042
Side slope 1:	0 To 1	
Side slope 2:	0 To 1	
Side slope 3:	0 To 1	
Side slope 4:	0 To 1	
Discharge Structure		
Riser Height:	5.5 ft.	
Riser Diameter:	18 in.	
Orifice 1 Diameter:	1.9 in.	Elevation:0 ft.
Orifice 2 Diameter:	3 in.	Elevation:4 ft.

Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.371	0.000	0.000	0.000
0.0778	0.371	0.028	0.027	0.093
0.1556	0.371	0.057	0.038	0.093
0.2333	0.371	0.086	0.047	0.093
0.3111	0.371	0.115	0.054	0.093
0.3889	0.371	0.144	0.061	0.093
0.4667	0.371	0.173	0.066	0.093
0.5444	0.371	0.202	0.072	0.093
0.6222	0.371	0.231	0.077	0.093
0.7000	0.371	0.260	0.082	0.093
0.7778	0.371	0.289	0.086	0.093
0.8556	0.371	0.318	0.090	0.093
0.9333	0.371	0.347	0.094	0.093
1.0111	0.371	0.376	0.098	0.093
1.0889	0.371	0.405	0.102	0.093
1.1667	0.371	0.433	0.105	0.093
1.2444	0.371	0.462	0.109	0.093
1.3222	0.371	0.491	0.112	0.093
1.4000	0.371	0.520	0.115	0.093
1.4778	0.371	0.549	0.119	0.093
1.5556	0.371	0.578	0.122	0.093
1.6333	0.371	0.607	0.125	0.093
1.7111	0.371	0.636	0.128	0.093
1.7889	0.371	0.665	0.131	0.093
1.8667	0.371	0.694	0.133	0.093

1.9444	0.371	0.723	0.136	0.093
2.0222	0.371	0.752	0.139	0.093
2.1000	0.371	0.781	0.142	0.093
2.1778	0.371	0.809	0.144	0.093
2.2556	0.371	0.838	0.147	0.093
2.3333	0.371	0.867	0.149	0.093
2.4111	0.371	0.896	0.152	0.093
2.4889	0.371	0.925	0.154	0.093
2.5667	0.371	0.954	0.156	0.093
2.6444	0.371	0.983	0.159	0.093
2.7222	0.371	1.012	0.161	0.093
2.8000	0.371	1.041	0.163	0.093
2.8778	0.371	1.070	0.166	0.093
2.9556	0.371	1.099	0.168	0.093
3.0333	0.371	1.128	0.170	0.093
3.1111	0.371	1.157	0.172	0.093
3.1889	0.371	1.186	0.174	0.093
3.2667	0.371	1.214	0.177	0.093
3.3444	0.371	1.243	0.179	0.093
3.4222	0.371	1.272	0.181	0.093
3.5000	0.371	1.301	0.183	0.093
3.5778	0.371	1.330	0.185	0.093
3.6556	0.371	1.359	0.187	0.093
3.7333	0.371	1.388	0.189	0.093
3.8111	0.371	1.417	0.191	0.093
3.8889	0.371	1.446	0.193	0.093
3.9667	0.371	1.475	0.195	0.093
4.0444	0.371	1.504	0.248	0.093
4.1222	0.371	1.533	0.284	0.093
4.2000	0.371	1.562	0.310	0.093
4.2778	0.371	1.590	0.331	0.093
4.3556	0.371	1.619	0.350	0.093
4.4333	0.371	1.648	0.367	0.093
4.5111	0.371	1.677	0.382	0.093
4.5889	0.371	1.706	0.397	0.093
4.6667	0.371	1.735	0.411	0.093
4.7444	0.371	1.764	0.424	0.093
4.8222	0.371	1.793	0.436	0.093
4.9000	0.371	1.822	0.448	0.093
4.9778	0.371	1.851	0.460	0.093
5.0556	0.371	1.880	0.471	0.093
5.1333	0.371	1.909	0.482	0.093
5.2111	0.371	1.938	0.492	0.093
5.2889	0.371	1.966	0.502	0.093
5.3667	0.371	1.995	0.512	0.093
5.4444	0.371	2.024	0.522	0.093
5.5222	0.371	2.053	0.584	0.093
5.6000	0.371	2.082	1.042	0.093
5.6778	0.371	2.111	1.731	0.093
5.7556	0.371	2.140	2.558	0.093
5.8333	0.371	2.169	3.449	0.093
5.9111	0.371	2.198	4.328	0.093
5.9889	0.371	2.227	5.121	0.093
6.0667	0.371	2.256	5.771	0.093
6.1444	0.371	2.285	6.249	0.093
6.2222	0.371	2.314	6.583	0.093
6.3000	0.371	2.343	6.954	0.093
6.3778	0.371	2.371	7.263	0.093

6.4556	0.371	2.400	7.559	0.093
6.5333	0.371	2.429	7.842	0.093
6.6111	0.371	2.458	8.116	0.093
6.6889	0.371	2.487	8.380	0.093
6.7667	0.371	2.516	8.636	0.093
6.8444	0.371	2.545	8.885	0.093
6.9222	0.371	2.574	9.126	0.093
7.0000	0.371	2.603	9.361	0.093
7.0778	0.371	2.632	9.590	0.093

Flow Splitter 1

Bottom Length:	10.00 ft.
Bottom Length:	10.00 ft.
Depth:	10 ft.
Side slope 1:	0 To 1
Side slope 2:	0 To 1
Side slope 3:	0 To 1
Side slope 4:	0 To 1

Control Structure Splitter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Primary(cfs)	Secondary(cfs)
0.000	0.002	0.000	0.000	0.000
0.111	0.002	0.000	5.210	0.000
0.222	0.002	0.000	7.368	0.000
0.333	0.002	0.000	9.024	0.000
0.444	0.002	0.001	10.42	0.000
0.555	0.002	0.001	11.65	0.000
0.666	0.002	0.001	12.76	0.000
0.777	0.002	0.001	13.78	0.000
0.888	0.002	0.002	14.73	0.000
1.000	0.002	0.002	15.63	0.000
1.111	0.002	0.002	16.47	0.000
1.222	0.002	0.002	17.28	0.000
1.333	0.002	0.003	18.04	0.000
1.444	0.002	0.003	18.78	0.000
1.555	0.002	0.003	19.49	0.000
1.666	0.002	0.003	20.17	0.000
1.777	0.002	0.004	20.84	0.000
1.888	0.002	0.004	21.48	0.000
2.000	0.002	0.004	22.10	0.000
2.111	0.002	0.004	22.71	0.000
2.222	0.002	0.005	23.30	0.000
2.333	0.002	0.005	23.87	0.000
2.444	0.002	0.005	24.43	0.000
2.555	0.002	0.005	24.98	0.000
2.666	0.002	0.006	25.52	0.000
2.777	0.002	0.006	26.05	0.000
2.888	0.002	0.006	26.56	0.000
3.000	0.002	0.006	27.07	0.000
3.111	0.002	0.007	27.57	0.000
3.222	0.002	0.007	28.05	0.000
3.333	0.002	0.007	28.53	0.000
3.444	0.002	0.007	29.01	0.000
3.555	0.002	0.008	29.47	0.000
3.666	0.002	0.008	29.93	0.000
3.777	0.002	0.008	30.38	0.000
3.888	0.002	0.008	30.82	0.000
4.000	0.002	0.009	31.26	0.000
4.111	0.002	0.009	31.69	0.000
4.222	0.002	0.009	32.11	0.000
4.333	0.002	0.009	32.53	0.000
4.444	0.002	0.010	32.95	0.000
4.555	0.002	0.010	33.36	0.000
4.666	0.002	0.010	33.76	0.000
4.777	0.002	0.011	34.16	0.000
4.888	0.002	0.011	34.56	0.000
5.000	0.002	0.011	34.95	0.000
5.111	0.002	0.011	35.33	0.000

5.222	0.002	0.012	35.72	0.000
5.333	0.002	0.012	36.09	0.000
5.444	0.002	0.012	36.47	0.000
5.555	0.002	0.012	36.84	0.000
5.666	0.002	0.013	37.20	0.000
5.777	0.002	0.013	37.57	0.000
5.888	0.002	0.013	37.93	0.000
6.000	0.002	0.013	38.28	0.000
6.111	0.002	0.014	38.64	0.000
6.222	0.002	0.014	38.99	0.000
6.333	0.002	0.014	39.33	0.000
6.444	0.002	0.014	39.68	0.000
6.555	0.002	0.015	40.02	0.000
6.666	0.002	0.015	40.35	0.000
6.777	0.002	0.015	40.69	0.000
6.888	0.002	0.015	41.02	0.000
7.000	0.002	0.016	41.35	0.000
7.111	0.002	0.016	41.68	0.000
7.222	0.002	0.016	42.00	0.000
7.333	0.002	0.016	42.32	0.000
7.444	0.002	0.017	42.64	0.000
7.555	0.002	0.017	42.96	0.000
7.666	0.002	0.017	43.28	0.000
7.777	0.002	0.017	43.59	0.000
7.888	0.002	0.018	43.90	0.000
8.000	0.002	0.018	44.21	0.000
8.111	0.002	0.018	44.51	0.000
8.222	0.002	0.018	44.82	0.000
8.333	0.002	0.019	45.12	0.000
8.444	0.002	0.019	45.42	0.000
8.555	0.002	0.019	45.72	0.000
8.666	0.002	0.019	46.01	0.000
8.777	0.002	0.020	46.31	0.000
8.888	0.002	0.020	46.60	0.000
9.000	0.002	0.020	46.89	0.000
9.111	0.002	0.020	47.18	0.000
9.222	0.002	0.021	47.46	0.000
9.333	0.002	0.021	47.75	0.000
9.444	0.002	0.021	48.03	0.000
9.555	0.002	0.021	48.31	0.000
9.666	0.002	0.022	48.59	0.000
9.777	0.002	0.022	48.87	0.000
9.888	0.002	0.022	49.15	0.000
10.00	0.002	0.023	49.42	0.000
10.11	0.002	0.023	49.70	0.000

Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.
Orifice 1 Diameter: 24 in. Elevation:0 ft.
Element Flows To:

Outlet 1	Outlet 2
Trapezoidal Pond 1	Trapezoidal Pond 1

Flow Splitter 2

Bottom Length: 10.00 ft.
Bottom Length: 10.00 ft.
Depth: 10 ft.
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1
Control Structure Splitter Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Primary(cfs)**	**Secondary(cfs)**
0.000	0.002	0.000	0.000	0.000
0.111	0.002	0.000	5.210	0.000
0.222	0.002	0.000	7.368	0.000
0.333	0.002	0.000	9.024	0.000
0.444	0.002	0.001	10.42	0.000
0.555	0.002	0.001	11.65	0.000
0.666	0.002	0.001	12.76	0.000
0.777	0.002	0.001	13.78	0.000
0.888	0.002	0.002	14.73	0.000
1.000	0.002	0.002	15.63	0.000
1.111	0.002	0.002	16.47	0.000
1.222	0.002	0.002	17.28	0.000
1.333	0.002	0.003	18.04	0.000
1.444	0.002	0.003	18.78	0.000
1.555	0.002	0.003	19.49	0.000
1.666	0.002	0.003	20.17	0.000
1.777	0.002	0.004	20.84	0.000
1.888	0.002	0.004	21.48	0.000
2.000	0.002	0.004	22.10	0.000
2.111	0.002	0.004	22.71	0.784
2.222	0.002	0.005	23.30	2.205
2.333	0.002	0.005	23.87	3.979
2.444	0.002	0.005	24.43	5.917
2.555	0.002	0.005	24.98	7.826
2.666	0.002	0.006	25.52	9.523
2.777	0.002	0.006	26.05	10.86
2.888	0.002	0.006	26.56	11.81
3.000	0.002	0.006	27.07	12.59
3.111	0.002	0.007	27.57	13.28
3.222	0.002	0.007	28.05	13.92
3.333	0.002	0.007	28.53	14.54
3.444	0.002	0.007	29.01	15.14
3.555	0.002	0.008	29.47	15.71
3.666	0.002	0.008	29.93	16.26
3.777	0.002	0.008	30.38	16.79
3.888	0.002	0.008	30.82	17.31
4.000	0.002	0.009	31.26	17.81
4.111	0.002	0.009	31.69	18.30
4.222	0.002	0.009	32.11	18.78
4.333	0.002	0.009	32.53	19.24
4.444	0.002	0.010	32.95	19.69
4.555	0.002	0.010	33.36	20.14
4.666	0.002	0.010	33.76	20.57
4.777	0.002	0.011	34.16	20.99
4.888	0.002	0.011	34.56	21.41
5.000	0.002	0.011	34.95	21.82
5.111	0.002	0.011	35.33	22.22

5.222	0.002	0.012	35.72	22.61
5.333	0.002	0.012	36.09	23.00
5.444	0.002	0.012	36.47	23.38
5.555	0.002	0.012	36.84	23.75
5.666	0.002	0.013	37.20	24.12
5.777	0.002	0.013	37.57	24.48
5.888	0.002	0.013	37.93	24.84
6.000	0.002	0.013	38.28	25.19
6.111	0.002	0.014	38.64	25.54
6.222	0.002	0.014	38.99	25.88
6.333	0.002	0.014	39.33	26.22
6.444	0.002	0.014	39.68	26.56
6.555	0.002	0.015	40.02	26.89
6.666	0.002	0.015	40.35	27.21
6.777	0.002	0.015	40.69	27.53
6.888	0.002	0.015	41.02	27.85
7.000	0.002	0.016	41.35	28.17
7.111	0.002	0.016	41.68	28.48
7.222	0.002	0.016	42.00	28.79
7.333	0.002	0.016	42.32	29.09
7.444	0.002	0.017	42.64	29.39
7.555	0.002	0.017	42.96	29.69
7.666	0.002	0.017	43.28	29.99
7.777	0.002	0.017	43.59	30.28
7.888	0.002	0.018	43.90	30.57
8.000	0.002	0.018	44.21	30.86
8.111	0.002	0.018	44.51	31.14
8.222	0.002	0.018	44.82	31.42
8.333	0.002	0.019	45.12	31.70
8.444	0.002	0.019	45.42	31.98
8.555	0.002	0.019	45.72	32.25
8.666	0.002	0.019	46.01	32.52
8.777	0.002	0.020	46.31	32.79
8.888	0.002	0.020	46.60	33.06
9.000	0.002	0.020	46.89	33.33
9.111	0.002	0.020	47.18	33.59
9.222	0.002	0.021	47.46	33.85
9.333	0.002	0.021	47.75	34.11
9.444	0.002	0.021	48.03	34.37
9.555	0.002	0.021	48.31	34.63
9.666	0.002	0.022	48.59	34.88
9.777	0.002	0.022	48.87	35.13
9.888	0.002	0.022	49.15	35.38
10.00	0.002	0.023	49.42	35.63
10.11	0.002	0.023	49.70	35.88

Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.
Orifice 1 Diameter: 24 in. Elevation:0 ft.
Element Flows To:

Outlet 1	Outlet 2
Trapezoidal Pond 1	Trapezoidal Pond 1

Trapezoidal Pond 2

Bottom Length:	55.00 ft.	
Bottom Width:	30.00 ft.	
Depth:	7 ft.	
Volume at riser head:	0.1915 acre-feet.	
Infiltration On		
Infiltration rate:	0.5	
Infiltration safety factor:	0.5	
Total Volume Infiltrated (ac-ft.):		44.415
Total Volume Through Riser (ac-ft.):		117.146
Total Volume Through Facility (ac-ft.):		161.56
Percent Infiltrated:		27.49
Total Precip Applied to Facility:		8.667
Total Evap From Facility:		1.514
Side slope 1:	0 To 1	
Side slope 2:	0 To 1	
Side slope 3:	0 To 1	
Side slope 4:	0 To 1	
Discharge Structure		
Riser Height:	5 ft.	
Riser Diameter:	12 in.	
Orifice 1 Diameter:	1.5 in.	Elevation:0 ft.
Orifice 2 Diameter:	1 in.	Elevation:4 ft.
Element Flows To:		
Outlet 1	Outlet 2	

Pond Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.037	0.000	0.000	0.000
0.0778	0.037	0.002	0.017	0.009
0.1556	0.037	0.005	0.024	0.009
0.2333	0.037	0.008	0.029	0.009
0.3111	0.037	0.011	0.034	0.009
0.3889	0.037	0.014	0.038	0.009
0.4667	0.037	0.017	0.041	0.009
0.5444	0.037	0.020	0.045	0.009
0.6222	0.037	0.023	0.048	0.009
0.7000	0.037	0.026	0.051	0.009
0.7778	0.037	0.029	0.053	0.009
0.8556	0.037	0.032	0.056	0.009
0.9333	0.037	0.035	0.059	0.009
1.0111	0.037	0.038	0.061	0.009
1.0889	0.037	0.041	0.063	0.009
1.1667	0.037	0.044	0.065	0.009
1.2444	0.037	0.047	0.068	0.009
1.3222	0.037	0.050	0.070	0.009
1.4000	0.037	0.053	0.072	0.009
1.4778	0.037	0.056	0.074	0.009
1.5556	0.037	0.058	0.076	0.009
1.6333	0.037	0.061	0.078	0.009
1.7111	0.037	0.064	0.079	0.009
1.7889	0.037	0.067	0.081	0.009
1.8667	0.037	0.070	0.083	0.009
1.9444	0.037	0.073	0.085	0.009
2.0222	0.037	0.076	0.086	0.009

2.1000	0.037	0.079	0.088	0.009
2.1778	0.037	0.082	0.090	0.009
2.2556	0.037	0.085	0.091	0.009
2.3333	0.037	0.088	0.093	0.009
2.4111	0.037	0.091	0.094	0.009
2.4889	0.037	0.094	0.096	0.009
2.5667	0.037	0.097	0.097	0.009
2.6444	0.037	0.100	0.099	0.009
2.7222	0.037	0.103	0.100	0.009
2.8000	0.037	0.106	0.102	0.009
2.8778	0.037	0.109	0.103	0.009
2.9556	0.037	0.112	0.105	0.009
3.0333	0.037	0.114	0.106	0.009
3.1111	0.037	0.117	0.107	0.009
3.1889	0.037	0.120	0.109	0.009
3.2667	0.037	0.123	0.110	0.009
3.3444	0.037	0.126	0.111	0.009
3.4222	0.037	0.129	0.113	0.009
3.5000	0.037	0.132	0.114	0.009
3.5778	0.037	0.135	0.115	0.009
3.6556	0.037	0.138	0.116	0.009
3.7333	0.037	0.141	0.118	0.009
3.8111	0.037	0.144	0.119	0.009
3.8889	0.037	0.147	0.120	0.009
3.9667	0.037	0.150	0.121	0.009
4.0444	0.037	0.153	0.128	0.009
4.1222	0.037	0.156	0.133	0.009
4.2000	0.037	0.159	0.137	0.009
4.2778	0.037	0.162	0.140	0.009
4.3556	0.037	0.165	0.143	0.009
4.4333	0.037	0.167	0.146	0.009
4.5111	0.037	0.170	0.149	0.009
4.5889	0.037	0.173	0.151	0.009
4.6667	0.037	0.176	0.154	0.009
4.7444	0.037	0.179	0.156	0.009
4.8222	0.037	0.182	0.158	0.009
4.9000	0.037	0.185	0.160	0.009
4.9778	0.037	0.188	0.163	0.009
5.0556	0.037	0.191	0.303	0.009
5.1333	0.037	0.194	0.676	0.009
5.2111	0.037	0.197	1.146	0.009
5.2889	0.037	0.200	1.618	0.009
5.3667	0.037	0.203	2.007	0.009
5.4444	0.037	0.206	2.263	0.009
5.5222	0.037	0.209	2.453	0.009
5.6000	0.037	0.212	2.618	0.009
5.6778	0.037	0.215	2.773	0.009
5.7556	0.037	0.218	2.920	0.009
5.8333	0.037	0.221	3.059	0.009
5.9111	0.037	0.223	3.192	0.009
5.9889	0.037	0.226	3.319	0.009
6.0667	0.037	0.229	3.442	0.009
6.1444	0.037	0.232	3.560	0.009
6.2222	0.037	0.235	3.674	0.009
6.3000	0.037	0.238	3.785	0.009
6.3778	0.037	0.241	3.893	0.009
6.4556	0.037	0.244	3.997	0.009
6.5333	0.037	0.247	4.099	0.009

6.6111	0.037	0.250	4.198	0.009
6.6889	0.037	0.253	4.295	0.009
6.7667	0.037	0.256	4.390	0.009
6.8444	0.037	0.259	4.483	0.009
6.9222	0.037	0.262	4.573	0.009
7.0000	0.037	0.265	4.662	0.009
7.0778	0.037	0.268	4.750	0.009

Flow Splitter 3

Bottom Length: 10.00 ft.
Bottom Length: 10.00 ft.
Depth: 10 ft.
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1
Control Structure Splitter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Primary(cfs)	Secondary(cfs)
0.000	0.002	0.000	0.000	0.000
0.111	0.002	0.000	5.210	0.000
0.222	0.002	0.000	7.368	0.000
0.333	0.002	0.000	9.024	0.000
0.444	0.002	0.001	10.42	0.000
0.555	0.002	0.001	11.65	0.000
0.666	0.002	0.001	12.76	0.000
0.777	0.002	0.001	13.78	0.000
0.888	0.002	0.002	14.73	0.000
1.000	0.002	0.002	15.63	0.000
1.111	0.002	0.002	16.47	0.000
1.222	0.002	0.002	17.28	0.000
1.333	0.002	0.003	18.04	0.000
1.444	0.002	0.003	18.78	0.000
1.555	0.002	0.003	19.49	0.000
1.666	0.002	0.003	20.17	0.000
1.777	0.002	0.004	20.84	0.000
1.888	0.002	0.004	21.48	0.000
2.000	0.002	0.004	22.10	0.000
2.111	0.002	0.004	22.71	0.784
2.222	0.002	0.005	23.30	2.205
2.333	0.002	0.005	23.87	3.979
2.444	0.002	0.005	24.43	5.917
2.555	0.002	0.005	24.98	7.826
2.666	0.002	0.006	25.52	9.523
2.777	0.002	0.006	26.05	10.86
2.888	0.002	0.006	26.56	11.81
3.000	0.002	0.006	27.07	12.59
3.111	0.002	0.007	27.57	13.28
3.222	0.002	0.007	28.05	13.92
3.333	0.002	0.007	28.53	14.54
3.444	0.002	0.007	29.01	15.14
3.555	0.002	0.008	29.47	15.71
3.666	0.002	0.008	29.93	16.26
3.777	0.002	0.008	30.38	16.79
3.888	0.002	0.008	30.82	17.31
4.000	0.002	0.009	31.26	17.81
4.111	0.002	0.009	31.69	18.30
4.222	0.002	0.009	32.11	18.78
4.333	0.002	0.009	32.53	19.24
4.444	0.002	0.010	32.95	19.69
4.555	0.002	0.010	33.36	20.14
4.666	0.002	0.010	33.76	20.57
4.777	0.002	0.011	34.16	20.99
4.888	0.002	0.011	34.56	21.41
5.000	0.002	0.011	34.95	21.82
5.111	0.002	0.011	35.33	22.22

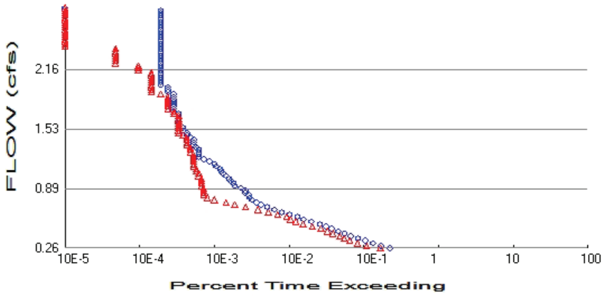
5.222	0.002	0.012	35.72	22.61
5.333	0.002	0.012	36.09	23.00
5.444	0.002	0.012	36.47	23.38
5.555	0.002	0.012	36.84	23.75
5.666	0.002	0.013	37.20	24.12
5.777	0.002	0.013	37.57	24.48
5.888	0.002	0.013	37.93	24.84
6.000	0.002	0.013	38.28	25.19
6.111	0.002	0.014	38.64	25.54
6.222	0.002	0.014	38.99	25.88
6.333	0.002	0.014	39.33	26.22
6.444	0.002	0.014	39.68	26.56
6.555	0.002	0.015	40.02	26.89
6.666	0.002	0.015	40.35	27.21
6.777	0.002	0.015	40.69	27.53
6.888	0.002	0.015	41.02	27.85
7.000	0.002	0.016	41.35	28.17
7.111	0.002	0.016	41.68	28.48
7.222	0.002	0.016	42.00	28.79
7.333	0.002	0.016	42.32	29.09
7.444	0.002	0.017	42.64	29.39
7.555	0.002	0.017	42.96	29.69
7.666	0.002	0.017	43.28	29.99
7.777	0.002	0.017	43.59	30.28
7.888	0.002	0.018	43.90	30.57
8.000	0.002	0.018	44.21	30.86
8.111	0.002	0.018	44.51	31.14
8.222	0.002	0.018	44.82	31.42
8.333	0.002	0.019	45.12	31.70
8.444	0.002	0.019	45.42	31.98
8.555	0.002	0.019	45.72	32.25
8.666	0.002	0.019	46.01	32.52
8.777	0.002	0.020	46.31	32.79
8.888	0.002	0.020	46.60	33.06
9.000	0.002	0.020	46.89	33.33
9.111	0.002	0.020	47.18	33.59
9.222	0.002	0.021	47.46	33.85
9.333	0.002	0.021	47.75	34.11
9.444	0.002	0.021	48.03	34.37
9.555	0.002	0.021	48.31	34.63
9.666	0.002	0.022	48.59	34.88
9.777	0.002	0.022	48.87	35.13
9.888	0.002	0.022	49.15	35.38
10.00	0.002	0.023	49.42	35.63
10.11	0.002	0.023	49.70	35.88

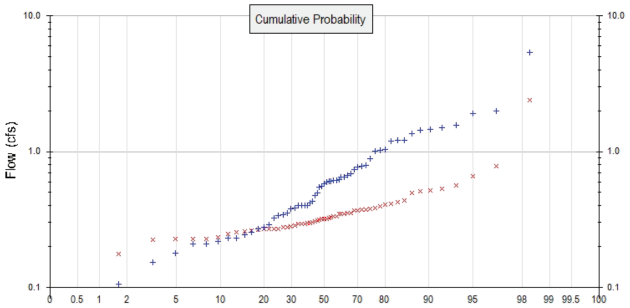
Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.
Orifice 1 Diameter: 24 in. Elevation:0 ft.
Element Flows To:

Outlet 1	Outlet 2
Trapezoidal Pond 2	Trapezoidal Pond 2

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 9.8
Total Impervious Area: 0.2

Mitigated Landuse Totals for POC #1
Total Pervious Area: 4.87
Total Impervious Area: 5.13

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.521641
5 year	1.010245
10 year	1.448232
25 year	2.150329
50 year	2.7932
100 year	3.548955

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.320254
5 year	0.45499
10 year	0.563746
25 year	0.725969
50 year	0.866626
100 year	1.02587

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.472	0.515
1950	0.420	0.286
1951	1.217	0.312
1952	0.386	0.320
1953	0.646	0.319
1954	1.432	0.380
1955	0.544	0.256
1956	1.355	0.493
1957	0.888	0.314
1958	0.625	0.368

1959	0.351	0.224
1960	0.289	0.248
1961	0.688	0.395
1962	0.336	0.276
1963	0.401	0.283
1964	0.495	0.301
1965	0.764	0.425
1966	0.598	0.293
1967	0.558	0.263
1968	0.610	0.349
1969	0.791	0.437
1970	5.377	0.656
1971	0.254	0.234
1972	0.580	0.271
1973	0.219	0.307
1974	1.015	0.534
1975	0.376	0.269
1976	1.030	0.317
1977	0.092	0.227
1978	1.560	0.412
1979	0.232	0.345
1980	0.401	0.298
1981	1.210	0.406
1982	0.785	0.353
1983	1.978	0.347
1984	0.326	0.278
1985	0.277	0.322
1986	0.243	0.292
1987	1.189	0.333
1988	0.229	0.292
1989	0.209	0.228
1990	0.210	0.226
1991	0.606	0.268
1992	0.612	0.268
1993	0.401	0.367
1994	0.429	0.332
1995	0.269	0.512
1996	1.916	2.394
1997	1.507	0.785
1998	0.607	0.384
1999	0.650	0.376
2000	0.663	0.174
2001	0.105	0.176
2002	1.456	0.375
2003	1.033	0.354
2004	0.154	0.256
2005	0.178	0.265
2006	0.736	0.296
2007	0.341	0.567
2008	0.399	0.326

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	5.3773	2.3937
2	1.9782	0.7849
3	1.9164	0.6556
4	1.5598	0.5668

5	1.5072	0.5343
6	1.4563	0.5148
7	1.4316	0.5124
8	1.3549	0.4934
9	1.2172	0.4368
10	1.2102	0.4249
11	1.1888	0.4122
12	1.0331	0.4064
13	1.0295	0.3947
14	1.0151	0.3836
15	0.8876	0.3805
16	0.7911	0.3758
17	0.7845	0.3753
18	0.7640	0.3684
19	0.7359	0.3671
20	0.6875	0.3538
21	0.6633	0.3535
22	0.6496	0.3489
23	0.6456	0.3468
24	0.6247	0.3454
25	0.6121	0.3328
26	0.6102	0.3316
27	0.6071	0.3264
28	0.6065	0.3221
29	0.5983	0.3198
30	0.5800	0.3192
31	0.5580	0.3171
32	0.5443	0.3142
33	0.4952	0.3125
34	0.4725	0.3068
35	0.4290	0.3011
36	0.4203	0.2975
37	0.4012	0.2962
38	0.4007	0.2927
39	0.4005	0.2921
40	0.3995	0.2920
41	0.3865	0.2864
42	0.3762	0.2829
43	0.3512	0.2783
44	0.3410	0.2762
45	0.3362	0.2708
46	0.3260	0.2692
47	0.2892	0.2682
48	0.2770	0.2680
49	0.2694	0.2654
50	0.2543	0.2631
51	0.2435	0.2565
52	0.2316	0.2559
53	0.2289	0.2476
54	0.2187	0.2341
55	0.2096	0.2281
56	0.2087	0.2269
57	0.1784	0.2259
58	0.1536	0.2239
59	0.1049	0.1761
60	0.0916	0.1738

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2608	4668	3511	75	Pass
0.2864	3530	2281	64	Pass
0.3120	2794	1722	61	Pass
0.3376	2203	1360	61	Pass
0.3631	1749	1149	65	Pass
0.3887	1412	990	70	Pass
0.4143	1150	813	70	Pass
0.4399	963	686	71	Pass
0.4655	782	558	71	Pass
0.4910	650	428	65	Pass
0.5166	543	323	59	Pass
0.5422	414	260	62	Pass
0.5678	330	220	66	Pass
0.5934	272	194	71	Pass
0.6189	212	147	69	Pass
0.6445	168	110	65	Pass
0.6701	132	81	61	Pass
0.6957	107	55	51	Pass
0.7213	88	39	44	Pass
0.7468	77	30	38	Pass
0.7724	67	21	31	Pass
0.7980	62	17	27	Pass
0.8236	61	15	24	Pass
0.8492	55	15	27	Pass
0.8747	54	15	27	Pass
0.9003	47	15	31	Pass
0.9259	39	14	35	Pass
0.9515	38	14	36	Pass
0.9770	35	14	40	Pass
1.0026	33	14	42	Pass
1.0282	30	13	43	Pass
1.0538	27	13	48	Pass
1.0794	26	12	46	Pass
1.1049	25	12	48	Pass
1.1305	22	11	50	Pass
1.1561	21	11	52	Pass
1.1817	18	11	61	Pass
1.2073	15	11	73	Pass
1.2328	13	11	84	Pass
1.2584	13	11	84	Pass
1.2840	13	10	76	Pass
1.3096	13	10	76	Pass
1.3352	12	10	83	Pass
1.3607	11	9	81	Pass
1.3863	11	9	81	Pass
1.4119	11	9	81	Pass
1.4375	10	9	90	Pass
1.4631	9	8	88	Pass
1.4886	9	7	77	Pass
1.5142	8	7	87	Pass
1.5398	8	7	87	Pass
1.5654	7	7	100	Pass
1.5910	7	7	100	Pass

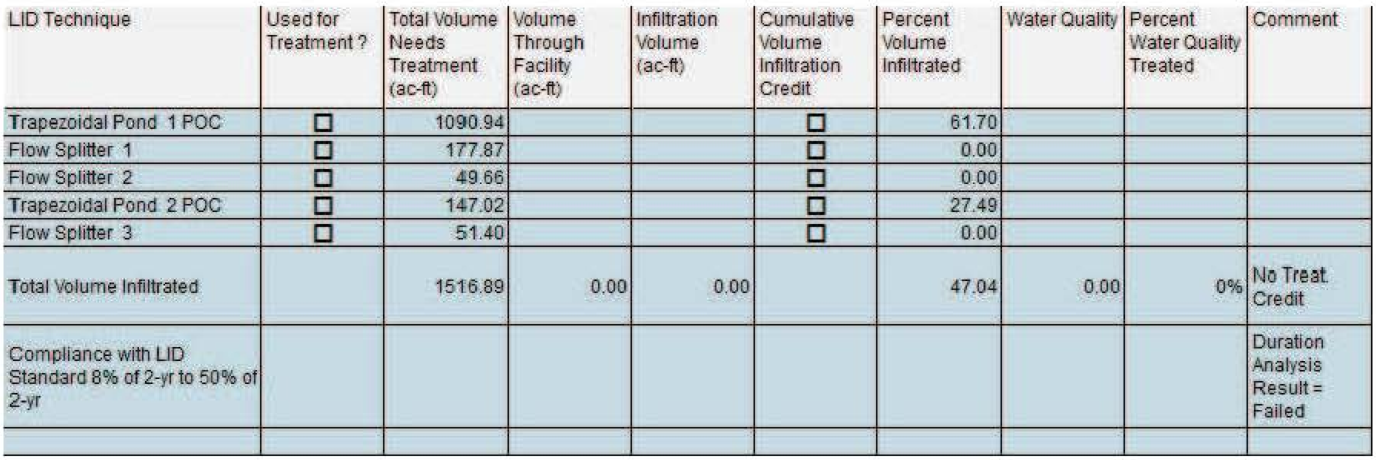
1.6165	7	7	100	Pass
1.6421	7	7	100	Pass
1.6677	7	7	100	Pass
1.6933	7	6	85	Pass
1.7189	6	6	100	Pass
1.7444	6	5	83	Pass
1.7700	6	5	83	Pass
1.7956	6	5	83	Pass
1.8212	6	5	83	Pass
1.8468	6	5	83	Pass
1.8723	6	5	83	Pass
1.8979	6	4	66	Pass
1.9235	5	3	60	Pass
1.9491	5	3	60	Pass
1.9747	5	3	60	Pass
2.0002	4	3	75	Pass
2.0258	4	3	75	Pass
2.0514	4	3	75	Pass
2.0770	4	3	75	Pass
2.1026	4	3	75	Pass
2.1281	4	3	75	Pass
2.1537	4	2	50	Pass
2.1793	4	2	50	Pass
2.2049	4	2	50	Pass
2.2304	4	1	25	Pass
2.2560	4	1	25	Pass
2.2816	4	1	25	Pass
2.3072	4	1	25	Pass
2.3328	4	1	25	Pass
2.3583	4	1	25	Pass
2.3839	4	1	25	Pass
2.4095	4	0	0	Pass
2.4351	4	0	0	Pass
2.4607	4	0	0	Pass
2.4862	4	0	0	Pass
2.5118	4	0	0	Pass
2.5374	4	0	0	Pass
2.5630	4	0	0	Pass
2.5886	4	0	0	Pass
2.6141	4	0	0	Pass
2.6397	4	0	0	Pass
2.6653	4	0	0	Pass
2.6909	4	0	0	Pass
2.7165	4	0	0	Pass
2.7420	4	0	0	Pass
2.7676	4	0	0	Pass
2.7932	4	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report



LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Trapezoidal Pond 1 POC	☐	1090.94			☐	61.70			
Flow Splitter 1	☐	177.87			☐	0.00			
Flow Splitter 2	☐	49.66			☐	0.00			
Trapezoidal Pond 2 POC	☐	147.02			☐	27.49			
Flow Splitter 3	☐	51.40			☐	0.00			
Total Volume Infiltrated		1516.89	0.00	0.00		47.04	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

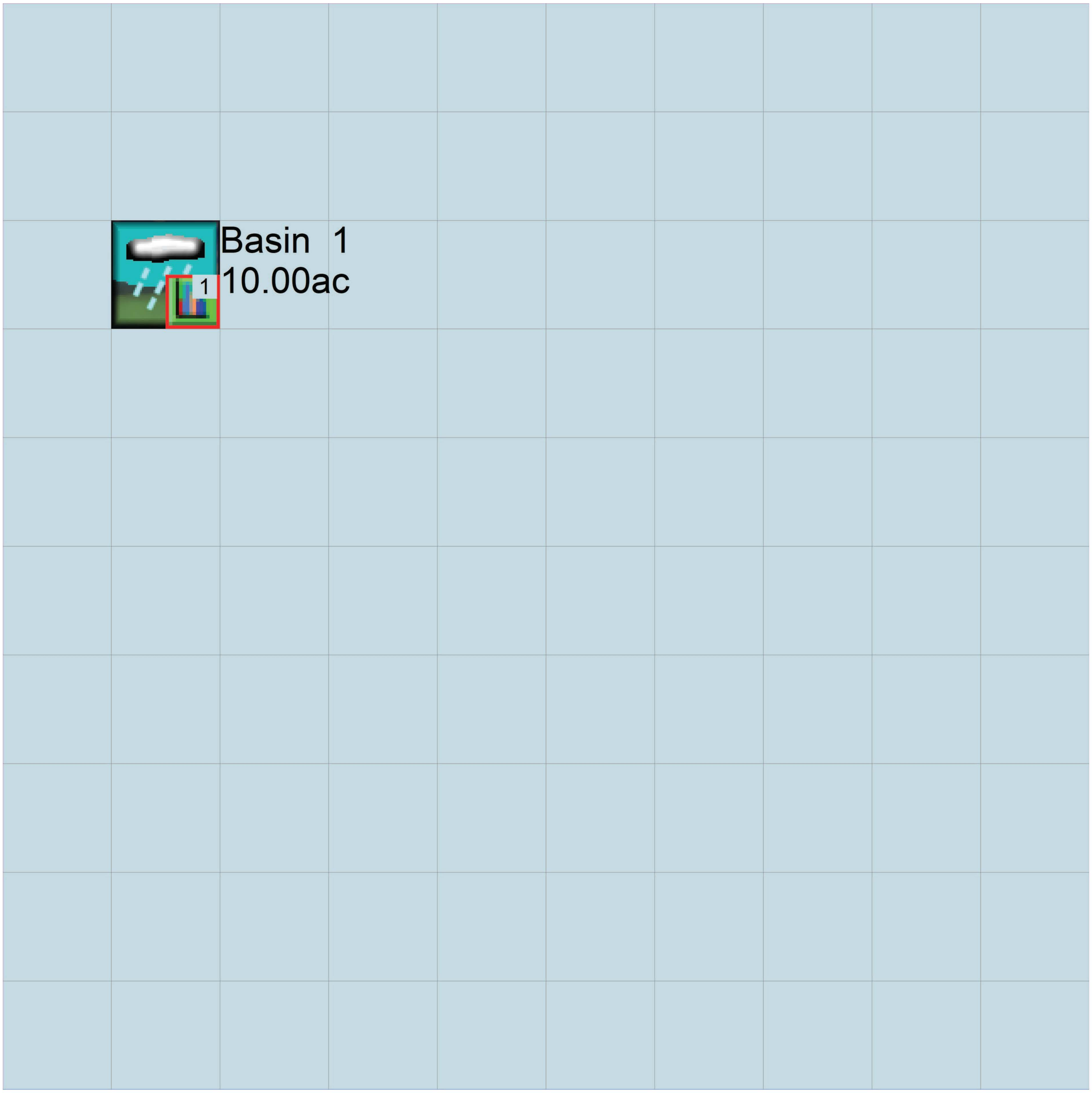
No PERLND changes have been made.

IMPLND Changes

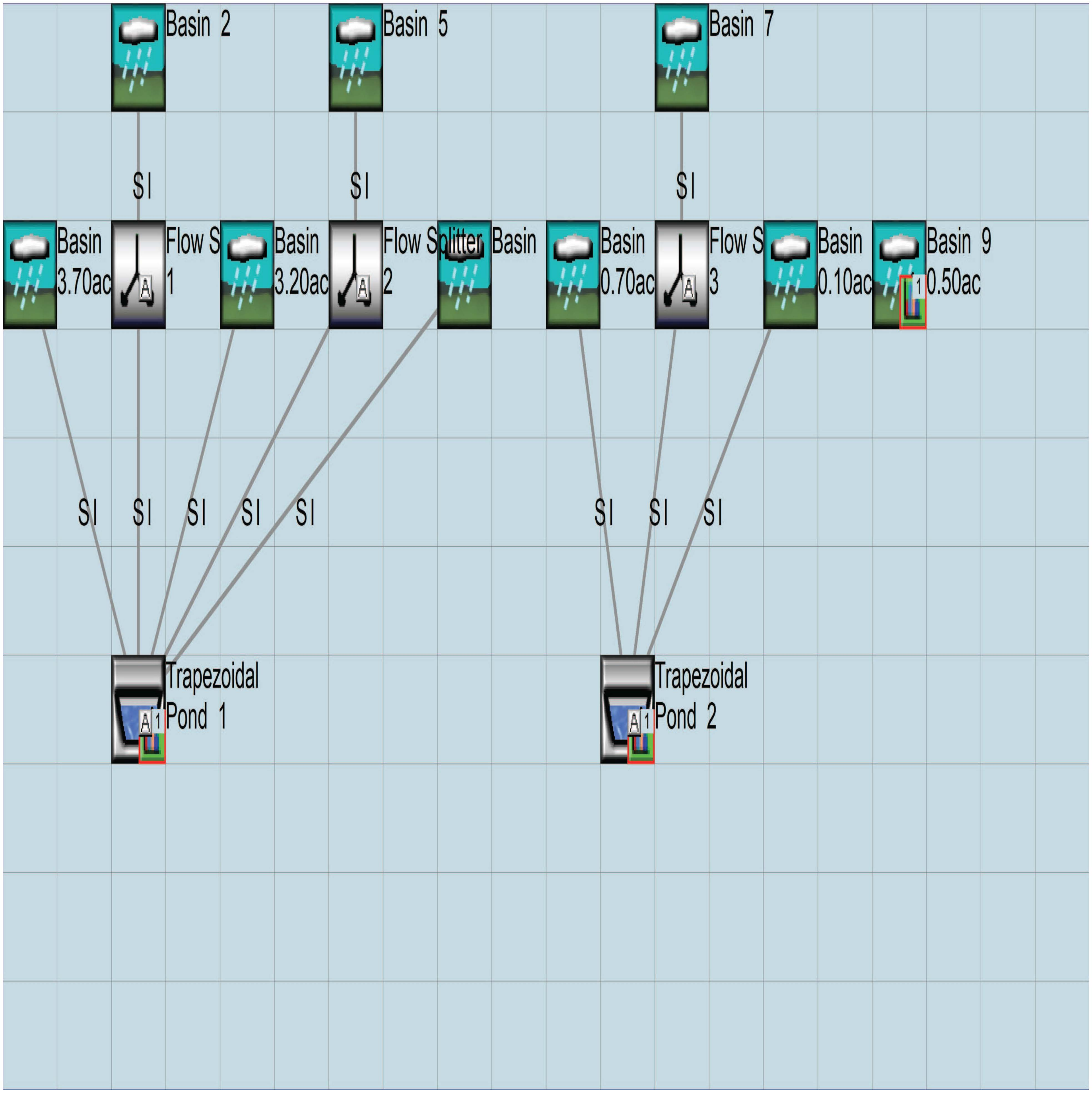
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   Valley View Estates.wdm
MESSU      25   PreValley View Estates.MES
           27   PreValley View Estates.L61
           28   PreValley View Estates.L62
           30   POCValley View Estates1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      21
      IMPLND       3
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   21      SG3, Forest, Steep      1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   21         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   21         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   21         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   21             0         9      0.08       400      0.15         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   21             0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   21           0.2         1      0.35         4       0.4       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   21             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------> Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out          ***
    3      ROADS/STEEP            1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    3         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    3         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    3         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    3            400       0.1       0.1      0.05
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    3             0         0
```

```
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    3             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                    <--Area-->     <-Target->   MBLK   ***
<Name>   #                    <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  21                           9.2     COPY   501     12
PERLND  21                           9.2     COPY   501     13
IMPLND   3                           0.2     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                         in  out                            ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                     ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
```

```
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   Valley View Estates.wdm
MESSU      25   MitValley View Estates.MES
           27   MitValley View Estates.L61
           28   MitValley View Estates.L62
           30   POCValley View Estates1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      26
      IMPLND       4
      IMPLND       5
      IMPLND       2
      PERLND      27
      IMPLND       3
      PERLND      25
      IMPLND      11
      IMPLND       1
      RCHRES       1
      RCHRES       2
      RCHRES       3
      RCHRES       4
      RCHRES       5
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  2         MAX                        1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                           in  out           ***
```

```
   26      SG3, Lawn, Mod          1    1    1    1   27    0
   27      SG3, Lawn, Steep        1    1    1    1   27    0
   25      SG3, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   26         0    0    1    0    0    0    0    0    0    0    0    0
   27         0    0    1    0    0    0    0    0    0    0    0    0
   25         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   26         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   27         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   25         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   26         0    0    0    0    0    0    0    0    0    0    0
   27         0    0    0    0    0    0    0    0    0    0    0
   25         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   26             0         9      0.05       400       0.1         0      0.96
   27             0         9      0.05       400      0.15         0      0.96
   25             0         9      0.05       400      0.05         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   26             0         0       2.5         2         0         0         0
   27             0         0       2.5         2         0         0         0
   25             0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   26           0.1       0.8      0.25         4       0.4      0.25
   27           0.1       0.8      0.25         4       0.4      0.25
   25           0.1       0.8      0.25         4       0.4      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   26             0         0         0         0         3         1         0
   27             0         0         0         0         3         1         0
   25             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
```

```
  5      DRIVEWAYS/FLAT         1    1    1   27    0
  2      ROADS/MOD              1    1    1   27    0
  3      ROADS/STEEP            1    1    1   27    0
 11      PARKING/FLAT           1    1    1   27    0
  1      ROADS/FLAT             1    1    1   27    0
END GEN-INFO
*** Section IWATER***

ACTIVITY
  <PLS > ************* Active Sections *****************************
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  4         0    0    1    0    0    0
  5         0    0    1    0    0    0
  2         0    0    1    0    0    0
  3         0    0    1    0    0    0
 11         0    0    1    0    0    0
  1         0    0    1    0    0    0
END ACTIVITY

PRINT-INFO
  <ILS > ******** Print-flags ******** PIVL  PYR
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  4         0    0    4    0    0    0    1    9
  5         0    0    4    0    0    0    1    9
  2         0    0    4    0    0    0    1    9
  3         0    0    4    0    0    0    1    9
 11         0    0    4    0    0    0    1    9
  1         0    0    4    0    0    0    1    9
END PRINT-INFO

IWAT-PARM1
  <PLS >  IWATER variable monthly parameter value flags  ***
  # -  # CSNO RTOP  VRS  VNN RTLI     ***
  4         0    0    0    0    0
  5         0    0    0    0    0
  2         0    0    0    0    0
  3         0    0    0    0    0
 11         0    0    0    0    0
  1         0    0    0    0    0
END IWAT-PARM1

IWAT-PARM2
  <PLS >      IWATER input info: Part 2         ***
  # -  # ***  LSUR     SLSUR      NSUR     RETSC
  4            400      0.01       0.1       0.1
  5            400      0.01       0.1       0.1
  2            400      0.05       0.1      0.08
  3            400       0.1       0.1      0.05
 11            400      0.01       0.1       0.1
  1            400      0.01       0.1       0.1
END IWAT-PARM2

IWAT-PARM3
  <PLS >      IWATER input info: Part 3         ***
  # -  # ***PETMAX    PETMIN
  4              0         0
  5              0         0
  2              0         0
  3              0         0
 11              0         0
  1              0         0
END IWAT-PARM3

IWAT-STATE1
  <PLS > *** Initial conditions at start of simulation
  # -  # ***  RETS      SURS
  4              0         0
  5              0         0
  2              0         0
  3              0         0
```

```
   11              0         0
    1              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  26                         2.2     RCHRES   5      2
PERLND  26                         2.2     RCHRES   5      3
IMPLND   4                           1     RCHRES   5      5
IMPLND   5                         0.5     RCHRES   5      5
Basin  2***
IMPLND   2                           1     RCHRES   1      5
Basin  3***
PERLND  26                         1.9     RCHRES   5      2
PERLND  26                         1.9     RCHRES   5      3
IMPLND   4                         0.9     RCHRES   5      5
IMPLND   5                         0.4     RCHRES   5      5
Basin  4***
IMPLND   2                         0.2     RCHRES   5      5
Basin  5***
IMPLND   2                         0.3     RCHRES   2      5
Basin  6***
PERLND  27                         0.4     RCHRES   4      2
PERLND  27                         0.4     RCHRES   4      3
IMPLND   4                         0.2     RCHRES   4      5
IMPLND   5                         0.1     RCHRES   4      5
Basin  7***
IMPLND   3                         0.3     RCHRES   3      5
Basin  8***
PERLND  25                        0.07     RCHRES   4      2
PERLND  25                        0.07     RCHRES   4      3
IMPLND  11                        0.03     RCHRES   4      5
Basin  9***
PERLND  25                         0.3     COPY   501     12
PERLND  25                         0.3     COPY   601     12
PERLND  25                         0.3     COPY   501     13
PERLND  25                         0.3     COPY   601     13
IMPLND   1                         0.2     COPY   501     15
IMPLND   1                         0.2     COPY   601     15

******Routing******
PERLND  26                         2.2     COPY     1     12
IMPLND   4                           1     COPY     1     15
IMPLND   5                         0.5     COPY     1     15
PERLND  26                         2.2     COPY     1     13
RCHRES   1                           1     RCHRES   5      7
RCHRES   1                                 COPY     1     17
RCHRES   1                           1     RCHRES   5      8
RCHRES   1                                 COPY     1     18
PERLND  26                         1.9     COPY     1     12
IMPLND   4                         0.9     COPY     1     15
IMPLND   5                         0.4     COPY     1     15
PERLND  26                         1.9     COPY     1     13
IMPLND   2                         0.2     COPY     1     15
RCHRES   2                           1     RCHRES   5      7
RCHRES   2                                 COPY     1     17
RCHRES   2                           1     RCHRES   5      8
RCHRES   2                                 COPY     1     18
PERLND  27                         0.4     COPY     1     12
IMPLND   4                         0.2     COPY     1     15
IMPLND   5                         0.1     COPY     1     15
PERLND  27                         0.4     COPY     1     13
RCHRES   3                           1     RCHRES   4      7
RCHRES   3                                 COPY     1     17
RCHRES   3                           1     RCHRES   4      8
RCHRES   3                                 COPY     1     18
```

```
PERLND  25                        0.07     COPY     1     12
IMPLND  11                        0.03     COPY     1     15
PERLND  25                        0.07     COPY     1     13
RCHRES   5                           1     COPY   501     17
RCHRES   4                           1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG             ***
                                          in  out                            ***
    1     Flow Splitter  1-010    2    1    1    1   28    0    1
    2     Flow Splitter  2-013    2    1    1    1   28    0    1
    3     Flow Splitter  3-018    2    1    1    1   28    0    1
    4     Trapezoidal Pond-015    2    1    1    1   28    0    1
    5     Trapezoidal Pond-006    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
    3         1    0    0    0    0    0    0    0    0    0
    4         1    0    0    0    0    0    0    0    0    0
    5         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         4    0    0    0    0    0    0    0    0    0    1    9
    4         4    0    0    0    0    0    0    0    0    0    1    9
    5         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    2        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    3        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    4        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    5        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.01       0.0       0.0       0.5       0.0
    2              2      0.01       0.0       0.0       0.5       0.0
    3              3      0.01       0.0       0.0       0.5       0.0
    4              4      0.01       0.0       0.0       0.5       0.0
```

```
    5              5      0.03       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    4            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    5            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      5
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.371901  0.000000  0.000000  0.000000
  0.077778  0.371901  0.028926  0.027321  0.093750
  0.155556  0.371901  0.057851  0.038637  0.093750
  0.233333  0.371901  0.086777  0.047321  0.093750
  0.311111  0.371901  0.115702  0.054642  0.093750
  0.388889  0.371901  0.144628  0.061091  0.093750
  0.466667  0.371901  0.173554  0.066922  0.093750
  0.544444  0.371901  0.202479  0.072284  0.093750
  0.622222  0.371901  0.231405  0.077275  0.093750
  0.700000  0.371901  0.260331  0.081962  0.093750
  0.777778  0.371901  0.289256  0.086396  0.093750
  0.855556  0.371901  0.318182  0.090613  0.093750
  0.933333  0.371901  0.347107  0.094642  0.093750
  1.011111  0.371901  0.376033  0.098507  0.093750
  1.088889  0.371901  0.404959  0.102225  0.093750
  1.166667  0.371901  0.433884  0.105813  0.093750
  1.244444  0.371901  0.462810  0.109283  0.093750
  1.322222  0.371901  0.491736  0.112647  0.093750
  1.400000  0.371901  0.520661  0.115912  0.093750
  1.477778  0.371901  0.549587  0.119089  0.093750
  1.555556  0.371901  0.578512  0.122182  0.093750
  1.633333  0.371901  0.607438  0.125200  0.093750
  1.711111  0.371901  0.636364  0.128146  0.093750
  1.788889  0.371901  0.665289  0.131026  0.093750
  1.866667  0.371901  0.694215  0.133844  0.093750
  1.944444  0.371901  0.723140  0.136604  0.093750
  2.022222  0.371901  0.752066  0.139309  0.093750
  2.100000  0.371901  0.780992  0.141963  0.093750
  2.177778  0.371901  0.809917  0.144568  0.093750
  2.255556  0.371901  0.838843  0.147127  0.093750
  2.333333  0.371901  0.867769  0.149642  0.093750
  2.411111  0.371901  0.896694  0.152116  0.093750
  2.488889  0.371901  0.925620  0.154550  0.093750
  2.566667  0.371901  0.954545  0.156946  0.093750
  2.644444  0.371901  0.983471  0.159306  0.093750
  2.722222  0.371901  1.012397  0.161632  0.093750
  2.800000  0.371901  1.041322  0.163925  0.093750
  2.877778  0.371901  1.070248  0.166186  0.093750
  2.955556  0.371901  1.099174  0.168417  0.093750
  3.033333  0.371901  1.128099  0.170618  0.093750
  3.111111  0.371901  1.157025  0.172792  0.093750
  3.188889  0.371901  1.185950  0.174939  0.093750
  3.266667  0.371901  1.214876  0.177059  0.093750
  3.344444  0.371901  1.243802  0.179155  0.093750
  3.422222  0.371901  1.272727  0.181226  0.093750
  3.500000  0.371901  1.301653  0.183274  0.093750
  3.577778  0.371901  1.330579  0.185299  0.093750
  3.655556  0.371901  1.359504  0.187302  0.093750
```

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3.733333  0.371901  1.388430  0.189284  0.093750
3.811111  0.371901  1.417355  0.191246  0.093750
3.888889  0.371901  1.446281  0.193187  0.093750
3.966667  0.371901  1.475207  0.195110  0.093750
4.044444  0.371901  1.504132  0.248502  0.093750
4.122222  0.371901  1.533058  0.284283  0.093750
4.200000  0.371901  1.561983  0.309990  0.093750
4.277778  0.371901  1.590909  0.331338  0.093750
4.355556  0.371901  1.619835  0.350082  0.093750
4.433333  0.371901  1.648760  0.367040  0.093750
4.511111  0.371901  1.677686  0.382675  0.093750
4.588889  0.371901  1.706612  0.397276  0.093750
4.666667  0.371901  1.735537  0.411040  0.093750
4.744444  0.371901  1.764463  0.424108  0.093750
4.822222  0.371901  1.793388  0.436585  0.093750
4.900000  0.371901  1.822314  0.448550  0.093750
4.977778  0.371901  1.851240  0.460069  0.093750
5.055556  0.371901  1.880165  0.471191  0.093750
5.133333  0.371901  1.909091  0.481959  0.093750
5.211111  0.371901  1.938017  0.492408  0.093750
5.288889  0.371901  1.966942  0.502567  0.093750
5.366667  0.371901  1.995868  0.512461  0.093750
5.444444  0.371901  2.024793  0.522112  0.093750
5.522222  0.371901  2.053719  0.584275  0.093750
5.600000  0.371901  2.082645  1.042934  0.093750
5.677778  0.371901  2.111570  1.731359  0.093750
5.755556  0.371901  2.140496  2.558530  0.093750
5.833333  0.371901  2.169421  3.449815  0.093750
5.911111  0.371901  2.198347  4.328725  0.093750
5.988889  0.371901  2.227273  5.121849  0.093750
6.066667  0.371901  2.256198  5.771055  0.093750
6.144444  0.371901  2.285124  6.249903  0.093750
6.222222  0.371901  2.314050  6.583203  0.093750
6.300000  0.371901  2.342975  6.954791  0.093750
6.377778  0.371901  2.371901  7.263491  0.093750
6.455556  0.371901  2.400826  7.559016  0.093750
6.533333  0.371901  2.429752  7.842939  0.093750
6.611111  0.371901  2.458678  8.116541  0.093750
6.688889  0.371901  2.487603  8.380881  0.093750
6.766667  0.371901  2.516529  8.636850  0.093750
6.844444  0.371901  2.545455  8.885204  0.093750
6.922222  0.371901  2.574380  9.126590  0.093750
7.000000  0.371901  2.603306  9.361569  0.093750
END FTABLE  5
FTABLE      1
 90    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)    (cfs)     (cfs)   (ft/sec)    (Minutes)***
0.000000  0.002296  0.000000  0.000000  0.000000
0.111111  0.002296  0.000255  5.210267  0.000000
0.222222  0.002296  0.000510  7.368430  0.000000
0.333333  0.002296  0.000765  9.024447  0.000000
0.444444  0.002296  0.001020  10.42053  0.000000
0.555556  0.002296  0.001275  11.65051  0.000000
0.666667  0.002296  0.001530  12.76249  0.000000
0.777778  0.002296  0.001786  13.78507  0.000000
0.888889  0.002296  0.002041  14.73686  0.000000
1.000000  0.002296  0.002296  15.63080  0.000000
1.111111  0.002296  0.002551  16.47631  0.000000
1.222222  0.002296  0.002806  17.28050  0.000000
1.333333  0.002296  0.003061  18.04889  0.000000
1.444444  0.002296  0.003316  18.78588  0.000000
1.555556  0.002296  0.003571  19.49503  0.000000
1.666667  0.002296  0.003826  20.17928  0.000000
1.777778  0.002296  0.004081  20.84107  0.000000
1.888889  0.002296  0.004336  21.48248  0.000000
2.000000  0.002296  0.004591  22.10529  0.000000
2.111111  0.002296  0.004846  22.71103  0.000000
2.222222  0.002296  0.005102  23.30102  0.000000
2.333333  0.002296  0.005357  23.87644  0.000000
```

```
    2.444444  0.002296  0.005612  24.43832  0.000000
    2.555556  0.002296  0.005867  24.98756  0.000000
    2.666667  0.002296  0.006122  25.52499  0.000000
    2.777778  0.002296  0.006377  26.05133  0.000000
    2.888889  0.002296  0.006632  26.56725  0.000000
    3.000000  0.002296  0.006887  27.07334  0.000000
    3.111111  0.002296  0.007142  27.57014  0.000000
    3.222222  0.002296  0.007397  28.05814  0.000000
    3.333333  0.002296  0.007652  28.53781  0.000000
    3.444444  0.002296  0.007907  29.00954  0.000000
    3.555556  0.002296  0.008162  29.47372  0.000000
    3.666667  0.002296  0.008418  29.93070  0.000000
    3.777778  0.002296  0.008673  30.38081  0.000000
    3.888889  0.002296  0.008928  30.82435  0.000000
    4.000000  0.002296  0.009183  31.26160  0.000000
    4.111111  0.002296  0.009438  31.69281  0.000000
    4.222222  0.002296  0.009693  32.11824  0.000000
    4.333333  0.002296  0.009948  32.53810  0.000000
    4.444444  0.002296  0.010203  32.95262  0.000000
    4.555556  0.002296  0.010458  33.36198  0.000000
    4.666667  0.002296  0.010713  33.76639  0.000000
    4.777778  0.002296  0.010968  34.16600  0.000000
    4.888889  0.002296  0.011223  34.56100  0.000000
    5.000000  0.002296  0.011478  34.95153  0.000000
    5.111111  0.002296  0.011733  35.33775  0.000000
    5.222222  0.002296  0.011989  35.71979  0.000000
    5.333333  0.002296  0.012244  36.09779  0.000000
    5.444444  0.002296  0.012499  36.47187  0.000000
    5.555556  0.002296  0.012754  36.84215  0.000000
    5.666667  0.002296  0.013009  37.20875  0.000000
    5.777778  0.002296  0.013264  37.57177  0.000000
    5.888889  0.002296  0.013519  37.93131  0.000000
    6.000000  0.002296  0.013774  38.28748  0.000000
    6.111111  0.002296  0.014029  38.64037  0.000000
    6.222222  0.002296  0.014284  38.99007  0.000000
    6.333333  0.002296  0.014539  39.33665  0.000000
    6.444444  0.002296  0.014794  39.68021  0.000000
    6.555556  0.002296  0.015049  40.02082  0.000000
    6.666667  0.002296  0.015305  40.35855  0.000000
    6.777778  0.002296  0.015560  40.69348  0.000000
    6.888889  0.002296  0.015815  41.02568  0.000000
    7.000000  0.002296  0.016070  41.35521  0.000000
    7.111111  0.002296  0.016325  41.68213  0.000000
    7.222222  0.002296  0.016580  42.00651  0.000000
    7.333333  0.002296  0.016835  42.32841  0.000000
    7.444444  0.002296  0.017090  42.64787  0.000000
    7.555556  0.002296  0.017345  42.96496  0.000000
    7.666667  0.002296  0.017600  43.27973  0.000000
    7.777778  0.002296  0.017855  43.59222  0.000000
    7.888889  0.002296  0.018110  43.90249  0.000000
    8.000000  0.002296  0.018365  44.21058  0.000000
    8.111111  0.002296  0.018621  44.51654  0.000000
    8.222222  0.002296  0.018876  44.82041  0.000000
    8.333333  0.002296  0.019131  45.12223  0.000000
    8.444444  0.002296  0.019386  45.42205  0.000000
    8.555556  0.002296  0.019641  45.71990  0.000000
    8.666667  0.002296  0.019896  46.01583  0.000000
    8.777778  0.002296  0.020151  46.30986  0.000000
    8.888889  0.002296  0.020406  46.60204  0.000000
    9.000000  0.002296  0.020661  46.89240  0.000000
    9.111111  0.002296  0.020916  47.18097  0.000000
    9.222222  0.002296  0.021171  47.46779  0.000000
    9.333333  0.002296  0.021426  47.75288  0.000000
    9.444444  0.002296  0.021681  48.03629  0.000000
    9.555556  0.002296  0.021937  48.31803  0.000000
    9.666667  0.002296  0.022192  48.59813  0.000000
    9.777778  0.002296  0.022447  48.87663  0.000000
    9.888889  0.002296  0.022702  49.15356  0.000000
  END FTABLE  1
  FTABLE      2
```

```
  90    5
    Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
     (ft)   (acres) (acre-ft)    (cfs)     (cfs)   (ft/sec)    (Minutes)***
 0.000000  0.002296  0.000000  0.000000  0.000000
 0.111111  0.002296  0.000255  5.210267  0.000000
 0.222222  0.002296  0.000510  7.368430  0.000000
 0.333333  0.002296  0.000765  9.024447  0.000000
 0.444444  0.002296  0.001020  10.42053  0.000000
 0.555556  0.002296  0.001275  11.65051  0.000000
 0.666667  0.002296  0.001530  12.76249  0.000000
 0.777778  0.002296  0.001786  13.78507  0.000000
 0.888889  0.002296  0.002041  14.73686  0.000000
 1.000000  0.002296  0.002296  15.63080  0.000000
 1.111111  0.002296  0.002551  16.47631  0.000000
 1.222222  0.002296  0.002806  17.28050  0.000000
 1.333333  0.002296  0.003061  18.04889  0.000000
 1.444444  0.002296  0.003316  18.78588  0.000000
 1.555556  0.002296  0.003571  19.49503  0.000000
 1.666667  0.002296  0.003826  20.17928  0.000000
 1.777778  0.002296  0.004081  20.84107  0.000000
 1.888889  0.002296  0.004336  21.48248  0.000000
 2.000000  0.002296  0.004591  22.10529  0.000000
 2.111111  0.002296  0.004846  22.71103  0.784769
 2.222222  0.002296  0.005102  23.30102  2.205262
 2.333333  0.002296  0.005357  23.87644  3.979211
 2.444444  0.002296  0.005612  24.43832  5.917238
 2.555556  0.002296  0.005867  24.98756  7.826549
 2.666667  0.002296  0.006122  25.52499  9.523132
 2.777778  0.002296  0.006377  26.05133  10.86741
 2.888889  0.002296  0.006632  26.56725  11.81283
 3.000000  0.002296  0.006887  27.07334  12.59852
 3.111111  0.002296  0.007142  27.57014  13.28001
 3.222222  0.002296  0.007397  28.05814  13.92819
 3.333333  0.002296  0.007652  28.53781  14.54752
 3.444444  0.002296  0.007907  29.00954  15.14154
 3.555556  0.002296  0.008162  29.47372  15.71312
 3.666667  0.002296  0.008418  29.93070  16.26462
 3.777778  0.002296  0.008673  30.38081  16.79803
 3.888889  0.002296  0.008928  30.82435  17.31501
 4.000000  0.002296  0.009183  31.26160  17.81700
 4.111111  0.002296  0.009438  31.69281  18.30523
 4.222222  0.002296  0.009693  32.11824  18.78076
 4.333333  0.002296  0.009948  32.53810  19.24456
 4.444444  0.002296  0.010203  32.95262  19.69743
 4.555556  0.002296  0.010458  33.36198  20.14013
 4.666667  0.002296  0.010713  33.76639  20.57330
 4.777778  0.002296  0.010968  34.16600  20.99753
 4.888889  0.002296  0.011223  34.56100  21.41337
 5.000000  0.002296  0.011478  34.95153  21.82128
 5.111111  0.002296  0.011733  35.33775  22.22170
 5.222222  0.002296  0.011989  35.71979  22.61504
 5.333333  0.002296  0.012244  36.09779  23.00165
 5.444444  0.002296  0.012499  36.47187  23.38186
 5.555556  0.002296  0.012754  36.84215  23.75600
 5.666667  0.002296  0.013009  37.20875  24.12433
 5.777778  0.002296  0.013264  37.57177  24.48712
 5.888889  0.002296  0.013519  37.93131  24.84462
 6.000000  0.002296  0.013774  38.28748  25.19704
 6.111111  0.002296  0.014029  38.64037  25.54460
 6.222222  0.002296  0.014284  38.99007  25.88750
 6.333333  0.002296  0.014539  39.33665  26.22591
 6.444444  0.002296  0.014794  39.68021  26.56001
 6.555556  0.002296  0.015049  40.02082  26.88996
 6.666667  0.002296  0.015305  40.35855  27.21591
 6.777778  0.002296  0.015560  40.69348  27.53801
 6.888889  0.002296  0.015815  41.02568  27.85638
 7.000000  0.002296  0.016070  41.35521  28.17115
 7.111111  0.002296  0.016325  41.68213  28.48244
 7.222222  0.002296  0.016580  42.00651  28.79037
 7.333333  0.002296  0.016835  42.32841  29.09504
```

```
  7.444444  0.002296  0.017090  42.64787  29.39655
  7.555556  0.002296  0.017345  42.96496  29.69500
  7.666667  0.002296  0.017600  43.27973  29.99048
  7.777778  0.002296  0.017855  43.59222  30.28307
  7.888889  0.002296  0.018110  43.90249  30.57287
  8.000000  0.002296  0.018365  44.21058  30.85995
  8.111111  0.002296  0.018621  44.51654  31.14438
  8.222222  0.002296  0.018876  44.82041  31.42623
  8.333333  0.002296  0.019131  45.12223  31.70558
  8.444444  0.002296  0.019386  45.42205  31.98249
  8.555556  0.002296  0.019641  45.71990  32.25702
  8.666667  0.002296  0.019896  46.01583  32.52924
  8.777778  0.002296  0.020151  46.30986  32.79920
  8.888889  0.002296  0.020406  46.60204  33.06695
  9.000000  0.002296  0.020661  46.89240  33.33255
  9.111111  0.002296  0.020916  47.18097  33.59605
  9.222222  0.002296  0.021171  47.46779  33.85751
  9.333333  0.002296  0.021426  47.75288  34.11695
  9.444444  0.002296  0.021681  48.03629  34.37444
  9.555556  0.002296  0.021937  48.31803  34.63002
  9.666667  0.002296  0.022192  48.59813  34.88372
  9.777778  0.002296  0.022447  48.87663  35.13559
  9.888889  0.002296  0.022702  49.15356  35.38567
  END FTABLE  2
  FTABLE      4
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)     (cfs)     (cfs)  (ft/sec)     (Minutes)***
  0.000000  0.037879  0.000000  0.000000  0.000000
  0.077778  0.037879  0.002946  0.017028  0.009549
  0.155556  0.037879  0.005892  0.024082  0.009549
  0.233333  0.037879  0.008838  0.029494  0.009549
  0.311111  0.037879  0.011785  0.034056  0.009549
  0.388889  0.037879  0.014731  0.038076  0.009549
  0.466667  0.037879  0.017677  0.041710  0.009549
  0.544444  0.037879  0.020623  0.045052  0.009549
  0.622222  0.037879  0.023569  0.048163  0.009549
  0.700000  0.037879  0.026515  0.051085  0.009549
  0.777778  0.037879  0.029461  0.053848  0.009549
  0.855556  0.037879  0.032407  0.056476  0.009549
  0.933333  0.037879  0.035354  0.058987  0.009549
  1.011111  0.037879  0.038300  0.061396  0.009549
  1.088889  0.037879  0.041246  0.063714  0.009549
  1.166667  0.037879  0.044192  0.065950  0.009549
  1.244444  0.037879  0.047138  0.068113  0.009549
  1.322222  0.037879  0.050084  0.070209  0.009549
  1.400000  0.037879  0.053030  0.072245  0.009549
  1.477778  0.037879  0.055976  0.074224  0.009549
  1.555556  0.037879  0.058923  0.076152  0.009549
  1.633333  0.037879  0.061869  0.078033  0.009549
  1.711111  0.037879  0.064815  0.079869  0.009549
  1.788889  0.037879  0.067761  0.081664  0.009549
  1.866667  0.037879  0.070707  0.083421  0.009549
  1.944444  0.037879  0.073653  0.085141  0.009549
  2.022222  0.037879  0.076599  0.086827  0.009549
  2.100000  0.037879  0.079545  0.088481  0.009549
  2.177778  0.037879  0.082492  0.090105  0.009549
  2.255556  0.037879  0.085438  0.091700  0.009549
  2.333333  0.037879  0.088384  0.093267  0.009549
  2.411111  0.037879  0.091330  0.094809  0.009549
  2.488889  0.037879  0.094276  0.096326  0.009549
  2.566667  0.037879  0.097222  0.097820  0.009549
  2.644444  0.037879  0.100168  0.099291  0.009549
  2.722222  0.037879  0.103114  0.100740  0.009549
  2.800000  0.037879  0.106061  0.102169  0.009549
  2.877778  0.037879  0.109007  0.103579  0.009549
  2.955556  0.037879  0.111953  0.104969  0.009549
  3.033333  0.037879  0.114899  0.106341  0.009549
  3.111111  0.037879  0.117845  0.107696  0.009549
  3.188889  0.037879  0.120791  0.109034  0.009549
```

```
3.266667  0.037879  0.123737  0.110355  0.009549
3.344444  0.037879  0.126684  0.111661  0.009549
3.422222  0.037879  0.129630  0.112952  0.009549
3.500000  0.037879  0.132576  0.114229  0.009549
3.577778  0.037879  0.135522  0.115491  0.009549
3.655556  0.037879  0.138468  0.116740  0.009549
3.733333  0.037879  0.141414  0.117975  0.009549
3.811111  0.037879  0.144360  0.119197  0.009549
3.888889  0.037879  0.147306  0.120408  0.009549
3.966667  0.037879  0.150253  0.121606  0.009549
4.044444  0.037879  0.153199  0.128513  0.009549
4.122222  0.037879  0.156145  0.133454  0.009549
4.200000  0.037879  0.159091  0.137267  0.009549
4.277778  0.037879  0.162037  0.140587  0.009549
4.355556  0.037879  0.164983  0.143609  0.009549
4.433333  0.037879  0.167929  0.146424  0.009549
4.511111  0.037879  0.170875  0.149084  0.009549
4.588889  0.037879  0.173822  0.151621  0.009549
4.666667  0.037879  0.176768  0.154057  0.009549
4.744444  0.037879  0.179714  0.156409  0.009549
4.822222  0.037879  0.182660  0.158687  0.009549
4.900000  0.037879  0.185606  0.160901  0.009549
4.977778  0.037879  0.188552  0.163059  0.009549
5.055556  0.037879  0.191498  0.303895  0.009549
5.133333  0.037879  0.194444  0.676889  0.009549
5.211111  0.037879  0.197391  1.146064  0.009549
5.288889  0.037879  0.200337  1.618721  0.009549
5.366667  0.037879  0.203283  2.007702  0.009549
5.444444  0.037879  0.206229  2.263316  0.009549
5.522222  0.037879  0.209175  2.453042  0.009549
5.600000  0.037879  0.212121  2.618508  0.009549
5.677778  0.037879  0.215067  2.773643  0.009549
5.755556  0.037879  0.218013  2.920181  0.009549
5.833333  0.037879  0.220960  3.059418  0.009549
5.911111  0.037879  0.223906  3.192352  0.009549
5.988889  0.037879  0.226852  3.319776  0.009549
6.066667  0.037879  0.229798  3.442325  0.009549
6.144444  0.037879  0.232744  3.560523  0.009549
6.222222  0.037879  0.235690  3.674805  0.009549
6.300000  0.037879  0.238636  3.785540  0.009549
6.377778  0.037879  0.241582  3.893039  0.009549
6.455556  0.037879  0.244529  3.997574  0.009549
6.533333  0.037879  0.247475  4.099377  0.009549
6.611111  0.037879  0.250421  4.198654  0.009549
6.688889  0.037879  0.253367  4.295584  0.009549
6.766667  0.037879  0.256313  4.390329  0.009549
6.844444  0.037879  0.259259  4.483029  0.009549
6.922222  0.037879  0.262205  4.573813  0.009549
7.000000  0.037879  0.265152  4.662796  0.009549
END FTABLE  4
FTABLE      3
 90    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)    (cfs)     (cfs)   (ft/sec)    (Minutes)***
0.000000  0.002296  0.000000  0.000000  0.000000
0.111111  0.002296  0.000255  5.210267  0.000000
0.222222  0.002296  0.000510  7.368430  0.000000
0.333333  0.002296  0.000765  9.024447  0.000000
0.444444  0.002296  0.001020  10.42053  0.000000
0.555556  0.002296  0.001275  11.65051  0.000000
0.666667  0.002296  0.001530  12.76249  0.000000
0.777778  0.002296  0.001786  13.78507  0.000000
0.888889  0.002296  0.002041  14.73686  0.000000
1.000000  0.002296  0.002296  15.63080  0.000000
1.111111  0.002296  0.002551  16.47631  0.000000
1.222222  0.002296  0.002806  17.28050  0.000000
1.333333  0.002296  0.003061  18.04889  0.000000
1.444444  0.002296  0.003316  18.78588  0.000000
1.555556  0.002296  0.003571  19.49503  0.000000
1.666667  0.002296  0.003826  20.17928  0.000000
```

```
1.777778  0.002296  0.004081  20.84107  0.000000
1.888889  0.002296  0.004336  21.48248  0.000000
2.000000  0.002296  0.004591  22.10529  0.000000
2.111111  0.002296  0.004846  22.71103  0.784769
2.222222  0.002296  0.005102  23.30102  2.205262
2.333333  0.002296  0.005357  23.87644  3.979211
2.444444  0.002296  0.005612  24.43832  5.917238
2.555556  0.002296  0.005867  24.98756  7.826549
2.666667  0.002296  0.006122  25.52499  9.523132
2.777778  0.002296  0.006377  26.05133  10.86741
2.888889  0.002296  0.006632  26.56725  11.81283
3.000000  0.002296  0.006887  27.07334  12.59852
3.111111  0.002296  0.007142  27.57014  13.28001
3.222222  0.002296  0.007397  28.05814  13.92819
3.333333  0.002296  0.007652  28.53781  14.54752
3.444444  0.002296  0.007907  29.00954  15.14154
3.555556  0.002296  0.008162  29.47372  15.71312
3.666667  0.002296  0.008418  29.93070  16.26462
3.777778  0.002296  0.008673  30.38081  16.79803
3.888889  0.002296  0.008928  30.82435  17.31501
4.000000  0.002296  0.009183  31.26160  17.81700
4.111111  0.002296  0.009438  31.69281  18.30523
4.222222  0.002296  0.009693  32.11824  18.78076
4.333333  0.002296  0.009948  32.53810  19.24456
4.444444  0.002296  0.010203  32.95262  19.69743
4.555556  0.002296  0.010458  33.36198  20.14013
4.666667  0.002296  0.010713  33.76639  20.57330
4.777778  0.002296  0.010968  34.16600  20.99753
4.888889  0.002296  0.011223  34.56100  21.41337
5.000000  0.002296  0.011478  34.95153  21.82128
5.111111  0.002296  0.011733  35.33775  22.22170
5.222222  0.002296  0.011989  35.71979  22.61504
5.333333  0.002296  0.012244  36.09779  23.00165
5.444444  0.002296  0.012499  36.47187  23.38186
5.555556  0.002296  0.012754  36.84215  23.75600
5.666667  0.002296  0.013009  37.20875  24.12433
5.777778  0.002296  0.013264  37.57177  24.48712
5.888889  0.002296  0.013519  37.93131  24.84462
6.000000  0.002296  0.013774  38.28748  25.19704
6.111111  0.002296  0.014029  38.64037  25.54460
6.222222  0.002296  0.014284  38.99007  25.88750
6.333333  0.002296  0.014539  39.33665  26.22591
6.444444  0.002296  0.014794  39.68021  26.56001
6.555556  0.002296  0.015049  40.02082  26.88996
6.666667  0.002296  0.015305  40.35855  27.21591
6.777778  0.002296  0.015560  40.69348  27.53801
6.888889  0.002296  0.015815  41.02568  27.85638
7.000000  0.002296  0.016070  41.35521  28.17115
7.111111  0.002296  0.016325  41.68213  28.48244
7.222222  0.002296  0.016580  42.00651  28.79037
7.333333  0.002296  0.016835  42.32841  29.09504
7.444444  0.002296  0.017090  42.64787  29.39655
7.555556  0.002296  0.017345  42.96496  29.69500
7.666667  0.002296  0.017600  43.27973  29.99048
7.777778  0.002296  0.017855  43.59222  30.28307
7.888889  0.002296  0.018110  43.90249  30.57287
8.000000  0.002296  0.018365  44.21058  30.85995
8.111111  0.002296  0.018621  44.51654  31.14438
8.222222  0.002296  0.018876  44.82041  31.42623
8.333333  0.002296  0.019131  45.12223  31.70558
8.444444  0.002296  0.019386  45.42205  31.98249
8.555556  0.002296  0.019641  45.71990  32.25702
8.666667  0.002296  0.019896  46.01583  32.52924
8.777778  0.002296  0.020151  46.30986  32.79920
8.888889  0.002296  0.020406  46.60204  33.06695
9.000000  0.002296  0.020661  46.89240  33.33255
9.111111  0.002296  0.020916  47.18097  33.59605
9.222222  0.002296  0.021171  47.46779  33.85751
9.333333  0.002296  0.021426  47.75288  34.11695
9.444444  0.002296  0.021681  48.03629  34.37444
```

```
  9.555556  0.002296  0.021937  48.31803  34.63002
  9.666667  0.002296  0.022192  48.59813  34.88372
  9.777778  0.002296  0.022447  48.87663  35.13559
  9.888889  0.002296  0.022702  49.15356  35.38567
  END FTABLE  3
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1.3            RCHRES   4     EXTNL  PREC
WDM      2 PREC     ENGL    1.3            RCHRES   5     EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            RCHRES   4     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.8            RCHRES   5     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   5 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   5 HYDR   O      1 1        1      WDM   1006 FLOW     ENGL      REPL
RCHRES   5 HYDR   O      2 1        1      WDM   1007 FLOW     ENGL      REPL
RCHRES   5 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     1 1        1      WDM   1010 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1011 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1012 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1013 STAG     ENGL      REPL
RCHRES   2 HYDR   RO     1 1        1      WDM   1014 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      1 1        1      WDM   1015 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      2 1        1      WDM   1016 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1017 STAG     ENGL      REPL
RCHRES   4 HYDR   RO     1 1        1      WDM   1018 FLOW     ENGL      REPL
RCHRES   4 HYDR   O      1 1        1      WDM   1019 FLOW     ENGL      REPL
RCHRES   4 HYDR   O      2 1        1      WDM   1020 FLOW     ENGL      REPL
RCHRES   4 HYDR   STAGE  1 1        1      WDM   1021 STAG     ENGL      REPL
RCHRES   3 HYDR   RO     1 1        1      WDM   1022 FLOW     ENGL      REPL
RCHRES   3 HYDR   O      1 1        1      WDM   1023 FLOW     ENGL      REPL
RCHRES   3 HYDR   O      2 1        1      WDM   1024 FLOW     ENGL      REPL
RCHRES   3 HYDR   STAGE  1 1        1      WDM   1025 STAG     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        7
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
```

```
  END MASS-LINK     8

  MASS-LINK        12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    13

  MASS-LINK        15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK    17

  MASS-LINK        18
RCHRES     OFLOW  OVOL   2                 COPY           INPUT  MEAN
  END MASS-LINK    18


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

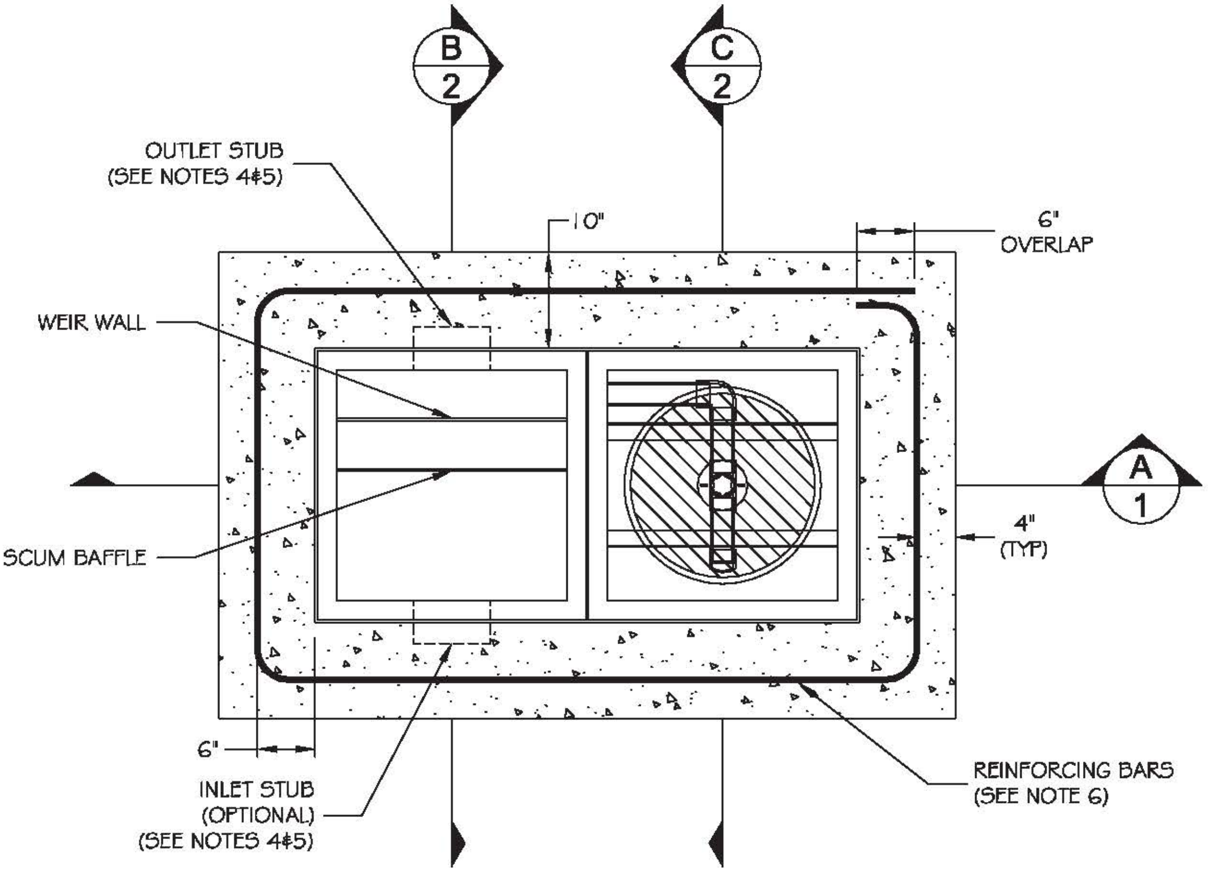
Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

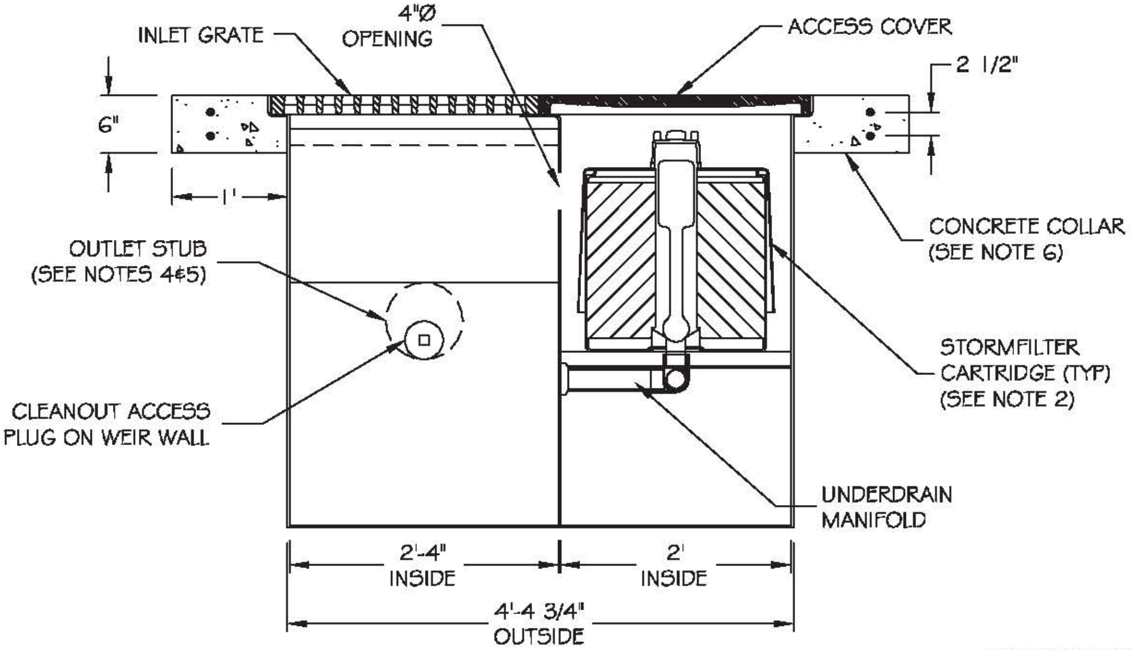
Appendix II: Perk Filter Information

Water Quality

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.



1-CARTRIDGE CATCHBASIN - PLAN VIEW (1/1)



1-CARTRIDGE CATCHBASIN - SECTION VIEW (A/1)

THE STORMWATER MANAGEMENT
StormFilter®
U.S. PATENT No. 5,322,629,
No. 5,707,527, No. 6,027,639
No. 6,649,048, No. 5,624,576,
AND OTHER U.S. AND FOREIGN
PATENTS PENDING

CONTECH® STORMWATER SOLUTIONS INC.
contechstormwater.com

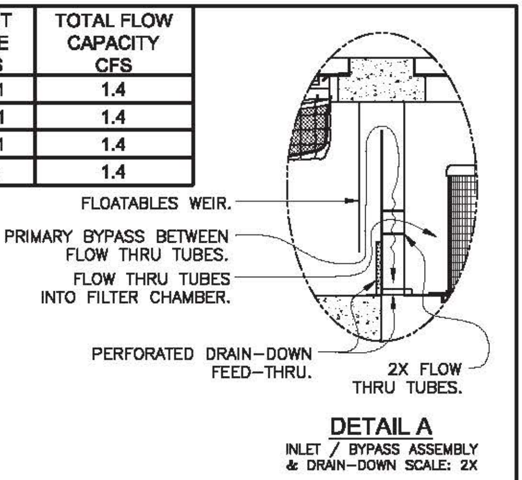
STEEL CATCHBASIN STORMFILTER
PLAN AND SECTION VIEWS
STANDARD DETAIL - 1 CARTRIDGE UNIT

DRAWING
1
1/3

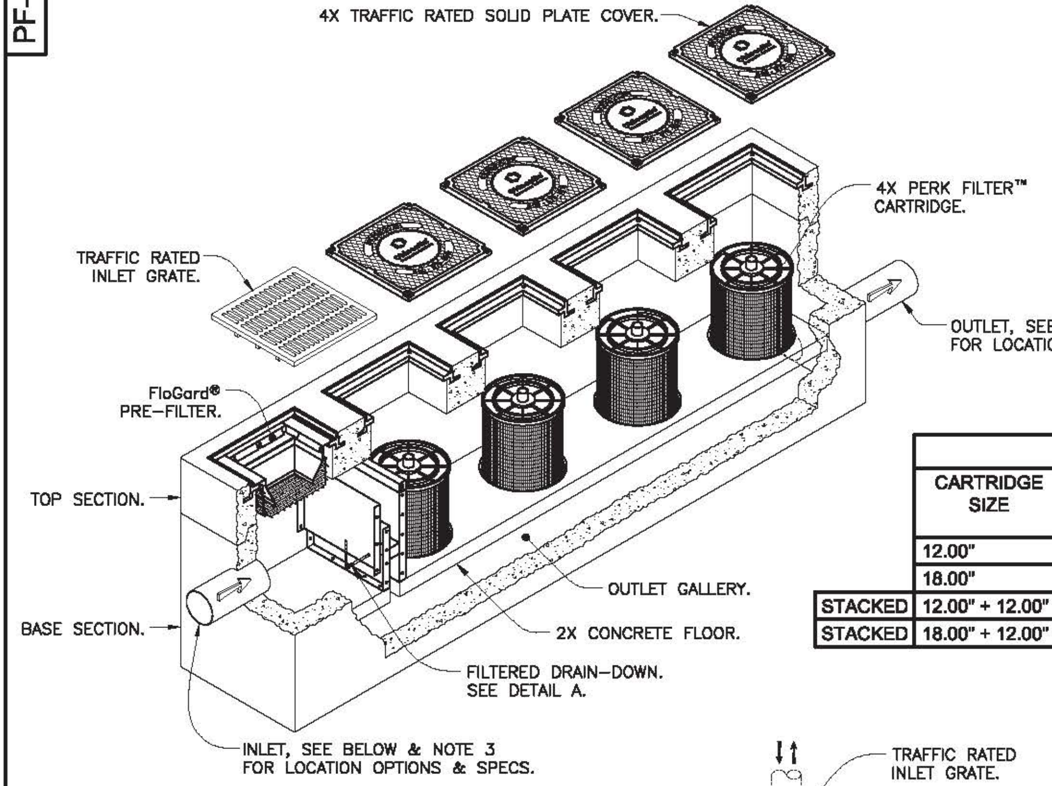
DATE: 11/01/05 | SCALE: NONE | FILE NAME: CBSF1-S-DTL | DRAWN: MJW | CHECKED: ARG

Washington GULD*

	CARTRIDGE SIZE	TREATMENT FLOW RATE GPM / CFS	TOTAL FLOW CAPACITY CFS
	12.00"	27.2 / 0.061	1.4
	18.00"	40.8 / 0.091	1.4
STACKED	12.00" + 12.00"	54.4 / 0.121	1.4
STACKED	18.00" + 12.00"	68 / 0.152	1.4

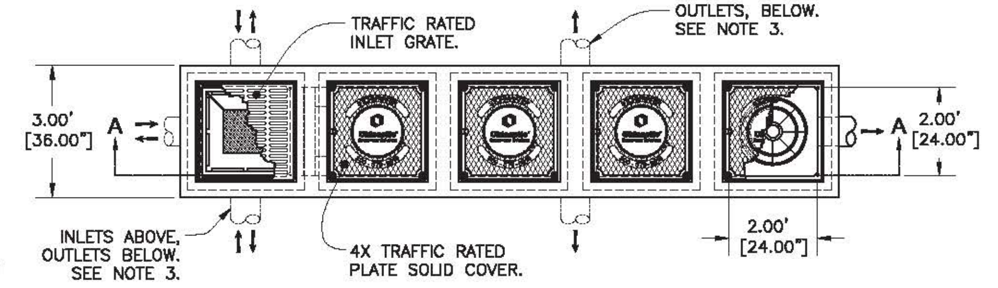


DETAIL A
INLET / BYPASS ASSEMBLY & DRAIN–DOWN SCALE: 2X



MINIMUM DEPTHS (SEE NOTE 6)

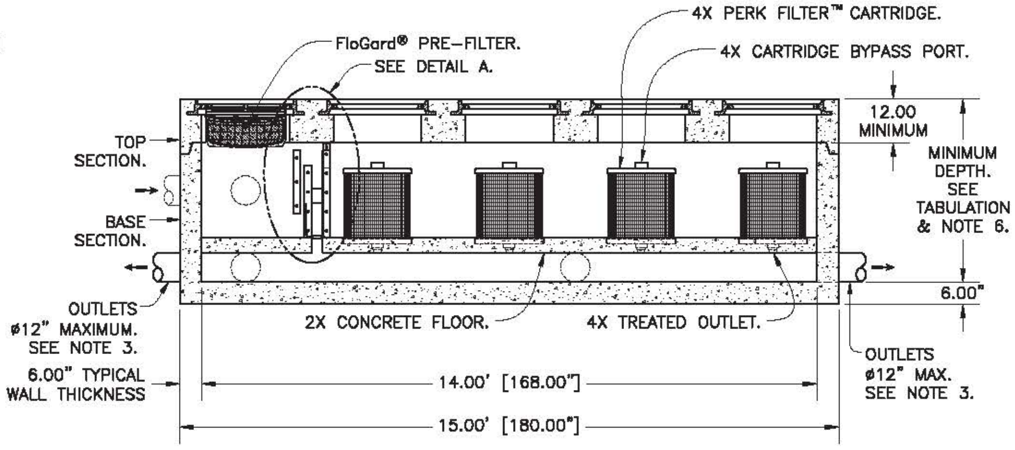
	CARTRIDGE SIZE	Ø 6.0" OUTLET PIPE (IN INCHES)	Ø 8.0" OUTLET PIPE (IN INCHES)	Ø 10.0" OUTLET PIPE (IN INCHES)	Ø 12.0" OUTLET PIPE (IN INCHES)
	12.00"	39	41	43	45
	18.00"	46	48	50	52
STACKED	12.00" + 12.00"	56	58	60	62
STACKED	18.00" + 12.00"	63	65	67	69



Notes:

1. Precast concrete structure shall be manufactured in accordance with ASTM Designation C857 and C858.
2. Perk Filter™ Catch basin shall be supplied with traffic rated (H20) bicycle-proof grates and solid plate cover.
3. Inlet pipe(s) may enter device on three sides of the inlet chamber. Outlet pipe(s) may exit on all four sides. All pipe is Ø 12" maximum.
4. Inlet chamber shall be supplied with a drain-down device designed to remove standing water between storm events.
5. Perk Filter™ catch basin shall be supplied with FloGard® pre-filter device. FloGard® pre-filter and Perk Filter™ cartridge shall be maintained in accordance with manufacturer recommendations.
6. For depths less than the specified minimum contact Oldcastle® Stormwater Solutions for engineering assistance.

*** Treatment Flow Rates shown conform to Washington State GULD Specifications.**



SECTION A-A
FOUR CARTRIDGE CONCRETE CATCH BASIN
(END GRATE CONFIGURATION)

Media Filtration

Perk Filter™
Concrete Catch Basin
Four Cartridge
Washington State GULD
(End Grate Configuration)

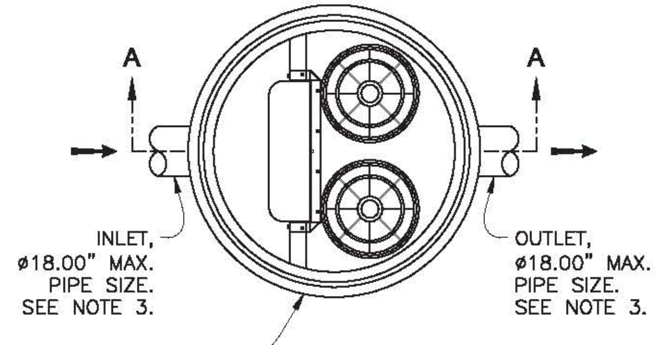
Oldcastle®
Stormwater Solutions

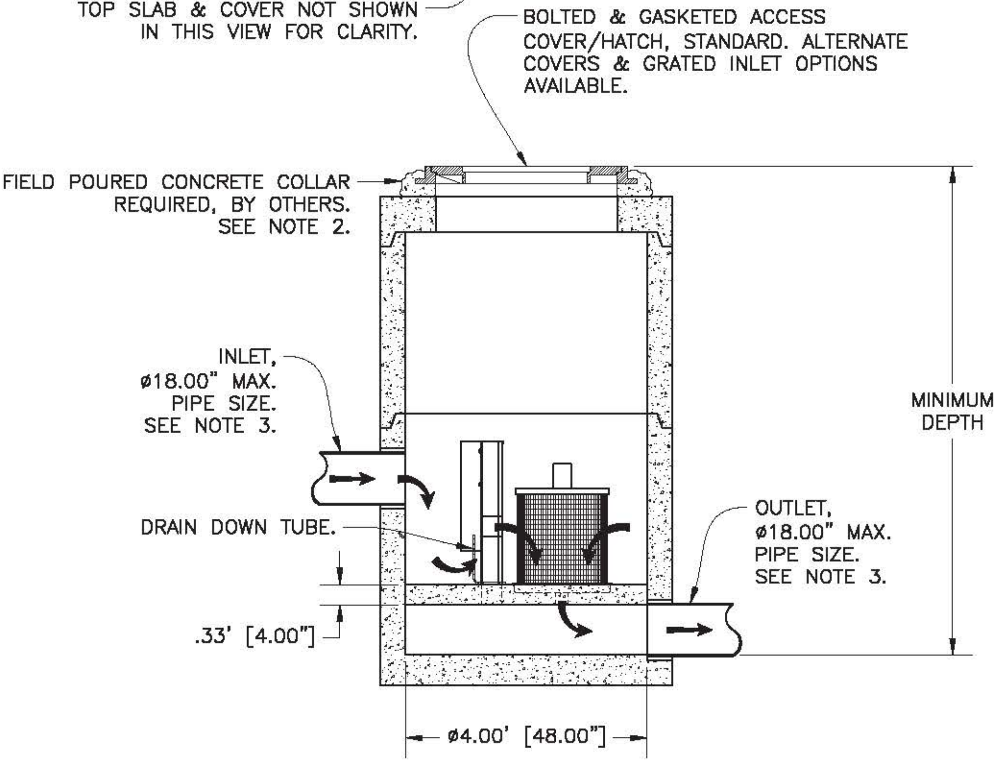
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	
PF-CCB-WA-0006	E	ECO–0140 JPR 4/18/16	JPR 3/2/11	SHEET 1 OF 1

PF-MH-48-WA

Washington GULD*





SECTION A-A

Minimum Depth

PIPE SIZE	Ø6.00"	Ø8.00"	Ø10.00"	Ø12.00"	Ø15.00"	Ø18.00"
CARTRIDGE TYPE	MINIMUM DEPTH RIM TO OUTLET	MINIMUM DEPTH RIM TO OUTLET	MINIMUM DEPTH RIM TO OUTLET	MINIMUM DEPTH RIM TO OUTLET	MINIMUM DEPTH RIM TO OUTLET	MINIMUM DEPTH RIM TO OUTLET
12"	3.67' [44.00"]	3.92' [47.00"]	4.17' [50.00"]	4.42' [53.00"]	4.67' [56.00"]	4.92' [59.00"]
18"	4.42' [53.00"]	4.67' [56.00"]	4.92' [59.00"]	5.17' [62.00"]	5.42' [65.00"]	5.67' [68.00"]
12" + 12"	5.17' [62.00"]	5.42' [65.00"]	5.67' [68.00"]	5.92' [71.00"]	6.17' [74.00"]	6.42' [77.00"]
12" + 18"	5.67' [68.00"]	5.92' [71.00"]	6.17' [74.00"]	6.42' [77.00"]	6.67' [80.00"]	6.92' [83.00"]

Ø48.00" PERK FILTER MANHOLE
TREATMENT FLOW RATES, TOTAL FLOW CAPACITIES & MAXIMUM HEAD LOSS

CARTRIDGE STACK QUANTITY	CARTRIDGE STACK CONFIGURATION							
	12"		18"		12" & 12"		12" & 18"	
	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)
1	6.8 / 0.015	2.47	10.2/ 0.022	3.05	13.6 / 0.03	3.45	17 / 0.037	3.62
2	13.6 / 0.03	2.47	20.4 / 0.045	3.05	27.2 / 0.06	3.45	34 / 0.075	3.62
MAXIMUM HEAD LOSS	1.7 FEET		2.3 FEET		2.9 FEET		3.5 FEET	

Media Filtration

Perk Filter™

Ø48.00" Manhole

Washington State GULD

One to Two Cartridges / Stacks

Oldcastle®
Stormwater Solutions
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	
PF-MH-48-WA	NR	ECO-0132 ISM 4/27/15	ISM 4/27/15	SHEET 2 OF 2

Appendix III: Geotechnical Report

Geotechnical Report

Valley View Sub-division

Camas, Washington

Prepared for:
Stan Firestone
Vancouver, Washington
30 April 2014
Updated 1 May 2018

MIA MAHEDY-SEXTON
STATE OF WASHINGTON
42135
REGISTERED
PROFESSIONAL ENGINEER

Rapid Soil Solutions LLC
3915 SW Plum St
Portland, OR
503-816-3689

TABLE OF CONTENTS

1.0 PROJECT AND SITE DESCRIPTIONS

Introduction

Rapid Soil Solutions has prepared this Geotechnical Report to provide bearing capacity, roadway design values, soil parameters for earth work operations and installation of utilities for the 30 lot sub-division.

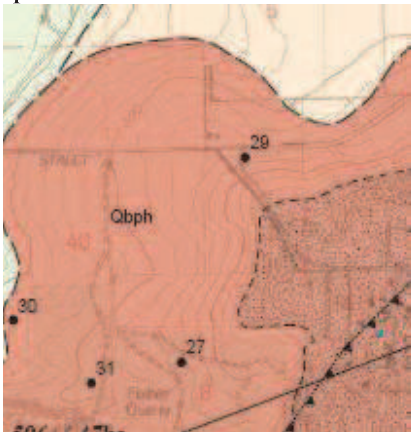
2.0 SITE CONDITIONS

2.1 Surface Conditions

The property is located in the Clark County Washington, accessed off of SE 40th Street. The site was cleared in past. The site was covered with tall grasses and weeds. See below site photo.

2.2 Regional Geology

The Camas Quadrangle developed in 2008 by Evarts and O'Connor maps the site as boring volcanic rock. However, the rock is far below the site and the site is cover with fine grained flood deposits.



2.3 Field Exploration and Subsurface Conditions

2.3.1 Field Explorations

Four (4) hand augur holes were excavated. The location of the augur holes are shown on Figure 2 in Appendix A. A registered professional engineer performed the excavation and logged the subsurface materials. Hand augur logs detailing materials encountered is in Appendix B. The logs were created using the Unified Soil Classification and Visual Manual Procedure (ASTM-D 2488).

2.3.1 Subsurface Conditions

The soil conditions were fine grained stiff damp sandy SILT. The soil conditions in all augur holes were consistent with each other and local geology map. Moistures ranged from 23.1 % to 28%.

2.3.2 Groundwater

No ground water was found during the explorations.

3.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

3.1 Foundation Design

The building foundations may be installed on either engineered fill or firm native sub-grade that is found at a depth of about 0.5 feet. This depth may be locally variable and should be confirmed by a geotechnical engineer or their representative at the time of construction.

Continuous wall and isolated spread footings should be at least 16 and 24 inches wide, respectively. The bottom of exterior footings should be at least 16 inches below the lowest adjacent exterior grade. The bottom of interior footings should be at least 12 inches below the base of the floor slab.

Footings placed on engineered fill or firm native sub-grade should be designed for an allowable bearing capacity of 2,000 *pounds per square foot* (**psf**) by IBC 2012/2015 code. The recommended allowable bearing pressure can be doubled for short-term loads such as those resulting from wind or seismic forces.

Based on our analysis the total post-construction settlement is calculated to be less than 1 inch, with differential settlement of less than 0.5 inch over a 50-foot span for maximum column, perimeter footing loads of less than 100 kips and 6.0 kips per linear foot.

Lateral loads on footings can be resisted by passive earth pressure on the sides of the structures and by friction at the base of the footings. An allowable lateral bearing pressure of 150 *pounds per cubic foot* (**psf/f**) below grade may be used. Adjacent floor slabs, pavements or the upper 12-inch depth of adjacent, unpaved areas should not be considered when calculating passive resistance. An angle of internal friction of 30 degrees can be used.

If construction is undertaken during periods of rain, then I recommend a 2-inch (or greater) layer of compacted, crushed rock be placed over the native soil. The silty soil is moisture sensitive. Meaning when dry it is firm and non-yielding but exposed to season rains it will lose its strength and need to be excavated and replaced with rock. See section 4.1.2 for wet weather conditions.

3.2 Retaining Walls

The retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls; (2) the walls are less than 8 feet in height; (3) the backfill is drained; and (4) the backfill has a slope flatter than 4H: 1V. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project varies from these assumptions.

Unrestrained site walls that retain native soils should be designed to resist an active equivalent fluid unit weight of 35 pcf where supporting slopes are flatter than 4H: 1V. If retaining walls are restrained from rotation prior to being backfilled, the active equivalent fluid unit weight shall be increased to 50 pcf. For embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $5H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied at 0.6H from the base of the wall. If other surcharges (e.g., slopes steeper than 4H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, then additional pressures will need to be accounted for in the wall design. Our office should be contacted for appropriate wall surcharges based upon the actual magnitude and configuration of the applied loads.

The wall footings should be designed in accordance with the guidelines provided in the “Foundation Design” section of this report.

These design parameters have been provided assuming that back-of-wall drains will be installed to prevent buildup of hydrostatic pressures behind all walls.

The backfill material placed behind the walls and extending a horizontal distance equal to at least half of the height of the retaining wall should consist of granular retaining wall backfill as specified in the “Structural Fill” section of this report.

The wall backfill should be compacted to a minimum of 92 percent of the maximum dry density, as determined by ASTM D1557. However, backfill located within a horizontal distance of 3 feet from the retaining walls should only be compacted to approximately 90 percent of the maximum dry density, as determined by ASTM D1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (e.g., jumping jack or vibratory plate compactors). If flat work (e.g., sidewalks or pavements) will be placed atop the wall backfill, we recommend that the upper

2 feet of material be compacted to 92 percent of the maximum dry density, as determined by ASTM D1557.

A minimum 12-inch-wide zone of drain rock, extending from the base of the wall to within 6 inches of finished grade, should be placed against the back of all retaining walls. Perforated collector pipes should be embedded at the base of the drain rock. The drain rock should meet the requirements provided in the "Structural Fill" section of this report. The perforated collector pipes should discharge at an appropriate location away from the base of the wall. The discharge pipe(s) should not be tied directly into storm water drain systems, unless measures are taken to prevent backflow into the wall's drainage system.

Settlements of up to 1 percent of the wall height commonly occur immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend that construction of flat work adjacent to retaining walls be postponed at least 4 weeks after backfilling of the wall, unless survey data indicates that settlement is complete prior to that time.

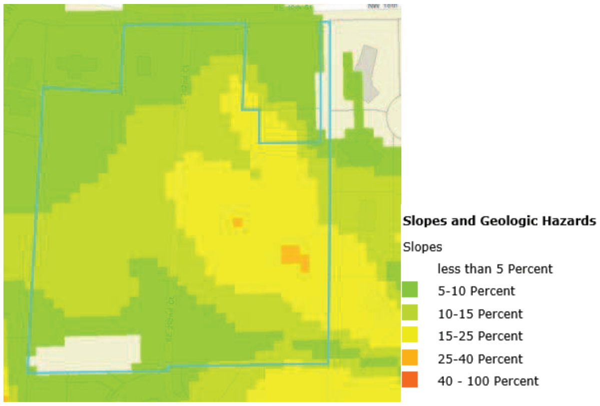
3.3 Seismic Design Criteria

The seismic design criteria for this project USGS Earthquake Hazards Program. A summary of IBC 2012/2015 seismic design criterion below: using a Lat of 45.5909 and Long of -122.4650, site class D.

	Short Period	**1 Second**
Maximum Credible Earthquake Spectral Acceleration	Ss = 0.94	S1 = 0.38
Adjusted Spectral Acceleration	Sms = 1.05	Sm1 = 0.38
Design Spectral Response Acceleration Perimeters	Sds = 0.70	Sd1= 0.42

3.4 Hazards

Slopes: The field reconnaissance on 27 March 2014 showed the steepest slopes are located in the southern end of the property. Here the slopes vary from less than 5% to 25% in the SE corner of the lot. See below figure from Clark County GIS mapping of the site.



Liquefaction: From the Liquefaction Susceptibility Map of Clark County, Washington

2004. The site has very little susceptibility.

Landslide Hazards
RSS site reconnaissance on 27 March 2014 found no signs of land slide hazards. Site is covered with black berries, grasses. See site photo's of the slopes. Figure 3 shows the mapped landslides in Clark County as well as slope stability map of the Vancouver area. As well as IMS -43, this uses LIDAR to map landslides. LIDAR is a bare earth photo that shows landside and slow moving slopes as the lines on the map become fuzzy when the ground is moving. *There are no mapped slides on the project site. Figure 3 also lists the site has having little to no issues with liquefaction.*

From field reconnaissance RSS reviewed all the steep slopes surrounding the project site. There are no signs of slope instability, any sages, slumps or fan of debris from slides on the slopes in the SW corner of the property. There also no surface water features on the property. No seeps springs or other surface expressions of ground water were found when RSS was on site on 3/27/14.

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 Site Preparation

Demolition should include removal of existing improvements throughout the project site. Underground utility lines, vaults, basement walls or tanks should be removed or grouted full if left in place. I recommend that soil disturbed during grubbing operations be removed to firm, undisturbed sub-grade. The excavations should then be backfilled with compacted structural fill. On this site only disturb the area in which can be covered with rock during the day. The moisture sensitive SILT soil when exposed to wet weather becomes soft and yielding. See wet weather conditions below.

4.1.1 Proof Rolling

Following stripping and prior to placing aggregate base course, pavement the exposed sub-grade should be evaluated by proof rolling. The sub-grade should be proof rolled to identify soft, loose, or unsuitable areas. Please give 24 hour notice to observe the proof rolling. Soft or loose zones identified during the field evaluation should be compacted to an unyielding condition or be excavated and replaced with structural fill, as discussed in the *Structural Fill* section of this report.

4.1.2 Wet Weather Conditions

The near-surface soils will be difficult during or after extended wet periods or when the moisture content of the surface soil is more than a few percentage points above optimum. Soils that have been disturbed during site preparation activities, or soft or loose zones identified during probing or proof rolling, should be removed and replaced with compacted structural fill. Track-mounted excavating equipment will be required during wet weather. The imported granular material should be placed in one lift over the prepared, undisturbed sub-grade and compacted using a smooth drum, non-vibratory roller. Additionally, a geo-textile fabric should be placed as a barrier between the sub-grade and imported granular material in areas of repeated traffic.

4.2 Excavation

Subsurface conditions of accessible cleared areas of the project site show predominately sands, silty soil to the depth explored (4.0 feet). Excavations in the upper soils may be readily accomplished with conventional earthwork equipment with smooth and teeth faced bucket.

4.3 Structural Fills

Fills should be placed over sub-grade prepared in compliance with Section 4.1 of this report. Material used, as structural fill should be free of organic matter or other unsuitable materials and should meet specifications provided in WSDOT, depending upon the application. A discussion of these materials is in the following sections.

4.3.1 Native Soils

Native soil can be used for filling operations to raise the site grades for flat backyards. Compaction testing of native soils shall use a standard ASTM D698 proctor and achieve 95%. See lab results in appendix b. Compaction testing is required as per WSDOT every 18in of fill material. Native soils can only be used if they are within optimum moisture content.

4.3.2 Imported Granular Fill

Material meeting WSDOT 9.03.12(1) B or WSDOT 9.03.11 Imported granular material should be placed in lifts 8 to12 inches and be compacted to at least 95% of the maximum dry density, as determined by ASTM D 698. Where imported granular material is placed over wet or soft soil sub-grades, we recommend that a geo-textile serve as a barrier between the sub-grade and imported granular material. Compaction testing is required as per WSDOT every 18in of fill material.

4.3.3 Floor Slab Base and Footing Base Aggregate

Base aggregate for floor slabs should be clean, crushed rock or crushed gravel meeting WSDOT 9.03.12(1) B Class B Gravel Backfill for Foundations, if acceptable WSDOT 9.03.11 Recycled Portland Cement Concrete Rubble can be used. The imported granular material should be placed in lifts and compacted to at least 95% of the maximum dry density, as determined by ASTM D 698. Compaction testing is required as per WSDOT every 18in of fill material.

4.4 Surface and Subsurface Drainage Requirements

The Contractor shall be made responsible for temporary drainage of surface water and groundwater as necessary to prevent standing water and/or erosion at the working surface. We recommend removing only the foliage necessary for construction to help minimize erosion. Slope the ground surface around the structures to create a minimum gradient of 2% away from the building foundations for a distance of at least 5 feet. Surface water should be directed away from all buildings into drainage swales or into a storm drainage system.

5.0 CONSTRUCTION OBSERVATIONS

Satisfactory pavement and earthwork performance depends on the quality of construction. Sufficient monitoring of the activities of the contractor is a key part of determining that the work is completed in accordance with the construction drawings and specifications. I recommend that a geotechnical engineer observe general excavation, stripping, fill placement, and sub-grades in addition to base. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions requires experience. Therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions changes significantly from those anticipated.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the addressee, and their architects and engineers for aiding in the design and construction of the proposed development. It is the addressee's responsibility to provide this report to the appropriate design professionals, building officials, and contractors to ensure correct implementation of the recommendations. The opinions, comments and conclusions presented in this report were based upon information derived from our literature review, field investigation, and laboratory testing. Conditions between, or beyond, our exploratory borings may vary from those encountered. Unanticipated soil conditions and seasonal soil moisture variations are commonly encountered and cannot be fully determined by merely taking soil samples or soil borings. Such variations may result in changes to our recommendations and may require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

If there is more than 2years time between the submission of this report and the start of work at the site; if conditions have changed due to natural causes or construction operations at, or adjacent to, the site; or, if the basic project scheme is significantly modified from that assumed, it is recommended this report be reviewed to determine the applicability of the conclusions and recommendations.

The work has been conducted in general conformance with the standard of care in the field of geotechnical engineering currently in practice in the Pacific Northwest for projects of this nature and magnitude. No warranty, express or implied, exists on the information presented in this report. By utilizing the design recommendations within this report, the addressee acknowledges and accepts the risks and limitations of development at the site, as outlined within the report.

APPENDIX A

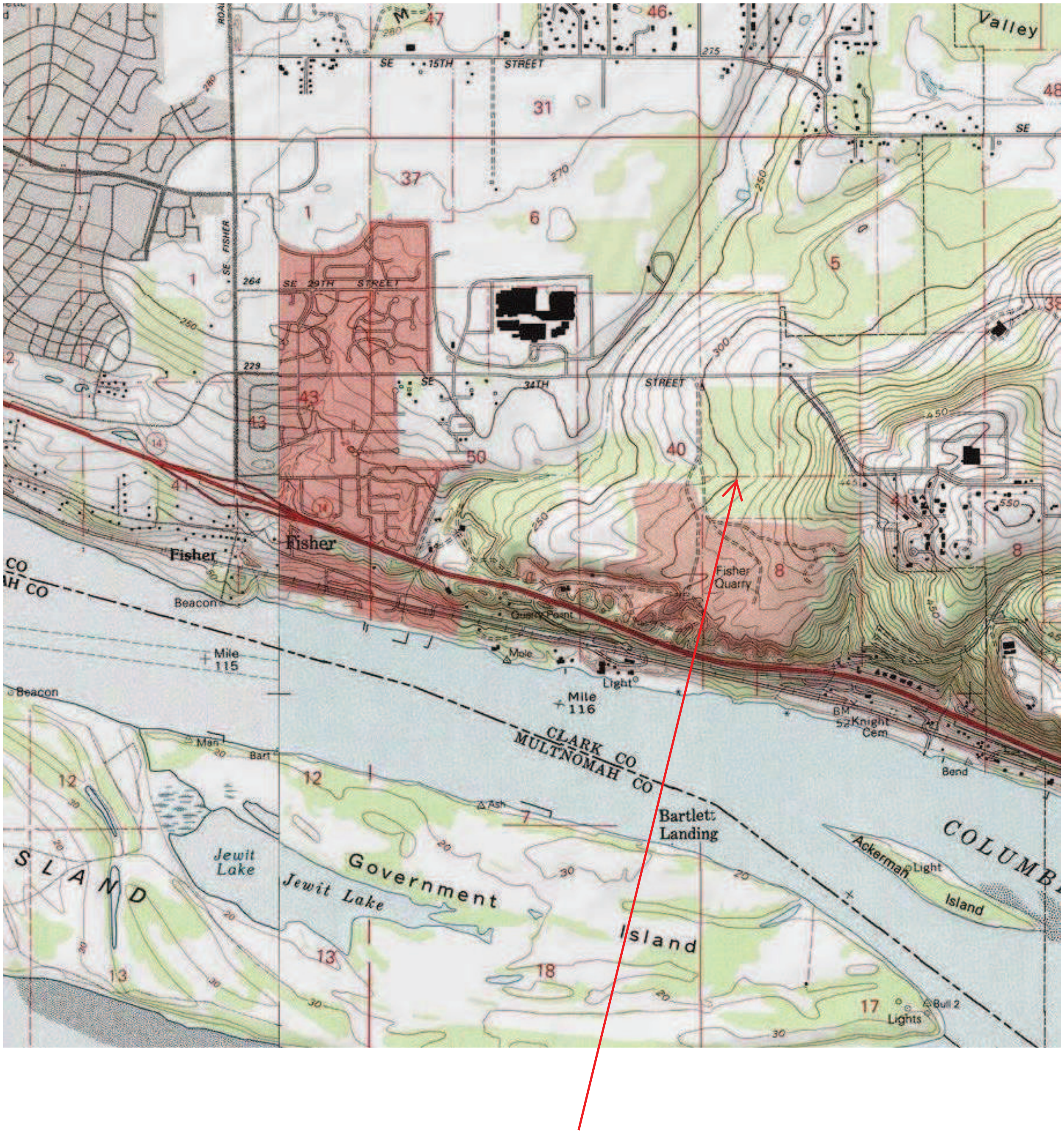


Figure 1 – Site locations

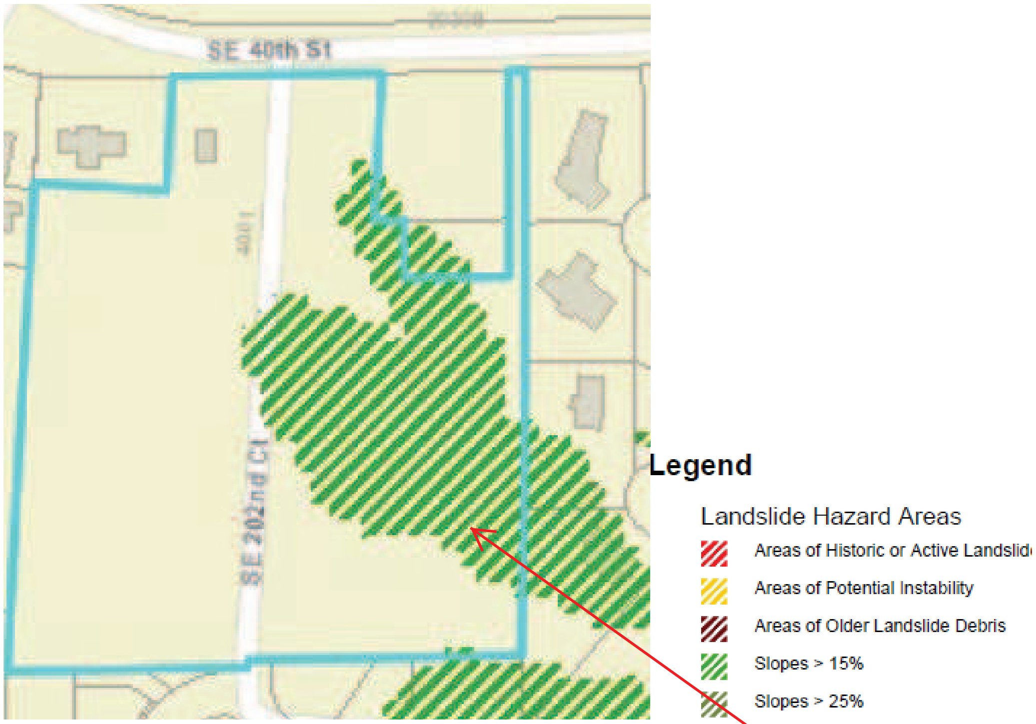
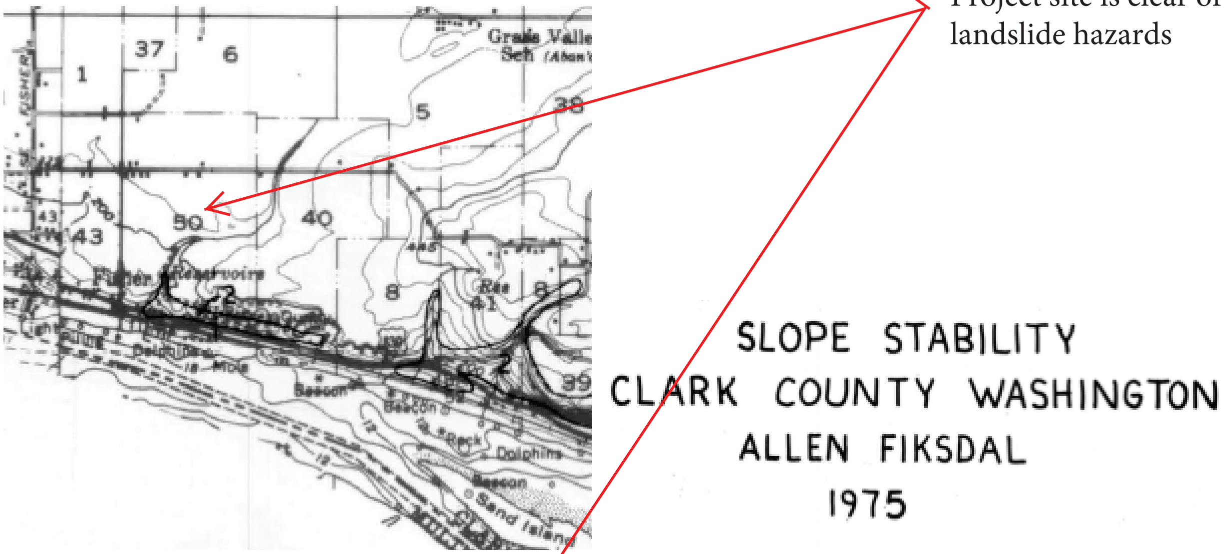
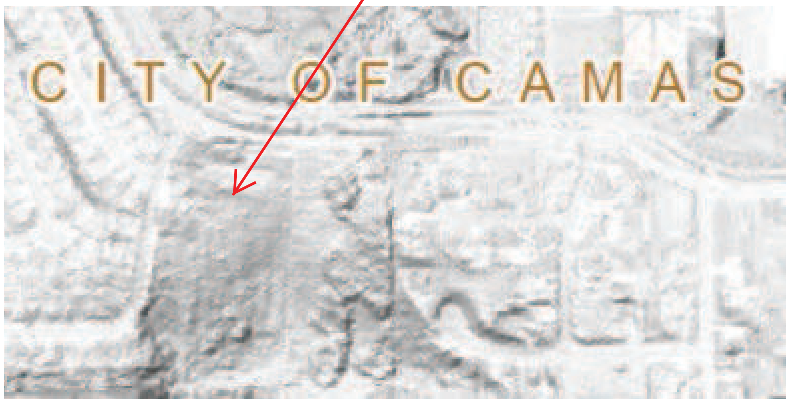


Figure 3 – Landslide hazards

Project site is clear of landslide hazards





IMS-43

APPENDIX B

ASPHALT
CONCRETE
SOILS
TESTING, INC
503.443.3799

7409 SW Tech Center Dr, #145
Tigard, OR 97223
phn: 503-443-3799
fax: 503-620-2748

RAPID SOIL SOLUTIONS
3915 SW PLUM STREET
PORTLAND, OR 97219-6018

PROJECT: RSS 2014 LAB SERVICES
LOCATION: VALLEY VIEW ESTATES
SAMPLE SOURCE: SEE BELOW

JOB NO: 14-4790
WORK ORDER NO: N/A
DATE SAMPLED: 4/18/14

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or Clay	SAND								GRAVEL									COBBLES	
					Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #

PERCENT PASSING BY WEIGHT

HA1@2'		27	3																				7267
HA2@ 4'		28	9																				7267

BORING	DEPTH	MC%
HA1@2'		25.9
HA2 @ 4'		28.0
HA3@ 4'		23.1
HA4@ 4'		24.9

REVIEWED BY

DE/js

#1

Surface Elevation: 414
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, medium light brown, fine grained medium plastic SILT
1								
2	PI=3, LL=27	25.9					ML	End hand augur hole
3								
4								
5								
6								
7								

LOG OF BORING

Rapid Soil Solutions

Valley View Sub-division
Stan Firestone

Plate 1

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Happy Valley Dental Clinic\HA 1.log Date: 4/30/2014

#2

Surface Elevation: 464
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, dark brown, fine grained medium plastic SILT
1								
							ML	Damp, dark to medium brown clayey SILT trace gray
2								
3								
4		28					ML	End hand augur hole
5								
6								
7								

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

#3

Surface Elevation: 418
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, dark brown, fine grained medium plastic clayey SILT
4	PI=9, LL=28	23.1					ML	End hand augur hole

LOG OF BORING

Rapid Soil Solutions

Valley View Sub-division
Stan Firestone

Plate 1

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Valley View\HA 3.log Date: 4/30/2014

#4

Surface Elevation: 448
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, dark brown, fine grained medium plastic clayey SILT
4		23.1					ML	End hand augur hole

0
1
2
3
4
5
6
7

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Valley View\HA 3.log Date: 4/30/2014

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

Appendix IV: Maintenance Manual (Clark County Version)

4.6 Maintenance Standards for Drainage Facilities

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table 4.5.2 Maintenance Standards

No. 1 – Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	~~No contaminants or pollutants present.~~
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)

No. 1 – Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.

No. 1 – Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Emergency Overflow/ Spillway and Berms over 4 feet in height.	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway	Emergency Overflow/ Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See “Side Slopes of Pond”	

No. 2 – Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Piping	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

No. 3 – Closed Detention Systems (Tanks/Vaults)

Maintenance Component	**Defect**	**Conditions When Maintenance is Needed**	**Results Expected When Maintenance is Performed**
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See “Catch Basins” (No. 5)	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 4 – Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall.	Structure securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes--other than designed holes--in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).
Catch Basin	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

No. 7 – Energy Dissipaters

Maintenance Components	**Defect**	**Conditions When Maintenance is Needed**	**Results Expected When Maintenance is Performed**
External:			
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
	Perforations Plugged.	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	Water Flows Out Top of “Distributor” Catch Basin.	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
Manhole/Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure replaced to design standards.
	Other Defects	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 8 – Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

No. 9 – Wet Biofiltration Swale

Maintenance Component	**Defect or Problem**	**Condition When Maintenance is Needed**	**Recommended Maintenance to Correct Problem**
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
	Trash and Debris Accumulation	See "Detention Ponds" (No. 1).	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

No. 10 – Filter Strips

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

No. 11 – Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

No. 12 – Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Remove sediment from vault.
	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.

No. 13 – Sand Filters (above ground/open)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Above Ground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds 1/2-inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.
	Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.
	Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
	Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.
	Short Circuiting	When flows become concentrated over one section of the sand filter rather than dispersed.	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.
	Erosion Damage to Slopes	Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.	Slopes stabilized using proper erosion control measures.
	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.
	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.	Spreader leveled and cleaned so that flows are spread evenly over sand filter.
	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired or replaced.

No. 14 –Sand Filters (below ground/enclosed)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault.	Sediment Accumulation on Sand Media Section	Sediment depth exceeds 1/2-inch.	No sediment deposits on sand filter section that which would impede permeability of the filter section.
	Sediment Accumulation in Pre-Settling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	No sediment deposits in first chamber of vault.
	Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
	Sediment in Drain Pipes/Cleanouts	When drain pipes, cleanouts become full with sediment and/or debris.	Sediment and debris removed.
	Short Circuiting	When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.	Cover repaired to proper working specifications or replaced.
	Ventilation	Ventilation area blocked or plugged	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.

No. 15 – Manufactured Media Filters)

Maintenance Component	**Defect**	**Condition When Maintenance is Needed**	**Results Expected When Maintenance is Performed**
Below Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

No. 16 – Baffle Oil/Water Separators (API Type)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with out thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulations that exceed 1-inch, at the surface of the water.	Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	See “Catch Basins” (No. 5)	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

No. 17 – Coalescing Plate Oil/Water Separators

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulation that exceeds 1-inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

No. 18 – Catchbasin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

No. 19 – MEDIA FILTER DRAIN (MFD)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of Media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

No. 20 – COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width

No. 21 - Maintenance Standards and Procedures for Bioretention Facilities.

Note that the inspection and routine maintenance frequencies listed below are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for “stormwater treatment and flow control BMPs/facilities.”

Maintenance Component	**Recommended Frequency** [a]		**Condition when Maintenance is Needed (Standards)**	**Action Needed (Procedures)**
	Inspection	**Routine Maintenance**		
Facility Footprint				
Earthen side slopes and berms	B, S		Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made. • Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3 inches (relative to undisturbed sections of berm)	Restore to design height
	A, S		Downstream face of berm wet, seeps or leaks evident	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm	• Eradicate rodents (see "Pest control") • Fill holes and compact (may require consultation with engineer, particularly for larger berms)
Concrete sidewalls	A		Cracks or failure of concrete sidewalls	• Repair/ seal cracks • Replace if repair is insufficient
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Facility area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		Accumulated sediment to extent that infiltration rate is reduced (see “Ponded water”) or surface storage capacity significantly impacted	• Remove excess sediment • Replace any vegetation damaged or destroyed by sediment accumulation and removal • Mulch newly planted vegetation • Identify and control the sediment source (if feasible) • If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet
		During/after fall leaf drop	Accumulated leaves in facility	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded
Low permeability check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage
	A, S		Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting
	A		Grade board or top of weir damaged or not level	Restore to level position

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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No. 21 (continued) - Maintenance Standards and Procedures for Bioretention Facilities.

Maintenance Component	**Recommended Frequency [a]**		**Condition when Maintenance is Needed (Standards)**	**Action Needed (Procedures)**
	Inspection	**Routine Maintenance**		
Facility Footprint (cont'd)				
Ponded water	B, S		Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Determine cause and resolve in the following order: 1) Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2) Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3) Check for other water inputs (e.g., groundwater, illicit connections). 4) Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increas ed. If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.
Bioretention soil media	As needed		Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint	• Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. • Never drive equipment or apply heavy loads in facility footprint. • Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. • Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. • If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.
Inlets/Outlets/Pipes				
Splash block inlet	A		Water is not being directed properly to the facility and away from the inlet structure	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M during the wet season and before severe storm is forecasted	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		A	Maintain access for inspections	• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Erosion control at inlet	A		Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale)

No. 21 (continued) - Maintenance Standards and Procedures for Bioretention Facilities.

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes (cont'd)				
Trash rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	• Plant roots, sediment or debris reducing capacity of underdrain • Prolonged surface ponding (see "Ponded water")	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring		Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	• Determine cause of poor vegetation growth and correct condition • Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound). • Confirm that plant selection is appropriate for site growing conditions • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Vegetation (general)	As needed		Presence of diseased plants and plant material	• Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • See Pacific Northwest Plant Disease Management Handbook for information on disease recognition and for additional resources • Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".
Trees and shrubs		All pruning seasons (timing varies by species)	Pruning as needed	• Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques • All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and shrubs, if necessary.
	Fall and Spring		Standing dead vegetation is present	• Remove standing dead vegetation • Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season) • If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately. • Determine cause of dead vegetation and address issue, if possible • If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.
	Fall and Spring		Planting beneath mature trees	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.

No. 21 (continued) - Maintenance Standards and Procedures for Bioretention Facilities.

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Trees and shrubs (cont'd)	Fall and Spring		Planting beneath mature trees	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.
	Fall and Spring		Presence of or need for stakes and guys (tree growth, maturation, and support needs)	• Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage • Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree. • Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. • Backfill stake holes after removal.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		Vegetation causes some visibility (line of sight) or driver safety issues	• Maintain appropriate height for sight clearance • When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location. • Remove or transplant if continual safety hazard • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	Vegetation compromises conveyance	• Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)		Winter and Spring	Dead material from previous year's growing cycle or dead collapsed foliage	• Leave dry foliage for winter interest • Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow
Ornamental grasses (evergreen)		Fall and Spring	Dead growth present in spring	• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring • Clean, rake, and comb grasses when they become too tall • Cut back to ground or thin every 2-3 years as needed
Noxious weeds		M (March – October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions • Apply mulch after weed removal (see "Mulch")

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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No. 21 (continued) - Maintenance Standards and Procedures for Bioretention Facilities.

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)
Excessive vegetation		Once in early to mid-May and once in early- to mid-September	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	• Edge or trim groundcovers and shrubs at facility edge • Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks • While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging
	As needed		Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety	• Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics • Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow) • Remove plants that are weak, broken or not true to form; replace in-kind • Thin grass or plants impacting facility function without leaving visual holes or bare soil areas • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
	As needed		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	• Remove vegetation and sediment buildup
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels) • Keep all mulch away from woody stems
Watering				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	• Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/located to properly water plants	• Redirect sprinklers or move drip irrigation to desired areas
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present ○ Pulse water to enhance soil absorption, when feasible ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff • Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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No. 21 (continued) - Maintenance Standards and Procedures for Bioretention Facilities.

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Watering (cont'd)				
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present ○ Pulse water to enhance soil absorption, when feasible ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear • Water during drought conditions or more often if necessary to maintain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority. • Use of pesticides or *Bacillus thuringiensis israelensis* (Bti)may be considered only as a temporary measure while addressing the standing water cause. If overflow to a surface water will occur within 2 weeks after pesticide use, apply for coverage under the Aquatic Mosquito Control NPDES General Permit.
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.
Insect pests	Every site visit associated with vegetation management		Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	• Reduce hiding places for pests by removing diseased and dead plants • For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols)

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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No. 22 - Maintenance Standards and Procedures for Permeable Pavement.

Note that the inspection and routine maintenance frequencies listed below are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for “stormwater treatment and flow control BMPs/facilities.”

Component	**Recommended Frequency** [a]		**Condition when Maintenance is Needed (Standards)**	**Action Needed (Procedures)**
	Inspection	**Routine Maintenance**		
Surface/Wearing Course				
Permeable Pavements, all	A, S		Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place) • Mulch and/or plant all exposed soils that may erode to pavement surface
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ○ Walk-behind vacuum (sidewalks) ○ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ○ ShopVac or brush brooms (small areas) • Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.
	A[b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods: • Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. • Hand held pressure washer or power washer with rotating brushes • Pure vacuum sweepers Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A		Major cracks or trip hazards and concrete spalling and raveling	• Fill potholes or small cracks with patching mixes • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

No. 22 (continued) - Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency[a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (cont'd)				
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	Clean pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ○ Walk-behind vacuum (sidewalks) ○ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ○ ShopVac or brush brooms (small areas) • Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A[b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. • Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). • Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface
	A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations
	A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections
	A		Settlement of surface	May require resetting
Open-celled paving grid with gravel		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A[b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Use vacuum truck to remove and replace top course aggregate • Replace aggregate in paving grid per manufacturer's recommendations
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace gravel • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Loss of aggregate material in paving grid	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	• Manually remove weeds • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue)

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

No. 22 (continued) - Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (cont'd)				
Open-celled paving grid with grass		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A [b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Rehabilitate per manufacturer's recommendations.
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace grass • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	• May require resetting
	A		Poor grass coverage in paving grid	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible
		As needed	None (routine maintenance)	• Use a mulch mower to mow grass
		A	None (routine maintenance)	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in • Do not use fertilizer
		A	Weeds present	• Manually remove weeds • Mow, torch, or inoculate and replace with preferred vegetation
Inlets/Outlets/Pipes				
Inlet/outlet pipe	A		Pipe is damaged	Repair/replace
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

No. 22 (continued) - Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes (cont'd)				
Overflow	B		Native soil is exposed or other signs of erosion damage are present at discharge point	Repair erosion and stabilize surface
Aggregate Storage Reservoir				
Observation port	A, S		Water remains in the storage aggregate longer than anticipated by design after the end of a storm	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
Vegetation				
Adjacent large shrubs or trees		As needed	Vegetation related fallout clogs or will potentially clog voids	• Sweep leaf litter and sediment to prevent surface clogging and ponding • Prevent large root systems from damaging subsurface structural components
		Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Accumulation of organic debris and leaf litter	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

GUIDANCE DOCUMENT

WESTERN WASHINGTON LOW IMPACT DEVELOPMENT (LID) OPERATION AND MAINTENANCE (O&M)

Prepared for
Washington State Department of Ecology
Water Quality Program

Prepared by
Herrera Environmental Consultants, Inc.
and
Washington Stormwater Center

Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

GUIDANCE DOCUMENT

WESTERN WASHINGTON LOW IMPACT DEVELOPMENT (LID) OPERATION AND MAINTENANCE (O&M)

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CONTENTS

(*Note: The examples provided in the appendices were included as examples based on format only; the content of these examples has not been reviewed for consistency with the 2013-2018 Permit requirements or the material included in this guidance document.*)

TABLES

ACKNOWLEDGMENTS

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INTRODUCTION

Purpose

As local governments in western Washington implement the Washington State Department of Ecology (Ecology) National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater permits (Permits), our region will increasingly rely on low impact development (LID) practices to protect water quality and aquatic natural resources. LID is a stormwater and land use management strategy that strives to mimic the pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design. LID best management practices (BMPs), such as bioretention and permeable pavements, are also commonly known as green stormwater infrastructure, integrated management practices, and on-site stormwater management BMPs.

This guidance provides recommendations on LID operations and maintenance (O&M) to help ensure that LID BMPs continue to function as designed in the long-term and is intended to support municipal stormwater Permittees in implementing their LID maintenance programs. While intended for a municipal audience, some guidance in this document may also be useful for private entities. Ecology encourages local governments to draw on this document to educate developers, homeowners' associations, and private property owners who are responsible for the O&M of LID BMPs.

Ecology Requirements for LID BMP Maintenance

The Phase I and Western Washington Phase II Municipal Stormwater Permits (Phase I Permit and Phase II Permit, or "Permits"), effective from August 2013 to July 2018, include provisions for municipalities to adopt and implement O&M programs and to facilitate proper O&M of LID BMPs. The Permit maintenance-related requirements for "On-site Stormwater Management BMPs" differ depending on if they are classified as "Stormwater Treatment and Flow Control BMPs/Facilities[1]". The side bars below highlight the distinctions made for Stormwater Treatment and Flow Control BMPs/Facilities. In general, the O&M Permit requirements for Stormwater Treatment and Flow Control BMPs/Facilities are more extensive and include, for example, long-term inspection and maintenance obligations that do not apply to other LID BMPs. The Phase I and Phase II Permits provisions that apply to LID BMPs are summarized in the following sections.

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[1] This document does not include guidance for traditional end of pipe treatment and detention facilities; though these facilities are included in the definition of "Stormwater Treatment and Flow Control BMPs/Facilities".

Phase I Permit Special Conditions

The Phase I Permit[2] (Ecology 2012a) special conditions that pertain to LID BMP maintenance are listed below:

- **S5.C.5.a.v.(4)** – Requires municipalities to inspect all permitted development sites, that meet certain thresholds, upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent storm water facilities. It also requires identification of a party responsible for maintenance, and verification of a maintenance plan for all Stormwater Treatment and Flow Control BMPs/Facilities.
- **S5.C.9.a.** – Requires adoption of maintenance standards that are at least as protective of facility function as those in Chapter 4 of Volume V of the 2012 Stormwater Management Manual for Western Washington (2012 SWMMWW).
- **S5.C.9.b.i.** – Requires adoption of an ordinance or other enforceable mechanism requiring maintenance of all permanent Stormwater Treatment and Flow Control BMPs/Facilities regulated by the Permittee.
- **S5.C.9.b.ii.** – Requires annual inspections of all Stormwater Treatment and Flow Control BMPs/Facilities regulated by the Permittee. Permittees must enforce compliance with the adopted maintenance standards as needed based on inspection.

"On-site Stormwater Management BMPs"

"On-site Stormwater Management BMPs" (also known as LID BMPs) used to meet Permit Minimum Requirement #5 (On-site Stormwater Management) include:

- Rain Gardens (BMP T5.14A)
- Bioretention (BMP T5.14B)
- Permeable Pavement (BMP T5.15)
- Vegetated Roofs (BMP T5.17)
- Downspout Full Infiltration (BMP T5.10B)
- Downspout Dispersion (BMP T5.10A)
- Concentrated Flow Dispersion (BMP T5.11)
- Sheet Flow Dispersion (BMP T5.12)
- Compost-amended soils (BMP T5.13)

Permit requirements for On-site Stormwater Management BMPs that are not also Stormwater Treatment and Flow Control BMPs/Facilities are less extensive and include, for example, construction inspections to ensure proper installation.

"Stormwater treatment and flow control BMPs/facilities"

The LID BMPs listed below are considered to be "Stormwater Treatment and Flow Control BMPs/Facilities" if they are used to help meet Minimum Requirements #6 (Treatment) and/or #7 (Flow Control):

- Bioretention (BMP T5.14B)
- Permeable Pavement (BMP T5.15)
- Vegetated Roofs (BMP T5.17)

Permit requirements for Stormwater Treatment and Flow Control BMPs/Facilities are more extensive and include, for example, long-term inspection and maintenance obligations.

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[2] The special conditions listed in this document are for city and county permittees. Secondary permittees should refer Section S6 of the permit for their special conditions that pertain to LID BMP maintenance.

- **S5.C.9.b.iii.** – Requires inspection of all permanent Stormwater Treatment and Flow Control BMPs/Facilities and catch basins regulated by the Permittee every 6 months during construction of residential developments until 90 percent of the lots are constructed (or when construction is stopped and the site is fully stabilized). Permittees must identify maintenance needs and enforce compliance with maintenance standards as needed.

- **S5.C.9.c.i.** – Requires annual inspection of all permanent Stormwater Treatment and Flow Control BMPs/Facilities owned or operated by the Permittee. Permittees are to implement appropriate maintenance action(s) in accordance with adopted maintenance standards.

- **S5.C.9.c.ii.** – Requires spot checks of potentially damaged permanent Stormwater Treatment and Flow Control BMPs/Facilities after major storm events. If spot checks indicate widespread damage/maintenance needs, inspect all Stormwater Treatment and Flow Control BMPs/Facilities that may be affected. Conduct repairs or perform maintenance in accordance with the standards established under S5.C.9.a.

Phase II Permit Special Conditions

The Phase II Permit[3] (Ecology 2012b) special conditions that pertain to LID BMP maintenance are listed below:

- **S5.C.4.b.iv.** – Requires municipalities to inspect all permitted development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater facilities. Municipalities must require identification of a party responsible for maintenance, and a maintenance plan for all Stormwater Treatment and Flow Control BMPs/Facilities.

- **S5.C.4.c.** – Requires a program to verify adequate operation and maintenance of Stormwater Treatment and Flow Control BMPs/Facilities that have been and will be approved and built under local code requirements adopted to comply with the 2007, 2012, and 2013 NPDES municipal stormwater Permits. The program must include:

  i) Implementation of an ordinance or other enforceable mechanism that requires identification of a party responsible for maintenance, and requires inspections of facilities in accordance with ii) through iv) below.

  ii) Requires establishment of maintenance standards that are at least as protective of facility function as those in Chapter 4 of Volume V of the 2012 SWMMWW.

  iii) Requires annual inspection of all Stormwater Treatment and Flow Control BMPs/Facilities that discharge to the MS4 and were permitted according to S5.C.4.b. including those permitted pursuant to the 2007 – 2012 Permit.

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[3] The special conditions listed in this document are for city and county permittees. Secondary permittees should refer Section S6 of the permit for their special conditions that pertain to LID BMP maintenance.

    iv) Requires inspections of permanent Stormwater Treatment and Flow Control BMPs/Facilities and catch basins every 6 months during construction of residential developments until 90 percent of the lots are constructed (or when construction is stopped and the site is fully stabilized).

- **S5.C.5.a.** – Requires implementation of maintenance standards that are at least as protective of facility function as those in Chapter 4 of Volume V of the 2012 SWMMWW.
- **S5.C.5.b.** – Requires annual inspections of all municipally owned or operated permanent Stormwater Treatment and Flow Control BMPs/Facilities, and taking appropriate maintenance actions in accordance with the adopted maintenance standards.
- **S5.C.5.c.** – Requires spot checks of potentially damaged permanent Stormwater Treatment and Flow Control BMPs/Facilities after major storm events. If spot checks indicate widespread damage/maintenance needs, inspect all "storm water treatment and flow control BMPs" that may be affected. Conduct repairs or perform maintenance in accordance with the standards established under S5.C.5.a.

Summary

Both Phase I and Phase II municipal Permittees bear long-term inspection and enforcement responsibilities to require proper maintenance of Stormwater Treatment and Flow Control BMPs/Facilities. Although the On-site Stormwater Management BMPs that are not Stormwater Treatment and Flow Control BMPs/Facilities do not require long-term inspections, municipalities are obligated to inspect these BMPs upon completion of construction to ensure proper installation.

The Permits also require Permittees to adopt site planning requirements (Western Washington Phase II Permit – S5.C.4.a.ii; Western Washington Phase I Permit – S5.C.5.a.ii). They can choose to use the site planning requirements in the 2012 SWMMWW, or they can adopt requirements that protect water quality, reduce the discharge of pollutants to the maximum extent practicable (MEP), and satisfy the "all known, available and reasonable" provisions of State statute (Chapter 90.48 RCW). The 2012 SWMMWW site planning guidance includes information on the production, submission and recording of legal documents that provide both design information and maintenance instructions for each On-site Stormwater Management BMP, and help allow local government access to these BMPs.

Ecology encourages local governments to use the guidance in this document to meet their Permit obligation to adopt maintenance standards for LID BMPs. Additionally, they can use the guidance to gain an understanding of the procedures, equipment, materials, legal documents and staffing they will need to meet their inspection and maintenance responsibilities.

How to Use this Guidance Document

This guidance document is organized into two sections. The first section, “Maintaining LID BMPs,” provides detailed maintenance guidance for LID BMPs, recommendations for equipment and materials, and information on what types of skills and staffing may be needed. The second section, “Programmatic and Administrative Guidance,” includes guidance to support jurisdictions in administering their LID maintenance programs.

Maintaining LID BMPs Section

The “Maintaining LID BMPs” section is intended to be used by municipal maintenance staff and private parties who are responsible for LID BMP O&M. The tables and guidance in this document may be used:

- To create O&M manuals for Stormwater Treatment and Flow Control BMPs/Facilities
- As maintenance instructions that can be submitted as part of the stormwater site plan for LID BMPs that are not Stormwater Treatment and Flow Control BMPs/Facilities
- As a reference to help homeowners maintain on-site LID BMPs

The guidance provides support by:

- Explaining how LID BMPs function (e.g., how water moves through the facility and the importance of key facility components) to provide a framework for the maintenance standards and procedures, and support smart maintenance decisions in the field
- Providing clear guidance on LID BMP maintenance frequencies, standards and procedures in an easy-to-use table. These tables can easily be reformatted as maintenance checklists.
- Providing a comprehensive equipment and materials list for each BMP
- Providing information on staff skills needed for O&M
- Providing information on the level of effort required to maintain bioretention, permeable pavement, and vegetated roofs

The maintenance standards and procedures presented in this guidance should be used by municipalities for the long-term inspection and maintenance of Stormwater Treatment and Flow Control BMPs/Facilities. While not required, long-term observation of all on-site systems by municipal inspectors is recommended, particularly when the property is subject to inspection for Stormwater Treatment and Flow Control BMPs/Facilities.

Programmatic and Administrative Guidance Section

The Programmatic and Administrative Guidance section is intended to be used by municipal staff responsible for developing and implementing LID BMP maintenance programs. The guidance provides support by:

- Presenting Ecology’s requirements that relate to LID BMP maintenance programs, such as systems for permitting, plan review, inspections, enforcement and record keeping
- Providing guidance regarding administrative tools for implementing these requirements, such as municipal stormwater codes, stormwater manuals, legal agreements, financial surety measures, inspection programs, and mapping systems
- Providing examples of administrative tools, including covenants and easements, and private property owner education

Definitions/Acronyms

- **Applicant:** Individuals, associations, organizations, partnerships, firms, corporations, developers, or other entities applying for a development proposal, permit, or approval.
- **Bond:** A surety bond, cash deposit or escrow account, assignment of savings, irrevocable letter of credit or other means acceptable to or required by the manager to guarantee that work is completed in compliance with the project's drainage plan and in compliance with all local government requirements. Bonds can also be used to protect and guarantee the performance of a stormwater BMP after construction.
- **Codes:** Collections of laws and regulations which have been codified based on the activities they regulate. These laws are ordinances that are enforced locally in addition to state and federal law. City or county stormwater codes may include laws regulating the requirements for maintenance of private stormwater facilities, the right of the jurisdiction to intervene in maintenance or repair of the facility, or any documents or contracts required for the construction of a stormwater facility.
- **Covenants:** Binding legal documents in which a person (commonly a property owner) promises the local government to either engage in or refrain from a certain action. A jurisdiction’s code, at the jurisdiction’s option, may require a covenant or easement agreement for the construction of a stormwater facility. The agreement may require the facility owner to perform certain maintenance activities and grants the jurisdiction limited authority to access the site (through an easement or agreement) for facility inspection, maintenance, or repair work.
- **Developer:** A person who purchases and develops property, primarily by preparing a site for residential or commercial use.
- **Director:** Typically the Public Works Director, Planning and Development Services Director, or Natural Resources and Parks Director (depending on the organization of the City or County and what department the stormwater program is included in) or an appointed representative or designee with an appropriate background.
- **Green stormwater infrastructure:** A synonym for Low Impact Development BMPs (see definition below).

- **Integrated management practices:** Used in the LID Technical Guidance Manual for Puget Sound as a synonym for Low Impact Development BMPs (see definition below).

- **Low impact development (LID):** A stormwater and land use management strategy that strives to mimic pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design.

- **LID best management practices (BMPs):** Distributed stormwater management practices, integrated into a project design, that emphasize pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration. LID BMPs include, but are not limited to, bioretention/rain gardens, permeable pavements, roof downspout controls, dispersion, soil quality and depth, vegetated roofs, minimum excavation foundations, and water re-use.

- **On-site Stormwater Management BMPs:** A synonym for Low Impact Development BMPs.

- **Pollution-generating surfaces:** Any hard or impervious surface considered to be a significant source of pollutants in stormwater runoff, or any pervious surface that is subject to rainfall and vehicular use, industrial activities, storage of erodible or leachable materials, wastes, or chemicals, or use of pesticides or fertilizers, or loss of soil.

- **Property owner:** The person who is the legal record owner of the parcel.

- **Responsible party:** The parties (e.g., property owners, homeowners' associations, corporations, public agencies) responsible for maintaining stormwater features at a site and/or in a public right-of-way.

- **Stormwater Treatment and Flow Control BMPs:** Detention facilities, treatment BMPs/facilities, bioretention, vegetated roofs, and permeable pavements that help meet Appendix 1 Minimum Requirements #6 (treatment), #7 (flow control), or both.

- **Surety:** A surety is a bond or other security signed by the contractor and a surety company that assures the project owner or municipality the contract will be completed. A surety can include bonds or assignment of accounts (also called assignment of savings).

MAINTAINING LID BMPS

This section is organized by BMP type and includes guidance for the following LID BMPs:

- Bioretention facilities
- Rain gardens
- Permeable pavement
- Vegetated roofs
- Downspout full infiltration systems
- Downspout, sheet flow, and concentrated dispersion systems
- Compost-amended soils

Each BMP section includes the following information:

- **BMP Description:** brief description of the BMP and how the facility functions (i.e., how water moves through the facility).
- **Key Maintenance Considerations:** summary of key facility maintenance considerations for each main BMP components, such as inlets, aggregate, soil, vegetation.
- **Key Operations to Preserve Facility Function:** operational considerations that may reduce routine maintenance needs and prevent the need for corrective maintenance.
- **Maintenance Standards and Procedures:** a table providing detailed guidance for regular maintenance (e.g., bioretention vegetation care) and some guidance for corrective maintenance (e.g., bioretention soil replacement). The table lists the recommended inspection frequency, conditions when maintenance is needed (maintenance "standards") and the associated maintenance actions triggered by those conditions (maintenance "procedures").
- **Equipment and Material List:** a sample list of equipment and materials that field crews can take into the field.
- **Skills and Staffing:** a list of the skills needed for routine and corrective maintenance, and summary of the staffing resources recommended for BMP maintenance based on input from local jurisdictions and other nationally-recognized LID programs (for the Stormwater Treatment and Flow Control BMPs/Facilities only).

This section's detailed maintenance guidance can be pared down to meet project-specific needs. For example, tables can be tailored to show only site-specific BMPs and their subcomponents (e.g., underdrains). Additionally, the routine maintenance frequencies should be tailored to minimize a site's need for corrective maintenance (e.g., specify more frequent sweeping of permeable pavement located under deciduous tree canopies).

Jurisdictions may also want to consider tailoring the tables to address "level of service" (i.e., the BMP conditions that trigger maintenance procedures). As an example, the City of Seattle maintains public facilities to levels of service "A" through "D", with level A being the highest degree of maintenance. Lower levels of service require only maintenance activities that preserve facility function (not aesthetics). While this guidance document includes recommended quantitative thresholds for some BMP maintenance actions (e.g., supplemental planting is triggered when bioretention vegetative coverage falls below 75 percent), jurisdictions may wish to develop their own maintenance triggers and/or establish ranges of triggers based on higher levels of service. Such decisions will affect the maintenance resources required to maintain public projects.

The maintenance standards provided in this section are not intended to be a measure of the facility's required condition at all times between inspections. However, the inspection and maintenance schedules should be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

All LID BMPs

The maintenance recommendations included in this section are applicable to all LID BMPs.

Maintenance Standards and Procedures

Table 1 provides the recommended maintenance frequencies, standards, and procedures for spill prevention, spill response, and pest management actions common to all LID BMP facilities included in this guidance document.

Table 1. Maintenance Standards and Procedures for All LID BMPs.

Category	Recommended Frequency: Inspection	Recommended Frequency: Routine Maintenance	Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
General				
Facility presence	All visits		None (ongoing inspections)	Inspect to ensure the facility is present on site as shown on the as-built (or record drawings) and previous photos.
Spill Prevention and Response				
Spill prevention	Ongoing		None (ongoing inspections)	All sites must implement BMPs to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater.
Spill cleanup	As needed		Release of pollutants	• Call your local or regional hotline number to report any spills or other illicit discharges • Clean up spills as soon as possible to prevent contamination of stormwater • Restore BMP facility design and function per the record drawings
Pests				
Pest management	As needed		Pest of concern is present and impacting BMP facility function	• Pesticide use should be generally discouraged, even conditionally prohibited in some cases • Pesticides include the following: herbicides, fungicides, insecticides, rodenticides, and pediculicides • If pesticide use is planned in or near LID BMPs, make sure to check the following current regulations: 1) Federal- Environmental Protection Agency (EPA) Federal Insecticide and Rodenticide Act 2) State- Ecology, Washington State Department of Agriculture, Washington Department of Fish and Wildlife, Natural Resources Conservation Services 3) Local city or county ordinances/codes, and/or applicable Integrated Pest Management (IPM) plan • For the protection of health and safety, check the following: 1) Washington State Department of Labor & Industries 2) Washington State Department of Health (local branch if applicable)

Equipment and Materials

Table 2 includes recommendations for equipment and materials common to all LID BMPs included in this guidance document.

Table 2. Equipment and Materials List for All LID BMPs.

☐ **Camera**

☐ **Safety gear/equipment (including boots, long sleeves and pants, gloves, eye and ear protection, and/or high visibility safety vest)**

☐ **Shovel (to check depth and condition of soils)**

☐ **Measuring tape**

☐ **Photos, reports, and/or checklists from past maintenance visits (to help identify changes such as thinning plants and changing pavement conditions)**

☐ **Copy of the site's O&M manual or maintenance plan**

☐ **O&M checklist**

☐ **As-built (i.e., record) drawings of the facility, including site drawings with facility location(s)**

☐ **Manufacturer information (if applicable)**

Skills

The required skills common to maintenance of all LID BMPs are listed in the text box to the right.

Skills Needed for Maintenance of all LID BMPs

- Understanding of as-built (or record) drawings of the facility
- Understanding of facility design and intent (to identify issues that would inhibit function)
- General labor (manual tool skills)

Bioretention Facilities

Bioretention facilities are engineered facilities that store and treat stormwater by filtering it through a specified soil profile. Water that enters the facility ponds in an earthen depression or other basin (e.g., concrete planter) before it infiltrates into the underlying bioretention soil. Stormwater that exceeds the surface storage capacity overflows to an adjacent drainage system. Treated water is either infiltrated into the underlying native soil or collected by an underdrain and discharged. Bioretention facilities are considered Stormwater Treatment and Flow Control BMPs/Facilities when used to help meet Minimum Requirements #6 (treatment), #7 (flow control), or both.

Key Maintenance Considerations

The main components of bioretention facilities are listed below with descriptions of their function and key maintenance considerations.

- **Inlet**: Stormwater can flow into a bioretention facility in a number of ways including: dispersed flow across vegetated areas, sheet flow across impervious areas, or concentrated flow through curb cuts and/or piped flow inlets. Inlets must be maintained to be unobstructed to ensure that stormwater enters the facility as designed. Erosion control measures must also be maintained in areas of concentrated flows (e.g., pipes inlets or narrow curb cuts).
- **Facility footprint**: The facility footprint is typically an earthen depression or another type of basin (e.g., concrete planter box) that provides surface storage for stormwater before it infiltrates into the underlying bioretention soil. If the facility is located on a slope, low permeability check dams may be included (oriented perpendicular to the slope) to encourage ponding. Key maintenance considerations for the facility footprint include the following:
    - The integrity of earthen berms and basin walls must be maintained, soil areas must be protected from erosion, and accumulated sediment must be removed.
    - Bioretention facilities are designed to infiltrate all ponded water within a 24- to 48-hour “drawdown” time after the end of a storm. This allows the soil to dry out periodically in order to restore the hydraulic capacity of the system and prevent conditions supportive of mosquito breeding. Slower drawdown times may indicate that the underdrain (if present) is plugged or the bioretention soil is overly compacted, clogged, or does not meet design specifications. Corrective maintenance may include clearing underdrain obstructions or partial or complete replacement of bioretention soil to restore bioretention facility function.
- **Bioretention soil**: Infiltration of stormwater through the engineered bioretention soil mix provides water quality treatment. All maintenance activities must be performed in a manner to prevent compaction of the bioretention soil.
- **Mulch**: The bioretention soil is covered by a layer of mulch, comprised of arborist wood chips, compost, and/or rocks. Mulch reduces weed establishment. Organic

mulches regulate soil temperatures and moisture, and add organic matter to soil. The mulch layer must be supplemented regularly.

- **Vegetation**: Bioretention systems rely on vegetation (i.e., grasses, shrubs, and sometimes trees) to intercept, uptake, and evapotranspire stormwater. In addition, plant roots improve soil structure and increase infiltration capacity. Regular maintenance activities associated with vegetation include weeding and pruning. Plants also require irrigation during the first 2 to 3 years of establishment and during extended dry periods.
- **Overflow**: Flows exceeding the capacity of the facility are discharged via an overflow structure (e.g., pipe, curb cut, earthen channel). It is important to maintain clear outlet pipes and overflow structures to ensure that stormwater can be safely conveyed to a designated discharge point (e.g., storm drain system).
- **Underdrains (optional)**: Underdrains are optional components of a bioretention facility that may be included in bioretention systems where, for example, infiltration to underlying soil is not prudent or feasible. Underdrains are installed under the bioretention soil layer to collect and convey treated water. An underdrain system can be comprised of perforated or slotted pipe, wrapped in an aggregate blanket. It is important to maintain clear drains so that water moves through system as designed. Maintenance may include occasional cleaning to remove plant roots or debris. If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be inspected and cleaned regularly.

Nutrient sensitivity of the receiving water is also an important maintenance consideration, particularly in watersheds draining to phosphorous limited water bodies. The addition of excess fertilizers to the system and/or systems operating in bypass, can increase the potential for export of phosphorous found in bioretention soil or compost and increase nutrient loads to downstream receiving waters.

Key Operations to Preserve Facility Function

For a bioretention system to function properly, stormwater must infiltrate freely through the bioretention soil. The soil infiltration rate can be reduced if the soil is subject to compaction (e.g., foot and vehicle traffic loads). To limit the likelihood of corrective maintenance (e.g., bioretention soil replacement), the facility footprint area should be protected from external loads. Because the risk of compaction is higher when soils are saturated, any type of loading in the bioretention facility (including foot traffic) should be avoided during wet conditions.

Signage can also be used to identify the vegetated area as a stormwater BMP and inform maintenance crews and the general public about protecting the facility’s function.

Maintenance Standards and Procedures

Table 3 provides the recommended maintenance frequencies, standards, and procedures for bioretention facility components. The level of routine maintenance required and the frequency of corrective maintenance actions may increase for facilities subject to high sediment loads from the contributing drainage area.

Table 3. Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint				
Earthen side slopes and berms	B, S		Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made. • Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3 inches (relative to undisturbed sections of berm)	Restore to design height
	A, S		Downstream face of berm wet, seeps or leaks evident	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm	• Eradicate rodents (see "Pest control") • Fill holes and compact (may require consultation with engineer, particularly for larger berms)
Concrete sidewalls	A		Cracks or failure of concrete sidewalls	• Repair/ seal cracks • Replace if repair is insufficient
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Facility area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		Accumulated sediment to extent that infiltration rate is reduced (see “Ponded water”) or surface storage capacity significantly impacted	• Remove excess sediment • Replace any vegetation damaged or destroyed by sediment accumulation and removal • Mulch newly planted vegetation • Identify and control the sediment source (if feasible) • If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet
		During/after fall leaf drop	Accumulated leaves in facility	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded
Low permeability check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage
	A, S		Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting
	A		Grade board or top of weir damaged or not level	Restore to level position

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint (cont'd)				
Ponded water	B, S		Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Determine cause and resolve in the following order: 1) Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2) Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3) Check for other water inputs (e.g., groundwater, illicit connections). 4) Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.
Bioretention soil media	As needed		Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint	• Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. • Never drive equipment or apply heavy loads in facility footprint. • Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. • Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. • If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.
Inlets/Outlets/Pipes				
Splash block inlet	A		Water is not being directed properly to the facility and away from the inlet structure	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M during the wet season and before severe storm is forecasted	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		A	Maintain access for inspections	• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Erosion control at inlet	A		Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale)

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes (cont'd)				
Trash rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	• Plant roots, sediment or debris reducing capacity of underdrain • Prolonged surface ponding (see "Ponded water")	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring		Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	• Determine cause of poor vegetation growth and correct condition • Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound). • Confirm that plant selection is appropriate for site growing conditions • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Vegetation (general)	As needed		Presence of diseased plants and plant material	• Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • See Pacific Northwest Plant Disease Management Handbook for information on disease recognition and for additional resources • Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".
Trees and shrubs		All pruning seasons (timing varies by species)	Pruning as needed	• Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques • All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and shrubs, if necessary.
	Fall and Spring		Standing dead vegetation is present	• Remove standing dead vegetation • Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season) • If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately. • Determine cause of dead vegetation and address issue, if possible • If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.
	Fall and Spring		Planting beneath mature trees	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Trees and shrubs (cont'd)	Fall and Spring		Planting beneath mature trees	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.
	Fall and Spring		Presence of or need for stakes and guys (tree growth, maturation, and support needs)	• Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage • Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree. • Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. • Backfill stake holes after removal.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		Vegetation causes some visibility (line of sight) or driver safety issues	• Maintain appropriate height for sight clearance • When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location. • Remove or transplant if continual safety hazard • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	Vegetation compromises conveyance	• Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)		Winter and Spring	Dead material from previous year's growing cycle or dead collapsed foliage	• Leave dry foliage for winter interest • Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow
Ornamental grasses (evergreen)		Fall and Spring	Dead growth present in spring	• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring • Clean, rake, and comb grasses when they become too tall • Cut back to ground or thin every 2-3 years as needed
Noxious weeds		M (March – October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions • Apply mulch after weed removal (see "Mulch")

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)
Excessive vegetation		Once in early to mid- May and once in early- to mid-September	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	• Edge or trim groundcovers and shrubs at facility edge • Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks • While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging
	As needed		Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety	• Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics • Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow) • Remove plants that are weak, broken or not true to form; replace in-kind • Thin grass or plants impacting facility function without leaving visual holes or bare soil areas • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
	As needed		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	• Remove vegetation and sediment buildup
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels) • Keep all mulch away from woody stems
Watering				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	• Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/located to properly water plants	• Redirect sprinklers or move drip irrigation to desired areas
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present ○ Pulse water to enhance soil absorption, when feasible ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff • Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Watering (cont'd)				
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present ○ Pulse water to enhance soil absorption, when feasible ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear • Water during drought conditions or more often if necessary to maintain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority. • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.
Insect pests	Every site visit associated with vegetation management		Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	• Reduce hiding places for pests by removing diseased and dead plants • For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols)

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Additional Maintenance Resources

Useful related guidance documents include the following:

- LID Technical Guidance Manual for Puget Sound: http://www.wastormwatercenter.org/files/library/lid-manual-2012-final-secure.pdf.
- Natural Lawn and Garden Care resources (King County and SPU 2008; Saving Water Partnership 2006, 2007, and 2012) include guidance on building healthy soil with compost and mulch, selecting appropriate plants, watering, using alternatives to pesticides, and implementing natural lawn care techniques.
- Integrated Pest Management (IPM) protocols (the term "pest" covers a broad range of species including harmful insects, plant pathogens, rodents, and weedy vegetation) provide an approach to pest control that uses regular monitoring to determine if and when treatments are needed, and employs physical, mechanical, cultural, and biological tactics to keep pest numbers low enough to prevent intolerable damage or annoyance (Ecology 2012c) while avoiding or minimizing the use of pesticides and fertilizers herbicides as a management strategy.
- See EPA's website for general information on IPM: www.epa.gov/pesticides/factsheets/ipm.htm
- See the City of Seattle's website for IPM Fact Sheets and Washington specific resources: www.seattle.gov/util/forbusinesses/landscapes/integrated_pest_management
- The International Society of Arboriculture (ISA) is a group that promotes the professional practice of arboriculture and fosters a greater worldwide awareness of the benefits of trees through research, technology, and education. ISA standards used for managing trees, shrubs, and other woody plants are the American National Standards Institute (ANSI) A300 standards. The ANSI A300 standards are voluntary industry consensus standards developed by the Tree Care Industry Association (TCIA) and written by the Accredited Standards Committee (ASC). The ANSI standards can be found on the ISA website: www.isa-arbor.com/education/publications/index.aspx.
- Volume IV (Source Control) of Ecology's 2012 SWMMWW provides guidance on herbicide and pesticide application and alternative management strategies for controlling weeds and pests.
- WSU Weeding Guidelines: http://gardening.wsu.edu
- Pacific Northwest Plant Disease Management Handbook for information on disease recognition and for additional resources: http://pnwhandbooks.org/plantdisease/diagnosis-and-testing/disease-diagnosis-and-control

These resources are supplemental and do not supersede guidance provided in the S*tandards and Procedures* tables.

Equipment and Materials

Table 4 includes recommendations for equipment and materials commonly used to maintain bioretention facilities. Some of the equipment and materials will be used for routine maintenance activities, while other equipment and materials will be necessary for specialized maintenance.

Table 4. Bioretention Equipment and Materials List.

Landscaping equipment

☐ Gloves
☐ Weeding tool
☐ Soil knife
☐ Pruners
☐ Loppers
☐ Stakes and guys
☐ Manual edger
☐ Line trimmer (also known as a string trimmer, weed eater, or weed whacker)
☐ Rototiller
☐ Hoe
☐ Rake
☐ Wheelbarrow
☐ Shovel
☐ Push broom
☐ Hand tamper
☐ Blade sharpeners
☐ Tarp/ Buckets (to remove leaf litter/debris)
☐ Garbage bags (for disposal of trash/noxious weeds)
☐ Bark and mulch blower
☐ Boards to stand on during maintenance to prevent soil compaction (if maintenance is necessary during periods when Bioretention media is wet)

Watering equipment

☐ Soaker hose
☐ Hose/shower-type wand
☐ Sprinklers
☐ Tree watering bags
☐ Buckets
☐ Keys for irrigation boxes
☐ Water source (e.g., watering truck), if necessary

Landscaping materials*

☐ Plants
☐ Stakes and ties

Erosion control material*

☐ Rock or cobbles for rock pad
☐ Erosion control matting

Mulch

☐ Arborist wood chip mulch
☐ Coarse compost mulch
☐ Rock mulch

Pipe/structure inspection and maintenance equipment

☐ Hand tools
☐ Wrench or manhole lifter (for opening manhole lids, grates, etc.)
☐ Flashlight
☐ Mirror (for viewing pipes without entering structure)
☐ Garden hose
☐ Plumbing snake
☐ Measuring tape or ruler

Specialized equipment*

☐ Mini excavator
☐ Vactor truck
☐ Manual seed broadcaster
☐ Soil monitoring equipment (T handle core sampler, soil auger, soil nutrient test kit)
☐ Flame weeder or hot water weeder
☐ Water jet or root saw (Vactor truck tools) for clearing roots from underdrains
☐ Equipment for infiltration testing

Bioretention soil*

☐ Bioretention soil per design specifications

* Items not required for routine maintenance

Skills and Staffing

The skills required for maintenance of bioretention facilities are listed in the text box to the right. Additional specialized skills may also be required for corrective maintenance such as: horticulturalists, arborists, erosion control specialists, engineers, landscape architects, and soil scientists.

The staff effort required for maintenance varies. Table 5 provides some examples of staffing estimates from Washington jurisdictions, the City of Portland, a study conducted among Minnesota jurisdictions (Wilson et al. 2008), and the BMP and LID Whole Life Cost Models (WERF 2009). Annual staff hours are listed for an individual facility (i.e., a "typical" facility of undefined area), 1,000 square feet of facility, or 1,000 linear feet of facility.

Skills Needed for Maintenance of Bioretention Facilities

- Landscaping skills (e.g., general plant care)
- Plant identification skills (weeds vs. planted species, invasive vs. common weeds, how to dispose of invasive weeds, timing of weed seed dispersal)
- Erosion control knowledge
- General drainage system maintenance skills (e.g., inlet/pipe/underdrain cleaning experience, inlet/ pipe maintenance or repair experience)
- Operation of specialized equipment
- Engineer and/or landscape architect for major maintenance
- Certified arborist (or equivalently trained staff) for pruning of mature trees

Table 5. Maintenance Frequency and Staffing for Bioretention Facilities.

Routine Maintenance Activity	Frequency [a]	Annual Staff Hours	Source
General (no activity specified)	A or B	1 to 16 hours (per facility)	Maintenance of Stormwater BMPs: Frequency, Effort, and Cost (Wilson et al. 2008)
Vegetation management	A	0 to 2 hours (per facility)	BMP and LID Whole Life Cost Models (WERF 2009)
General (no activity specified)	M	24 hours (per 1,000 sf)	City of Bellevue
General (no activity specified)	M	16 hours (per facility)	Kitsap County
Weeding	M (May-Sept)	7 hours (per 1,000 lf)	Thurston County
Replanting and mulching	A		
Typical facility maintenance	Q	10 to 30 hours [b] (per 1,000 sf)	City of Portland
More complex site maintenance [c]	> Q	14 to 38 hours [b] (per 1,000 sf)	
General (no activity specified)	Unspecified	10 hours (per 1,000 sf)	City of Olympia

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; Q = Quarterly (four times per year)

[b] Low end of range pertains to City staff and high end of range pertains to Contractor staff

[c] Deciduous canopy, poor soils, adjacent weed vectors, unmaintained commercial right-of-way

lf = linear feet

sf = square feet

Staffing estimates averaged approximately 16 to 22 hours per bioretention facility on an annual basis. The City of Portland estimated that bioretention facilities with more complex maintenance requirements could require up to 38 hours of staff time when using less seasoned maintenance crews.

Rain Gardens

Rain gardens are non-engineered, shallow, landscaped depressions with compost-amended soils and adapted plants. The depression temporarily stores stormwater runoff from adjacent areas. Some or all of the influent stormwater passes through the amended soil profile and into the underlying native soil. Stormwater that exceeds the storage capacity is designed to overflow to an adjacent drainage system.

Key Maintenance Considerations

The main components of rain gardens (and the associated maintenance considerations) are very similar to those listed for bioretention facilities. However, rain gardens do not require an engineered soil mix (native soils may be amended) and usually do not have underdrains or other control structures.

Fertilizer use should be avoided in rain gardens, particularly those located in watersheds draining to phosphorous limited water bodies.

Key Operations to Preserve Facility Function

As explained for bioretention facilities, rain gardens must be protected from foot traffic, vehicles and other loads, particularly during wet conditions, to prevent compaction of the amended soil and preserve infiltration capacity.

Signage can also be used to identify the vegetated area as a stormwater BMP and inform maintenance crews and the general public about protecting the rain garden's function (e.g., no walking in the garden).

Maintenance Standards and Procedures

Table 6 provides the recommended maintenance frequencies, standards, and procedures for rain garden components. For guidance on underdrains, check dams and other control structures, see "Bioretention Facilities".

Table 6. Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a] Inspection	Routine Maintenance	Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
Rain Garden Footprint				
Earthen side slopes	B (during the wet season)		Persistent soil erosion on slopes	If erosion persists, water may be flowing into the garden too rapidly. In this case, the slope of the pipe or swale directing water to the garden, or the amount of water may need to be reduced (see “Erosion control at inlet”)
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Rain garden footprint		B	Trash and debris present	Clean out trash and debris
Rain garden bottom area	A		Visible sediment deposition in the rain garden that reduces drawdown time of water in the rain garden	• Remove sediment accumulation • If sediment is deposited from water entering the rain garden, determine the source and stabilize the area
		During/after fall leaf drop	Accumulated leaves in rain garden (may reduce infiltration capacity of rain garden or clog overflow)	Remove leaves
Ponded water	B, S		Excessive ponding water: Ponded water remains in the basin more than 3 days after the end of a storm	Confirm leaf, debris or sediment buildup in the bottom of the rain garden is not impeding infiltration. If necessary, remove leaf litter/debris/sediment. If this does not solve the problem, consultation with a professional with rain garden expertise is recommended to evaluate the following: • Check for other water inputs (e.g., groundwater, illicit connections) • Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased • Determine if the soil is clogged by sediment accumulation at the surface or if the soil has become overly compacted

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes				
Splash block inlet	A		Water is not being directed properly to the rain garden and away from the building	Reconfigure/ repair blocks to direct water to the rain garden and away from building
Pipe inlet/ outlet	A		Pipe capacity is reduced by sediment or debris (can cause backups and flooding)	Clear pipes of sediment and debris
	A		Damaged/cracked drain pipes	• Repair/seal cracks • Replace when repair is insufficient
Erosion control at inlet	A		Rock or cobble is removed or missing and concentrated flows are contacting soil	Maintain a cover of rock or cobbles to protect the ground where concentrated water flows into the rain garden from a pipe or swale
Vegetation				
Vegetation		As needed	Dying, dead, or unhealthy plants	• Maintain a healthy cover of plants • Remove any diseased plants or plant parts and dispose of in commercial landfill to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • Re-stake trees if they need more support, but plan to remove stakes and ties after the first year • Cars can damage roots – protect root areas of trees and plants from vehicle traffic
		As needed	Vegetation inhibits sight distances and sidewalks	Keep sidewalks and sight distances on roadways clear
		As needed	Broken, dead, or sucker vegetation is present	Remove broken or dead branches and suckers
		As needed	Vegetation is crowding inlets and outlets	Keep water inlets and outlets in the rain garden clear of vegetation

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Vegetation (cont'd)		As needed	Broken, dead, or sucker vegetation is present	Remove broken or dead branches and suckers
		As needed	Vegetation is crowding inlets and outlets	Keep water inlets and outlets in the rain garden clear of vegetation
	One time March through June		• Yellowing: possible Nitrogen (N) deficiency • Poor growth: possible Phosphorous (P) deficiency • Poor flowering, spotting or curled leaves, or weak roots or stems: possible Potassium (K) deficiency	• Test soil to identify specific nutrient deficiencies • Consult with a professional knowledgeable in the area of natural amendments or refer to Natural Lawn and Garden Care resources and avoid synthetic fertilizers • Consider selecting different plants for soil conditions
Weeds		As needed, preceding seed dispersal	Problem weeds are present	• Remove weeds by hand, especially in spring when the soil is moist and the weeds are small • Dig or pull weeds out by the roots before they go to seed • Apply mulch after weeding (see "Mulch")
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Use coarse compost in the bottom of the rain garden and arborist wood chips on side slopes and rim (above typical water levels) • Keep all mulch from being in contact with woody stems.

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Watering				
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Tree, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present • Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Tree, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Water during drought conditions or more often if necessary to maintain plant cover • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different rain garden species and water immediately after initial signs of stress appear

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see “Ponded water”) • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Additional Maintenance Resources

In addition to the resources listed for bioretention, useful guidance for rain gardens can be found in the Rain Garden Handbook for Western Washington Homeowners (http://www.wastormwatercenter.org/low-impact/). These resources are supplemental and do not supersede guidance provided in the Standards and Procedures tables.

Equipment and Materials

Table 7 includes recommendations for equipment and materials commonly used to maintain rain gardens. Some of the equipment and materials will be used for routine maintenance activities, while other equipment and materials will be necessary for specialized maintenance.

Table 7. Rain Garden Equipment and Materials List.

Landscaping equipment

- ☐ **Gloves**
- ☐ **Weeding tool**
- ☐ **Soil knife**
- ☐ **Pruners**
- ☐ **Loppers**
- ☐ **Stakes and guys**
- ☐ **Manual edger**
- ☐ **Line trimmer (also known as a string trimmer, weed eater, or weed whacker)**
- ☐ **Rototiller**
- ☐ **Hoe**
- ☐ **Rake**
- ☐ **Wheelbarrow**
- ☐ **Shovel**
- ☐ **Push broom**
- ☐ **Hand tamper**
- ☐ **Blade sharpeners**
- ☐ **Tarp/Buckets (to remove leaf litter/debris)**
- ☐ **Garbage bags (for disposal of trash/noxious weeds)**

Watering equipment

- ☐ **Soaker hose**
- ☐ **Hose/shower-type wand**
- ☐ **Sprinklers**
- ☐ **Tree watering bags**
- ☐ **Buckets**

Mulch

- ☐ **Arborist wood chip mulch**
- ☐ **Coarse compost mulch**
- ☐ **Rock mulch**

Landscaping materials*

- ☐ **Plants**

Erosion control materials*

- ☐ **Rock or cobbles for rock pad**
- ☐ **Erosion control matting**

Soil*

- ☐ **Compost (for soil amendment)**
- ☐ **Bioretention soil mix**

* Items not required for routine maintenance

Permeable Pavement

Permeable pavement is a paving system which allows rainfall to percolate through the surface into the underlying soil or an aggregate bed, where stormwater is stored and infiltrated to underlying subgrade, or removed by an overflow drainage system. Permeable pavement facilities are considered Stormwater Treatment and Flow Control BMPs and can be used to meet Minimum Requirements #6 (treatment), #7 (flow control), or both. To satisfy Minimum Requirement #6, stormwater must be infiltrated into underlying soils that meet Ecology's soil treatment requirements or filtered through an engineered treatment layer included in the pavement section.

Key Maintenance Considerations

The main components of permeable pavement facilities are listed below with descriptions of their function and key maintenance considerations.

- **Wearing course**: The surface layer of any permeable pavement system is the wearing course. Categories of wearing courses include:
  - Porous asphalt**:** A flexible pavement similar to standard asphalt that uses a bituminous binder to adhere aggregate. However, the fine material (sand and finer) is reduced or eliminated, resulting in the formation of voids between the aggregate in the pavement surface that allows water to infiltrate to the underlying aggregate base.
  - Pervious concrete**:** A rigid pavement similar to conventional concrete that uses a cementitious material to bind aggregate together. However, the fine aggregate (sand) component is reduced or eliminated in the gradation, resulting in the formation of voids between the aggregate in the pavement surface that allows water to infiltrate to the underlying aggregate base.
  - Interlocking concrete paver blocks: Solid, precast, manufactured modular units. Pavements constructed with these units create joints that are filled with permeable aggregate and installed on an open-graded aggregate base.
  - Aggregate Pavers (or Pervious Pavers): Modular precast paving units made with uniformly sized aggregates and bound with Portland cement concrete using a high strength adhesive. Unlike concrete paver blocks, these pavers are permeable. Pavements constructed with these units create joints that are filled with permeable aggregate and installed on an open-graded aggregate base.
  - Open-celled paving grid with gravel**:** Concrete or plastic grids that are filled with permeable aggregate. The system can be installed on an open-graded aggregate base.
  - Open-celled paving grid with grass**:** Concrete or plastic grids that are filled with a mix of sand, gravel, and topsoil for planting vegetation. The cells can be planted with a variety of non-turf forming grasses or low-growing groundcovers. The system can be installed on an open-graded aggregate base.

A critical component of a successful maintenance program is regular removal of sediment and debris, excessive moss from the facility surface to prevent clogging of the permeable wearing course.

- **Inlet (optional):** While permeable pavement facilities often manage only the rain falling directly on the pavement surface, they may also be designed to accept stormwater runoff from additional areas (e.g., adjacent impervious areas, nearby rooftops). Runoff can be directed to the facility by two main methods:
    - <u>Sheet flow to the surface</u>: Surface areas of the facility receiving runoff contributions will likely be prone to clogging due to sediment inputs, particularly in areas of concentrated inflow. These areas should be carefully inspected and corrective maintenance should be performed as necessary to maintain the function of the pavement at these sites. In addition, the source of the sediment loads should be evaluated to determine if modifications to features in the drainage area landscape (e.g., stabilization of adjacent planted areas) would help to prevent clogging.
    - <u>Piped flow into the aggregate base</u>: Pipes dispersing water into the aggregate bed should be designed with cleanout access to allow pipe maintenance. Runoff that is piped into the aggregate base should be pretreated for sediment removal (e.g., screens, sumps) to protect the subbase from sedimentation and clogging. The pretreatment system must be maintained to remove accumulated sediment.
- **Aggregate Base / Storage Reservoir:** Stormwater passes through the wearing course to an underlying aggregate storage reservoir where it is stored prior to infiltration into the underlying soil. This aggregate bed also provides the structural function of supporting design loads (e.g., vehicle loading) for flexible pavement systems. To allow inspection of the aggregate course, some facilities have an observation port (typically installed during construction) that allows monitoring of the water levels in the aggregate bed to determine if the facility is draining properly.
- **Overflow:** Unless designed to provide full infiltration of stormwater, permeable pavement facilities have an overflow. Facility overflow can be provided by subsurface slotted drain pipe(s) (elevated in the aggregate bed) routed to an inlet or catch basin structure or by lateral flow through the storage reservoir to a daylighted drainage system.
- **Underdrain with flow restrictor (optional):** A slotted drain pipe with flow restrictor assembly may be installed at the bottom of or elevated within the aggregate storage reservoir. Permeable pavement facilities with underdrains and flow restrictors operate as underground detention systems with some infiltration.

Key Operations to Preserve Facility Function

There are several permeable pavement operational actions that can limit the likelihood of corrective maintenance actions or replacement including the following:

- Prohibiting use of sealant on porous asphalt
- Protecting from construction site runoff with proper temporary erosion and sediment controls and flow diversion measures
- Modifying utility cut procedures for permeable pavements. Protocols should *recommend* restoring permeable pavement section in-kind, where feasible, and *require* restoring permeable pavement section in-kind where replacement with conventional pavement would impact overall facility function. Replacing permeable pavement with conventional pavement is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function.
- Modifying snow removal procedures such as:
    - Using a snow plow with skids or rollers to slightly raise the blade above permeable pavers or open-celled paving grid systems to prevent loss of top course aggregate and damage to paver blocks or grids
    - Avoiding stockpiling plowed snow (i.e., dirty snow) directly on top of permeable pavement
    - Avoiding application of sand to pervious pavement and adjacent streets where vehicles may track it onto the pervious pavement. If sand is applied, on an emergency basis during snowy conditions, vacuum sweep surface as soon as possible after the sand is no longer needed.
    - Use alternative deicers in moderation (e.g., salt, molasses-based and chemical deicers).
- Protecting the surface from stockpiles of landscaping materials (e.g., mulch, soil, compost) being used for adjacent pervious areas
- Stabilizing adjacent landscaped areas to avoid eroding soil and clogging surfaces or sloping adjacent landscaped areas away from permeable pavement , if possible

Signage or pavement marking can also be used to identify permeable pavement as a stormwater BMP and inform maintenance crews and the general public about protecting the facility's function (e.g., no stockpiling of soils or mulch on pavement surface).

Maintenance Standards and Procedures

Table 8 provides the recommended maintenance frequencies, standards, and procedures for permeable pavement components. The level of routine maintenance required and the frequency of corrective maintenance actions may increase for facilities receiving high sediment loads (e.g., sanding) or facilities subject to extended wet, shady conditions where moss may accumulate.

Table 8. Maintenance Standards and Procedures for Permeable Pavement.

	Recommended Frequency [a]			
Component	**Inspection**	**Routine Maintenance**	**Condition when Maintenance is Needed (Standards)**	**Action Needed (Procedures)**
Surface/Wearing Course				
Permeable Pavements, all	A, S		Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place) • Mulch and/or plant all exposed soils that may erode to pavement surface
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ○ Walk-behind vacuum (sidewalks) ○ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ○ ShopVac or brush brooms (small areas) • Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.
	A[b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods: • Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. • Hand held pressure washer or power washer with rotating brushes • Pure vacuum sweepers Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A		Major cracks or trip hazards and concrete spalling and raveling	• Fill potholes or small cracks with patching mixes • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

Table 8 (continued). Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (cont'd)				
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	Clean pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ○ Walk-behind vacuum (sidewalks) ○ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ○ ShopVac or brush brooms (small areas) • Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A [b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. • Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). • Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface
	A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations
	A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections
	A		Settlement of surface	May require resetting
Open-celled paving grid with gravel		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A [b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Use vacuum truck to remove and replace top course aggregate • Replace aggregate in paving grid per manufacturer's recommendations
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace gravel • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Loss of aggregate material in paving grid	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	• Manually remove weeds • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue)

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

Table 8 (continued). Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (cont'd)				
Open-celled paving grid with grass		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A [b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Rehabilitate per manufacturer's recommendations.
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace grass • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	• May require resetting
	A		Poor grass coverage in paving grid	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible
		As needed	None (routine maintenance)	• Use a mulch mower to mow grass
		A	None (routine maintenance)	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in • Do not use fertilizer
		A	Weeds present	• Manually remove weeds • Mow, torch, or inoculate and replace with preferred vegetation
Inlets/Outlets/Pipes				
Inlet/outlet pipe	A		Pipe is damaged	Repair/replace
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	• Jet clean or rotary cut debris/roots from under-drain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

Table 8 (continued). Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes (cont'd)				
Overflow	B		Native soil is exposed or other signs of erosion damage are present at discharge point	Repair erosion and stabilize surface
Aggregate Storage Reservoir				
Observation port	A, S		Water remains in the storage aggregate longer than anticipated by design after the end of a storm	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
Vegetation				
Adjacent large shrubs or trees		As needed	Vegetation related fallout clogs or will potentially clog voids	• Sweep leaf litter and sediment to prevent surface clogging and ponding • Prevent large root systems from damaging subsurface structural components
		Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Accumulation of organic debris and leaf litter	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

Equipment and Materials

Table 9 includes recommendations for equipment and materials commonly used to maintain permeable pavement. Some of the equipment and materials will be used for routine maintenance activities, while other equipment and materials will be necessary for specialized maintenance.

Table 9. Permeable Pavement Equipment and Materials List.

Equipment to address clogging of wearing course, such as:	*Weed / vegetation removal equipment, such as:*
☐ Hand held pressure washer or power washer with rotating brushes (not recommended for open-celled aggregate-filled systems) ☐ Walk-behind vacuum (sidewalks) ☐ Pure vacuum sweeper ☐ ShopVac (small areas) ☐ Combined higher pressure wash and vacuum system	☐ Weeding tools ☐ Weed burner ☐ Edging and trimming equipment to control groundcover and other vegetation from extending onto pavement surface
Equipment to remove sediment, debris, and leaf litter, such as:	*Additional equipment for grass-filled open-celled grid systems*
☐ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ☐ Push broom (can also be used to spread and clean aggregate in gravel-filled open-celled grid and permeable paver systems) ☐ Brush broom (course bristled broom) to remove moss ☐ Leaf blower	☐ Mower or mulch mower ☐ Topdress grass seed ☐ Compost ☐ Replacement grid segments
*Erosion control equipment (to stabilize adjacent landscaped areas and protect pavement from sediment inputs)**	*Additional equipment for gravel-filled open-celled grid systems*
☐ Erosion control matting ☐ Rocks ☐ Mulch ☐ Plants ☐ Landscaping tools ☐ Tarps (to protect pavement in area of landscaping from clogging, e.g., mulch stockpiles)	☐ Rakes and shovels ☐ Aggregate to replace material after vacuuming or to replenish material in high use areas ☐ Replacement grid segments ☐ Wheelbarrow (for transporting replacement aggregate)
Pipe/structure inspection and maintenance equipment	*Additional equipment for permeable paver systems*
☐ Hand tools ☐ Wrench or manhole opener (for opening manhole lids, grates, etc.) ☐ Flashlight ☐ Mirror (for viewing pipes without entering structure) ☐ Garden hose ☐ Plumbing snake ☐ Measuring tape or ruler	☐ Rakes and shovels ☐ Extra pavers and bedding material ☐ Aggregate to replace materials between pavers after vacuuming ☐ Wheelbarrow (for transporting replacement aggregate)
	Snow removal equipment, such as:
	☐ Plow with skids to prevent damage to permeable pavement ☐ Snow blower

* Items not required for routine maintenance

Skills and Staffing

The skills required for the maintenance of permeable pavement facilities are listed in the text box to the right.

Skills Needed for Maintenance of Permeable Pavement

- Sweeper and equipment operation
- Commercial driver's license (CDL)
- Landscaping skills (e.g., general plant care) for grass-filled open-celled grid systems
- Engineer and/or landscape architect for major maintenance

The staff effort required for maintenance varies based on the type of facility, sediment loading, and site conditions. Table 10 provides some examples of staffing estimates from Washington jurisdictions, Washington contractors/vendors, a study conducted among Minnesota jurisdictions (Wilson et al. 2008), and the BMP and LID Whole Life Cost Models (WERF 2009). Staff estimates are listed as the number of hours to maintain an individual facility (i.e., a "typical" facility of undefined area) per year or as the area of facility maintained per hour of staff time. Staffing estimates ranged from 1 to 24 hours per facility on an annual basis, with an average of approximately 4 to 6 hours per permeable pavement facility on an annual basis. Cleaning estimates in sf/hr ranged from 1,000 to 87,000 sf/hr depending on the type of maintenance activity.

Table 10. Maintenance Frequency and Staffing for Permeable Pavement.

Type of Pavement	Routine Maintenance Activity	Frequency [a]	Annual Staff Hours	Source
Permeable Pavement (all)	NG	A or B	1 to 4 hours (per facility)	Maintenance of Stormwater BMPs: Frequency, Effort, and Cost (Wilson et al. 2008)
Permeable Pavement (all)	Permeable Pavement Sweeping; Litter and Minor Debris Removal; and Recordkeeping	A	4 to 6 hours (per facility)	BMP and LID Whole Life Cost Models (WERF 2009)
Permeable Pavement (all)	Cleaning	A	4,000 sf/hour	City of Olympia
Permeable Pavement (all)	NG	B	4 hours (per facility)	Kitsap County
Permeable Pavement (all)	NG	3 times/year	24 hours (per facility)	Pierce County
Pervious Concrete	Parking lot (dry)	Q	6,000-9,000 sf/hr	Backstrom Curb & Sidewalk
	Sidewalk (dry)	B	1,000 sf/hr	
GrassPave2	Mowing	Weekly to M	22,000-33,000 sf/hr	Northwest Linings & Geotextile
	Fertilizing and liming		65,000-87,000 sf/hr	
GravelPave2	Gravel raking / re-distribution		11,000-22,000 sf/hr	
	Weed control		65,000-87,000 sf/hr	

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; Q = Quarterly (four times per year); NG = no guidance provided

sf/hr = square feet per hour

Vegetated Roofs

Vegetated roofs (also known as ecoroofs and green roofs) are thin layers of engineered soil and vegetation constructed on top of a conventional roof. Vegetated roofs consist of four basic components: a waterproof membrane, drainage layer, lightweight growth medium, and vegetation. Deeper installations, referred to as "intensive" roofs, are comprised of at least 6 inches of growth media and are planted with groundcovers, grasses, shrubs and sometimes trees. These intensive systems require regular landscape maintenance. Shallower installations, referred to as "extensive" roofs, are comprised of less than 6 inches of growth media and use a planting palette of drought-tolerant, low maintenance groundcovers. The procedures outlined below focus on extensive roof systems, and different procedures for intensive roofs are noted.

Key Maintenance Considerations

The main components of vegetated roof facilities are listed below with descriptions of their function and key maintenance considerations. Components are listed in the order of installation from the roof deck upwards.

- **Waterproof membrane**: Waterproof membranes are installed on the roof deck below the vegetated roof system. Systems also include a protection layer and root barrier to preserve the integrity of the waterproof membrane. These components are not visible, so inspection is typically not possible unless a leak detection system is installed. During maintenance, sharp tools, lawn staples, and stakes should be avoided to prevent damage to membrane.

- **Drainage layer**: All vegetated roofs have a drainage component that routes excess water to the roof drain system. Usually this takes the form of a manufactured drain mat or granular drainage media. A separation layer (e.g., filter fabric) is typically installed above the drainage mat or granular drainage media to prevent fine components of the growth media from being washed into the roof drain system. This component is also not visible, so inspection is difficult. During maintenance, sharp tools, lawn staples, and stakes should be avoided to prevent damage to the drainage layer.

- **Growth media**: Vegetated roofs use a light-weight growth medium with adequate fertility and drainage capacity to support plant growth and allow infiltration and storage of water. In general the media is composed of porous and lightweight mineral aggregates such as pumice, lave rock, expanded shale and expanded slate. The growth media may be covered by a mat (or other erosion control measure) to prevent surface erosion due to rain and wind scour before plants are established.

- **Vegetation**: The plants on vegetated roofs are typically succulents, grass, herbs, and/or wildflowers adapted to the harsh conditions (minimal soils, seasonal drought, high winds, and strong sun exposure) prevalent on rooftops. A wider variety of vegetation types may be used on intensive roofs, but these typically require additional maintenance. Regular maintenance activities associated with vegetation include weeding and pruning. Plants also require watering during establishment and extended dry periods.

- **Structural drainage elements**: The roof drainage system routes water from the vegetated roof drainage layer to a nearby drainage system. It is important to maintain unobstructed outlet pipes and structures to ensure that stormwater is safely conveyed from the roof to a discharge point. There are also other structural components of a roof that may interface with the vegetated roof (e.g., flashing, roof ventilation points, utilities).

- **Border zone:** This zone forms an area, composed of gravel and devoid of vegetation, around the perimeter of the vegetated roof, typically used as a fire prevention method and to prevent water damage.

- **Gravel stops:** These are sheet metal edges, typically installed outside of the border zone, along the perimeter of the roof to prevent growth medium from blowing or washing off of the roof.

Key Operations to Preserve Facility Function

For vegetated roofs to function properly, stormwater must filter through several layers. Similar to bioretention facilities, filtration can be reduced if the growth media is subject to compaction (e.g., foot traffic). To limit the likelihood of corrective maintenance (e.g., growth media), the planted area of the vegetated roof should be protected from external loads. The risk of compaction is higher when soils are saturated, therefore any type of loading in the planted areas of the vegetated roof (including foot traffic) should be avoided or minimized during wet conditions.

Signage is recommended to identify the planted areas of the vegetated roof as a stormwater BMP and educate maintenance crews and the general public about protecting the facility's function (e.g., no walking on the facility). Clear walkways or pathways should be present to discourage foot traffic on the planted portions of the vegetated roof.

Maintenance Standards and Procedures

Table 11 provides the recommended maintenance frequencies, standards, and procedures for vegetated roof components.

Each vegetated roof installation will have specific O&M guidelines provided by the manufacturer and installer. The following guidelines provide a general set of standards for prolonged vegetated roof performance. Note that some maintenance recommendations are different for extensive versus intensive vegetated roof systems. The procedures outlined below focus on extensive roof systems, and different procedures for intensive roofs are noted.

Table 11. Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Growth medium area				
Growth medium	A [b]		Water does not permeate growth media (runs off soil surface) or crusting is observed	Aerate (e.g., rake) or replace medium taking care not to damage the waterproof membrane
	A		Growth medium thickness is less than design thickness (due to erosion and plant uptake)	Supplement growth medium to design thickness
	B, W		Fallen leaves or debris are present	Remove/dispose
	A, W, S		Growth media erosion/scour is visible (e.g., gullies)	• Take steps to repair or prevent erosion • Fill, hand tamp, or lightly compact, and stabilize with additional soil substrate/growth medium (similar in nature to the original material) and additional plants
Erosion control measures	B [c]		Mat or other erosion control is damaged or depleted during plant establishment period	• Repair/replace erosion control measures until 90% vegetation coverage attained • Avoid application of mulch on extensive vegetated roofs
System Drainage and Structural Components				
Roof drain	B, S		Sediment, vegetation, or debris reducing capacity of inlet structure	• Clear blockage • Identify and correct any problems that led to blockage
	A		Pipe is clogged	Remove roots or debris
	A		Inlet pipe is in poor condition	Repair/replace

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

[c] Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
System Drainage and Structural Components (cont'd)				
Border zone	A		Vegetation is encroaching into border zone aggregate	Remove and dispose of weeds and transplant desirable vegetation to growth medium area
Flashing, gravel stops, utilities, or other structures on roof	A		Flashing, utilities or other structures on roof are deteriorating (can serve as source of metal pollution in vegetated roof runoff)	Repair (e.g., recoat) or replace to eliminate potential pollutant source. Note that any work done around flashings and drains should be done with care to protect the waterproof membrane.
Access and safety	B		Insufficient egress/ingress routes and fall protection	• Maintain egress and ingress routes to design standards and fire codes • Ensure appropriate fall protection
Vegetation				
Plant coverage	B		Vegetative coverage falls below 90% (unless design specifications stipulate less than 90% coverage)	• Plant bare areas with vegetation • If necessary, install erosion control measures until percent coverage goal is attained
Sedums		A (first 2 years in Spring); As needed (after first 2 years)	Extensive roof with low density sedum population	• Mulch mow sedums- creating cuttings from existing plants to encourage colonization
Dead plants	Fall and Spring		Dead vegetation is present	Normally dead plant material can be recycled on the roof; however, specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).
Trees and shrubs–intensive vegetated roof		All pruning seasons (timing varies by species)	Pruning as needed	All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

[c] Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Fertilization– extensive vegetated roof	A		Poor plant establishment and possible nutrient deficiency in growth medium	• Allow organic debris to replenish and maintain long-term nutrient balance and growth medium structure • Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. • Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. • Apply fertilizer only after acquiring required approval from facility owner and operator. Note that extensive vegetated roofs are designed to require zero to minimal fertilization after establishment (excess fertilization can contribute to nutrient export)
Fertilization– intensive vegetated roof	A		Fertilization may be necessary during establishment period or for plant health and survivability after establishment	• Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. • Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. • Apply fertilizer only after acquiring required approval from facility owner and operator. • Intensive vegetated roofs may require more fertilization than extensive vegetated roofs

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

[c] Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" for more information on IPM protocols)
Noxious weeds		M (March – October, proceeding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions
Irrigation System (or Watering)				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	Follow manufacturer's instructions for operation and maintenance
Summer watering – extensive vegetated roof		Once every 1-2 weeks as needed during prolonged dry periods	Vegetation in establishment period (1-2 years)	Water weekly during periods of no rain to ensure plant establishment (30 to 50 gallons per 100 square feet)
		As needed	Established vegetation (after 2 years)	Water during drought conditions or more often if necessary to maintain plant cover (30 to 50 gallons per 100 square feet)

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

[c] Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Irrigation System (or Watering) (cont'd)				
Summer watering – intensive vegetated roof		Once every 1-2 weeks as needed during prolonged dry periods	Vegetation in establishment period (1-2 years)	• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system not present
		As needed	Established vegetation (after 2 years)	Water during drought conditions or more often if necessary to maintain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (e.g., aerate or replace medium, unplug drainage) • Manually remove standing water and direct to storm drainage system • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols)

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

[c] Inspection should occur during plant establishment period (typically first 2 years).

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Additional Maintenance Resources

Useful related guidance documents include the following:

- Vegetation resources listed for bioretention
- LID Technical Guidance Manual for Puget Sound: http://www.wastormwatercenter.org/files/library/lid-manual-2012-final-secure.pdf
- Green Roof ANSI standards developed in conjunction with Green Roofs for Healthy Cities (GRHC). GRHC is a group working to increase awareness of the economic, social, and environmental benefits of vegetated roofs through education and outreach. GRHC standards used for fire and wind uplift design of vegetated roofs are the ANSI RP-14 and VF-1 standards. These standards cover several key design components of vegetated roofs that, once installed, require upkeep to maintain the functionality of these features.
- Integrated Pest Management (IPM) protocols (the term "pest" covers a broad range of species including harmful insects, plant pathogens, rodents, and weedy vegetation) provide an approach to pest control that uses regular monitoring to determine if and when treatments are needed, and employs physical, mechanical, cultural, and biological tactics to keep pest numbers low enough to prevent intolerable damage or annoyance (Ecology 2012c) while avoiding or minimizing the use of pesticides and fertilizers herbicides as a management strategy.
- See EPA's website for general information on IPM: www.epa.gov/pesticides/factsheets/ipm.htm.
- See the City of Seattle's website for IPM Fact Sheets and Washington specific resources: www.seattle.gov/util/forbusinesses/landscapes/integrated_pest_management
- The International Society of Arboriculture (ISA) is a group that promotes the professional practice of arboriculture and fosters a greater worldwide awareness of the benefits of trees through research, technology, and education. ISA standards used for managing trees, shrubs, and other woody plants are the American National Standards Institute (ANSI) A300 standards. The ANSI A300 standards are voluntary industry consensus standards developed by the Tree Care Industry Association (TCIA) and written by the Accredited Standards Committee (ASC). The ANSI standards can be found on the ISA website: www.isa-arbor.com/education/publications/index.aspx.

These resources are supplemental and do not supersede guidance provided in the S*tandards and Procedures* tables.

Equipment and Materials

Table 12 includes recommendations for equipment and materials commonly used to maintain vegetated roofs. Some of the equipment and materials will be used for routine maintenance activities, while other equipment and materials will be necessary for specialized maintenance.

Table 12. Vegetated Roof Equipment and Materials List.

General gardening and landscaping equipment

☐ **Gloves**
☐ **Weeding tool**
☐ **Soil knife**
☐ **Hand tamper**
☐ **Hoe**
☐ **Rake**
☐ **Push broom**
☐ **Buckets**
☐ **Garbage bags (for disposal of noxious weeds)**

Additional equipment for intensive roofs:

☐ **Pruners**
☐ **Loppers**
☐ **Manual edger**
☐ **Line trimmer (also known as a string trimmer, weed eater, or weed whacker)**
☐ **Wheelbarrow**
☐ **Shovel**
☐ **Stakes and guys**

Gardening and landscaping materials

☐ **Plants/seeds**
☐ **Growing media**
☐ **Fertilizer (encapsulated, slow release)**

Erosion control material*

☐ **Mulch (intensive roofs)**
☐ **Erosion control matting**

Equipment and materials for subsurface or drip irrigation system repairs

☐ **Soaker hose**
☐ **Hose/shower-type wand**
☐ **Sprinklers**
☐ **Tree watering bags**
☐ **Buckets**
☐ **Water source, if necessary**

Safety equipment

☐ **Fall protection as applicable**

* Items not required for routine maintenance

Skills and Staffing

The skills required for the maintenance of vegetated roofs are listed in the text box to the right. Additional specialized skills may also be required for corrective maintenance of intensive vegetated roofs such as: horticulturalists and arborists.

The maintenance associated with vegetated roofs may sometimes pose safety hazards and require controls (e.g., fall protection) currently covered under the Washington State Department of Labor & Industries.

Table 13 provides some examples of staffing estimates from the City of Olympia and the BMP and LID Whole Life Cost Models (WERF 2009). The WERF (2009) study provides annual staffing estimates for a "typical" facility of undefined area, while the City of Olympia provided a staffing estimate as the area of vegetated roof that can be maintained per hour of staff time. Staffing estimates presented below range from 53 to 90 hours per facility from the WERF (2009) study (summing all of the routine maintenance activities) or 2,000 sf/hr for the City of Olympia.

Skills Needed for Maintenance of Vegetated Roofs

- Landscaping skills (e.g., general plant care)
- Plant identification skills (weeds vs. planted species, invasive vs. common weeds, how to dispose of invasive weeds, timing of weed seed dispersal)
- General drainage system maintenance skills (e.g., subsurface or drip irrigation system repair)
- Roof work safety training
- Engineer and/or landscape architect for major maintenance
- Certified arborist (or equivalently trained staff) for pruning of mature trees (intensive vegetated roofs)

Table 13. Maintenance Frequency and Staffing for Vegetated Roofs.

Routine Maintenance Activity	Frequency [a]	Annual Staff Hours	Source
Vegetation management	Every 2 months	30 to 60 hours (per facility)	BMP and LID Whole Life Cost Models (WERF 2009)
Irrigation repair	A	5 to 10 hours (per facility)	
Corrective maintenance [b]	A	8 hours (per facility)	
Soil replacement	A	8 hours (per facility)	
Recordkeeping	A	2 to 4 hours (per facility)	
General (no activity specified)	M	2,000 sf/hr	City of Olympia

[a] Frequency: A = Annually; M = Monthly

[b] Membrane patching, re-vegetation, component failure

sf/hr = square feet per hour

Downspout Full Infiltration Systems

Downspout full infiltration systems include infiltration trenches or drywells intended only for use in infiltrating runoff from roof downspout drains. Infiltration trenches and drywells are backfilled withwashed drain rock, allowing for temporary storage of stormwater runoff in the voids of the drain rock material. Stored runoff gradually infiltrates into the surrounding soil. These systems are considered On-site Stormwater Management BMPs and can be used to help meet Minimum Requirements #5 (On-site Stormwater Management BMPs), #7 (flow control), or both.

Key Maintenance Considerations

The main components of downspout full infiltration systems are listed below with descriptions of their function and key maintenance considerations.

- **Rock trench/well**: Trenches and drywells are excavated depressions filled with uniformly graded washed drain rock. Non-woven geotextile fabric may be used along the walls, bottom, and top of the drain rock. The surface of the trench can be covered with grating, pavement, and/or consist of stone, gabion, sand, or a grassed covered area with a surface inlet. To allow inspection of the drain rock trench/well, some facilities have an observation port (typically installed during construction) that allows monitoring of the water levels in the drain rock bed to determine if the facility is dewatering properly.

- **Inlet:** Stormwater runoff is typically routed to a trench/well with a solid-wall pipe and then distributed into the drain rock bed using a perforated or slotted subsurface pipe. Some trenches are designed to receive sheet flow that enters the facility by infiltrating through a top course of drain rock or sand. Maintenance must be performed to ensure inlets (e.g., pipes) are unobstructed and that surface sheet flow first passes through a grass buffer strip to remove larger sediment particles.

- **Storage sump:** Trenches and drywells designed to receive concentrated flows (e.g., piped flow) typically include a storage sump to settle particulates from inflow. Concentrated flows must be distributed into the aggregate using a perforated or slotted subsurface pipe. The sump must be maintained to remove accumulated sediment.

Key Operations to Preserve Facility Function

When the rock trench/well is designed to receive inflow from the surface via a grate or by infiltrating through an exposed top course of drain rock or sand, the following operational actions can limit the need for corrective maintenance actions or replacement:

- Protecting the surface inlet from stockpiles of landscaping materials (e.g., mulch, soil, compost)

- Prevent discharge of debris to the infiltration trench from roof cleaning practices (e.g., moss removal)

- Stabilize adjacent landscaped areas to avoid runoff mobilizing soil into the surface inlet

Maintenance Standards and Procedures

Table 14 provides the recommended maintenance frequencies, standards, and procedures for downspout full infiltration system components. The level of routine maintenance required and the frequency of corrective maintenance actions may increase for facilities subject to high sediment loads from the contributing drainage area.

Table 14. Maintenance Standards and Procedures for Downspout Full Infiltration Systems.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Rock Trench/Well				
Surface of trench/well (i.e., water enters through exposed aggregate)	Fall and Spring		Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow into facility	Remove/dispose in accordance with local solid waste requirements
	A, W		Vegetation/moss present on drain rock surface impedes sheet flow into facility	Maintain open, freely draining drain rock surface
Drain rock	Fall and Spring		• If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events • If buried drain rock, observe drawdown through observation port or cleanout	• Clear piping through facility when ponding occurs • Replace rock/sand reservoirs as necessary • Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill
Inlet/ Outlet Pipe Conveyance				
Pipe(s)	A, W		Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	Remove/ dispose
	A, W		Pipe from sump to trench or drywell has accumulated sediment or is plugged	Clear sediment from inlet/outlet pipe screen and inlet/outlet pipe
	A, W		Cracked, collapsed, broken, or misaligned drain pipes	• Repair/seal cracks • Replace when repair is insufficient
Roof downspout	B, W		Splash pad missing or damaged	Repair/ replace
	A, W		Leaves or other debris plugging downspout	Remove/ dispose

[a] Frequency: A= Annually; B= Biannually (twice per year); W= At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

Table 14 (continued). Maintenance Standards and Procedures for Downspout Full Infiltration Systems.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Storage Sump				
Sump	A		Sediment in the sump	Remove/ dispose in accordance with local solid waste requirements
Access lid	A		Cannot be easily opened	Repair/ replace
	A		Buried	Refer to record drawings for design intent. If the access lid was designed to be exposed, expose and restore to surface grade
	A		Cover missing	Replace

[a] Frequency: A= Annually; B= Biannually (twice per year); W= At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

Equipment and Materials

Table 15 includes recommendations for equipment and materials commonly used to maintain downspout full infiltration systems.

Table 15. Downspout Full Infiltration System Equipment and Materials List.

Pipe/ structure system inspection and maintenance equipment	***Weed / vegetation removal equipment, such as:***
☐ **Hand tools**	☐ **Weeding tools**
☐ **Flashlight**	☐ **Weed burner**
☐ **Mirror (for viewing pipes without entering structure)**	☐ **Buckets**
☐ **Garden hose**	***Equipment to clear accumulated sediment from sump***
☐ **Plumbing snake**	☐ **Shop-Vac**
	☐ **Shovel**

Skills

The skills required for the maintenance of downspout full infiltration systems are listed in the text box to the right.

Skills Needed for Maintenance of Downspout Full Infiltration Systems

- General drainage system maintenance skills (e.g., inlet/pipe cleaning experience, inlet/pipe maintenance or repair experience)
- Landscape or drainage contractor for major maintenance

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Dispersion attenuates peak flows by slowing the runoff entering into the conveyance system, allowing some infiltration, and providing some water quality benefits. The following three types of dispersion systems are covered in this section:

- **Downspout dispersion systems**: Splash blocks or gravel-filled trenches, which serve to spread roof runoff over vegetated pervious areas.
- **Sheet flow dispersion systems**: Sheet flow dispersion is the simplest method of runoff control. This BMP can be used for any impervious or pervious surface that is graded to avoid concentrating flows. Because flows are already dispersed as they leave the surface, they need only traverse a narrow band of adjacent vegetation for effective attenuation and treatment.
- **Concentrated dispersion systems**: Dispersion of concentrated flows from driveways or other pavement through a vegetated pervious area.

Key Maintenance Considerations

The main components of dispersion systems are listed below with descriptions of their function and key maintenance considerations.

- **Splash block (downspout dispersion):** Splash blocks are used to spread stormwater runoff from a downspout drain over vegetated pervious area. A downspout extension may be included if the ground is fairly level, if the structure includes a basement, or if foundation drains are proposed.
- **Dispersion trench (downspout dispersion):** Gravel-filled trenches are also used to spread stormwater runoff from a downspout drain over a vegetated pervious area. Downspout drains are routed to a trench via a perforated or slotted pipe. The trench typically includes a notched grade board or other device to distribute flow equally along the length of the trench. This board must be maintained at a level grade to prevent concentrated flow. Downspout drains are directed to the trench via a storage sump that must be maintained to remove accumulated sediment.
- **Transition zone (sheet flow dispersion):** A 2-foot-wide transition zone is typically included to discourage channeling between the edge of the impervious surface (or building eaves) and the downslope vegetation. This transition zone may consist of an extension of subgrade material (crushed rock), modular pavement, drain rock, or other material.
- **Rock pad at discharge point (concentrated flow dispersion):** A rock pad must be maintained at any point that a concentrated flow enters a dispersion area.
- **Dispersal area:** Stormwater is dispersed to an area vegetated with well-established lawn or pasture, landscaping with well-established groundcover, or native vegetation with natural groundcover. The required vegetated flow path is 50 feet for splash

blocks and concentrated dispersion, 25 feet when using a dispersion trench and varies for sheet flow dispersion. The groundcover for the extent of the flow must be maintained to be dense enough to help disperse and infiltrate flows and to prevent erosion.

Key Operations to Preserve Facility Function

For dispersion practices to be effective, the dispersion area must remain covered with dense, well-established vegetation. Site uses should protect vegetation and avoid compaction.

Maintenance Standards and Procedures

Table 16 provides the recommended maintenance frequencies, standards, and procedures for dispersion system components.

Table 16. Maintenance Standards and Procedures for Downspout, Sheet Flow, and Concentrated Dispersion Systems.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Splash Block (Downspout Dispersion)				
Splash block	B		Water is being directed towards building structure	Reconfigure/ repair blocks to direct water away from building structure
	B		Water disrupts soil media	Reconfigure/ repair blocks
Transition Zone (Sheet Flow Dispersion)				
Transition zone	A		Adjacent soil erosion; uneven surface creating concentrated flow discharge; or less than 2 foot of width	Repair/replace transition zone to meet design criteria and eliminate concentrated flows
Dispersion Trench (Downspout Dispersion)				
Dispersion trench	A		Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" from edge of trench; intent is to prevent erosion damage)	• Remove debris from trench surface, if necessary • Realign notched grade board or other distributor type, if possible • Rebuild trench to standards, if necessary
Surface of trench	Fall and Spring		Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow from facility	• Remove/dispose in accordance with local solid waste requirements
	A, W		Vegetation/moss present on drain rock surface impedes sheet flow from facility	• Maintain open, freely draining drain rock surface
Pipe(s) to trench	A, W		Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	• Remove/ dispose
	A, W		Pipe from sump to trench or drywell has accumulated sediment or is plugged	• Clear sediment from inlet/outlet pipe screen and inlet/outlet pipe
	A, W		Cracked, collapsed, broken, or misaligned drain pipes	• Repair/seal cracks • Replace when repair is insufficient
Sump	A		Sediment in the sump	• Remove/ dispose in accordance with local solid waste requirements • Clear sediment from inlet/outlet pipe screen and/or inlet/outlet pipe
Access lid	A		Cannot be easily opened	• Repair/ replace
	A		Buried	• Refer to record drawings for design intent. If the access lid was designed to be exposed, expose and restore to surface grade
	A		Cover missing	• Replace
Rock Pad (Concentrated Flow Dispersion)				
Rock pad	A		Only one layer of rock exists above native soil in area 6 square feet or larger, or any exposure of native soil	• Replace/ repair rock pad to meet design standards • Enlarge pad size or add additional courses of rock, if necessary
	A		Soil erosion in or adjacent to rock pad	Repair/replace rock pad to meet design standards
Dispersal Area				
Dispersal area (general)	B, S		Erosion (gullies/ rills) greater than 2 inches deep in dispersal area	Eliminate cause of erosion and stabilize damaged area (regrade, rock, revegetate)
	B, S		Accumulated sediment or debris to extent that blocks or channelizes flow path	• Remove excess sediment or debris • Identify and control the sediment source (if feasible)
Ponded water	B, S		Standing surface water in dispersion area remains for more than 3 days after the end of a storm event	• Identify the cause of the standing water (e.g., grade depressions, compacted soil) and take appropriate actions to address the problem (e.g., regrade to eliminate depressions or aerate/ amend soils)

[a] Frequency: A= Annually; B= Biannually (twice per year); W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during plant establishment period (1-2 years, or additional 3rd year during extreme dry weather). IPM – Integrated Pest Management

Table 16 (continued). Maintenance Standards and Procedures for Downspout, Sheet Flow, and Concentrated Dispersion Systems.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Dispersal Area (cont'd)				
Plant establishment	B	Once every 1-2 weeks or as needed during prolonged dry periods [b]	Dispersal area vegetation in establishment period (1-2 years, or additional 3rd year during extreme dry weather)	Water weekly during periods of no rain to ensure plant establishment
Vegetation	As needed		Poor vegetation cover such that erosion is occurring	• Ensure proper care (e.g., watering) • Assess for nutrient deficiencies • Replant as needed with appropriate plant species for the soil and moisture conditions • Consider amending soils to promote plant health
	B, S		Vegetation inhibits dispersed flow along flow path	Trim, weed or replant to restore dispersed flow path
Storage Sump				
Sump	A		Accumulated sediment in the sump	• Remove/ dispose in accordance with local solid waste requirements • Clear sediment from inlet/outlet pipe screen and/or inlet/outlet pipe
Access lid	A		Cannot be easily opened	Repair/ replace
	A		Buried	Expose and restore to surface grade
	A		Cover missing	Replace
Pest Control				
General Pests	As needed		Signs of pest infestations (IPM protocol threshold(s) are exceeded)	• Follow IPM protocols for weed and pest management (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols)
Mosquitoes	B, S		Standing surface water in dispersion area remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)
Rodents	As needed		Rodent holes or mounds disturb dispersion flow paths	Fill and compact soil around the holes and vegetate to restore flow path

[a] Frequency: A= Annually; B= Biannually (twice per year); W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during plant establishment period (1-2 years, or additional 3rd year during extreme dry weather).

Equipment and Materials

Table 17 includes recommendations for equipment and materials commonly used to maintain downspout, sheet flow, and concentrated dispersion systems.

Table 17. Downspout, Sheet Flow, and Concentrated Dispersion Systems Equipment and Materials List.

Pipe/ structure system inspection and maintenance equipment

- ☐ **Hand tools**
- ☐ **Flashlight**
- ☐ **Mirror (for viewing pipe s without entering structure)**
- ☐ **Garden hose**
- ☐ **Plumbing snake**
- ☐ **Level**

Equipment to clear accumulated sediment from sump

- ☐ **Shop-Vac**
- ☐ **Shovel**

Material to replenish rock pad for concentrated dispersion

- ☐ **Aggregate**

General landscaping equipment and materials to maintain dispersal area

- ☐ **Mower**
- ☐ **Gloves**
- ☐ **Weeding tool**
- ☐ **Soil knife**
- ☐ **Manual edger**
- ☐ **Line trimmer (also known as a string trimmer, weed eater, or weed whacker)**
- ☐ **Hoe**
- ☐ **Rake**
- ☐ **Shovel**
- ☐ **Push broom**
- ☐ **Compost**
- ☐ **Seeds**
- ☐ **Plants**
- ☐ **Watering equipment**

* Items not required for routine maintenance

Skills

The skills required for the maintenance of downspout, sheet flow, and concentrated dispersion systems are listed in the text box to the right. Additional specialized skills may also be required for corrective maintenance such as: horticulturalists, arborists, erosion control specialists, and soil scientists.

Skills Needed for Maintenance of Dispersion Systems

- General drainage system maintenance skills (e.g., inlet/pipe cleaning experience, inlet/ pipe maintenance or repair experience)
- Landscaping skills (e.g., general plant care)
- Landscape or drainage contractor for major maintenance

Compost-amended Soils

Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions including: water infiltration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition. Compaction from construction can reduce the soils natural ability to provide these functions. Establishing a minimum soil quality and depth in the post-development landscape can regain some of these stormwater functions including increased treatment of pollutants and sediments that result from development and habitation, and minimizes the need for some landscaping chemicals. Sufficient organic content is a key to soil quality. Soil organic matter can be attained through numerous amendments such as compost, composted woody material, biosolids, and forest product residuals.

Key Maintenance Considerations

Key maintenance considerations for compost-amended soils include the replenishment of soil media as needed (as a result of erosion) and addressing compacted, poorly draining soils. Site uses should protect vegetation and avoid compaction.

Key Operations to Preserve Facility Function

The full benefits of compost-amended soils are realized when desired soil media depths are maintained and soil compaction is minimized. Care should be taken to prevent compaction of soils via vehicular loads and/or excessive foot traffic, especially during wet conditions.

Maintenance Standards and Procedures

Table 18 provides the recommended maintenance frequencies, standards, and procedures for compost-amended soils. The level of routine maintenance required and the frequency of corrective maintenance actions may increase for facilities prone to erosion due to site conditions such as steep slopes or topography tending to concentrate flows.

Table 18. Maintenance Standards and Procedures for Compost-amended Soils.

Component	Recommended Frequency[a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
General				
Soil media (maintain high organic soil content)	A		Vegetation not fully covering ground surface or vegetation health is poor	• Maintain 2 to 3 inches of mulch over bare areas in landscape beds • Add plants if sufficient space • Re-seed bare turf areas until the vegetation fully covers ground surface
		Ongoing	None (routine maintenance)	Return leaf fall and shredded woody materials from the landscape to the site when possible in order to replenish soil nutrients and structure
		Ongoing	None (routine maintenance)	On turf areas, "grasscycle" (mulch-mow or leave the clippings) to build turf health
		Ongoing	None (routine maintenance)	Avoiding use of pesticides (bug and weed killers), like "weed & feed", which damage the soil
		A	None (routine maintenance)	• Where fertilization is needed (mainly turf and annual flower beds), a moderate fertilization program should be used which relies on compost, natural fertilizers or slow-release synthetic balanced fertilizers • Follow IPM protocols for fertilization procedures (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols)
Soil media (maintain infiltration)	A[b]		Soils become waterlogged, do not appear to be infiltrating	• To remediate compaction, aerate soil, till to at least 8-inch depth, or further amend soil with compost and re-till • If areas are turf, aerate compacted areas and topdress them with 1/4 to 1/2 inch of compost to renovate them • If drainage is still slow, consider investigating alternative causes (e.g., high wet season groundwater levels, low permeability soils) • Also consider site use and protection from compacting activities

[a] Frequency: A= Annually; B= Biannually (twice per year); M = monthly; S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval); W = At least one inspection/maintenance visit should occur during the wet season (for debris/clog related maintenance, this maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

[b] Inspection should occur during storm event.

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Table 18 (continued). Maintenance Standards and Procedures for Compost-amended Soils.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
General (cont'd)				
Erosion/ Scouring	A, W, S		Areas of potential erosion are visible	• Identify and address cause of erosion (e.g., concentrate flow entering area, channelization of runoff) and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.
Grass/ Vegetation		A	Less than 75% of planted vegetation is healthy with a generally good appearance.	• Take appropriate maintenance actions (e.g., remove/ replace plants) • If problem persists, evaluate if vegetation is appropriate for the location (e.g., exposure, soil, soil moisture)
Noxious weeds		M (March – October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan blackberry, Japanese knotweed, morning glory, English ivy, and reed canary grass to avoid invasions • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions

[a] Frequency: A= Annually; B= Biannually (twice per year); M = monthly; S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).; W = At least one inspection/maintenance visit should occur during the wet season (for debris/clog related maintenance, this maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

[b] Inspection should occur during storm event.

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Table 18 (continued). Maintenance Standards and Procedures for Compost-amended Soils.

Component	Recommended Frequency[a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
General (cont'd)				
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management(see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols)

[a] Frequency: A= Annually; B= Biannually (twice per year); M = monthly; S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).; W = At least one inspection/maintenance visit should occur during the wet season (for debris/clog related maintenance, this maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

[b] Inspection should occur during storm event.

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Equipment and Materials

Table 19 includes recommendations for equipment and materials commonly used to maintain compost-amended soils. Some of the equipment and materials will be used for routine maintenance activities, while other equipment and materials will be necessary for specialized maintenance.

Table 19. Compost Amended Soils Equipment and Materials List.

General landscaping equipment

☐ **Gloves**
☐ **Pincer-type weeding tool**
☐ **Soil knife**
☐ **Pruners**
☐ **Loppers**
☐ **Hoe**
☐ **Rake**
☐ **Wheelbarrow**
☐ **Shovel**
☐ **Push broom**
☐ **Garbage bags (for disposal of noxious weeds)**

General landscaping materials

☐ **Arborist wood chip mulch (around trees and woody plants)**
☐ **Compost or leaf mulch (around annuals)**
☐ **Fertilizer (natural fertilizers or slow-release synthetic balanced fertilizers)**

Specialized equipment*

☐ **Deep tine aerator and compost (or compost/sand mixture) to fill aeration holes (if necessary to correct overly compacted soil)**
☐ **Flame weeder or hot water weeder**
☐ **Rototiller**
☐ **Soil probe**

* Items not required for routine maintenance

Skills

The skills required for the maintenance of compost-amended soils are listed in the text box to the right. Additional specialized skills may also be required for corrective maintenance of compost-amended soils such as: horticulturalists, arborists, erosion control specialists, and soil scientists.

Skills Needed for Maintenance of Compost-amended Soils

- Landscaping skills (e.g., general plant care)
- Landscaper for major maintenance

PROGRAMMATIC AND ADMINISTRATIVE GUIDANCE

To implement the new Phase I Permit and Phase II Permit requirements for LID BMP maintenance, local governments may face a variety of programmatic and administrative challenges. This section summarizes Ecology's requirements that relate to LID BMP maintenance and provides guidance regarding administrative tools for implementing these requirements.

This section is not intended to identify specific administrative actions for meeting LID BMP maintenance requirements (e.g., specify how jurisdictions administer bonds) but rather to support jurisdictions by providing optional and flexible guidance for administrative procedures and tools related to LID BMP maintenance programs.

Ecology Requirements for LID BMP Maintenance Programs

Phase I and Phase II municipal stormwater Permittees are required to:

- Adopt an ordinance or other enforceable mechanism requiring maintenance of all permanent Stormwater Treatment and Flow Control BMPs/Facilities
- Adopt maintenance standards that are at least as protective of facility function as those in Chapter 4 of Volume V of the 2012 Stormwater Management Manual for Western Washington (2012 SWMMWW)
- Establish legal authority to inspect private stormwater facilities and enforce maintenance standards
- Implement permitting, plan review, inspections, and enforcement programs to meet the Permit standards for both private and public projects

To implement these requirements, Permittees may need to revise their programs and procedures to support plan review, inspection, enforcement, record keeping, and mapping for LID BMPs. Tables 20 and 21 summarize and reference municipal Permit requirements and 2012 SWMMWW guidance in regard to O&M of LID BMPs. Please refer to the Permits and 2012 SWMMWW for more complete and accurate descriptions.

Table 20. Phase I Permit[4] Requirements and 2012 SWMMWW Guidance Related to LID BMP Maintenance Programs.

Requirement	LID BMP Type	
	On-site Stormwater Management BMPs	Stormwater Treatment and Flow Control BMPs/Facilities (MR #6 and/or MR #7)
Standards		
Implement maintenance standards	S5.C.9.a	S5.C.9.a
Update ordinance or other enforceable documents	N/A	S5.C.9.b.i
Implement practices, policies, & procedures to reduce stormwater impacts associated with runoff	N/A	S5.C.9.e
Plan Review		
Verify that a maintenance plan is completed and responsibility for maintenance is assigned for each Stormwater Treatment and Flow Control BMP	N/A	S5.C.5.a.v.4
Verify submission of maintenance instructions for each On-site Stormwater Management BMP	Vol. I, Section 3.1.5	Vol. 1, Section 3.1.5
Verify that an O&M manual is complete for each Stormwater Treatment and Flow Control BMP	N/A	Appendix 1 (Section 4.9) and Vol. 1, Section 3.1.7
Review and approve declaration of covenant (including design details, figures, and maintenance instructions for each On-site Stormwater Management BMP) and grant of easement	Vol. 1, Section 3.1.7	Vol. 1, Section 3.1.7
Inspections		
Legal authority to inspect private stormwater facilities and enforce maintenance standards for all new and redevelopment	S5.C.5.a.iv	S5.C.5.a.iv
Conduct post-construction inspections to ensure proper installation	S5.C.5.a.v.4	S5.C.5.a.v.4
Conduct inspections during construction for all permanent Stormwater Treatment and Flow Control BMPs/Facilities and catch basins in new residential developments (every 6 months until 90% of the lots are constructed or when construction is stopped and the site is fully stabilized)	N/A	S5.C.9.b.iii
Conduct ongoing annual inspections	N/A	S5.C.9.b.ii and c.i
Perform spot checks of potentially damaged BMPs owned or operated by the Permittee after major storm events	N/A	S5.C.9.c.ii

BMPs = best management practices
N/A = not applicable
Note: Phase I Permit references are from Ecology (2012a) and 2012 SWMMWW references are from Ecology (2012c).

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[4] The special conditions listed in this document are for city and county permittees. Secondary permittees should refer Section S6 of the permit for their special conditions that pertain to LID BMP maintenance.

Table 20 (continued). Phase I Permit Requirements and 2012 SWMMWW Guidance Related to LID BMP Maintenance Programs.

Requirement	LID BMP Type	
	On-site Stormwater Management BMPs	Stormwater Treatment and Flow Control BMPs/Facilities (MR #6 and/or MR #7)
Enforcement		
Enforce compliance with maintenance standards as needed based on inspections	N/A	S5.C.9.b.ii
Training		
Train staff involved in plan review, permitting, construction site inspections, and enforcement.	S5.C.5.a.vii	S5.C.5.a.vii
Implement an ongoing training program for employees who have primary O&M job functions that may impact stormwater quality	S5.C.9.f	S5.C.9.f
Record Keeping		
Keep records of inspections and enforcement actions (e.g., inspection reports, notices of violations)	S5.C.5.a.v.6 and S5.C.9.h	S5.C.5.a.v.6 and S5.C.9.h
Mapping		
Scale drawing of the lot(s), and any public-right-of-way that displays the location of On-site Stormwater Management BMPs	Vol. I, Section 3.1.5	Vol. I, Section 3.1.5
Map Stormwater Treatment and Flow Control BMPs/Facilities owned or operated by the Permittee	N/A	S5.C.2.a.iii
Map connections between Stormwater Treatment and Flow Control BMPs/Facilities and tributary conveyances mapped in accordance with S5.C.2	N/A	S5.C.2.b.iv

BMPs = best management practices

N/A = not applicable

Note: Phase I Permit references are from Ecology (2012a) and 2012 SWMMWW references are from Ecology (2012c).

Table 21. Phase II[5] WWA Permit Requirements and 2012 SWMMWW Guidance Related to LID BMP Maintenance Programs.

Requirement	LID BMP Type On-site Stormwater Management BMPs	LID BMP Type Stormwater Treatment and Flow Control BMPs/Facilities (MR #6 and/or MR #7)
Standards		
Implement maintenance standards	S5.C.5.a	S5.C.4.c.ii and S5.C.5.a
Adopt and make effective ordinance or other enforceable mechanisms	N/A	S5.C.4.a
Implement practices, policies, & procedures to reduce stormwater impacts associated with runoff	N/A	S5.C.5.f
Plan Review		
Verify that maintenance plan is completed and responsibility for maintenance is assigned for each Stormwater Treatment and Flow Control BMP.	N/A	S5.C.4.b.iv
Verify submission of maintenance instructions for each On-site Stormwater Management BMP	Vol. I, Section 3.1.5	Vol. 1, Section 3.1.5
Verify that an O&M manual is complete for each Stormwater Treatment and Flow Control BMP	N/A	Appendix 1 (Section 4.9) and Vol. 1, Section 3.1.7
Review and approve declaration of covenant (including design details, figures and maintenance instructions for each BMP) and grant of easement	Vol. 1, Section 3.1.7	Vol. 1, Section 3.1.7
Inspections		
Legal authority to inspect private stormwater facilities and enforce maintenance standards for all new and redevelopment	S5.C.4.a.iii	S5.C.4.a.iii
Conduct post-construction inspections to ensure proper installation	S5.C.4.a.iv	S5.C.4.a.iv
Conduct inspections during construction for all permanent Stormwater Treatment and Flow Control BMPs/Facilities in new residential developments (every 6 months until 90% of the lots are constructed or when construction is stopped and the site is fully stabilized)	N/A	S5.C.4.c.iv
Conduct ongoing annual inspections	N/A	S5.C.4.c.iii and S5.C.5.b
Perform spot checks of potentially damaged BMPs owned or operated by the Permittee after major storm events	N/A	S5.C.5.c

BMPs = best management practices
N/A = not applicable
Note: Phase II Permit references are from Ecology (2012b) and 2012 SWMMWW references are from Ecology (2012c).

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[5] The special conditions listed in this document are for city and county permittees. Secondary permittees should refer Section S6 of the permit for their special conditions that pertain to LID BMP maintenance.

Table 21 (continued). Phase II WWA Permit Requirements and 2012 SWMMWW Guidance Related to LID BMP Maintenance Programs.

	LID BMP Type	
Requirement	On-site Stormwater Management BMPs	Stormwater Treatment and Flow Control BMPs/Facilities (MR #6 and/or MR #7)
Enforcement		
Enforce compliance with maintenance standards as needed based on inspections	N/A	S5.C.4.b.iii and iv
Training		
Train staff involved in plan review, permitting, construction site inspections, and enforcement.	S5.C.4.e	S5.C.4.e
Implement an ongoing training program for employees who have primary O&M job functions that may impact stormwater quality	S5.C.5.g	S5.C.5.g
Record Keeping		
Keep records of inspections and enforcement actions (e.g., inspection reports, notices of violations)	S5.C.4.c.vii and S5.C.5.i	S5.C.4.c.vii and S5.C.5.i
Mapping		
Scale drawing of the lot(s), and any public-right-of-way that displays the location of On-site Stormwater Management BMPs	Vol. I, Section 3.1.5	Vol. I, Section 3.1.5
Map Stormwater Treatment and Flow Control BMPs/Facilities owned or operated by the Permittee	N/A	S5.C.3.a.iii

BMPs = best management practices

N/A = not applicable

Note: Phase II Permit references are from Ecology (2012b) and 2012 SWMMWW references are from Ecology (2012c).

Tools for Implementing an LID Maintenance Program

This section discusses a range of administrative tools available to assist jurisdictions in implementing the LID BMP maintenance requirements outlined above. The following key tools are discussed in detail below.

- Stormwater code/manual
- Legal agreements (such as declarations of covenant and access easements between a property owner and the City/County)
- Project-specific BMP maintenance requirements
- Financial surety measures
- Record keeping and tracking process
- Inspection programs
- Mapping
- Private property owner education

Table 22 summarizes the utility of these tools for typical elements of a maintenance program (e.g., plan review, inspection program). A local government can select and tailor the tools described in this section to meet Permit requirements in a manner that fits within their existing program.

Table 22. Administrative Tools to Implement O&M Programs.

Maintenance Program Element	Administrative Tool
Maintenance Requirements	
Require maintenance of all permanent Stormwater Treatment and Flow Control BMPs/Facilities	• Stormwater code/manual
Set forth minimum inspection and O&M requirements	• Stormwater code/manual
Plan Review	
Define permitting and plan review process to meet NPDES Permit requirements for both private and public projects	• Stormwater code/manual • Permitting and plan review processes are typically streamlined or modified for public projects
List required development project submittal elements	• Stormwater code/manual
Identify and characterizes stormwater features on site	• Stormwater Site Plan including scale drawing of the lot(s), and any public-right-of-way that displays the location of On-site Stormwater Management BMPs • Legal agreements/documents should include scale drawings, design details, figures, and maintenance instructions as attachments or refer to building permit, plan, or document in public files
Provide project-specific (or BMP-specific) inspection, operation, and maintenance requirements	• Legal agreements (direct responsible party to code and/or project-specific maintenance requirements) • Stormwater code/manual provides general requirements • Project-specific maintenance requirements include maintenance instructions for each On-site Stormwater Management BMP and project O&M manual for each Stormwater Treatment and Flow Control BMP/Facility • Private property owner education
Identify the party responsible for the retention, protection and maintenance of the BMPs	• Stormwater code/manual sets forth requirements for legal agreements • Legal agreements describe maintenance responsibility
Describe how the responsibility for maintenance is transferred when property ownership changes	• Stormwater code/manual sets forth requirements for legal agreements • Legal agreements describe maintenance responsibility
Inspection	
Set forth inspection process to meet NPDES Permit requirements for both private and public projects	• Stormwater code/manual or internal procedures
Establish legal authority of local government to inspect private stormwater facilities	• Stormwater code/manual sets forth requirements for legal agreements • Legal agreements help allow access for inspection
Ensure proper construction of BMPs	• Inspections during construction and immediately after construction • Inspection checklists
Ensure long-term maintenance of BMPs	• Ongoing annual inspections and inspections after large storm events (review record drawings during inspection) • Inspection checklists
Enforcement	
Set forth enforcement process to meet NPDES Permit requirements for both private and public projects	• Stormwater code/manual or internal procedures • Enforcement processes may not be necessary for public projects, but are helpful to include in contractor specifications/contract language
Establish legal authority of local government to enforce BMP maintenance standards	• Stormwater code/manual
Establish enforcement mechanisms, such as fee triggers and schedule for unmaintained facilities	• Stormwater code/manual lists escalating enforcement actions • Stormwater code/manual sets forth requirement for financial surety measures (e.g., bonds) for development plats to guarantee maintenance of BMPs after construction

Table 22 (continued). Administrative Tools to Implement O&M Programs.

Maintenance Program Element	Administrative Tool
Record Keeping and Tracking Process	
Keep records of inspections and enforcement actions (e.g., inspection reports, notices of violations)	• Develop interdepartmental record keeping and tracking process
Mapping	
Implement ongoing program for mapping BMPs	• Update mapping program as needed, including procedures for mapping distributed LID BMPs within a larger development.
Education/Training	
Train inspectors and staff on LID maintenance	• Develop / update internal training program • Develop /update a public outreach and education program for LID maintenance
Train developers and contractors on LID maintenance	• Develop and provide training on LID maintenance requirements in stormwater code/manual or internal procedures

Stormwater Code / Manual

A stormwater code can be used to require maintenance of private LID BMPs, and legally authorize local governments to inspect BMPs and enforce BMP maintenance requirements. While codes can be written to explicitly address all maintenance requirements, they often refer to a stormwater manual for details (i.e., 2012 SWMMWW or equivalent). Stormwater code and manuals can be used to accomplish the following:

- Require maintenance of all permanent stormwater BMPs and facilities
- Set forth minimum inspection, operation, and maintenance requirements
- Define permitting and plan review processes
- List required development project submittal elements (e.g., Stormwater Site Plans, legal agreements, project O&M manual)
- Require legal agreements with private property owners that identify the party responsible for retention, protection, and maintenance of BMPs
- Require legal agreements with private property owners that describe how the responsibility for maintenance of BMPs is transferred when property ownership changes
- Define the inspection process
- Establish legal authority of local government to inspect private stormwater facilities
- Define the enforcement process
- Establish legal authority of local government to enforce BMP maintenance standards
- Establish enforcement mechanisms, such as fee triggers and schedule, for unmaintained facilities
- Set forth requirement for financial surety measures (e.g., bonds) for development plats to guarantee maintenance of BMPs after construction

Incorporating private facilities into a City/County stormwater maintenance program

Cities and counties generally have a maintenance program in place and have made decisions regarding whether they assume maintenance responsibility for private facilities. The jurisdiction's decision regarding LID BMP maintenance responsibility would be evaluated in the context of its existing program approach. Options include the following:

1) City/County could inspect facilities and require that the property owner hire a qualified contractor to conduct necessary maintenance
2) City/County could require facility owners to contract with a third party inspector and provide an inspection certification letter to the City/County, as well as proof that any required maintenance has been completed
3) City/County could perform maintenance and charge the property owner
4) City/County could assume maintenance responsibilities through a deed or easement.

- Establish limited legal authority to conduct maintenance when not conducted in a timely manner and bill the property owner for the costs.

Often the owner of the property on which the BMP is located is responsible for LID BMP maintenance. However, the local government can choose to incorporate private BMPs into a City/County stormwater maintenance program (see the sidebar for tips).

Legal Agreements and Recordable Documents

Legal agreements between a private party, responsible for BMP maintenance, and the local government can be recorded against a property title to help require and ensure long-term facility maintenance. Examples of these agreements include declarations of covenant and grants of access easement. Some type of legal agreements and recordable documents are necessary to accomplish the following:

- Identify and characterize the stormwater features on site (i.e., attach as-built drawing of the lot with the location of the On-site Stormwater Management BMPs and the area served by them, design details, figures, and maintenance instructions)
- Require inspection and O&M activities and direct responsible party to local municipal code, manual, and/or project-specific O&M manual
- Identify the party responsible for retention, protection, and maintenance of BMPs
- Describe how the responsibility for maintenance of BMPs is transferred when property ownership changes
- Help give the local government legal access for inspection of BMPs

What happens when a property is sold?

When a property is sold, it is important that the new owner is informed of their maintenance responsibilities and that the local government tracks the sale to ensure legal agreements are in place. Options include the following:

- Include language in the covenant that the property owner must inform all future purchasers of the existence and maintenance requirements of the stormwater BMPs on their property and transfer possession of the project O&M manual (or in the case of lots without Stormwater Treatment and Flow Control BMPs/Facilities, maintenance instructions) to the new property owner
- Require informational handouts at point-of-sale inspections
- Require escrow companies to fax or e-mail the City/County when they perform the “tap and connection” check at time of sale to help the local government track the responsible party
- If a financial surety is in place, require the new owner to obtain one before releasing the existing bond

Several example covenants and access easements from Washington jurisdictions are included in Appendix A. Note that a covenant to be recorded against the property can be used to identify the LID BMPs on the property and the land owner’s obligations to protect, operate, and maintain the BMPs. If the covenant does not cover access for maintenance then a separate legal agreement is necessary.

Permittees should review the local process for recording legal agreements through the recorder's office/county assessor in order to address barriers or time-consuming delays. For example, if an easement requires city/county council approval, solutions could include:

- Using a covenant instead
- Exempting access easements for maintenance from city/county council approval
- Streamlining or simplifying the process in other ways.

An administrative challenge related to legal agreements is establishing procedures to inform new property owners of their maintenance responsibilities for BMPs on their site. See side bar "What Happens When a Property is Sold" for tips.

Some local governments make the legal agreements with homeowners' associations (HOAs). An advantage of this is that it may be easier to work with the HOA than with individual property owners. The HOA can conduct maintenance or arrange for a qualified third party professional to conduct the maintenance. Another advantage of HOAs is as a point of contact for outreach and education. An incentive to encourage ongoing HOA responsibility for stormwater facility maintenance could include a reduced stormwater utility fee. A disadvantage of assigning responsibility to the HOA through a legal agreement is that some HOAs dissolve over time. The legal agreement can be written to transfer the maintenance responsibility for a shared facility to the individual property owners if an HOA goes defunct. For subdivisions, it is important to list the individual homeowners or lots on permit documents to simplify future enforcement actions, if necessary.

Tips for tracking LID BMP information

To establish an efficient inspection and maintenance program, it is critical to track and link pertinent information. Consider the following

- Establish an interdepartmental coordination process between information technology (IT), GIS, and different permitting administrators
- Develop a geodatabase or web-based database with tags to link electronic "as builts" or "record drawings", inspection forms, O&M manuals, and other BMP information to the BMP location. Consider indexing the BMP(s) by an identifier that will not change over time (e.g., parcel numbers can change).
- Tagging a property will alert plan review staff of the existence of a BMP and help to ensure the BMP is protected or replaced during redevelopment activities
- Conduct an end of the year audit to ensure that everything has been tracked and require that information is transferred between departments (e.g., from permitting administrators to department(s) responsible for inspections and enforcement)

Project-Specific BMP Maintenance Requirements

For development projects subject only to Minimum Requirements #1 through #5, Stormwater Site Plans should include maintenance instructions for On-Site Stormwater Management BMPs.

For projects subject to Minimum Requirements #1 through #9, maintenance instructions should also be developed for all On-site Stormwater Management BMPs that are not defined as Stormwater Treatment and Flow Control BMPs/Facilities.

Where projects must meet MR #6 and/or MR #7, O&M manuals must be developed for each Stormwater Treatment and Flow Control BMP. That means a manual for every bioretention, permeable pavement, and vegetated roof built as part of the project. These manuals identify the party responsible for maintenance, specify maintenance activities, and contain maintenance logs and a maintenance schedule.

At private facilities, a copy of each O&M manual must be retained onsite, or within reasonable access to the site, and must be transferred with the property to the new owner. If the LID BMPs are distributed on individual lots, then each property owner should have an O&M manual. For public facilities, a copy of the project O&M manual must be retained in the appropriate department. A log of maintenance activity, indicating actions taken, must be kept and made available for review upon request by the local government.

The project-specific maintenance requirements must be at least as stringent as those in the local maintenance standards. Because maintenance requirements and recommended procedures may evolve over time, consider allowing project proponents to include a reference to a document that can be updated periodically. The agreement can refer to "the current version of" the document. Some jurisdictions have online maintenance manuals that can be referenced in legal agreements, so that the most up-to-date maintenance information is available for property owners.

Financial Surety Measures

One mechanism for ensuring that LID BMPs are protected and maintained after construction is to require a financial surety, such as a bond or an assignment of accounts (also called an assignment of savings). If authorized by the jurisdiction's code, local governments can require that sureties are obtained by developers (surety measures are typically not used for single infill lots). The financial surety allows the government to enforce maintenance requirements (e.g., by pulling the bond) until the plat is fully constructed, or longer. This is particularly important if a jurisdiction assumes responsibility for private facility maintenance once construction has been completed. It is critical to ensure that adequate funds are available in the event of a non-compliant facility. One drawback to sureties is that they are generally only valid for two years before they are released (RCW 58.17.130), and if LID BMPs are on individual lots, they may not all be in place within 2 years.

Record Keeping & Tracking Process

An effective maintenance program requires the collection and tracking of LID BMP and maintenance information, beginning with the plan review process and continuing for the life of the facility. The following information should be included in a City/County record keeping system for BMP maintenance:

- Parcel information
- City/County permit (right-of-way permit for roads and utilities for a subdivision, and/or building permits for individual lots)

- Relevant sections of the Stormwater Site Plan (e.g., Permanent Stormwater Control Plan) and attached documents
- "As-builts" or "record drawings" for individual lots and for public rights-of-way
- Legal agreements (e.g., covenants or easements)
- Location information (e.g., GPS data, digital maps)
- Project O&M manual (where applicable, see Tables 20 and 21)
- Maintenance logs (typically included in a project O&M manual)
- Inspection forms (e.g., during construction, post-construction, ongoing annual)
- Enforcement documents

It is critical for local governments to develop effective interdepartmental recording and record management procedures to support ongoing annual inspections. The information including, but not limited to, the items listed above should be "linked" for individual property and to a related subdivision (if applicable). See the sidebar for some tips on how to approach tracking.

Inspection Programs

Inspections are required for all LID BMPs immediately post-construction. These inspections are critical to check that the BMPs are installed per plan and functioning properly. Inspections are also required for all permanent Stormwater Treatment and Flow Control BMPs/Facilities in new residential developments every 6 months until 90 percent of the lots are constructed (or when construction is stopped and the site is fully stabilized) to identify maintenance needs and enforce compliance with maintenance standards, as needed. These inspections can require interdepartmental coordination because the site/building inspection process may include multiple departments administering different permits.

Challenges & tips for larger development sites

Large subdivision development sites pose challenges for LID BMP maintenance programs because:

- Subdivisions may include numerous distributed LID BMPs with a large number of responsible parties
- The developer may not have all BMPs sited and designed at time of plan review
- There is a risk that the plat will be cleared and the project abandoned
- Lots could be sold to multiple builders and construction could occur over a long period of time

Local governments could consider the following:

- Require bonding until full build out and stormwater BMP construction
- Ensure financial surety amount is sufficient
- Require recording of multi-party covenants for BMPs in the right-of-way (e.g., roadside bioretention) for each lot adjacent to the right-of-way
- Prohibiting or limiting wholesale clearing (mass grading) of sites
- Require recording of covenant and access easement agreements prior to final plat or final short plat
- Revise/supplement plan review checklist and procedures to record, track and establish agreements for single lots in addition to full plats

Ongoing annual inspections are required for all Stormwater Treatment and Flow Control BMPs/Facilities (designed to meet or help meet MR #6 and/or MR #7). While legal agreements authorize some access to the BMP, the local jurisdiction procedures may include requirements to provide written notice and secure consent from the property owner prior to the inspection. Securing consent may help to avoid potential conflict and allows a "contact" and opportunity for education of the private property owner. In addition, educational door hangers or handouts can be distributed prior to and during inspections to inform property owners of the BMPs located on their site, how the BMP functions, and where to find BMP maintenance requirements.

Local governments could consider allowing third party inspection for BMPs in settings that are difficult for a City/County inspector to access (e.g., backyard of a private residence) or if property owners do not want City/County inspectors on their properties. The property owner would be required to provide the City/County with inspection documentation from an approved third party inspector, or inspections and maintenance could be arranged through the HOA. This would reduce the potential liability concerns and reduce staffing needs while still allowing the jurisdiction to meet their annual inspection requirements. Local governments could consider mitigating the cost to the private property owner by crediting the inspection fee on their utility bill.

Inspectors should be trained on the function of LID BMPs and proper procedures for BMP inspection during and after construction. Inspection checklists for LID BMPs are a good tool to support consistent inspection practices and can be used for record keeping. The project specific O&M document and record drawings should be reviewed before and during the inspection.

Mapping

Jurisdictions increasingly rely on Global Positioning System (GPS) data, digital maps, and field-accessible databases to locate and track inspection and maintenance of stormwater facilities. Unlike traditional centralized stormwater facilities, LID BMPs are small, distributed features. Because there are typically many LID BMPs scattered across development sites, mapping can be a challenge. Local governments can consider the following options for mapping LID BMPs:

- Placing single points on stormwater system maps that reference permanent stormwater control plans (also referred to as "as-builts," or "record drawings"). These plans typically contain the information to support inspections, provided they are maintained, to reflect any modifications made to the facilities, and are readily accessible to inspectors in the field. With this approach, single points would be placed on the map near the center of the dispersed LID BMPs.

- Mapping the location of each LID BMP. This may be more time consuming and clutter some stormwater system maps; however, it will provide the location of each known LID BMP and may be easier to track inspections and maintenance.

Private Property Owner Education

Education is a key component to ensuring that private property owners understand LID BMPs and their maintenance requirements. Some suggestions for public education include:

- Door hangers or handouts distributed at maintenance inspections
- Booklet on how to maintain LID features (e.g., rain gardens), provided to the homeowner, along with other property documentation, by the developer
- Homeowner education program(s) that require realtors to inform potential home buyers of the presence of LID features, their maintenance requirements, and recommends inspection prior to purchase (similar to side sewer education model)
- Placard in the house or signage outside of the house that identifies the LID BMP and refers to maintenance information
- Program for homeowner education provided at the permit counter (e.g., scheduled meeting in which the review staff “walk” the homeowner through the property “as builts” and explain how the BMPs function
- Program for HOA education provided in the classroom and as a site visit. Staff meet with the HOA to go through the property “as builts” and explain how the BMPs function. Staff also describe maintenance techniques specific to the HOA’s LID BMPs and review Operations & Maintenance manuals or maintenance instructions for the LID BMPs that HOA maintains. Then staff and the HOA visit their LID BMPs so that staff can teach the HOA about inspecting their LID BMPs and additional maintenance techniques.
- Classes for homeowners/private property owners/HOAs through universities or groups such as extension programs, Conservation Districts, or Master Gardeners Associations
- Educational handouts/fact sheets distributed via local partnerships and programs
- Utility bill inserts
- Broader community outreach through media, web resources, or activities at community events.

An excerpt from Pierce County’s stormwater maintenance manual for private facilities is included in Appendix B. Note that this document is provided as an example based on format only; the content has not been reviewed for consistency with the 2013-2018 Permit requirements or the material included in this guidance document.

REFERENCES

Ecology. 2012a. Phase I Municipal Stormwater Permit. Washington State Department of Ecology Water Quality Program. August 1, 2012.

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King County and SPU. 2008. Natural Yard Care. Five steps to make your piece of the planet a healthier place to live. King County Solid Waste Division and City of Seattle Public Utilities. December 9, 2008

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Saving Water Partnership. 2012. The Natural Lawn & Garden Series: Growing Healthy Soil; Choosing the Right Plants; and Natural Pest, Weed and Disease Control. January and August 2012.

WERF. 2009. BMP and LID Whole Life Cost Models. Developed by the Water Environment Research Foundation.

Wilson, B.C., J.S. Gulliver, J-H. Kang, and P.T. Weiss. 2008. Maintenance of Stormwater BMPs: Frequency, Effort, and Cost. Stormwater Magazine. November-December 2008.

APPENDIX A

Examples of Covenants and Easements

When Recorded, Return to

Department of Planning and Development
700 5th Ave, Suite 1800
P.O. Box 34019
Seattle, WA 98124-4019

11/08/11

MEMORANDUM OF DRAINAGE CONTROL
(SMC 22.807.020)

GRANTOR: 1) ________________________________

2) ________________________________

3) ________________________________

☐Additional Owners/Grantors on page ______

GRANTEE: The City of Seattle

LEGAL DESCRIPTION (ABBREVIATED):

☐Additional legal description on page 2.

ASSESSOR'S TAX PARCEL ID NO(S). ________________________________

Permit Street Address ____

Application No. (by DPD staff): _________________________

Date (by DPD staff): ______/______/______

Grantor's Address ____

City ________________________ State _________ Zip ___________

Memorandum of Drainage Control--1

MEMORANDUM OF DRAINAGE CONTROL
(SMC 22.807.020)

THIS Agreement is executed in favor of the City of Seattle ("City") by the undersigned owner(s ("Grantor") of the following described real property situated in City of Seattle, King County, State of Washington (the "Property") (insert complete legal description):

In consideration of the City's granting a permit for the drainage control facilities proposed by Grantor, and for the City's allowing the connection thereof to the City's drainage system if applicable, Grantor hereby agrees and covenants, pursuant to SMC 22.807.020, as follows:

On_____________, 20___________, Side Sewer Permit #_______________and

Building Permit #_________________were issued for the above described Property.

WHEREAS; the drainage control facilities permitted by said side sewer permit are the following and are key terms of the Property's drainage control plan, which is documented in the drainage control plan drawing(s) as amended by the side sewer construction as-built record drawing(s) on file with the City of Seattle:

1. The following flow control best management practices (BMPs):
   - ☐ Existing Trees
   - ☐ Dispersion (downspout or sheet flow)
   - ☐ Bioretention Cells/Planters
   - ☐ Rainwater Harvesting
   - ☐ Permeable Pavement Surfaces
   - ☐ Permeable Pavement Facilities
   - ☐ Green Roof
   - ☐ Detention Cistern for a Single-Family Project
   - ☐ Infiltration Basins
   - ☐ Infiltration Trenches
   - ☐ Dry wells
   - ☐ Detention Pond
   - ☐ Detention Pipe
   - ☐ Detention Vault
   - ☐ Surface Ponding
   - ☐ Other (describe)___________________________

2. The following stormwater treatment BMPs:
   - ☐ Pretreatment Facilities___________________________
   - ☐ Biofiltration Swales
   - ☐ Filter Strips
   - ☐ Infiltration Basins, Trenches or Dry Wells
   - ☐ Bioretention System
   - ☐ Permeable Pavement Facilities
   - ☐ Sand Filtration
   - ☐ Wet Pond/Wet Vault
   - ☐ Stormwater Treatment Wetland
   - ☐ Oil Control Facilities: API / Coalescing Plate
   - ☐ StormFilter Units
   - ☐ Filterra Units
   - ☐ Other (describe)____________________________
3. The following source control structures:
   - ☐ Roof, Awning, Cover
   - ☐ Ground Surface Treatment
   - ☐ Sumps, Tanks
   - ☐ Berms, Dikes
   - ☐ Pavement
   - ☐ Containment
   - ☐ Washpad
   - ☐ Other (describe)____________________________

   to contain the following activities:
   - ☐ Cleaning and Washing
   - ☐ Material Transfer
   - ☐ Product and Application
   - ☐ Storage and Stockpiling
   - ☐ Dust Control and Soil and Sediment Control
   - ☐ Other: (describe)____________________________
4. and the following items, terms and/or limitations:
   - ☐ catch basin(s), quantity ___
   - ☐ submersible pump(s), quantity ____
   - ☐ Roof leader connections
   - ☐ Pipes with less than 2% grade
   - ☐ Invert connection less than 12 inches above main sewer or drain
   - ☐ Other (describe)____________________________

NOW THEREFORE; the Grantor, on behalf of Grantor and Grantor's heirs, successors and assigns, agrees to the following and hereby creates a covenant running with the land that shall be binding upon all parties and their heirs, successors and assigns forever:

The Grantor, on behalf of Grantor and Grantor's heirs, successors and assigns, agrees to and shall (1) inspect and maintain the above described drainage control facilities in accordance with the provisions of Seattle Municipal Code (SMC) Chapters 22.800 – 22.808 and any other provisions applicable to the facilities, as now and hereafter in effect, (2) implement the terms of the drainage control plan required by the SMC and (3) inform all future purchasers, successors and assigns of the existence of the drainage control facilities and other elements of the drainage control plan, the limitations of the drainage control facilities, and of the requirement for the facilities' continued inspection and maintenance; and

The obligations of Grantor and each of Grantor's heirs, successors and assigns under this Memorandum of Drainage Control shall terminate when that person, sells, devises or transfers the Property, or his or her interest therein, unless the obligation arises out of a claim of negligence or intentional act of that person. Further, recording of this Memorandum of Drainage Control as required herein shall satisfy the obligations to inform under subsection (3) above.

The Grantor, on behalf of Grantor and Grantor's heirs, successors and assigns, hereby grants permission for authorized representatives of the City of Seattle to enter onto the Property for inspection, monitoring, correction or abatement of conditions related to the Property's drainage control plan, drainage control facilities, Chapters SMC 22.800 – 22.808 or any other SMC provision applicable to drainage control, as now and hereafter in effect; and

The Grantor, on behalf of Grantor and Grantor's heirs, successors and assigns, (1) agrees and acknowledges that the City is not responsible for the adequacy or performance of the drainage control plan or the drainage control facilities, (2) agrees to accept any and all risks of harm, loss, or damage related to the drainage control plan or the drainage control facilities and (3) hereby waives any right to assert any and all present and future claims against the City, whether known or unknown, for any harm, loss or damage occurring either on or off the Property, related to the drainage control plan, the drainage control facilities, or drainage or erosion on the Property, except only for such harm, damages and losses that directly result from the sole negligence of the City.

This Memorandum of Drainage Control shall be recorded in the real estate records of the Office of Records and Elections of King County, Washington. If any provision of this Memorandum is held invalid, the remainder of the Memorandum is not affected.

SIGNATURES, ACKNOWLEDGEMENTS AND NOTARY
(INDIVIDUAL—attach more pages if needed)

Dated:__________________

____
Owner/Grantor

____
Printed Name

____
Address

State of Washington)
) ss
County of _______________)

I certify that I know or have satisfactory evidence that________________________ is the person who appeared before me, and said person acknowledged that he/she signed this instrument and acknowledged it to be his/her free and voluntary act for the uses and purposes mentioned in the instrument.

Date: ____

NOTARY PUBLIC in and for the State of Washington
Residing at_______________________________
My commission expires:_____________________
PRINT NAME: ____________________________

Use this space for Notary Seal

Dated:__________________

____
Owner/Grantor

____
Printed Name

____
Address

) ss
County of _______________)

I certify that I know or have satisfactory evidence that________________________ is the person who appeared before me, and said person acknowledged that he/she signed this instrument and acknowledged it to be his/her free and voluntary act for the uses and purposes mentioned in the instrument.

Date: ____

NOTARY PUBLIC in and for the State of Washington
Residing at_____________________________
My commission expires:___________________
PRINT NAME: ___________________________

Use this space for Notary Seal

State of Washington)

Memorandum of Drainage Control—Page No. ____

(CORPORATE OWNER, PARTNERSHIP OWNER, LIMITED LIABILITY COMPANY OWNER/OTHER LEGAL ENTITY OWNER—attach more pages if needed)

Date:____________________

____
Owner/Grantor

____
Printed Name

____
Address

By______________________

____
Printed Name

Its______________________

State of Washington)
)ss
County of ________________)

I certify that I know or have satisfactory evidence that_______________________ is the person who appeared before me, and said person acknowledged that he/she signed this instrument, on oath stated that he/she was authorized to execute the instrument and acknowledged it as the_______________________ (type of authority, e.g., partner, trustee, title of officer, personal representative, guardian, attorney in fact for a principal, etc.) of___________________________ (name of owner/entity on behalf of whom instrument was executed), to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

Date: ____

NOTARY PUBLIC in and for the State of Washington
Residing at_______________________________
My commission expires: ____________________
PRINT NAME: ____________________________

Use this space for Notary Seal

Date:____________________

____
Owner/Grantor

____
Printed Name

____
Address

By______________________

____
Printed Name

Its______________________

State of Washington)
)ss
County of ________________)

I certify that I know or have satisfactory evidence that_______________________ is the person who appeared before me, and said person acknowledged that he/she signed this instrument, on oath stated that he/she was authorized to execute the instrument and acknowledged it as the_______________________ (type of authority, e.g., partner, trustee, title of officer, personal representative, guardian, attorney in fact for a principal, etc.) of___________________________ (name of owner/entity on behalf of whom instrument was executed), to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

Date: ____

NOTARY PUBLIC in and for the State of Washington
Residing at_______________________________
My commission expires: ____________________
PRINT NAME: ____________________________

Use this space for Notary Seal

Memorandum of Drainage Control—Page No. ____

Appendix I-G3

Maintenance Agreement, Non-Residential Stormwater Facilities

(CORPORATE VERSION)

AGREEMENT TO MAINTAIN
STORMWATER FACILITIES AND TO IMPLEMENT A
POLLUTION SOURCE CONTROL PLAN

BY AND BETWEEN ___________________________
(HEREINAFTER "THE LOCAL GOVERNMENT") AND
_________________________________, AND
ITS HEIRS, SUCCESSORS, OR ASSIGNS
(HEREINAFTER "OWNER")

The upkeep and maintenance of stormwater facilities and the implementation of pollution source control best management practices (BMPs) is essential to the protection of water resources in _____________. All property owners are expected to conduct business in a manner that promotes environmental protection. This Agreement contains specific provisions with respect to maintenance of stormwater facilities and use of pollution source control BMPs. The authority to require maintenance and pollution source control is provided by ordinance.

LEGAL DESCRIPTION:

Whereas, Owner has constructed improvements, including but not limited to, buildings, pavement, and stormwater facilities on the property described above. In order to further the goals of the Local Government to ensure the protection and enhancement of Local Government's water resources, the Local Government and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

OWNER SHALL:

(1) Implement the stormwater facility maintenance program included herein as Attachment "A".

(2) Implement the pollution source control program included herein as Attachment "B".

(3) Maintain a record (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by Local Government staff at Owner's business during normal business hours. The log book shall catalog the action taken, who took it, when it was done, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected on a monthly or more frequent basis as necessary. Owner is encouraged to photocopy the individual checklists in Attachment A and use them to complete its monthly inspections. These completed checklists would then, in combination, comprise the monthly log book.

(4) Submit an annual report to the Local Government regarding implementation of the programs referenced in (1) and (2) above. The report must be submitted on or before May 15 of each calendar year and shall contain, at a minimum, the following:

(a) Name, address, and telephone number of the business, the person, or the firm responsible for plan implementation, and the person completing the report.

(b) Time period covered by the report.

(c) A chronological summary of activities conducted to implement the programs referenced in (1) and (2) above. A photocopy of the applicable sections of the log book, with any additional explanation needed, shall normally suffice. For any activities conducted by paid parties not affiliated with Owner, include a copy of the invoice for services.

(d) An outline of planned activities for the next year.

THE LOCAL GOVERNMENT WILL, AS RESOURCES ALLOW:

(1) Provide technical assistance to Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and at no charge to Owner.

(2) Review the annual report and conduct occasional site visits to discuss performance and problems with Owner.

(3) Review this agreement with Owner and modify it as necessary.

REMEDIES:

(1) If the Local Government determines that maintenance or repair work is required to be done to the stormwater facility existing on the Owner property, the Stormwater Manual Administrator shall give Owner within which the drainage facility is located, and the person or agent in control of said property if different, notice of the specific maintenance and/or repair required. The Administrator shall set a reasonable time in which such work is to be completed by the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set, written notice will be sent to the persons who were given notice stating the Local Government's intention to perform such maintenance and bill Owner for all incurred expenses. The Local Government may also adjust stormwater utility charges on the Owner's bill if required maintenance is not performed.

(2) If at any time the Local Government determines that the existing system creates any imminent threat to public health or welfare, the Administrator may take immediate measures to remedy said threat. No notice to the persons listed in (1), above, shall be required under such circumstances.

(3) The Owner grants authority to the Local Government for access to any and all stormwater system features for the purpose of inspection, and performing maintenance or repair as may become necessary under Remedies (1) and/or (2).

(4) The persons listed in (1), above, shall assume all responsibility for the cost of any maintenance and for repairs to the stormwater facility. Such responsibility shall include reimbursement to the Local Government within 30 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the Local Government will be borne by the parties responsible for said reimbursements.

(5) The owner hereby grants to the Local Government a lien against the above-described property

in an amount equal to the cost incurred by the Local Government to perform the maintenance or repair work described herein.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the Local Government. It shall run with the land and be binding on all parties having or acquiring from Owner or their successors any right, title, or interest in the property or any part thereof, as well as their title, or interest in the property or any part thereof, as well as their heirs, successors, and assigns. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof, or interest therein, and to the benefit of all citizens of the Local Government.

Dated at ____________, Washington, this ______ day of _________________, _____.

OWNER

By:________________________________
Authorized Agent for Owner

____

STATE OF WASHINGTON)
) **ss**
COUNTY OF THURSTON)

On this day and year above personally appeared before me, a Notary Public in and for the State of Washington duly commissioned and sworn, personally appeared __________________, to me known to be the ______________________ of ______________________ and acknowledge the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that _____ is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal the day and year first above written.

____

Notary Public in and for the State of
Washington, residing in ___________________

My Commission Expires: _________________

Dated at ____________, Washington, this ______ day of _________________, _____.

For recording purposes, please ***do not*** write in margins.

LOCAL GOVERNMENT

By:________________________________
Authorized Agent for Local Government

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, ________________________, to me known to be acting as Authorized Agent for________________, a Municipal Corporation, who executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states he is authorized to execute the said instrument.

Given under my hand and official seal this ______ day of _____________, _____.

____
Notary Public in and for the State of
Washington, residing in __________________

My Commission Expires: _________________

APPROVED AS TO FORM:

____
Local Government Attorney

\\\\Calvin\\cpd\\FORMS\\Agree to Maint Strmwtr Facilties-Corporation.wpd 12/9/09

Appendix I-G4

Maintenance Agreement, Residential Stormwater Facilties

(RESIDENTIAL SUBDIVISION VERSION)

AGREEMENT TO MAINTAIN
STORMWATER FACILITIES AND TO IMPLEMENT A
POLLUTION SOURCE CONTROL PLAN

BY AND BETWEEN____________________
(HEREINAFTER "THE LOCAL GOVERNMENT") AND
__________________________________, AND
ITS HEIRS, SUCCESSORS, OR ASSIGNS
(HEREINAFTER "OWNER")

The upkeep and maintenance of stormwater facilities and the implementation of pollution source control best management practices (BMPs) is essential to the protection of water resources in the Local Government's jurisdiction. All property owners are expected to conduct business in a manner that promotes environmental protection. This Agreement contains specific provisions with respect to maintenance of stormwater facilities and use of pollution source control BMPs. The authority to require maintenance and pollution source control is provided in ordinance.

LEGAL DESCRIPTION:

Whereas, Owner has constructed improvements, including but not limited to, buildings, pavement, and stormwater facilities on the property described above. In order to further the goals of the Local Government to ensure the protection and enhancement of Local Government's water resources, the Local Government and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

OWNER SHALL:

(1) Implement the stormwater facility maintenance program included herein as Attachment "A".

(2) Implement the pollution source control program included herein as Attachment "B".

(3) Maintain a record (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by Local Government staff at Owner's business during normal business hours. The log book shall catalog the action taken, who took it, when it was done, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected on a monthly or more frequent basis as necessary. Owner is encouraged to photocopy the individual checklists in Attachment A and use them to complete its monthly inspections. These completed checklists would then, in combination, comprise the monthly log book.

(4) Submit an annual report to the Local Government regarding implementation of the programs

referenced in (1) and (2) above. The report must be submitted on or before May 15 of each calendar year and shall contain, at a minimum, the following:

(a) Name, address, and telephone number of the business, the person, or the firm responsible for plan implementation, and the person completing the report.

(b) Time period covered by the report.

(c) A chronological summary of activities conducted to implement the programs referenced in (1) and (2) above. A photocopy of the applicable sections of the log book, with any additional explanation needed, shall normally suffice. For any activities conducted by paid parties not affiliated with Owner, include a copy of the invoice for services.

(d) An outline of planned activities for the next year.

THE LOCAL GOVERNMENT WILL, AS RESOURCES ALLOW:

(1) Provide technical assistance to Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and at no charge to Owner.

(2) Review the annual report and conduct occasional site visits to discuss performance and problems with Owner.

(3) Review this agreement with Owner and modify it as necessary.

REMEDIES:

(1) If the Local Government determines that maintenance or repair work is required to be done to the stormwater facility existing on the Owner property, the Stormwater Manual Administrator shall give Owner, and the person or agent in control of said property if different, notice of the specific maintenance and/or repair required. The Administrator shall set a reasonable time in which such work is to be completed by the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set by the Administrator, written notice will be sent to the persons who were given notice stating the Local Government's intention to perform such maintenance and bill the owner for all incurred expenses. The Local Government may also adjust stormwater utility charges if required maintenance is not performed.

(2) If at any time the Local Government determines that the existing system creates any imminent threat to public health or welfare, the Administrator may take immediate measures to remedy said threat. No notice to the persons listed in (1), above, shall be required under such circumstances.

(3) The Owner grants authority to the Local Government for inspection, and access to any and all stormwater system features for the purpose of performing maintenance or repair as may become necessary under Remedies (1) and/or (2).

(4) The Owner shall assume all responsibility for the cost of any maintenance and for repairs to the stormwater facility. Such responsibility shall include reimbursement to the Local

Government within 30 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the Local Government will be borne by the parties responsible for said reimbursements.

(5) The Owner hereby grants to the Local Government a lien against the above-described property in an amount equal to the cost incurred by the Local Government to perform the maintenance or repair work described herein.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the Local Government. It shall run with the land and be binding on all parties having or acquiring from Owner or their successors any right, title, or interest in the property or any part thereof, as well as their title, or interest in the property or any part thereof, as well as their heirs, successors, and assigns. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof, or interest therein, and to the benefit of all citizens of the Local Government.

Dated at _______________, Washington, this ______ day of _________________, ______.

OWNER

____
Authorized Agent for Owner

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, __________________ __________________________ known to be the individual(s) described, and who executed the foregoing instrument and acknowledge that they signed the same as their free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this ______ day of _____________, _______.

____

Notary Public in and for the
State of Washington, residing in

_______________________________.

Dated at ________________, Washington, this ______ day of ________________, ______.

LOCAL GOVERNMENT

____
Authorized Agent for the Local Government

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me,_________________________, to me known to be the Authorized Agent for the Local Government, a Municipal Corporation, who executed the foregoing instrument and acknowledge the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states he is authorized to execute the said instrument.

Given under my hand and official seal this ______ day of _____________, _____.

____
Notary Public in and for the
State of Washington, residing in

______________________________.

APPROVED AS TO FORM:

____
Local Government Attorney

Z:\FORMSJ\Agree to Maint Strmwtr Facilties-Private.wpd 03/16/01

When Recorded, Return To:

City of Tacoma
Environmental Services / Science and Engineering
747 Market Street Tacoma, WA 98402

DOCUMENT TITLE: COVENANT AND EASEMENT
PROJECT NAME

Grantor(s):
DEVELOPER

Grantee:
CITY OF TACOMA, a Municipal Corporation

Legal Description (abbreviated):
*****EXAMPLE*****

See Page 4, Exhibit "A", for Legal Description

Reference Number(s):
City of Tacoma Short Plat No. xxxxxxxxx;
City of Tacoma Work Order No. xxxxxxxx;
City of Tacoma Building Permit No. xxxxxxxx

Assessor's Parcel Number(s):
XX-XX-XX-XX

COVENANT AND EASEMENT – PROJECT NAME

WHEREAS DEVELOPER, hereinafter collectively referred to as the Grantor(s), owns the real property known as Project Name, located at ***insert address here*** (the “Subject Property”), which is more fully described herein; and

WHEREAS pursuant to Tacoma Municipal Code 12.08.090(D), as may be hereafter amended, a condition of developing the Subject Property requires that it have adequate stormwater drainage; and

WHEREAS pursuant to _____________ approval, private storm drainage collection systems must be provided; and

WHEREAS Grantor(s) have/has chosen to install a private storm drainage system for the Subject Property, the location of which is legally described in Exhibit A, so as to proceed with _______________ approval; and

WHEREAS such a private storm drainage system will require ongoing maintenance to ensure it operates as designed;

NOW THEREFORE, in consideration of the mutual benefits herein described, Grantor(s) hereby make the following Covenant which shall be recorded with the Pierce County Auditor encumbering the Subject Property (Assessor’s Parcel Number(s) xx-xx-xx-x-xxx).

(1) The Grantor(s) shall construct and maintain at his/her/their/its own cost, a private storm drainage system on the Subject Property, in accordance with the approved construction plans under City of Tacoma Short Plat No. XXXXXXXXXXX. The private storm drainage system shall consist of storm drainage pipes, manholes, catch basins and various drainage facilities throughout the short plat including all drainage facilities located in private easements.

(2) It shall be the sole responsibility of the Grantor(s) and/or his/her/their/its successors-in-interest to maintain the private storm drainage system in its originally designed condition. Any damages caused by the failure of the system shall be the sole responsibility of the Grantor(s), owner(s) and/or his/her/their successor(s)-in-interest.

(3) This Covenant is made to ensure the proper maintenance of the storm drainage system. This Covenant shall run with the Subject Property and be binding upon the Grantor(s) and all successor(s)-in-interest. The Grantor(s) consent(s) to filing this Covenant with the Pierce County Auditor’s Office once it is executed.

(4) If the private storm drainage system is not maintained in accordance with the approved or as-built design, approved under City of Tacoma Work Short Plat No. XXXXXXXXXXX incorporated herein by reference, the City may enter the Subject Property, inspect and repair the system, and assess reasonable costs for the work that may be charged against the owner of any beneficiary lot(s).

(5) No permanent structures shall be constructed over or within any private storm sewer easements located within the Subject Property. Permanent structures shall mean any concrete foundation, concrete slab, wall, building, or other site improvement that would unreasonably interfere with the ability to access the utilities in said easement(s). Permanent structures shall not mean normal landscaping, asphalt paving, firewood or chain-link fences, or other similar site improvements.

NOW THEREFORE, to this end, the Grantor(s) hereby grant(s) a perpetual easement to the City of Tacoma to enter the Subject Property, inspect the private storm drainage system, and make necessary repairs at the expense of Grantor or other benefitted owners. Name, company, Address, designed the private storm drainage system.

By ____________________________
Name
Company
Address
City, state, zip code

ACKNOWLEDGEMENT

STATE OF WASHINGTON)
) SS.
COUNTY OF PIERCE)

I, the undersigned, a Notary Public, do hereby certify that on this _____ day of ______________, 20___, personally appeared before me____to me known to be the individual(s) described in and who executed the within instrument and acknowledged that he/she/they signed and sealed the same, on oath stated that he/she/they was authorized to execute the instrument and acknowledged it as his/her/their free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this _____ day of ________________, 20___.

____
Notary Public in and for the State of Washington
residing at ________________________________
My Commission expires ____________________

DESCRIPTION APPROVED:

____
City Surveyor

APPROVED AS TO FORM:

____
Deputy City Attorney

EXHIBIT A

LEGAL DESCRIPTION

****EXAMPLE****

When Recorded Return To:

City of Tacoma
Public Works
Real Property Services
747 Market Street, Room 737
Tacoma WA 98402-3769

DOCUMENT TITLE: COVENANT AND EASEMENT

****

Grantor(s):

Grantee:
CITY OF TACOMA, a Municipal Corporation

Legal Description (abbreviated):

See pages 5 thru ___, Exhibit's "A" and "B", for full Legal Description

Reference Number(s):
City of Tacoma Work Order

Assessor's Parcel Number(s):

COVENANT AND EASEMENT –Short Plat

WHEREAS*****************, hereinafter referred to as the Grantor, owns the properties on *****************. hereinafter referred to as *****************, which is more fully described in the attached and incorporated Exhibit A; and

WHEREAS in order to satisfy the requirements of TMC 12.08.090 (D), Grantor intends to construct a public bioretention facility located within the planting strip of the Fawcett Avenue right-of-way, for the benefit of the *****************; and

WHEREAS in order to satisfy requirements set forth in TMC Chapter 9.17, 9.18, and 9.19, *abutting property owners* are responsible for the maintenance of the planting strip and will be responsible for ongoing maintenance of the proposed bioretention facility to ensure it operates as designed.

WHEREAS Grantor, and all successors in interest, of those certain Lots within the *****************, (hereinafter collectively referred to as "Owner"), shall be obligated to maintain the public bioretention facility in accordance with this Covenant and Easement; and

WHEREAS the bioretention facility was designed by *****************who also designed the public storm drainage system;

NOW THEREFORE, in consideration of the mutual benefits herein described, Grantor hereby makes the following Covenant which shall be recorded with the Pierce County Auditor under Parcel Number's *****************.

.

COVENANT AND EASEMENT – *****************

(1) The Grantor shall construct and maintain, at its own cost, a public storm drainage system within the right-of-way adjacent to the property legally described in Exhibit B (which is incorporated herein by this reference), and in accordance with the approved Work Order under City of Tacoma Permit Number *****************

(2) The proposed bioretention facility in the right of way will be an asset of the City of Tacoma. However per Tacoma Municipal Code Chapter 9.17, 9.18, and 9.19, *abutting property owners* are responsible for the maintenance of the planting strip and will be responsible for maintenance of the proposed bioretention facility and Grantor hereby agrees to maintain the facility as outlined herein below.

Grantor shall:

- Weed and water the bioretention facility as necessary until the plants have become established,
- Remove leaves and debris blocking storm drains and pipes to prevent local flooding on an on-going basis,

- Keep sidewalks in front of homes clear of impediments to pedestrian access and safety, also on an on-going basis.

The City shall be responsible for:

- Regular monitoring and maintenance of the Natural Drainage System "hardware" – pipes, culverts, outlets, drains, and grates, and
- Providing emergency services and repairs.

(3) This Covenant is made to ensure the proper maintenance of the storm drainage system. It is the Grantor's intent that the terms and conditions of this Covenant shall run with the land and be binding upon the Grantor(s) and all successor(s) in interest. The Grantor consents to the City filing this Covenant with the Pierce County Auditor's Office once it is executed.

____

****

STATE OF WASHINGTON)
) ss
COUNTY OF ___________)

I certify that I know or have satisfactory evidence that *****************is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument and acknowledged it, as the owner of the property concerned in this agreement, to be his free and voluntary act for the uses and purposes mentioned in the instrument.

Dated this ______ day of _______________, 2009

____
Notary Public in and for the
State of Washington
My Commission Expires __________________

LEGAL DESCRIPTION APPROVED:

______________________________ City Surveyor ______________________________
****
****
/Environmental Services

APPROVED AS TO FORM:

____
Assistant City Attorney

EXHIBIT A-- *****************

EXHIBIT B

Legal Description

RECORDING REQUESTED BY AND
WHEN RECORDED MAIL TO:

____
____
____
____

RECORDING COVER SHEET

DECLARATION OF COVENANT AND GRANT OF EASEMENT

Grantor: ____

Grantee: ____

Legal Description: ____
____
____

Additional Legal(s) on: ____

Assessor’s Tax Parcel ID#: ____
____
____

DECLARATION OF COVENANT AND GRANT OF EASEMENT

For Stormwater Flow Control Best Management Practices

IN CONSIDERATION of the following approved King County (check one of the following) ☐ residential building permit, ☐ commercial building permit, ☐ clearing and grading permit, ☐ subdivision permit, or ☐ short subdivision permit for Application No. ____________________ relating to real property ("Property") legally described as follows:

____

____

____

____

The Grantor(s), the owner(s) in fee of the above described parcel of land, hereby covenants with King County, a political subdivision of the state of Washington its successors in interest and assigns ("King County"), that it will observe, consent to, and abide by the conditions and obligations set forth and described in Paragraphs 1 and 2 and 4 through 7 below with regard to the Property, and hereby grants an access easement on and to the Property to King County, for the purposes described in Paragraph 3 below. Grantor(s) hereby grants, covenants, and agrees as follows:

1. Owner(s) of the Property shall retain, uphold, and protect the stormwater management devices, features, pathways, limits, and restrictions, known as flow control best management practices ("Flow Control BMPs"), shown on the approved Flow Control BMP Site Plan for the Property attached hereto and incorporated herein as Exhibit A.

2. Owner(s) of the Property shall at their own cost, operate, maintain, and keep in good repair, the Property's Flow Control BMPs as described in the approved Design and Maintenance Details for each BMP attached hereto and incorporated herein as Exhibit B.

3. King County shall have a nonexclusive perpetual access easement on the Property in order to ingress and egress over the Property for the sole purposes of inspecting and monitoring the Property's Flow Control BMPs, and if applicable in accordance with the terms of Paragraph 4 below, performing any corrective work required to bring the Property's Flow Control BMPs into compliance with Title 9 of the King County Code.

4. If King County determines that maintenance, repair, restoration, and/or mitigation work is required to be done to the Flow Control BMPs and has not been performed by the Property owner(s), the Director of the Water and Land Resources Division of the King County Department of Natural Resources and Parks shall give notice to the Property owner (s) of the specific maintenance, repair, restoration, and/or mitigation work (Work) required pursuant to Title 9 of the King County Code. The Manager shall also set a reasonable time in which the Work is to be completed by the Property owner(s). If the Work is not completed within the time set by the Division Director, King County may perform the required Work. Written notice will be sent to the Property owner(s) stating King County’s intention to perform the Work. Performance of the Work by King County will not commence until at least seven (7) days after such notice is mailed. If, within the sole discretion of the Water and Land Resources Division Director, there exists an imminent or present danger, the owner hereby waives the seven (7) day notice period and the Work will begin immediately.

5. The owner(s) of the Property shall assume all responsibility for the cost of any Work required to be done to the Flow Control BMPs. Such responsibility shall include reimbursement to King County within thirty (30) days of the receipt of the invoice for any such Work performed by King County in accordance with the terms of Paragraph 3 above. Overdue payments will require payment of interest at the current legal rate as liquidated damages. In the event that King County does not receive reimbursement within the required time frame, it may elect to place a lien on the

Property and act upon the lien in accordance with the terms and procedures specified in Chapter 23.40 of the King County Code, as amended from time to time. If legal action is taken to enforce the provisions of this Paragraph, the prevailing party is entitled to costs and attorney's fees.

6. Apart from performing routine landscape maintenance, the Property owner(s) is (are) hereby required to obtain written approval from the Water and Land Resources Division Manager of the King County Department of Natural Resources and Parks prior to performing any alterations or modifications to the Flow Control BMPs. Any notice or consent required to be given or otherwise provided for by the provisions of this Declaration of Covenant and Grant of Easement shall be effective upon personal delivery, or three (3) days after mailing by Certified Mail, return receipt requested, whichever occurs sooner.

7. This Declaration of Covenant and Grant of Easement is intended to promote the efficient and effective management of surface water drainage on the Property, and it shall inure to the benefit of all the citizens of King County, its successors and assigns. This Declaration of Covenant and Grant of Easement shall run with the land and be binding upon Grantor(s), and Grantor's (s') successors in interest and assigns.

8. This Declaration of Covenant and Grant of Easement may be terminated by execution of a written agreement by Grantor(s) and King County expressing their mutual agreement to terminate this Declaration of Covenant and Grant of Easement.

IN WITNESS WHEREOF, this Declaration of Covenant and Grant of Easement is executed this _____________day of ___________________________, 20___.

By _______________________________________

Its _______________________________

By _______________________________________

Its _______________________________

STATE OF WASHINGTON)
)SS
COUNTY OF KING)

On this ______ day of ______________________________, 20___, before me, the undersigned, a Notary Public in and for the State of _________________________, duly commissioned and sworn personally appeared , to me known to be the individual described in and who executed the foregoing instrument, and acknowledged to me that he signed and sealed the said instrument as h free and voluntary act and deed for the uses and purposes therein mentioned.

WITNESS my hand and official seal hereto affixed the day and year in this certificate above written.

____

____
Printed name
Notary Public in and for the State of Washington,
residing at ______________________________

My appointment expires ___________________

RECORDING REQUESTED BY AND
WHEN RECORDED MAIL TO:

____
____
____
____

DECLARATION OF COVENANT

FOR INSPECTION AND MAINTENANCE OF STORMWATER FACILITIES AND BMPS

Grantor: __________________________________

Grantee: King County

Legal Description: ____
____
____

Additional Legal(s) on: ____

Assessor's Tax Parcel ID#: ____

IN CONSIDERATION of the approved King County ___________________________ permit for application No. _______________________ relating to the real property ("Property") described above, the Grantor(s), the owner(s) in fee of that Property, hereby covenants(covenant) with King County, a political subdivision of the state of Washington and its municipal successors in interest and assigns ("King County" and "the County", or "its municipal successor"), that he/she(they) will observe, consent to, and abide by the conditions and obligations set forth and described in Paragraphs 1 through

10 below with regard to the Property, and hereby grants(grant) an easement as described in Paragraphs 2 and 3. Grantor(s) hereby grants(grant), covenants(covenant), and agrees(agree) as follows:

1. The Grantor(s) or his/her(their) successors in interest and assigns ("Owners") shall at their own cost, operate, maintain, and keep in good repair, the Property's stormwater facilities and best management practices ("BMPs") identified in the plans and specifications submitted to King County for the review and approval of permit(s) #: ______________________________ . Stormwater facilities include pipes, swales, tanks, vaults, ponds, and other engineered structures designed to manage stormwater on the Property. Stormwater BMPs include dispersion and infiltration devices, native vegetated areas, permeable pavements, vegetated roofs, rainwater harvesting systems, reduced impervious surface coverage, and other measures designed to reduce the amount of stormwater runoff on the Property.

2. King County shall have the right to ingress and egress over those portions of the Property necessary to perform inspections of the stormwater facilities and BMPs and conduct other activities specified in this Declaration of Covenant and in accordance with King County Code ("KCC") 9.04.120 or relevant municipal successor's codes as applicable. This right of ingress and egress, right to inspect, and right to perform required maintenance or repair as provided for in Section 3 below, shall not extend over those portions of the Property shown in Exhibit "A."

3. If King County determines that maintenance or repair work is required to be done to any of the stormwater facilities or BMPs, the Director of the Water and Land Resources Division or its municipal successor in interest ("WLR") shall give notice of the specific maintenance and/or repair work required pursuant to KCC 9.04.120 or relevant municipal successor's codes as applicable. The Director shall also set a reasonable time in which such work is to be completed by the Owners. If the above required maintenance or repair is not completed within the time set by the Director, the County may perform the required maintenance or repair, and hereby is given access to the Property, subject to the exclusion in Paragraph 2 above, for such purposes. Written notice will be sent to the Owners stating the

County's intention to perform such work. This work will not commence until at least seven (7) days after such notice is mailed. If, within the sole discretion of the WLR Director, there exists an imminent or present danger, the seven (7) day notice period will be waived and maintenance and/or repair work will begin immediately.

4. If at any time King County reasonably determines that a stormwater facility or BMP on the Property creates any of the hazardous conditions listed in KCC 9.04.130 or relevant municipal successor's codes as applicable and herein incorporated by reference, the WLR Director or equivalent municipal successors official may take measures specified therein.

5. The Owners shall assume all responsibility for the cost of any maintenance or repair work completed by the County as described in Paragraph 3 or any measures taken by the County to address hazardous conditions as described in Paragraph 4. Such responsibility shall include reimbursement to the County within thirty (30) days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate as liquidated damages. If legal action ensues, the prevailing party is entitled to costs or fees.

6. The Owners are hereby required to obtain written approval from the King County WLR Director prior to filling, piping, cutting, or removing vegetation (except in routine landscape maintenance) in open vegetated stormwater facilities (such as swales, channels, ditches, ponds, etc.), or performing any alterations or modifications to the stormwater facilities and BMPs referenced in this Declaration of Covenant.

7. Any notice or consent required to be given or otherwise provided for by the provisions of this Agreement shall be effective upon personal delivery, or three (3) days after mailing by Certified Mail, return receipt requested.

8. With regard to the matters addressed herein, this agreement constitutes the entire agreement between the parties, and supersedes all prior discussions, negotiations, and all agreements whatsoever whether oral or written.

9. This Declaration of Covenant is intended to protect the value and desirability of the real property described above, and shall inure to the benefit of all the citizens of King County and its municipal successors and assigns. This Declaration of Covenant shall run with the land and be binding upon Grantor(s), and Grantor's(s') successors in interest, and assigns.

10. This Declaration of Covenant may be terminated by execution of a written agreement by the Owners and King County or the municipal successor that is recorded by King County in its real property records.

IN WITNESS WHEREOF, this Declaration of Covenant for the Inspection and Maintenance of Stormwater Facilities and BMPs is executed this _____ day of ____________________, 20_____.

____
GRANTOR, owner of the Property

____
GRANTOR, owner of the Property

STATE OF WASHINGTON)
COUNTY OF KING)ss.

On this day personally appeared before me:

____, to me known to be the individual(s) described in and who executed the within and foregoing instrument and acknowledged that they signed the same as their free and voluntary act and deed, for the uses and purposes therein stated.

Given under my hand and official seal this _____ day of ____________________, 20_____.

____

____
Printed name
Notary Public in and for the State of Washington,
residing at

____

My appointment expires _______________________

Drainage Facility Maintenance Covenant

We, the owners and contract purchasers of the lands herein platted (Grantor), agree that the obligations of Grantor shall inure to the benefit of and be binding upon the heirs, successors, and assigns. Grantor agrees that this covenant touches and concerns the land described herein and shall run with the land.

Grantor by execution of this covenant acknowledges that the benefits of this covenant inure to Grantor, downstream property owners, and the general public, and that Snohomish County (County) as third-party beneficiary of this covenant has the right, but not the obligation, to enforce this covenant on behalf of downstream property owners and the general public. County requires this covenant to protect private and public property, private and public drainage infrastructure, and natural resources of downstream property owners and the general public.

Grantor, in consideration of the approval of this subdivision, hereby covenants to perform regular maintenance upon the drainage facilities installed, or to be installed, upon Grantor's property. Regular maintenance shall include, at a minimum, annual inspection of the stormwater drainage system. As applicable, the system shall include the stormwater conveyance system pipes, ditches, swales, and catch basins; stormwater flow regulation system detention ponds, vaults, pipes, retention ponds, flow regulation and control structures; infiltration systems and water quality control system.

The scope of this covenant and right of entry shall be adequate to provide for the access, inspection, and maintenance of the stormwater drainage system, and shall be subject to the following terms and conditions:

1. County shall have the perpetual right of entry across adjacent lands of the Grantor for purposes of inspecting, auditing, or conducting required maintenance of the drainage facility.

2. If County inspection determines that maintenance is not being performed, County shall endeavor to provide Grantor reasonable advance notification of the need to perform the maintenance and a reasonable opportunity for Grantor to perform it. In the event that Grantor fails to complete the required maintenance within a reasonable time period, County

shall have the right to perform or contract with others to perform it at the sole expense of the Grantor. If County in its sole discretion determines that an imminent or present danger exists, required maintenance and/or repair may begin immediately at Grantor's expense without prior notice to Grantor. In such event, County shall provide Grantor with a written statement and accounting of all work performed and the fees, charges, and expenses incurred in making such repairs. Grantor shall agree to reimburse County or pay County's vendors directly for all reasonable fees, charges, and expenses identified in County's statement.

3. If County is required to act as a result of Grantor's failure to comply with this covenant, County may remove any obstructions and/or interferences that in the sole opinion of County impair the operation of the drainage facility or the maintenance thereof. Grantor agrees to hold County, its officers, employees, and agents harmless from any and all claims, actions, suits, liability, loss, expenses, damages and judgments of any nature whatsoever, including costs and attorney's fees, incurred by the removal of vegetation or physical interference from the drainage facility.

4. When exercising the maintenance provisions of the covenant, in the event of nonpayment, County may bring suit to recover such costs, including attorney's fees, and upon obtaining a judgment, such amount shall become a lien against the property of Grantor as provided in RCW 4.56.190.

5. Grantor covenants that all of the owners, contract purchasers and lien holders of the property described herein have signed the dedication and/or declaration of this subdivision, that they have the right to grant this covenant on the property, and that the title to the property is free and clear of any encumbrances which would interfere with the ability to grant this covenant.

Return Address:
Snohomish County Property Manager
3000 Rockefeller Avenue
Mail Stop 404
Everett, WA 98201-4046
PDS Reference PFN: ___________

Drainage Facility Maintenance Covenant

Grantor(s) hereinafter referred to as **Grantor:**

1.
2.
3.

Grantee: Snohomish County, hereinafter referred to as **County,** a Political Subdivision under the Laws of the State of Washington.

Legal Description of property encumbered by covenant**:**
Abbreviated:

(if applicable, insert lot, Block, Plat Name), and/or as described in Exhibit(s) “   “ *(typically Exhibit A).*

Located in *qtr./* *qtr.* Sec. Twp. N., Rge. E., W.M.

Reference Number(s) of documents assigned, released, or modified:

Assessor’s Property Tax Parcel/Account Number(s) of property(s) encumbered by the drainage covenant:

Grantor’s Initials__________

Grantor has a record interest in the property encumbered by the covenant and agrees that the obligations of Grantor shall inure to the benefit of and be binding upon the heirs, successors, and assigns. Grantor agrees that this covenant touches and concerns the land described in Exhibit __________ and shall run with the land.

Grantor by execution of this covenant acknowledges that the benefits of this covenant inure to Grantor, downstream property owners, and the general public, and that the County as third-party beneficiary of this covenant has the right, but not the obligation, to enforce this covenant on behalf of downstream property owners and the general public. The County requires this covenant to protect private and public property, private and public drainage infrastructure, and natural resources of downstream property owners and the general public.

Grantor in consideration of the approval of County development permit No. _____________, relating to the real property described in Exhibit ______ and in consideration of other valuable consideration, receipt and sufficiency of which is hereby acknowledged, hereby covenants to perform regular maintenance upon the drainage facilities installed, or to be installed, upon Grantor's property. Regular maintenance shall include, at a minimum, annual inspection of the stormwater drainage system. As applicable, the system shall include the stormwater conveyance system pipes, ditches, swales, and catch basins; stormwater flow regulation system detention ponds, vaults, pipes, retention ponds, flow regulation and control structures; infiltration systems and water quality control system.

The scope of this covenant and right of entry shall be adequate to provide for the access, inspection, and maintenance of the stormwater drainage system, and shall be subject to the following terms and conditions:

1. The County shall have the perpetual right of entry across adjacent lands of the Grantor for purposes of inspecting, auditing, or conducting required maintenance of the drainage facility.

2. If County inspection determines that maintenance is not being performed, the County shall endeavor to provide Grantor reasonable advance notification of the need to perform the maintenance and a reasonable opportunity for the Grantor to perform it. In the event that Grantor fails to complete the required maintenance within a reasonable time period, the County shall have the right to perform or contract with others to perform it at the sole expense of the Grantor. If the County in its sole discretion determines that an

Grantor's Initials__________

imminent or present danger exists, required maintenance and/or repair may begin immediately at Grantor's expense without prior notice to Grantor. In such event, the County shall provide Grantor with a written statement and accounting of all work performed and the fees, charges, and expenses incurred in making such repairs. Grantor shall agree to reimburse the County or pay the County's vendors directly for all reasonable fees, charges, and expenses identified in the County's statement.

3. If the County is required to act as a result of Grantor's failure to comply with this covenant, the County may remove any obstructions and/or interferences that in the sole opinion of the County impair the operation of the drainage facility or the maintenance thereof. Grantor agrees to hold the County, its officers, employees, and agents harmless from any and all claims, actions, suits, liability, loss, expenses, damages and judgments of any nature whatsoever, including costs and attorney's fees, incurred by the removal of vegetation or physical interference from the drainage facility.

4. When exercising the maintenance provisions of the covenant, in the event of nonpayment, the County may bring suit to recover such costs, including attorney's fees, and upon obtaining a judgment, such amount shall become a lien against the property of Grantor as provided in RCW 4.56.190.

5. Grantor covenants that the owners of the property described herein are the person or persons identified on page 1 of this covenant as Grantors, that they have the right to grant this covenant on the property, and that the title to the property is free and clear of any encumbrances which would interfere with the ability to grant this covenant.

Executed this _________ day of ____________________, __________

Grantors:

Signature(s): ________________________ ________________________

Printed
Name(s): ________________________ ________________________

Title of Authorized Representative(s):
(if signing on behalf of a corporation)

________________________ ________________________

Additional Signatures (if needed):

____
____

Note: Signature(s) of Grantor(s) must be acknowledged by appropriate Notary Form.

Accepted and approved
for Snohomish County:

____________________________ Date: ____________
Director
Snohomish County
Department of Planning and
Development Services

CONSENT TO AND APPROVAL OF DRAINAGE MAINTENANCE COVENANT

___________________________ (*lender)*, the current Beneficiary of a Deed of Trust recorded under AFN __________________ , records of Snohomish County, which deed of trust encumbers the real estate described in Exhibit ____________ of the attached Drainage Maintenance Covenant, does hereby consent to the establishment of said covenant

Signed: __________________________________

Title: __________________________________

Date: __________________

REPRESENTATIVE ACKNOWLEDGMENT

STATE OF WASHINGTON)
) ss
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that ____ is the person who appeared before me, and said person acknowledged that (he/she/they) signed this instrument , on oath stated that (he/she/they) was/were authorized to execute the instrument and acknowledged it as the ________________________________ of _________________________ to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

Dated: _____________

Signature: _______________________________
(print name) _______________________________

(Seal or stamp)

NOTARY PUBLIC IN AND FOR THE STATE OF WASHINGTON
My appointment expires _______________

Grantor’s Initials__________

INDIVIDUAL ACKNOWLEDGMENT

STATE OF WASHINGTON)
) ss
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that

____

is/are the person(s) who appeared before me, and said person(s) acknowledged that (he/she/they) signed this instrument and acknowledged it to be (his/her/their) free and voluntary act for the uses and purposes mentioned in the instrument.

Dated: _____________

Signature: _______________________________

(print name) _____________________________

(Seal or stamp)

NOTARY PUBLIC IN AND FOR THE STATE OF WASHINGTON

My appointment expires _______________

REPRESENTATIVE ACKNOWLEDGMENT

STATE OF WASHINGTON)
) ss
COUNTY OF SNOHOMISH)

I certify that I know or have satisfactory evidence that ____ is the person who appeared before me, and said person acknowledged that (he/she/they) signed this instrument , on oath stated that (he/she/they) was/were authorized to execute the instrument and acknowledged it as the _________________________________ of __________________________ to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

Dated: _____________

Signature: _______________________________

(print name) _____________________________

(Seal or stamp)

NOTARY PUBLIC IN AND FOR THE STATE OF WASHINGTON

My appointment expires _______________

APPENDIX B

Examples of Private Property Owner Education

Pierce County
Stormwater Maintenance Manual for Private Facilities

DRAFT 6/30/2009

1.0 Introduction: Maintaining Your Stormwater Facilites

The intent of this stormwater maintenance manual is to assist private stormwater management sytem owners in performing proper maintenance of these facilities.

Stormwater management facilities consist of a series of collection and conveyance systems, detention systems, and treatment facilities. They are typically a combination of landscape and structural components that slow, filter, detain, or infiltrate stormwater runoff on-site after a rainfall event. Properly designed, installed and maintained stormwater management facilites protect water quality and reduce flooding.

Pierce County Code Section 17A.40.020 states that private property owners are responsible for maintaining stormwater management structures that they own. Owners should have a maintenance program that addresses every component of the stormwater system, to ensure the system does not lose its intended capability to manage stormwater. Pierce County's "Stormwater Management and Site Development Manual", (Ord. 2008-59s, Ord. 96-47) requires that owners of private stormwater management facilities applying for development after the effective date of the Stormwater Manual conduct routine and non-routine inspection and maintenance of their stormwater system and prepare an annual inspection report to be submitted to Pierce County on or before May 15.

Property owners with private systems constructed prior to the effective date of the *Stormwater Manual* are also required to maintain their stormwater facilities, but are not required to submit the annual inspection and maintenance report to Pierce County.

1.1 How to Apply this Manual

Private owners should review this manual for understanding of the general function of their stormwater management facilities. After determining the type of facilities associated with the owner's site, the owner should download or copy the checklists for each facility and utilize them in facility inspection and maintenance.

It is important to note that there may be more than one facility associated with an individual site. For example, your site may include catch basins, a detention pond, and a control structure/flow restrictor. In this case, all three checklists should be utilized for inspection and maintenance.

1.2 Why Manage Stormwater Runoff?

When it rains or snows in urban areas, the stormwater runs off impervious surfaces (such as roofs and paved areas) instead of soaking into the ground. In the past stormwater runoff has mainly been directed into drains and pipes that carry it off-site for eventual discharge into a river or stream.

The past approach to stormwater management has a number of harmful effects:

- Impervious areas and residential lawns generate large volumes of runoff relatively quickly. The increased volume and rate of runoff can cause flooding and erosion of natural waterways, damage to roads and other manmade structures, and destroy natural wildlife habitat.

- The stormwater runoff picks up oil, pesticides, metals, chemicals, sediment, and other pollutants that harm water quality and fish habitat.

- During warm weather, the runoff absorbs heat from the impervious surfaces. This increases the temperature of the receiving waters, with negative impacts on fish and other aquatic life.

- Less water is able to infiltrate into the ground. This reduces groundwater recharge which reduces summer base flow in streams.

The current approach to stormwater management is for facilities to be designed to help mitigate for these negative effects of stormwater runoff by a combination of reducing or eliminating runoff, treatment of runoff, and/or retention or detention of runoff with a metered release through actions called “Best Management Practices”.

1.3 Frequently Asked Questions

1. **Q.** What are Best Management Practices (BMPs)?

   A. BMPs are a series of actions that are designed to reduce stormwater pollution, prevent discharging contaminants to natural water bodies and reduce stormwater facility maintenance costs. These actions can take several different forms. Examples of these are:

   Behavioral--For example, sweeping a driveway instead of hosing it into the storm drain.

   Procedural--Such as implementing an inventory control program for hydraulic oil or other lubricants to identify changes in consumption. This type of program can be used to identify maintenance problems, and save the business owner money on equipment down-time and lubricant costs.

   Structural--Such as building a roof over a production area, or installing an oil/water separator.

   In general, behavioral and procedural type BMPs will cost the least to implement initially and may save money over time. Structural BMPs typically cost more to construct, operate, and maintain.

   BMPs are separated into two broad categories, namely *source control* and *treatment BMPs*. As the name implies, source control BMPs prevent contaminants from entering stormwater runoff by controlling them at the source. Treatment BMPs are utilized to treat stormwater that is already contaminated. Most treatment BMPs require planning, designing, permitting, and construction, and none can remove 100% of the contaminants in stormwater. These factors, added to the typical expense of treatment BMPs, makes source control BMPs the preferred choice.

2. **Q.** There is a ditch in front of my home. Who is responsible for maintaining it?

   A. If you are in a private development: you and your neighbors will have to maintain the drainage. If you are within a city's limits: contact your city's public works department. If you are not within a city's limits: storm drainage systems in public roads are maintained by the Transportation Division of Public Works and Utilities. The contact number for the Road Maintenance Division is (253)-798-6000. You can also use the online request system at the following URL; http://www.co.pierce.wa.us/cfapps/secure/publicworks/request.cfm

3. **Q**. What methods should we use to control unwanted pests and vegetation?

A. Pierce County encourages the use of an Integrated Pest Management (IPM) approach to control unwanted pests. Pests are any plant or animal life that adversely interferes with the function, safety, and aesthetics of the stormwater facility. IPM is a coordinated decision-making and action process that uses the most appropriate control methods and strategy in an environmentally and economically sound manner.

The IPM approach emphasizes physical, mechanical, cultural, and biological tactics to keep pests and vegetation problems low enough to limit or eliminate the use of chemical control. The major elements of IPM include:

- Preventing pest problems;
- Monitoring for the presence of pests and pest damage;
- Establishing a level of pest population that can be tolerated without being detrimental to the stormwater facilities function or aesthetics of the facility.
- Treating pest problems to reduce populations below those established levels by using the most environmentally sensitive and safe method to control the pest;
- Evaluating the effects and effectiveness of the pest treatment.

Monitoring of pest populations is key to successful IPM implementation. Pest problems are easier to control if the problem is discovered early. With IPM, pesticides are used only as a last resort in order to protect water quality and human health.

More information on IPM is available from the Washington State Department of Agriculture (http://agr.wa.gov) and the Washington State University/Pierce County Extension Service (http://www.pierce.wa.wsu.edu).

4. **Q.** There is tall grass and debris in the pond/creek near my house. Who takes care of this?

A. Publicly owned storm drainage ponds and some creeks are maintained by Surface Water Management. Call the Water Quality/ Flooding and Storm Drainage Line at 253-798-4274 to report your concern. Your call will be routed to a member of our maintenance team for inspection and the scheduling of a work crew if needed. Privately owned storm drain systems must be maintained by the property owner or homeowner's association.

5. **Q.** *t plants should we avoid planting?*

A **.**Non-native, invasive plants should not be planted. Early detection and control of these plants are important to prevent future maintenance problems and increased maintenance costs. Some native plants, such as red alder (*Alnus rubra*), can increase maintenance costs due to leaf fall into the pond causing clogging problems. Additional plant species to avoid are: English ivy (*Hedera helix*), willow (*Salix* species), black cottonwood (*Populous balsamifera* spp. *trichocarpa*), Himalayan and evergreen blackberry (*Rubas discolor* and *laciniatus*), and cattails (*Typha*).

6. **Q.** *How can we make the stormwater facility more attractive?*

A. The Integrated Pond, a booklet produced by King County, provides information on Integrating stormwater facilities into attractive community spaces. This booklet provides information on planting appropriate vegetation around the facility to make it more attractive or to screen the facility. The booklet can be downloaded from King County's website at (http://www.kingcounty.gov/environment/waterandland/stormwater/documents/integrated-pond.aspx)

Pierce County recommends native plants be used around stormwater facilities. Native plants require less water once they are established, resist pests and diseases better, require less fertilizer and pesticides, and provide wildlife habitat.

Plants differ in their ability to cope with different soils, moisture levels, and sun exposure. When planting next to the stormwater facility, consider future maintenance requirements such as grass mowing and watering requirements. Avoid planting deciduous trees and shrubs adjacent to the facility as their falling leaves may cause blocking problems. Avoid plants with invasive root systems, such as willows, and plants that can blow over easily, such as Red alder and Cottonwood. See *The Integrated Pond* (King County) and the *Low Impact Development Technical Guidance Manual for Puget Sound – Appendices 1 and 3* at (http://www.pierce.wsu.edu/Water_Quality/LID/LID_manual2005.pdf) for a list of native plants appropriate for stormwater facilities. Additional information on native plants can be found on the Washington Native Plant Society website at (http://www.wnps.org/index.html).

To reduce maintenance costs and prevent future water flow problems, it is not recommended to plant shrubs or trees in stormwater ponds below the maximum designed water level. Planting grass or low growing, non-invasive, native plants within the facility may be appropriate but it should be done cautiously so as to not interfere with the functions of the facility. Promptly replant any bare soil areas that could contribute sediments to the stormwater system or cause erosion of the facility.

7. **Q.** *We have a limited maintenance budget. What are the most important vegetation maintenance activities we should do?*

A. The inlets and outlets should be kept clear of vegetation and other potentially blocking material. The pond should not be allowed to become overgrown with noxious or invasive vegetation.

8. **Q.** Where do I find more information on the cost of stormwater maintenance?

A. Unit costs for common maintenance procedures can be found on the Stormwater Managers Resource Center (SMRC) website at:

Stormwater Managers Resource Center (SMRC)

9. **Q.** Can I get credit for maintaining my stormwater facility?

A. A properly maintained storm drainage system can significantly reduce your Surface Water Management Fee.

Credits to the Surface Water Management Fee can be received by meeting the requirements of Pierce County Code Section 11.02.050B.

For more information on receiving stormwater credits call (253) 798-4020.

10. **Q.** Why can't I dump used motor oil and other wastes into the stormwater inlet on my street?

A. Stormwater inlets lead to stormwater management systems that discharge to natural water bodies (e.g. lakes or stream) or to the groundwater. Excessive contaminants, such as motor oils dumped into the storm system, will create the need for more frequent maintenance and higher maintenance costs.

11. **Q.** I wash my own car, how can I be environmentally responsible?

A. The best option is to use a commercial car wash where the wash water is recycled and does not drain to the storm system. Improper disposal of wash water will increase the required maintenance frequency resulting in higher maintenance costs. The Pierce County Stormwater Pollution Prevention Manual provides Best Management Practices (BMPs) for washing vehicles on private property; see additional resources section in Chapter 5.

12. **Q.** Can you make the flooding go away?

A. Not once the flooding has started, but we might be able to help keep it from flooding again. We use input from residents to figure out the best solution to flood problems and to prioritize which projects get constructed first. During a flood, sand bags can be picked up at your local Fire District Headquarters. If a blocked pipe or ditch in the public system is the cause of your flooding, the Road Maintenance Shops may also help with cleaning them out.

County Road Maintenance Hot Line .... (253) 798-6000
Requests will be acted on within 24 hours or the next business day.

Water Quality/ Flood & Storm Drainage Complaints: .... (253) 798-4274
Report flooding and private property storm drainage concerns.

13. Q. Where do I find information on the West Nile virus?

A. West Nile virus is a mosquito-borne virus that can cause encephalitis (or meningitis in humans and animals. Preventing mosquito bites and reducing mosquito-breeding habitat around your home are the best ways to protect your family. You should empty containers that hold standing water, such as old tires, buckets, and planters. Also, change the water in your birdbaths, fountains, wading pools and animal troughs weekly, and clean out your rain gutters so that they drain properly.

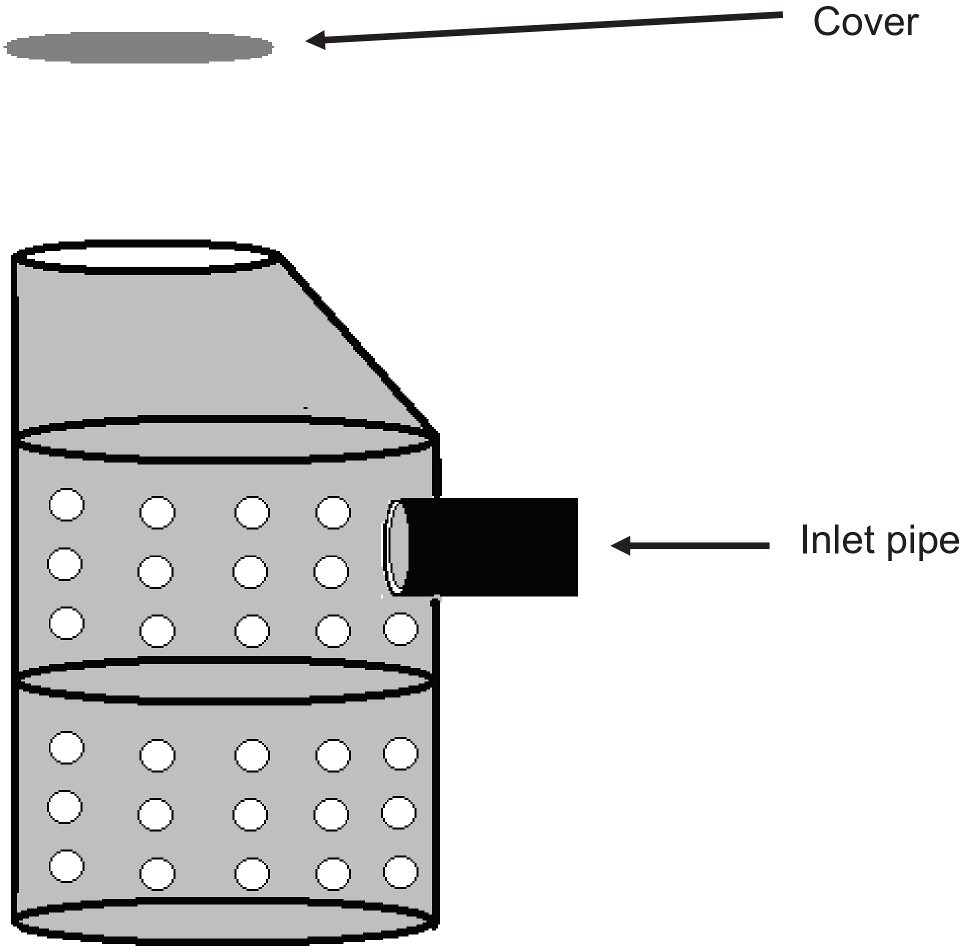
For questions related to West Nile Virus, contact the Tacoma-Pierce County Health Department at (253) 798-6578

Poorly maintained private stormwater drainage facilities can increase breeding sites for mosquitoes in your community or property. Owners of private stormwater drainage facilities can request a courtesy inspection of their system to insure proper operation by contacting Pierce County Surface Water Management at (253) 798-2725.

3.25 Drywell

A drywell is a perforated, open-bottomed manhole used to infiltrate stormwater into the ground. Drywells temporarily store stormwater runoff during rain events. Drywells do not discharge to a downstream conveyance system or nearby surface water. Instead, drywells rely on the ability of the site's soils to absorb the stormwater into the ground.

While not the intended use, drywells trap sediment and some of the oily pollutants in runoff. They are more likely to fill with oily sediment in areas that lack swales or other treatment facilities. Fine oil sediment can clog drywells and lead to localize street flooding. Also, pollutants discharged into drywells can migrate into groundwater. Drywells were often installed in closed topographic depressions, areas with well drained soils, or areas having inadequate storm sewers. Often, drywells contain groundwater. Because drywells can be easily clogged and tend to concentrate pollutants in one place; pollution and sediment control practices should be used to protect them.



3.25 Drywell Checklist

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
MONTHLY, STORM	General					Trash & Debris	Trash or debris (in the drywell) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the drywell, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the drywell.
MONTHLY	General					Contaminants and pollution	Any evidence of oil, gasoline, contaminants or other pollutants in or around facility.	Remove. (Coordinate removal and cleanup with local water quality agency).
MONTHLY	General					Cover damaged or difficult to remove	One maintenance person cannot remove lid after applying normal lifting pressure. Corrosion/deformation of cover. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and installed by one maintenance person.
MONTHLY	General					Cover not in place	Cover is missing or only partially in place. Any open manhole or catch basin requires maintenance.	Manhole or catch basin cover is closed.
MONTHLY	General					Does not dissipate stormwater	Does not dissipate stormwater	Replace or repair.
MONTHLY	General					Ladder damaged	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, cracks, corrosion, or sharp edges. Confined space warning sign is missing.	Ladder meets design standards. Allows maintenance person safe access. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.
ANNUAL	Structure					Structure damage	Maintenance/inspection personnel determine that drywell is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.

Drywell Checklist (Continued)

		DANNUALte						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
ANNUAL	Structure					Structure Damage	Cracks wider than ½-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than ¼-inch at the joint of the inlet/outlet pipe.
MONTHLY	General					Opening clogged	Openings are clogged, reducing capacity.	Water-jet clogged openings; or Convert existing, clogged drywell to a sediment trap and install a new drywell or drainage trench. To convert to a sediment trap, required are grouting holes, covering the base with concrete, and adding piping.
MONTHLY	General					Sediment	Sediment is greater than 1/3 of the distance between the base and the inlet pipe.	Remove. Do not allow sediment and water to discharge back into the storm sewer.
MONTHLY	General					Standing water	Standing water indicates the drywell is into the water table.	Rebuild drywell to prevent stormwater from going directly into groundwater.

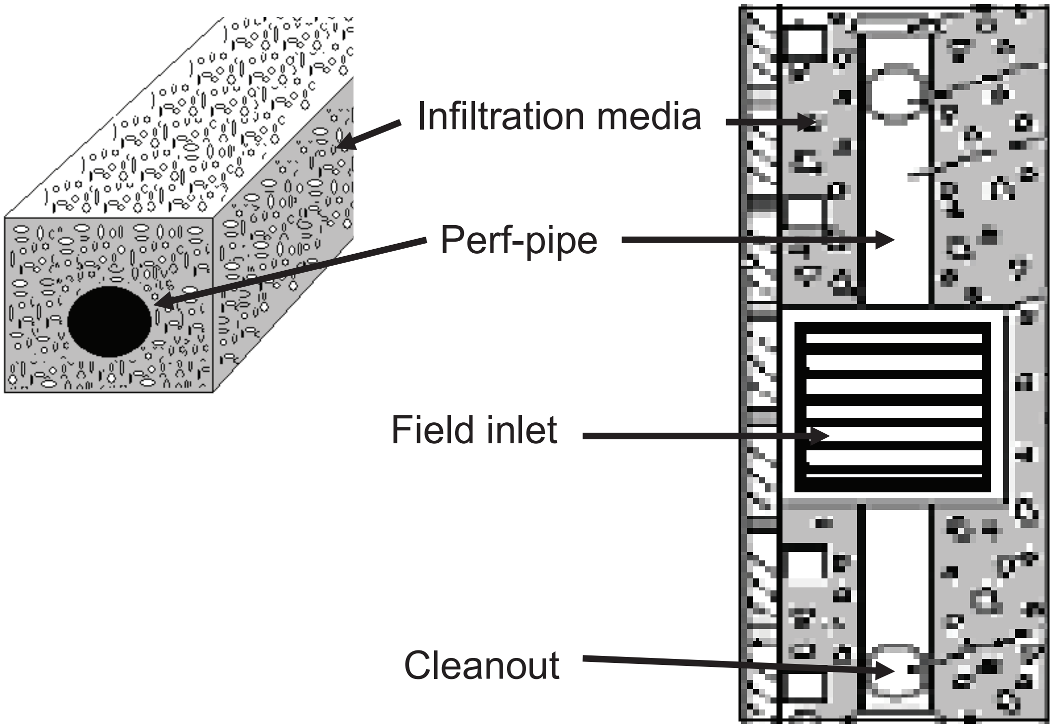
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from November through April.
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).

3.28 Infiltration Trench

A stormwater infiltration trench is a closed basin built by excavating below existing ground. Infiltration trenches temporarily store stormwater runoff during rain events. Infiltration trenches do not discharge to a downstream conveyance system or nearby surface water. Instead, infiltration trenches rely on the ability of the site's soils to absorb the stormwater into the ground.



3.28 Infiltration Trench Checklist

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
MONTHLY	General					Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants in or around facility.	Remove. (Coordinate removal and cleanup with local water quality response agency).
MONTHLY	General					Drainage Slow	Drainage Trench - decreased capacity that indicates slow drainage.	Verify facility design rate. Clean perforated drain pipe. Do not allow removed sediment and water to discharge back into the storm sewer.
MONTHLY	General					Sediment & Debris	Sediment depth is greater than 20% of pipe diameter.	Clean pipe and remove material.
MONTHLY	General					Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
MONTHLY	General					Trash & Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the trench.
MONTHLY	General					Trash & Debris	Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
MONTHLY	General					Trash & Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.

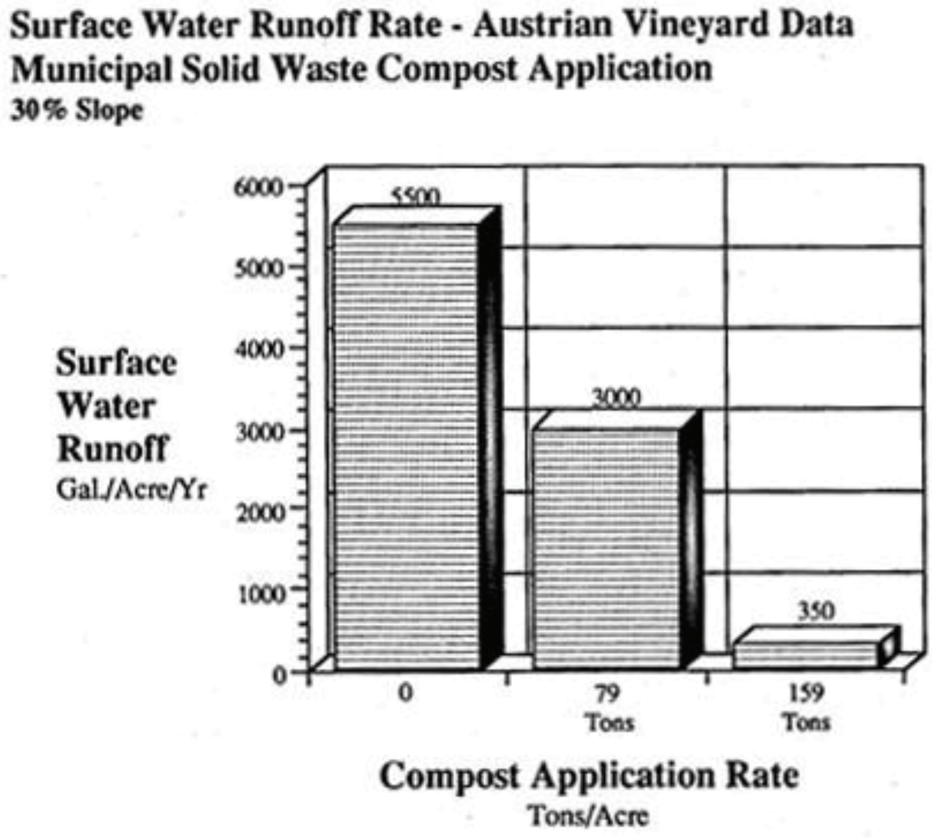
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from November through April.
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).

3.31 Compost Amended Soils

Amending a soil with compost increases the soil's permeability and water holding capacity, thereby delaying and often reducing the peak stormwater run-off flow rate, and decreasing irrigation water requirements. Amending soils will also enhance the lawn's long-term aesthetics while reducing fertilizer and pesticide requirements.



3.31 Compost Amended Soil

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
ANNUAL	General Facility Requirements					Soil media (maintain high organic soil content	Vegetation not fully covering ground surface.	Re-mulch landscape beds with 2-3 inches of mulch until the vegetation fully closes over the ground surface
Ongoing	General Facility Requirements					Soil media (maintain high organic soil content	None. Preventative maintenance	Return leaf fall and shredded woody materials from the landscape to the site as mulch.
Ongoing	General Facility Requirements					Soil media (maintain high organic soil content	None. Preventative maintenance	On turf areas, "grasscycle" (mulch-mow or leave the clippings) to build turf health
Ongoing	General Facility Requirements					Soil media (maintain high organic soil content	None. Preventative maintenance .	Avoiding broadcast use of pesticides (bug and weed killers) like "weed & feed," which damage the soil life.
ANNUAL	General Facility Requirements					Soil media (maintain high organic soil content	None. Preventative maintenance	Where fertilization is needed (mainly turf and annual flower beds), a moderate fertilization program which relies on natural organic fertilizers (like compost) or slow release synthetic balanced fertilizers.
ANNUAL	General Facility Requirements					Compaction	Soils become waterlogged, do not appear to be infiltrating.	To remediate, aerate soil, till or further amend soil. If drainage is still slow, consider investigating alternative causes (e.g., high wet-season groundwater levels, low permeability soils). Also consider landuse and protection from compacting activities. If areas are turf, aerate compacted areas and top dress them with ¼-½ inch of compost to renovate them.
ANNUAL	General Facility Requirements					Erosion/scouring	Areas of potential erosion are visible.	Take steps to repair or prevent erosion. Identify and address the causes of erosion.
ANNUAL	General Facility Requirements					Grass/vegetation	Less than 75% of planted vegetation is healthy with a generally good appearance.	Take appropriate maintenance actions (e.g., remove/replace plants)

MONTHLY	General Facility Requirements					Noxious weeds	Listed noxious vegetation is present. See Pierce County noxious weed list.	By law, noxious weeds must be removed and disposed immediately. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality.
QUARTERLY	General Facility Requirements					Weeds	Weeds are present.	Remove and dispose of weed material. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality.

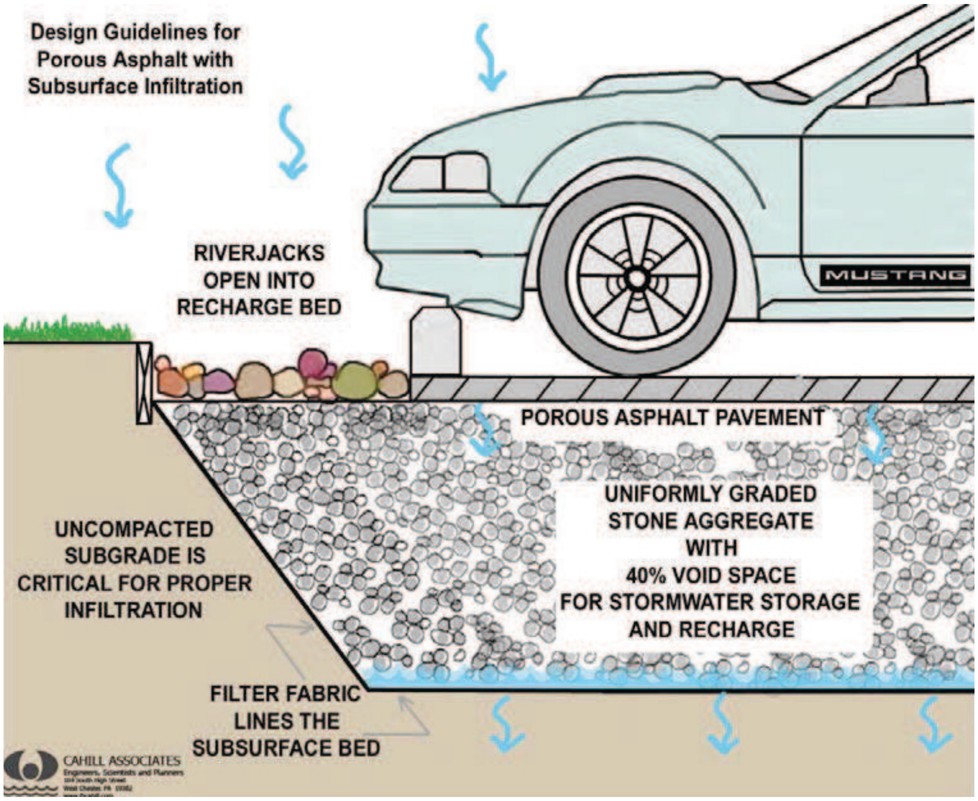
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

<u>Key</u>:
(MONTHLY) Monthly from November through April.
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).
(Biannually) Twice per year in the spring and fall
(Quarterly) 4 times per year

3.32 Pervious Pavement

Pervious paving allows water to infiltrate into layers of gravel placed below the paving and then into soil and groundwater below. By infiltrating most of the storm water on-site, the amount of water and pollution flowing into storm sewers and directly to rivers and streams is greatly reduced. This, in turn, protects water quality, maintains more stable base flows to streams, reduces flood peaks, and reduces stream bank erosion. With infiltration, groundwater is recharged and streams are replenished with cool, clean groundwater in a more natural way. Pervious paving is one component of Low Impact Development (LID).



3.32 Pervious Pavement

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
BIANNUAL	Surface					Pervious asphalt or cement concrete	None. Maintenance to prevent clogging with fine sediment.	Use conventional street sweepers equipped with vacuums, water, and brushes or pressure washer to restore permeability. Vacuum or pressure wash the pavement two to three times annually.
Ongoing	Surface					Pervious asphalt or cement concrete	None. Maintenance to prevent clogging with fine sediment.	Prohibit use of sand and sealant application and protect from construction runoff.
ANNUAL	Surface					Pervious asphalt or cement concrete	Major cracks or trip hazards.	Fill with patching mixes. Large cracks and settlement may require cutting and replacing the pavement section.
As needed	Surface					Pervious asphalt or cement concrete	Utility cuts. .	See utility restoration protocol on SPU NDS website.
BIANNUAL	Surface					Fallen leaves / debris	Fallen leaves or debris.	Remove/dispose.
BIANNUAL	Surface					Interlocking concrete paver blocks .	Interlocking paving block missing or damaged.	Replace damaged paver block .
ANNUAL	Surface					Interlocking concrete paver blocks	Settlement of surface. .	May require resetting
BIANNUAL	Surface					Interlocking concrete paver blocks	Sediment or debris accumulation between paver blocks.	Remove/dispose
ANNUAL	Surface					Interlocking concrete paver blocks	Loss of void material between paver blocks.	Refill per manufacturer's recommendations.
Varies	Surface					Interlocking concrete paver blocks	Varied conditions.	Perform O&M per manufacturer's recommendations.
BIANNUAL	Surface					Open-celled paving grid with gravel	Sediment or debris accumulation in grid voids.	Remove/dispose
ANNUAL	Surface					Open-celled paving grid with gravel	Loss of soil and/or grass material in grid.	Refill and/or replant per manufacturer's recommendations.

Varies	Surface					Open-celled paving grid with gravel	Varied conditions.	Perform O&M per manufacturer’s recommendations.
BIANNUAL	Surface					Open-celled paving grid with grass	Sediment or debris accumulation in grid voids.	Remove/dispose
ANNUAL	Surface					Open-celled paving grid with grass	Loss of soil and/or grass material in grid.	Refill and/or replant per manufacturer’s recommendations.
Varies	Surface					Open-celled paving grid with grass	Varied conditions.	Perform O&M per manufacturer’s recommendations.
BIANNUAL	Overflows and Emergency Spillways					Obstructions / debris	Obstructions or debris block 30% or more of outlet structure.	Remove/dispose
BIANNUAL	Overflows and Emergency Spillways					Erosion	Native soil is exposed or other signs of erosion damage are present.	Repair erosion and stabilize surface of spillway
Ongoing	Spill Prevention and Response					Spill prevention	Storage or use of potential contaminants in the vicinity of facility.	Exercise spill prevention measures whenever handling or storing potential contaminants
As needed	Spill Prevention and Response					Spill response	Release of pollutants. Call to report any spill to the the Wa Dept of Emergency Management 1-800-258-5990	Cleanup spills as soon as possible to prevent contamination of stormwater

If you are unsure whether a problem exists, please contact a Professional Engineer

Comments:

Key:
(MONTHLY) Monthly from November through April.
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5.0 Developing a Maintenance Program

A stormwater maintenance program is essential to ensure that the facilities continue to function as designed to prevent possible flooding, property damage, water quality problems and expensive future repairs. The maintenance program consists of inspections and repairs as detailed in the maintenance checklists provided in Section 3.0.

Stormwater management facilities are most effective coupled with good housekeeping procedures. Good housekeeping includes educating facility users of proper storage and disposal of chemicals and potential pollutants, procedures for spill cleanup, proper use of fertilizers and other lawn care products, and maintenance of equipment to prevent release of pollutants to the stormwater system. Guidelines for establishing good housekeeping procedures (I.E. Source Control BMPs) and developing a training program to educate facility users can be found in the Pierce County Surface Water Management Webpage at Stormwater Pollution Prevention Manual located at:

http://www.co.pierce.wa.us/swm

5.1 Who Should Perform Maintenance Duties?

Private stormwater facility owners are responsible for ensuring that the facilities are maintained and continue to function as designed. Some activities such as litter removal and mowing can be effectively undertaken by facility owners, however, it is usually worth the cost to have a professional do the more difficult tasks. Filling eroded areas and soil disturbing activities, such as reseeding or re-planting vegetation are tasks that a professional landscaping firm should manage. If these tasks are not performed properly, erosion may occur resulting in accelerated sedimentation of stormwater facilities. Grading and sediment removal are tasks that are best left to professional contractors with the equipment and experience to safely perform the task and who are also able to identify potential problems early when it is most cost effective to make repairs or alterations.

5.2 Working with Maintenance Contractors

The following is a guideline for researching and choosing a qualified contractor to meet your maintenance needs.

Start your search for a contractor the right way - be informed. The information provided below will help you in your search for the right contractor for your job.

- Landscape maintenance contractors are typically capable of providing most routine maintenance for stormwater facilities. Special, non-routine maintenance may require an earthwork contractor or vactor company. Recently, several contractors have started specializing in stormwater facility maintenance. Private owners can choose to hire contractors when individual maintenance needs arise or enter into annual maintenance agreements where the contractor monitors and provides routine maintenance throughout the year as needed.

- Develop a list of potential contractors. Look in the Yellow Pages and/or ask friends, neighbors, relatives, and coworkers who they have used. Find out if their experiences were good or bad and why. Ask if they would use the contractor again.

- Ask contractors for references. Call your potential contractors and ask for a list of their customers or locations of completed jobs. Call references and ask whether they were satisfied with the job done, if the contractor kept to the agreed upon schedule, and whether they would hire the same contractor again.

- Ask to which trade associations the contractor belongs. Membership in a professional association is one sign the contractor recognizes the responsibilities of being a professional.

- Make sure to obtain and evaluate bids. Ask for a free written estimate of the work you want done. Be sure everyone is bidding on the same exact scope of work and including the exact materials you want. Be sure all quotes include everything you want and that there is a clear understanding of work to be performed by owner and work to be performed by contractor.

- Remember *"you get what you pay for."* A higher bid may be worth the price for better workmanship and contractor reliability.

- Make sure you understand the different types of bids you may receive. Be careful about hiring a contractor on an hourly time-and-materials, or cost-plus basis. Although the price may seem high at first, a fixed-price bid may give you the best protection and price. Also beware of "special deals," "demonstration projects," or *"a great deal from a friend of a friend."* Completely review and understand the contract prior to authorizing work.

Questions to Ask Before Hiring a Contractor

- What experience, expertise and/or certification do you have? Do you specialize?

- Who will be doing the actual work: you personally, your employees, or subcontractors?

- Who will oversee the day-to-day job? (You may really like the contractor, but that person may not be the one performing or supervising the work.)

- How many other jobs will you be working on at the same time as mine? (If there are several, yours may not get the attention you want. On the other hand, the contractor's business may be large and he may be able to handle several jobs.)

- How long will the job take? What kind of mess, noise, and inconvenience should I expect? What problems may come up? (Asking questions before the job starts helps prevent surprises later.)

- Where will you dispose of material removed from storm drainage facilities? Is there an extra fee for contaminated materials?

- Does hiring this contractor feel right? (Use intuition - if you do not feel comfortable, find someone else.)

- Do I have rapport with this contractor? Am I confident in his expertise and ideas? Does he care about my concerns? Will he be reliable, keep his appointments, and return my telephone calls?

- Can I communicate with this person? Does he seem honest and forthright? (The contractor may be top-notch at the trade, but if the final product is not what you expected, you will not be happy.)

- Am I willing to be reasonable about unexpected costs that arise and to let my contractor make a profit?

- Am I ready for the unexpected, such as digging into solid rock, major replacement, etc.?

- Can I be flexible when the job takes longer than expected?

- Are my expectations so high that I will never be satisfied with my contractor?

5.3 How much will it Cost to Maintain a Stormwater Management System?

Specific maintenance costs depend on the characteristics of the facility, the site, and the area that contributes runoff to the facility. The general rule of thumb is that annual maintenance costs will be 5 to 10% of the facility's total capital cost. Routine, scheduled maintenance can help keep overall costs down by addressing problems before they require major attention.

Most of the routine maintenance measures recommended in the checklists (excluding major repair and replacement) are estimated to have an annual cost of $200 to $600 per acre of facility, above current landscape maintenance costs. Costs can vary depending on the types and level of maintenance practices used.

The cost and intensity of maintenance activities are usually higher during the two-year plant establishment period than after the facility has "settled in" after those first two years.

You need to determine how you will finance your maintenance needs. A healthy reserve should be put into place for both capital maintenance procedures (e.g., facility replacement and non-routine maintenance such as sediment removal, facility component repair or replacement, major replanting, or safety structure construction) and operating maintenance procedures (routine activities such as facility inspection, debris removal, and vegetation management).

The best recommendation is to establish a facility maintenance fund. For homeowner associations, this could be a portion of homeowner fees or a specific assessment. The fund should include:

- Ten percent of the facility's capital cost for annual routine maintenance per year.

- A percentage of the non-routine maintenance costs per year (i.e. for sediment removal, vegetation replacement) based on the frequency of removal. For example, if the facility needs mechanical sediment removal every 10 years, 10 percent of the total cost should be put aside each year.

- An additional 3 to 5% of the facility's capital cost per year for eventual facility replacement, based on the facility's life expectancy. Most of these facilities have a life expectancy of 25 to 50 years.

6.0 Additional Information/Resources

For more information on operation and maintenance of your stormwater management system contact:

Pierce County Department of Public Works and Utilities, Surface Water Management Division, (253) 798-2725

Or refer to information provided in the following resources:

Pierce County Stormwater Pollution Prevention Manual
http://www.co.pierce.wa.us/PC/services/home/environ/water/swm/sppman/

King County Drainage Maintenance Standards for Commercial and Multifamily Drainage Facilities, 1997.
http://dnr.metrokc.gov/wlr/stormwater/DrainMaint.htm

Puget Sound Shoreline Stewardship Guide Book,
http://dnr.metrokc.gov/wlr/watersheds/puget/puget-sound-guidebook.htm

Exhibit 13 SUB18-02

Geotechnical Report

Valley View Sub-division

Camas, Washington

Prepared for:
Stan Firestone
Vancouver, Washington
30 April 2014
Updated 1 May 2018

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TABLE OF CONTENTS

1.0 PROJECT AND SITE DESCRIPTIONS

Introduction

Rapid Soil Solutions has prepared this Geotechnical Report to provide bearing capacity, roadway design values, soil parameters for earth work operations and installation of utilities for the 30 lot sub-division.

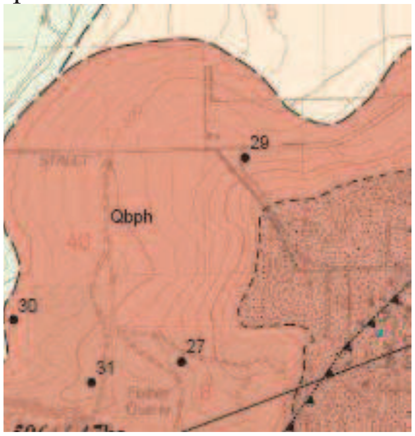
2.0 SITE CONDITIONS

2.1 Surface Conditions

The property is located in the Clark County Washington, accessed off of SE 40th Street. The site was cleared in past. The site was covered with tall grasses and weeds. See below site photo.

2.2 Regional Geology

The Camas Quadrangle developed in 2008 by Evarts and O'Connor maps the site as boring volcanic rock. However, the rock is far below the site and the site is cover with fine grained flood deposits.



2.3 Field Exploration and Subsurface Conditions

2.3.1 Field Explorations

Four (4) hand augur holes were excavated. The location of the augur holes are shown on Figure 2 in Appendix A. A registered professional engineer performed the excavation and logged the subsurface materials. Hand augur logs detailing materials encountered is in Appendix B. The logs were created using the Unified Soil Classification and Visual Manual Procedure (ASTM-D 2488).

2.3.1 Subsurface Conditions

The soil conditions were fine grained stiff damp sandy SILT. The soil conditions in all augur holes were consistent with each other and local geology map. Moistures ranged from 23.1 % to 28%.

2.3.2 Groundwater

No ground water was found during the explorations.

3.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

3.1 Foundation Design

The building foundations may be installed on either engineered fill or firm native sub-grade that is found at a depth of about 0.5 feet. This depth may be locally variable and should be confirmed by a geotechnical engineer or their representative at the time of construction.

Continuous wall and isolated spread footings should be at least 16 and 24 inches wide, respectively. The bottom of exterior footings should be at least 16 inches below the lowest adjacent exterior grade. The bottom of interior footings should be at least 12 inches below the base of the floor slab.

Footings placed on engineered fill or firm native sub-grade should be designed for an allowable bearing capacity of 2,000 *pounds per square foot* (**psf**) by IBC 2012/2015 code. The recommended allowable bearing pressure can be doubled for short-term loads such as those resulting from wind or seismic forces.

Based on our analysis the total post-construction settlement is calculated to be less than 1 inch, with differential settlement of less than 0.5 inch over a 50-foot span for maximum column, perimeter footing loads of less than 100 kips and 6.0 kips per linear foot.

Lateral loads on footings can be resisted by passive earth pressure on the sides of the structures and by friction at the base of the footings. An allowable lateral bearing pressure of 150 *pounds per cubic foot* (**psf/f**) below grade may be used. Adjacent floor slabs, pavements or the upper 12-inch depth of adjacent, unpaved areas should not be considered when calculating passive resistance. An angle of internal friction of 30 degrees can be used.

If construction is undertaken during periods of rain, then I recommend a 2-inch (or greater) layer of compacted, crushed rock be placed over the native soil. The silty soil is moisture sensitive. Meaning when dry it is firm and non-yielding but exposed to season rains it will lose its strength and need to be excavated and replaced with rock. See section 4.1.2 for wet weather conditions.

3.2 Retaining Walls

The retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls; (2) the walls are less than 8 feet in height; (3) the backfill is drained; and (4) the backfill has a slope flatter than 4H: 1V. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project varies from these assumptions.

Unrestrained site walls that retain native soils should be designed to resist an active equivalent fluid unit weight of 35 pcf where supporting slopes are flatter than 4H: 1V. If retaining walls are restrained from rotation prior to being backfilled, the active equivalent fluid unit weight shall be increased to 50 pcf. For embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $5H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied at 0.6H from the base of the wall. If other surcharges (e.g., slopes steeper than 4H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, then additional pressures will need to be accounted for in the wall design. Our office should be contacted for appropriate wall surcharges based upon the actual magnitude and configuration of the applied loads.

The wall footings should be designed in accordance with the guidelines provided in the “Foundation Design” section of this report.

These design parameters have been provided assuming that back-of-wall drains will be installed to prevent buildup of hydrostatic pressures behind all walls.

The backfill material placed behind the walls and extending a horizontal distance equal to at least half of the height of the retaining wall should consist of granular retaining wall backfill as specified in the “Structural Fill” section of this report.

The wall backfill should be compacted to a minimum of 92 percent of the maximum dry density, as determined by ASTM D1557. However, backfill located within a horizontal distance of 3 feet from the retaining walls should only be compacted to approximately 90 percent of the maximum dry density, as determined by ASTM D1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (e.g., jumping jack or vibratory plate compactors). If flat work (e.g., sidewalks or pavements) will be placed atop the wall backfill, we recommend that the upper

2 feet of material be compacted to 92 percent of the maximum dry density, as determined by ASTM D1557.

A minimum 12-inch-wide zone of drain rock, extending from the base of the wall to within 6 inches of finished grade, should be placed against the back of all retaining walls. Perforated collector pipes should be embedded at the base of the drain rock. The drain rock should meet the requirements provided in the "Structural Fill" section of this report. The perforated collector pipes should discharge at an appropriate location away from the base of the wall. The discharge pipe(s) should not be tied directly into storm water drain systems, unless measures are taken to prevent backflow into the wall's drainage system.

Settlements of up to 1 percent of the wall height commonly occur immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend that construction of flat work adjacent to retaining walls be postponed at least 4 weeks after backfilling of the wall, unless survey data indicates that settlement is complete prior to that time.

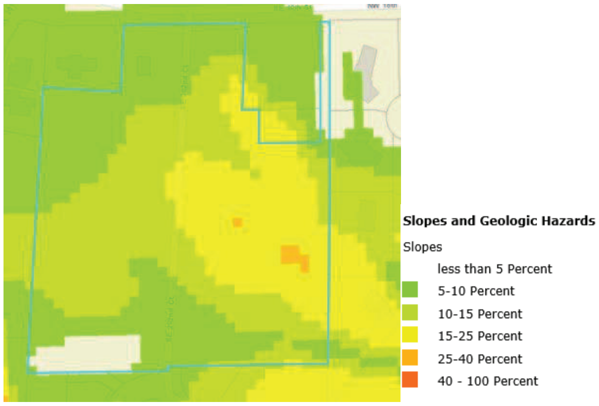
3.3 Seismic Design Criteria

The seismic design criteria for this project USGS Earthquake Hazards Program. A summary of IBC 2012/2015 seismic design criterion below: using a Lat of 45.5909 and Long of -122.4650, site class D.

	Short Period	**1 Second**
Maximum Credible Earthquake Spectral Acceleration	Ss = 0.94	S1 = 0.38
Adjusted Spectral Acceleration	Sms = 1.05	Sm1 = 0.38
Design Spectral Response Acceleration Perimeters	Sds = 0.70	Sd1= 0.42

3.4 Hazards

Slopes: The field reconnaissance on 27 March 2014 showed the steepest slopes are located in the southern end of the property. Here the slopes vary from less than 5% to 25% in the SE corner of the lot. See below figure from Clark County GIS mapping of the site.



Liquefaction: From the Liquefaction Susceptibility Map of Clark County, Washington

2004. The site has very little susceptibility.

Landslide Hazards
RSS site reconnaissance on 27 March 2014 found no signs of land slide hazards. Site is covered with black berries, grasses. See site photo’s of the slopes. Figure 3 shows the mapped landslides in Clark County as well as slope stability map of the Vancouver area. As well as IMS -43, this uses LIDAR to map landslides. LIDAR is a bare earth photo that shows landside and slow moving slopes as the lines on the map become fuzzy when the ground is moving. *There are no mapped slides on the project site. Figure 3 also lists the site has having little to no issues with liquefaction.*

From field reconnaissance RSS reviewed all the steep slopes surrounding the project site. There are no signs of slope instability, any sages, slumps or fan of debris from slides on the slopes in the SW corner of the property. There also no surface water features on the property. No seeps springs or other surface expressions of ground water were found when RSS was on site on 3/27/14.

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 Site Preparation

Demolition should include removal of existing improvements throughout the project site. Underground utility lines, vaults, basement walls or tanks should be removed or grouted full if left in place. I recommend that soil disturbed during grubbing operations be removed to firm, undisturbed sub-grade. The excavations should then be backfilled with compacted structural fill. On this site only disturb the area in which can be covered with rock during the day. The moisture sensitive SILT soil when exposed to wet weather becomes soft and yielding. See wet weather conditions below.

4.1.1 Proof Rolling

Following stripping and prior to placing aggregate base course, pavement the exposed sub-grade should be evaluated by proof rolling. The sub-grade should be proof rolled to identify soft, loose, or unsuitable areas. Please give 24 hour notice to observe the proof rolling. Soft or loose zones identified during the field evaluation should be compacted to an unyielding condition or be excavated and replaced with structural fill, as discussed in the *Structural Fill* section of this report.

4.1.2 Wet Weather Conditions

The near-surface soils will be difficult during or after extended wet periods or when the moisture content of the surface soil is more than a few percentage points above optimum. Soils that have been disturbed during site preparation activities, or soft or loose zones identified during probing or proof rolling, should be removed and replaced with compacted structural fill. Track-mounted excavating equipment will be required during wet weather. The imported granular material should be placed in one lift over the prepared, undisturbed sub-grade and compacted using a smooth drum, non-vibratory roller. Additionally, a geo-textile fabric should be placed as a barrier between the sub-grade and imported granular material in areas of repeated traffic.

4.2 Excavation

Subsurface conditions of accessible cleared areas of the project site show predominately sands, silty soil to the depth explored (4.0 feet). Excavations in the upper soils may be readily accomplished with conventional earthwork equipment with smooth and teeth faced bucket.

4.3 Structural Fills

Fills should be placed over sub-grade prepared in compliance with Section 4.1 of this report. Material used, as structural fill should be free of organic matter or other unsuitable materials and should meet specifications provided in WSDOT, depending upon the application. A discussion of these materials is in the following sections.

4.3.1 Native Soils

Native soil can be used for filling operations to raise the site grades for flat backyards. Compaction testing of native soils shall use a standard ASTM D698 proctor and achieve 95%. See lab results in appendix b. Compaction testing is required as per WSDOT every 18in of fill material. Native soils can only be used if they are within optimum moisture content.

4.3.2 Imported Granular Fill

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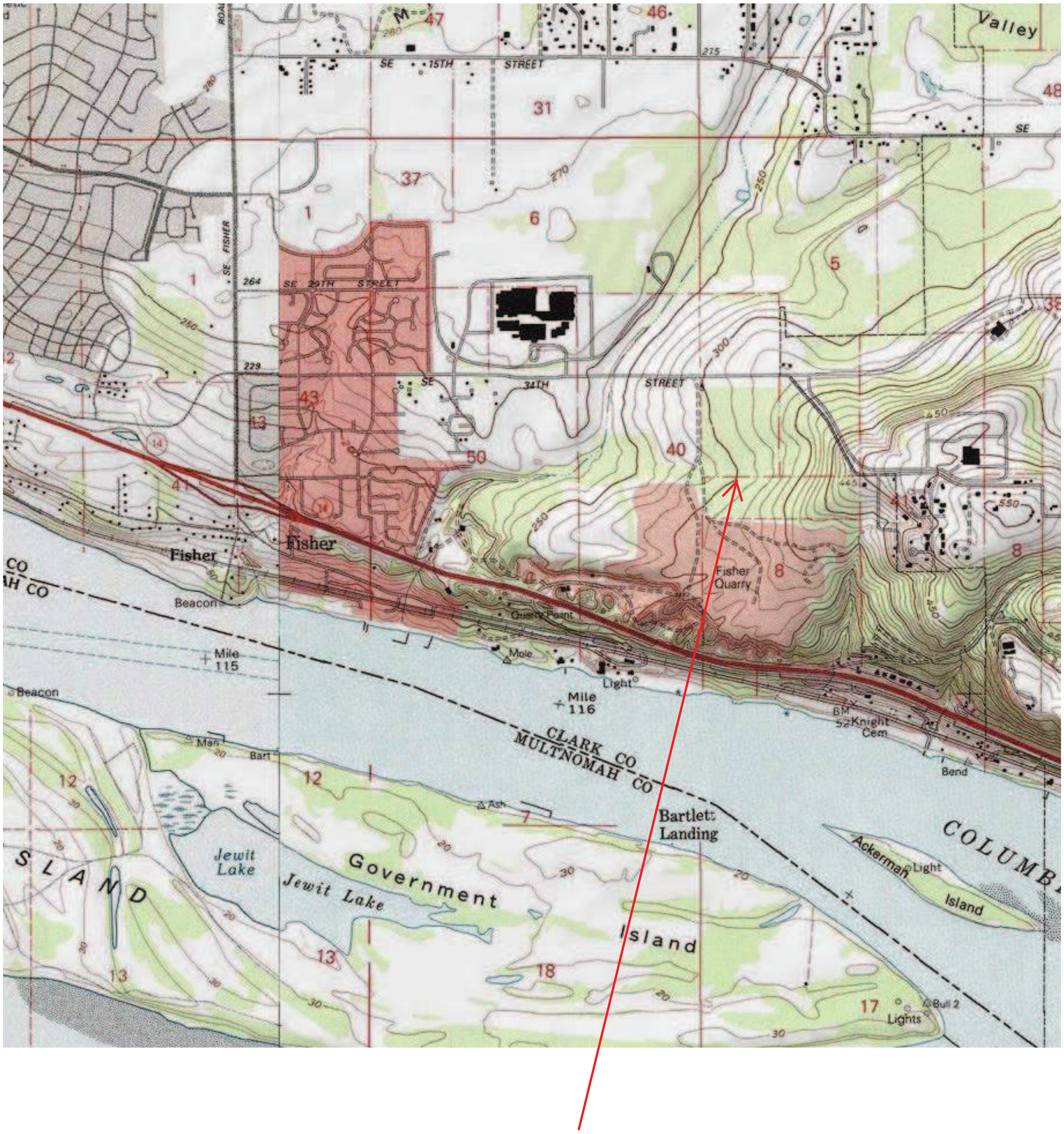


Figure 1 – Site locations

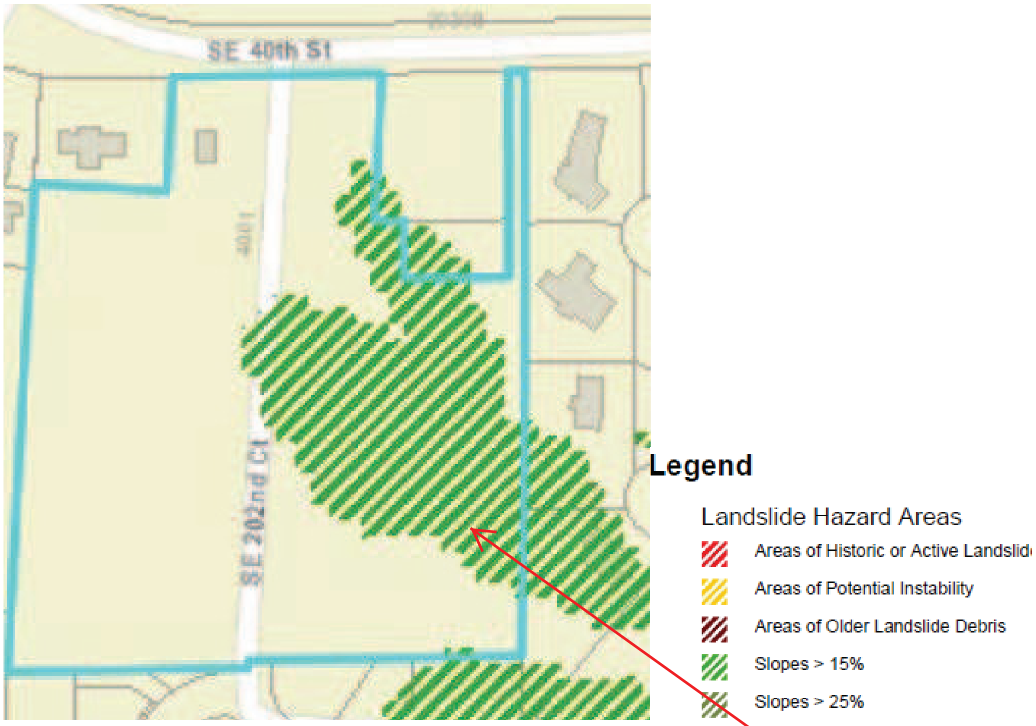
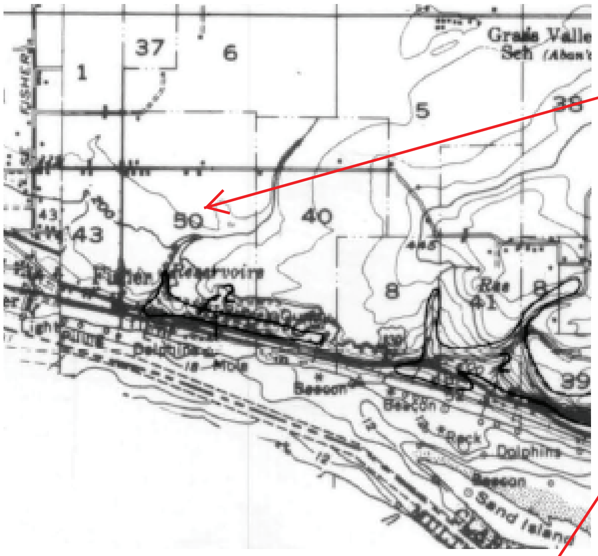
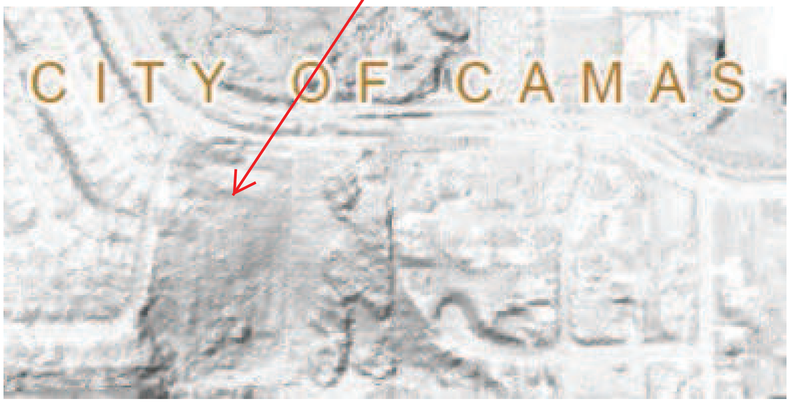


Figure 3 – Landslide hazards

Project site is clear of landslide hazards



SLOPE STABILITY
CLARK COUNTY WASHINGTON
ALLEN FIKSDAL
1975



IMS-43

APPENDIX B

ASPHALT CONCRETE SOILS TESTING, INC
503.443.3799

7409 SW Tech Center Dr, #145
Tigard, OR 97223
phn: 503-443-3799
fax: 503-620-2748

RAPID SOIL SOLUTIONS
3915 SW PLUM STREET
PORTLAND, OR 97219-6018

PROJECT: RSS 2014 LAB SERVICES
LOCATION: VALLEY VIEW ESTATES
SAMPLE SOURCE: SEE BELOW

JOB NO: 14-4790
WORK ORDER NO: N/A
DATE SAMPLED: 4/18/14

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

PERCENT PASSING BY WEIGHT

				Silt or Clay	SAND								GRAVEL									COBBLES	
					Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #
HA1@2'		27	3																				7267
HA2@ 4'		28	9																				7267

BORING	DEPTH	MC%
HA1@2'		25.9
HA2 @ 4'		28.0
HA3@ 4'		23.1
HA4@ 4'		24.9

REVIEWED BY DE/js

#1

Surface Elevation: 414
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, medium light brown, fine grained medium plastic SILT
1								
2	PI=3, LL=27	25.9					ML	End hand augur hole
3								
4								
5								
6								
7								

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Happy Valley Dental Clinic\HA 1.log Date: 4/30/2014

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

#2

Surface Elevation: 464
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, dark brown, fine grained medium plastic SILT
							ML	Damp, dark to medium brown clayey SILT trace gray
4		28					ML	End hand augur hole

0 1 2 3 4 5 6 7

LOG OF BORING

Rapid Soil Solutions

Valley View Sub-division
Stan Firestone

Plate 1

#3

Surface Elevation: 418
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, dark brown, fine grained medium plastic clayey SILT
1								
2								
3								
4	PI=9, LL=28	23.1					ML	End hand augur hole
5								
6								
7								

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Valley View\HA 3.log Date: 4/30/2014

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

#4

Surface Elevation: 448
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0								Top Soil
							ML	Damp, dark brown, fine grained medium plastic clayey SILT
1								
2								
3								
4		23.1					ML	End hand augur hole
5								
6								
7								

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Valley View\HA 3.log Date: 4/30/2014

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

Exhibit 14 SUB18-02

Geotechnical Report

Valley View Sub-division

Camas, Washington

Prepared for:
Stan Firestone
Vancouver, Washington
30 April 2014
Updated 1 May 2018
Revised 2 August 2018

MIA MAHEDY-SEXTON
42135

Rapid Soil Solutions LLC
3915 SW Plum St
Portland, OR
503-816-3689

TABLE OF CONTENTS

1.0 PROJECT AND SITE DESCRIPTIONS

Introduction

Rapid Soil Solutions has prepared this Geotechnical Report to provide bearing capacity, roadway design values, soil parameters for earth work operations and installation of utilities for the 36 lot sub-division.

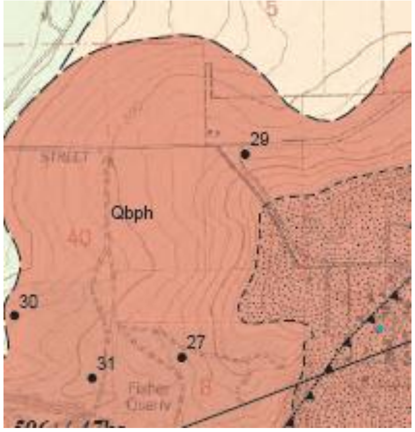
2.0 SITE CONDITIONS

2.1 Surface Conditions

The property is located in the Clark County Washington, accessed off of SE 40th Street. The site was cleared in past. The site was covered with tall grasses and weeds. See below site photo.

2.2 Regional Geology

The Camas Quadrangle developed in 2008 by Evarts and O’Connor maps the site as boring volcanic rock. However, the rock is far below the site and the site is cover with fine grained flood deposits.



2.3 Field Exploration and Subsurface Conditions

2.3.1 Field Explorations

Four (4) hand augur holes were excavated. The location of the augur holes are shown on Figure 2 in Appendix A. A registered professional engineer performed the excavation and logged the subsurface materials. Hand augur logs detailing materials encountered is in Appendix B. The logs were created using the Unified Soil Classification and Visual Manual Procedure (ASTM-D 2488).

2.3.1 Subsurface Conditions

The soil conditions were fine grained stiff damp clayey SILT. The soil conditions in all augur holes were consistent with each other and local geology map. Moistures ranged from 23.1 % to 28%.

2.3.2 Groundwater

No ground water was found during the explorations.

3.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

3.1 Foundation Design

The building foundations may be installed on either engineered fill or firm native sub-grade that is found at a depth of about 0.5 feet. This depth may be locally variable and should be confirmed by a geotechnical engineer or their representative at the time of construction.

Continuous wall and isolated spread footings should be at least 16 and 24 inches wide, respectively. The bottom of exterior footings should be at least 16 inches below the lowest adjacent exterior grade. The bottom of interior footings should be at least 12 inches below the base of the floor slab.

Footings placed on engineered fill or firm native sub-grade should be designed for an allowable bearing capacity of 2,000 *pounds per square foot* (**psf**) by IBC 2012/2015 code. The recommended allowable bearing pressure can be increased by 1/3 for short-term loads such as those resulting from wind or seismic forces.

Based on our analysis the total post-construction settlement is calculated to be less than 1 inch, with differential settlement of less than 0.5 inch over a 50-foot span for maximum column, perimeter footing loads of less than 100 kips and 6.0 kips per linear foot. Lateral loads on footings can be resisted by passive earth pressure on the sides of the structures and by friction at the base of the footings. An allowable lateral bearing pressure of 150 *pounds per cubic foot* (**psf/f**) below grade may be used. Adjacent floor slabs, pavements or the upper 12-inch depth of adjacent, unpaved areas should not be considered when calculating passive resistance. If construction is undertaken during periods of rain, then I recommend a 2-inch (or greater) layer of compacted, crushed rock be placed over the native soil. The silty soil is moisture sensitive. Meaning when dry it is firm and non-yielding but exposed to season rains it will lose its strength and need to be excavated and replaced with rock. See section 4.1.2 for wet weather conditions.

3.2 Retaining Walls

The retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls; (2) the walls are less than 8 feet in height; (3) the backfill is drained; and (4) the backfill has a slope flatter than 4H: 1V. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project varies from these assumptions.

Unrestrained site walls that retain native soils should be designed to resist an active equivalent fluid unit weight of 35 pcf where supporting slopes are flatter than 4H: 1V. If retaining walls are restrained from rotation prior to being backfilled, the active equivalent fluid unit weight shall be increased to 50 pcf. For embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $5H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied at 0.6H from the base of the wall. If other surcharges (e.g., slopes steeper than 4H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, then additional pressures will need to be accounted for in the wall design. Our office should be contacted for appropriate wall surcharges based upon the actual magnitude and configuration of the applied loads.

The wall footings should be designed in accordance with the guidelines provided in the “Foundation Design” section of this report. These design parameters have been provided assuming that back-of-wall drains will be installed to prevent buildup of hydrostatic pressures behind all walls.

The backfill material placed behind the walls and extending a horizontal distance equal to at least half of the height of the retaining wall should consist of granular retaining wall backfill as specified in the “Structural Fill” section of this report.

The wall backfill should be compacted to a minimum of 92 percent of the maximum dry density, as determined by ASTM D1557. However, backfill located within a horizontal distance of 3 feet from the retaining walls should only be compacted to approximately 90 percent of the maximum dry density, as determined by ASTM D1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (e.g., jumping jack or vibratory plate compactors). If flat work (e.g., sidewalks or pavements) will be placed atop the wall backfill, we recommend that the upper 2 feet of material be compacted to 92 percent of the maximum dry density, as determined by ASTM D1557.

A minimum 12-inch-wide zone of drain rock, extending from the base of the wall to within 6 inches of finished grade, should be placed against the back of all retaining walls. Perforated collector pipes should be embedded at the base of the drain rock. The drain rock should meet the requirements provided in the "Structural Fill" section of this report. The perforated collector pipes should discharge at an appropriate location away from the base of the wall. The discharge pipe(s) should not be tied directly into storm water drain systems, unless measures are taken to prevent backflow into the wall's drainage system.

Settlements of up to 1 percent of the wall height commonly occur immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend that construction of flat work adjacent to retaining walls be postponed at least 4 weeks after backfilling of the wall, unless survey data indicates that settlement is complete prior to that time.

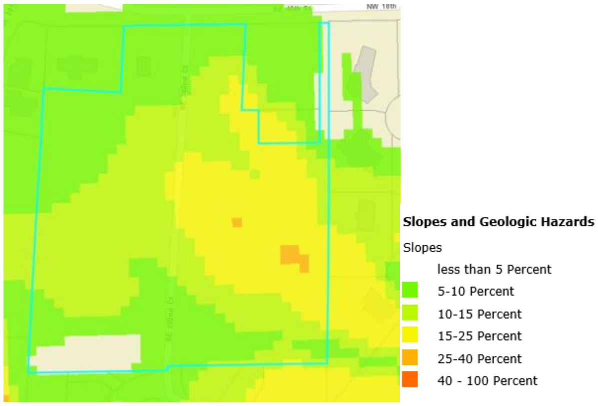
3.3 Seismic Design Criteria

The seismic design criteria for this project USGS Earthquake Hazards Program. A summary of IBC 2012/2015 seismic design criterion below: using a Lat of 45.5909 and Long of -122.4650, site class D.

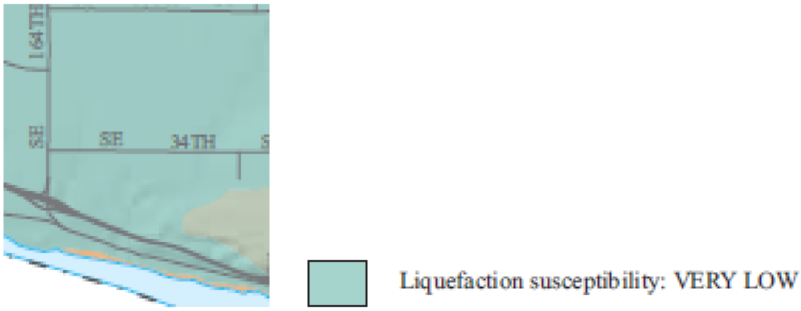
	Short Period	**1 Second**
Maximum Credible Earthquake Spectral Acceleration	Ss = 0.94	S1 = 0.38
Adjusted Spectral Acceleration	Sms = 1.05	Sm1 = 0.38
Design Spectral Response Acceleration Perimeters	Sds = 0.70	Sd1= 0.42

3.4 Hazards

Slopes: The field reconnaissance on 27 March 2014 showed the steepest slopes are located in the southern end of the property. Here the slopes vary from less than 5% to 25% in the SE corner of the lot. See below figure from Clark County GIS mapping of the site.



Liquefaction: From the Liquefaction Susceptibility Map of Clark County, Washington 2004. The site has very little susceptibility.



Landslide Hazards
RSS site reconnaissance on 27 March 2014 found no signs of land slide hazards. Site is covered with black berries, grasses. See site photo's of the slopes. Figure 3 shows the mapped landslides in Clark County as well as slope stability map of the Vancouver area. As well as IMS -43, this uses LIDAR to map landslides. LIDAR is a bare earth photo that shows landside and slow moving slopes as the lines on the map become fuzzy when the ground is moving. *There are no mapped slides on the project site. Figure 3 also lists the site has having little to no issues with liquefaction.*

From field reconnaissance RSS reviewed all the steep slopes surrounding the project site. There are no signs of slope instability, any sages, slumps or fan of debris from slides on the slopes in the SW corner of the property. There also no surface water features on the property. No seeps springs or other surface expressions of ground water were found when RSS was on site on 3/27/14.

RSS finds that the development of the site will not impart any geological hazards on the site as well as the surrounding areas.

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 Site Preparation

Demolition should include removal of existing improvements throughout the project site. Underground utility lines, vaults, basement walls or tanks should be removed or grouted full if left in place. I recommend that soil disturbed during grubbing operations be removed to firm, undisturbed sub-grade. The excavations should then be backfilled with compacted structural fill. On this site only disturb the area in which can be covered with rock during the day. The moisture sensitive clayey SILT soil when exposed to wet weather becomes soft and yielding. See wet weather conditions below.

4.1.1 Proof Rolling

Following stripping and prior to placing aggregate base course, pavement the exposed sub-grade should be evaluated by proof rolling. The sub-grade should be proof rolled to identify soft, loose, or unsuitable areas. Please give 24 hour notice to observe the proof rolling. Soft or loose zones identified during the field evaluation should be compacted to an unyielding condition or be excavated and replaced with structural fill, as discussed in the *Structural Fill* section of this report.

4.1.2 Wet Weather Conditions

The near-surface soils will be difficult during or after extended wet periods or when the moisture content of the surface soil is more than a few percentage points above optimum. Soils that have been disturbed during site preparation activities, or soft or loose zones identified during probing or proof rolling, should be removed and replaced with compacted structural fill. Track-mounted excavating equipment will be required during wet weather. The imported granular material should be placed in one lift over the prepared, undisturbed sub-grade and compacted using a smooth drum, non-vibratory roller. Additionally, a geo-textile fabric should be placed as a barrier between the sub-grade and imported granular material in areas of repeated traffic.

4.2 Excavation

Subsurface conditions of accessible cleared areas of the project site show predominately clayey SILT soil to the depth explored (4.0 feet). Excavations in the upper soils may be readily accomplished with conventional earthwork equipment with smooth and teeth faced bucket. See below sections regarding grading activities shown on the 4/9 of the preliminary grading plans by Sterling Design.

4.3 Structural Fills

Fills should be placed over sub-grade prepared in compliance with Section 4.1 of this report. Material used, as structural fill should be free of organic matter or other unsuitable materials and should meet specifications provided in WSDOT, depending upon the application. A discussion of these materials is in the following sections.

4.3.1 Native Soils

Native soil can be used for filling operations to raise the site grades for flat backyards. Compaction testing of native soils shall use a standard ASTM D698 proctor and achieve 95%. See lab results in appendix b. Compaction testing is required as per WSDOT every 18in of fill material. Native soils can only be used if they are within optimum moisture content. ***Proposed stock pile of native soils is planned for NE corner of the site. Any stock piles shall have erosion control fences around them as well as covered for the wet weather if the project proceeds into the winter months.***

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RSS has reviewed the preliminary storm water plans by Sterling Design and find plans protect the water quality and don’t proposed any geological hazards to the site.

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Satisfactory pavement and earthwork performance depends on the quality of construction. Sufficient monitoring of the activities of the contractor is a key part of determining that the work is completed in accordance with the construction drawings and specifications. I recommend that a geotechnical engineer observe general excavation, stripping, fill placement, and sub-grades in addition to base. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions requires experience. Therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions changes significantly from those anticipated.

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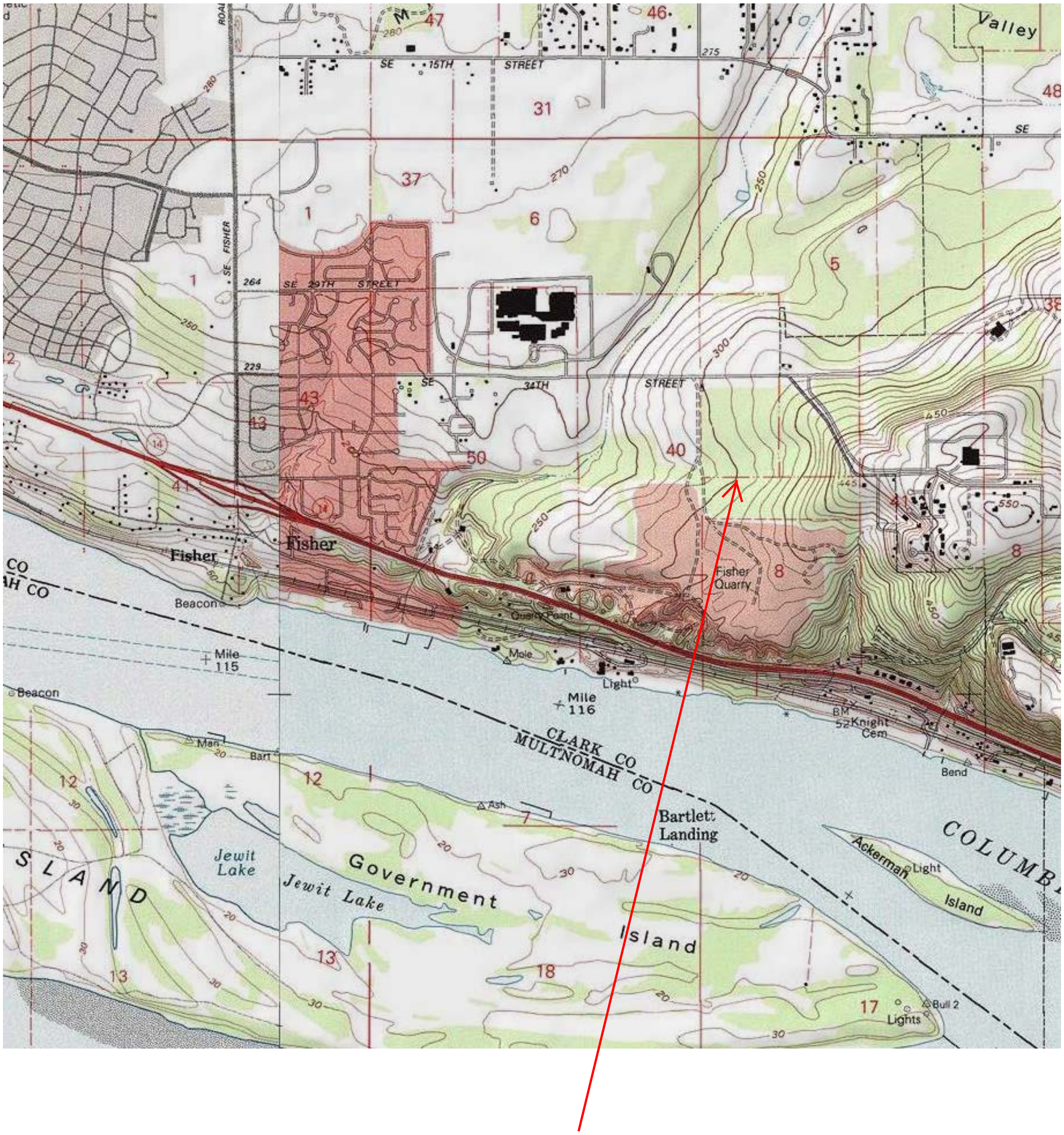

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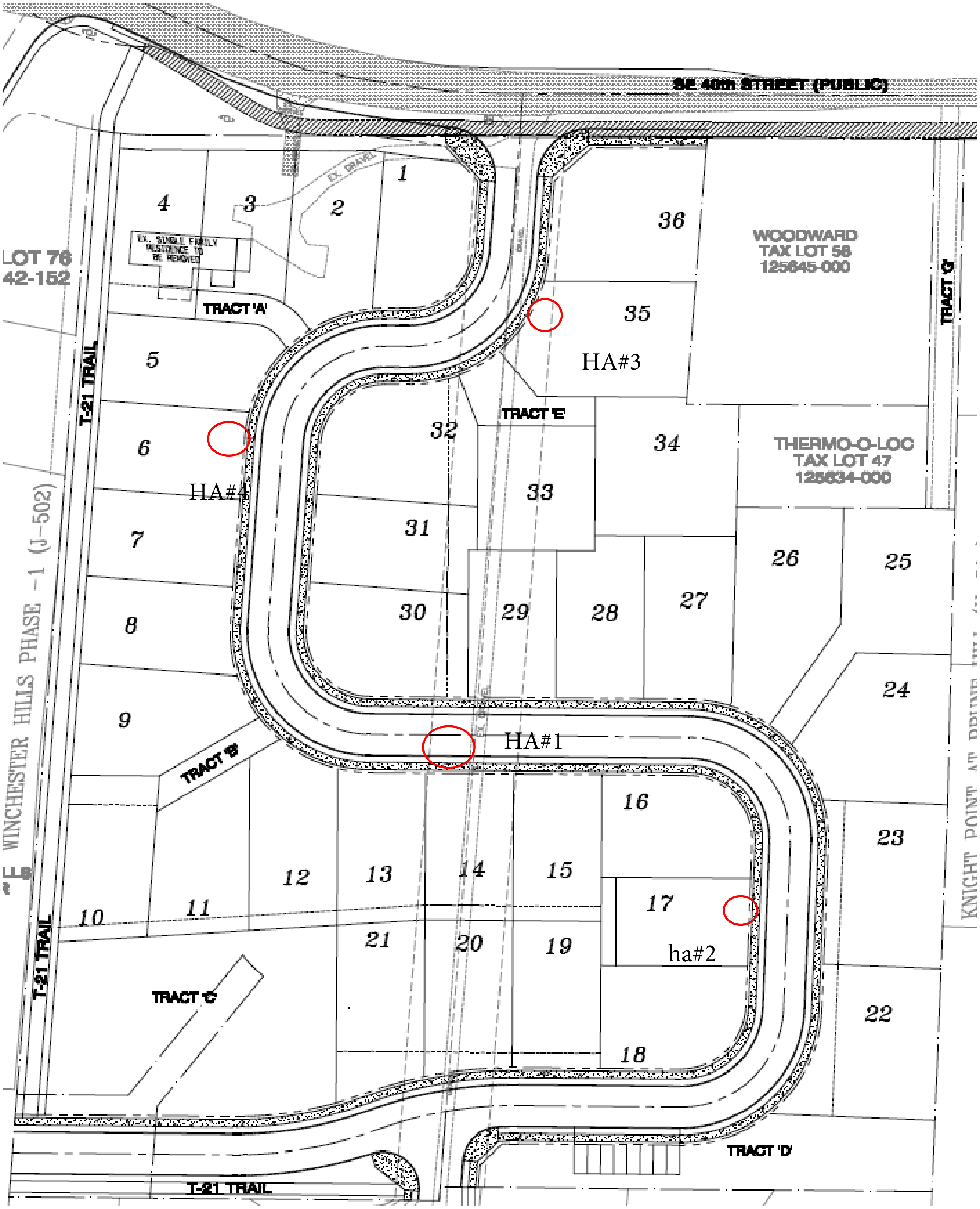
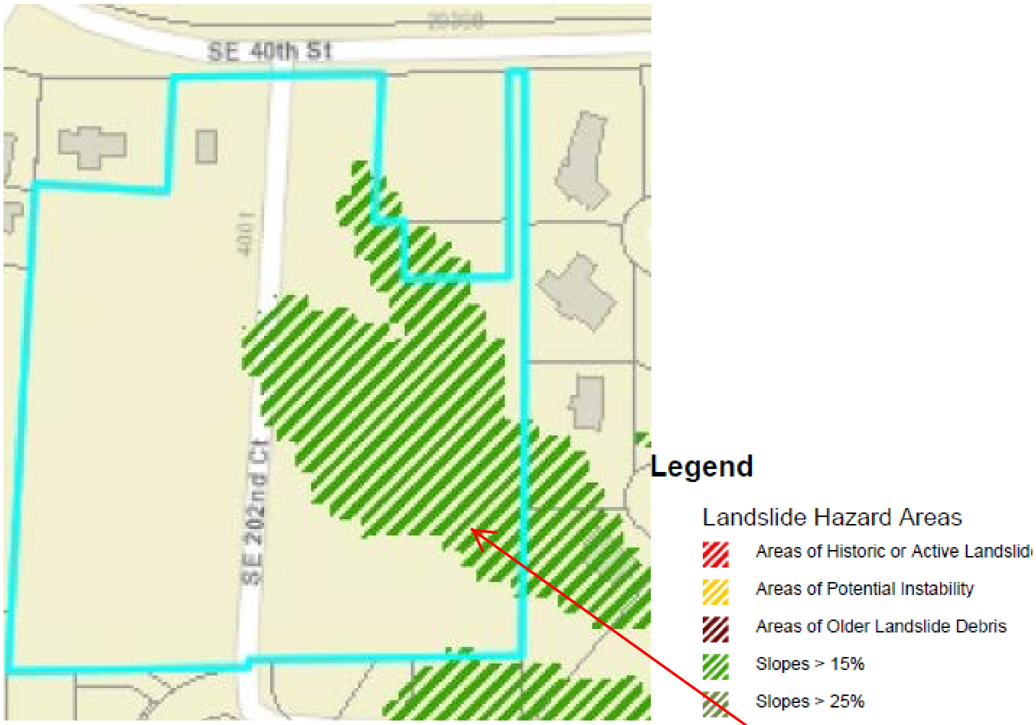


Figure 2 – site plan with testing locations



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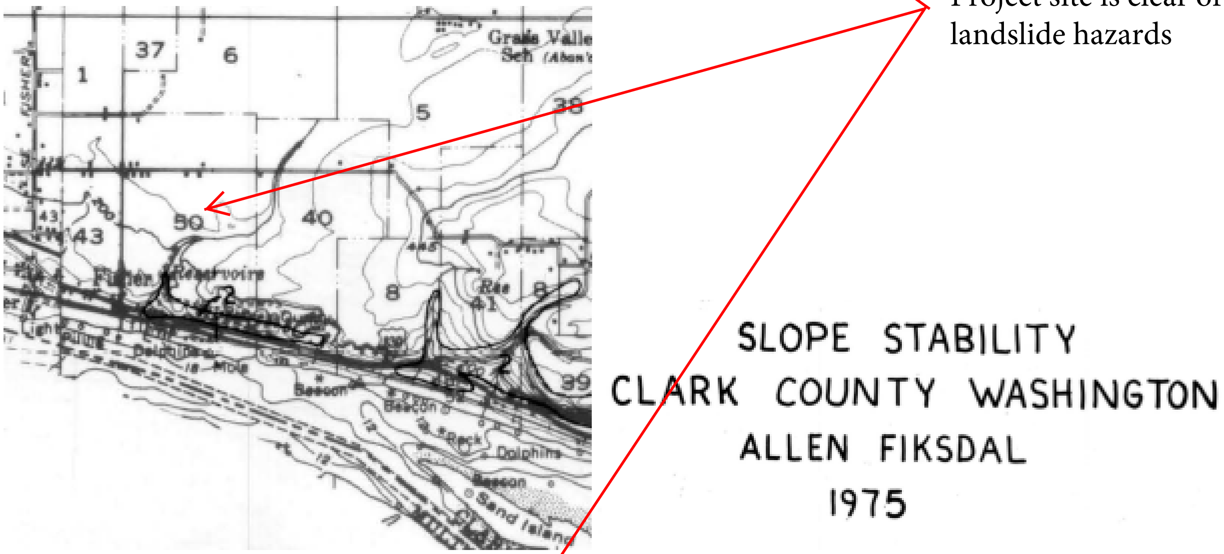

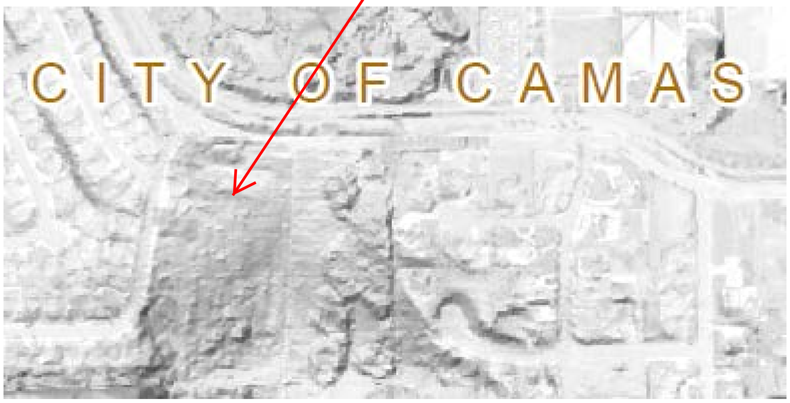

IMS-43

APPENDIX B

ASPHALT
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LOCATION: VALLEY VIEW ESTATES
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JOB NO: 14-4790
WORK ORDER NO: N/A
DATE SAMPLED: 4/18/14

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GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or Clay	SAND								GRAVEL									COBBLES	
					Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #

PERCENT PASSING BY WEIGHT

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HA2@ 4'		28	9																				7267

BORING	DEPTH	MC%
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LOG OF BORING

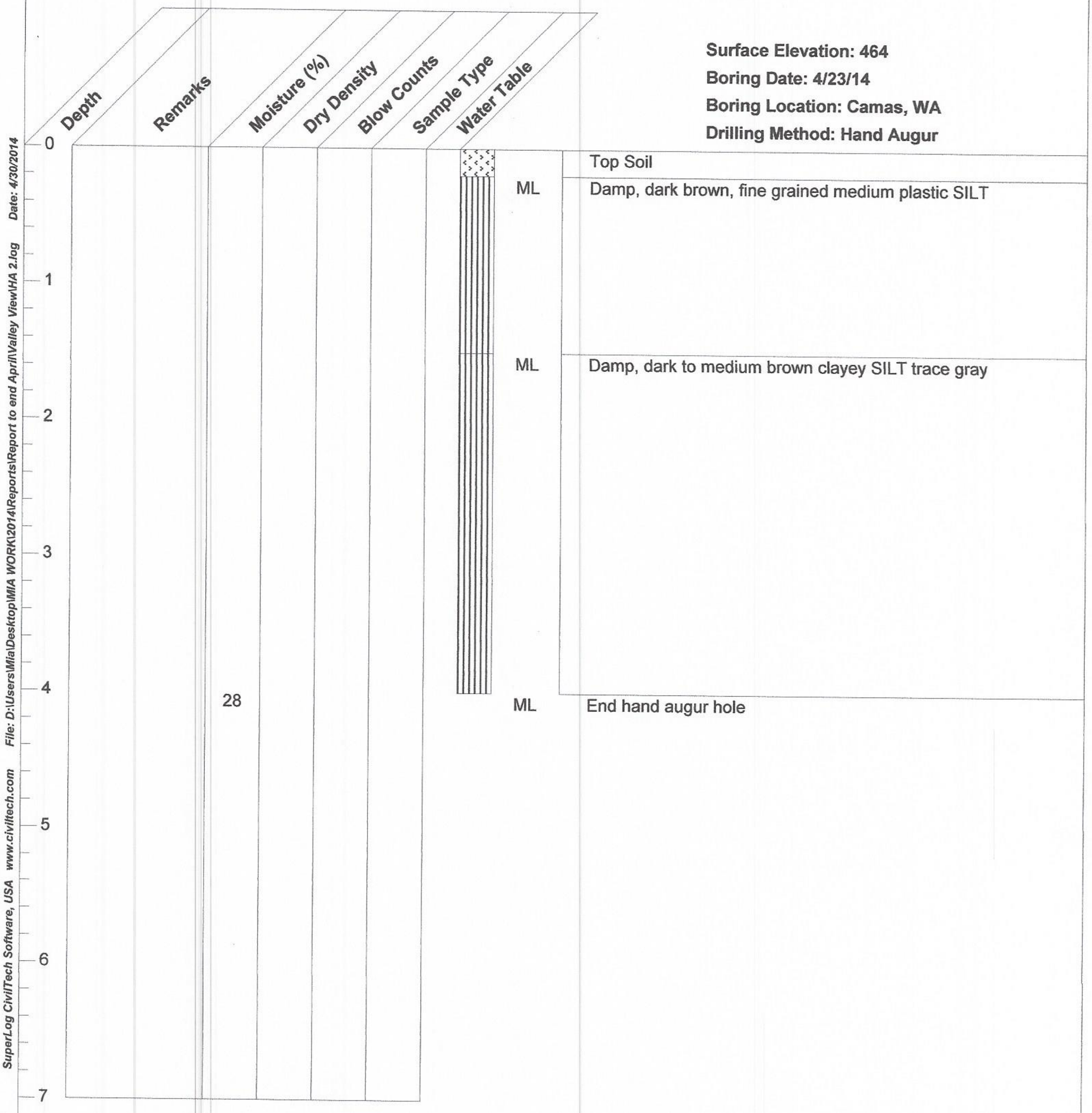
Rapid Soil Solutions

Valley View Sub-division
Stan Firestone

Plate 1

#2

Surface Elevation: 464
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur



	Top Soil
ML	Damp, dark brown, fine grained medium plastic SILT
ML	Damp, dark to medium brown clayey SILT trace gray
ML	End hand augur hole

LOG OF BORING

Rapid Soil Solutions

Valley View Sub-division
Stan Firestone

Plate 1

#3

Surface Elevation: 418
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table			
0							▨		Top Soil
							▥	ML	Damp, dark brown, fine grained medium plastic clayey SILT
1									
2									
3									
4	PI=9, LL=28	23.1						ML	End hand augur hole
5									
6									
7									

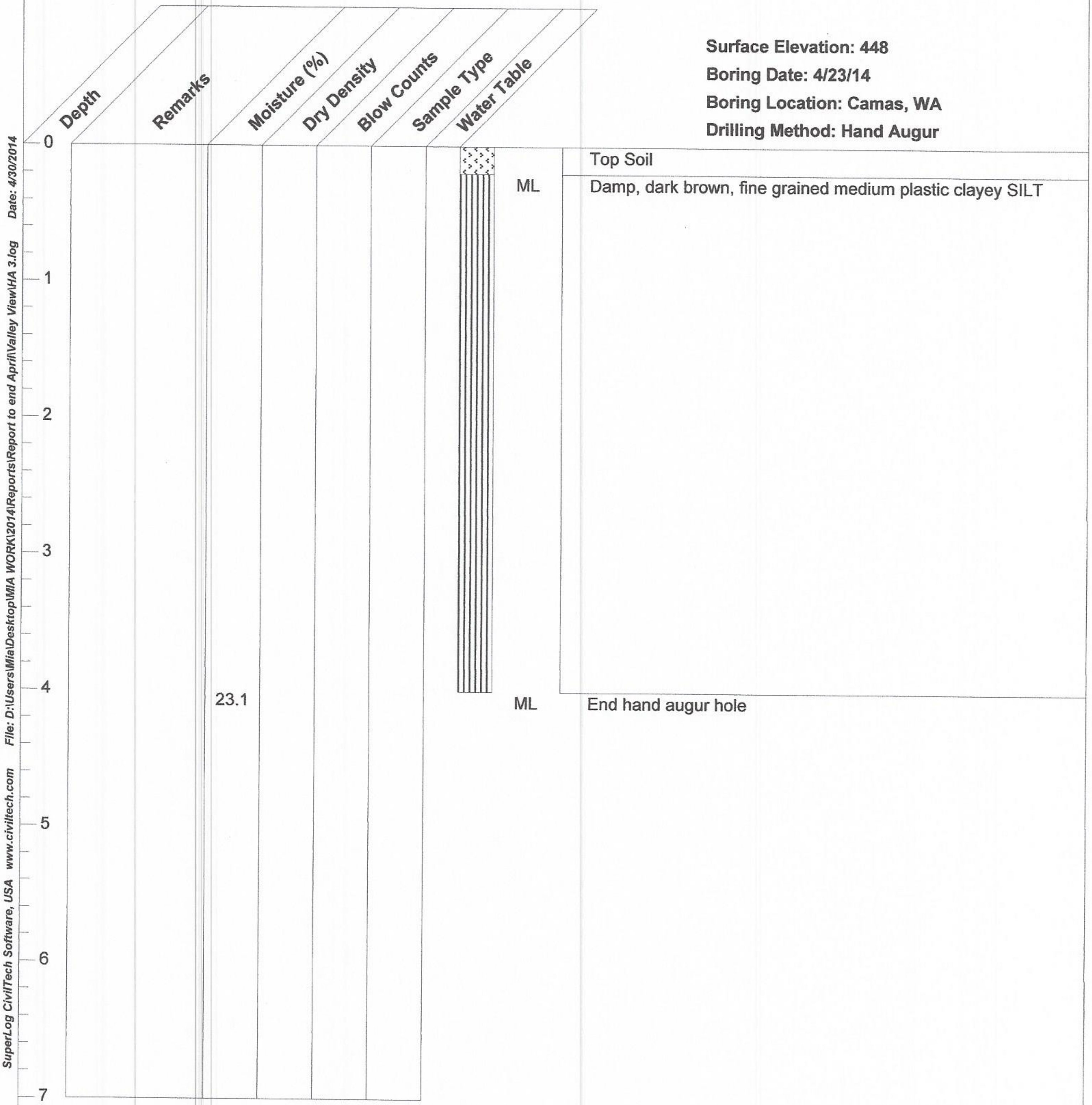
SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Valley View\HA 3.log Date: 4/30/2014

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

#4

Surface Elevation: 448
Boring Date: 4/23/14
Boring Location: Camas, WA
Drilling Method: Hand Augur



Top Soil

Damp, dark brown, fine grained medium plastic clayey SILT

End hand augur hole

SuperLog CivilTech Software, USA www.civiltech.com File: D:\Users\Mia\Desktop\MIA WORK\2014\Reports\Report to end April\Valley View\HA 3.log Date: 4/30/2014

LOG OF BORING

Rapid Soil Solutions	**Valley View Sub-division** **Stan Firestone**	**Plate 1**

Exhibit 15 SUB18-02

Earth Engineers, Inc.

2411 Southeast 8th Avenue ● Camas ● WA 98607
Phone: 360-567-1806 ● Fax: 360-253-8624
www.earth-engineers.com

July 23, 2018

City of Camas
616 Northeast 4th Avenue
Camas, Washington 98607
Attention: Lauren Hollenbeck, Senior Planner

Phone: 360-817-1568, ext. 4253
E-mail: lhollenbeck@cityofcamas.us

Subject: **Geotechnical Peer Review**
Proposed Valley View Subdivision
Tax Lot 48 and 59
20109 Southeast 40th Street, Camas, Washington
EEI Report No. 18-132-1

Dear Ms. Hollenbeck:

Per your request, **Earth Engineers, Inc. (EEI)** has completed a geotechnical review of the project referenced above.

PROJECT BACKGROUND INFORMATION

Our understanding of the project is based on the following information that has been provided to us.

- **May 1, 2018 report by Rapid Soil Solutions (RSS) titled "Geotechnical Report, Valley View Sub-division, Camas, Washington."** The report was performed for Stan Firestone. It was originally issued April 30, 2014 (we do not have a copy of that report) and the version we have is an updated report.

- **May 2018 drawing (Sheet 1 of 9, "Site Information") by Sterling Design titled "Valley View Estates, A Preliminary Subdivision within in a portion of the Ne ¼ of Sec. 8, T1N., R3E., W.M., Clark County, Washington."** This drawing shows a 36 lot subdivision development on the 9.26 acre property. There are also 8 designated tracts (A through H). Note that we have not been provided Sheets 2 through 9.

Briefly, we understand that the project consists of constructing a new residential subdivision, including streets and underground utilities on the property, which consists of 2 tax lots.

PURPOSE AND SCOPE OF SERVICES

The purpose of our geotechnical review was to assess the documents provided to us and provide a professional opinion on whether the geotechnical reports by RSS meet the geotechnical standard of care and Camas Municipal Code (CMC) Chapter 16.59.060—Critical Area Report Requirements for Geologically Hazardous Areas. It is our understanding that this site qualifies as a geologically hazardous area due to its steep slopes.

REVIEW COMMENTS

After reviewing the RRS report, we offer the following comments:

1. Section 16.59.060.C.1.b requires that the geotechnical site evaluation report include the following:

    a. Proposed structures
    b. Proposed grading
    c. Areas proposed for storage of materials
    d. Proposed storm drainage areas
    e. Related project impacts which have potential to adversely affect the geologic hazard(s) present

    It does not appear that the RSS report addresses the proposed grading, acceptable areas to store materials, and storm drainage areas. RSS should be provided the current grading and storm drainage plans and update their report accordingly.

2. RSS states the proposed project is a 30 lot subdivision. However, the drawing provided to us shows it is a 36 lot subdivision. We recommend RSS be given the opportunity to review the most current project drawings and update their report in order to make it clear that their report is for the currently proposed project.

3. The “Field Exploration and Subsurface Conditions” section of RSS’s January 23, 2018 report states that they encountered sandy silt in their hand auger borings. However, the boring logs describe the soils as silt and clayey silt. RSS should revise their report so that the soil descriptions in the text of the report and the boring logs are consistent and correct.

4. The “Foundation Design” section of the RSS report states that the allowable soil bearing pressure can be doubled for short-term loads such as those resulting from wind or seismic forces. We are familiar with a code allowance to increase the allowable soil bearing pressure by one-third, but not double. RSS should provide justification for this recommendation.

5. The “Hazards” section of the report states that they evaluated liquefaction and landslide hazards. The site was found to have very little susceptibility to liquefaction and no

mitigation recommendations were provided. The site was determined to not have risk to landslides.

6. With regard to general compliance with Camas Municipal Code (CMC) 16.59.060, it is our professional opinion that if the above listed items are satisfactorily addressed in a revised or supplemental report, then RSS will have met the intent of the code section.

Once RSS has responded to our comments, we will determine if there are any staff report conditions required from a geotechnical standpoint.

LIMITATIONS

This report has been prepared for the exclusive use of the City of Camas for the specific application to the proposed Valley View Estates Subdivision project located on tax lots 48 and 59 in Camas, Washington. EEI does not authorize the use of the advice herein nor the reliance upon the report by third parties without prior written authorization by EEI.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

We appreciate the opportunity to perform this geotechnical engineering evaluation. If you have any questions pertaining to this report, or if we may be of further service, please contact Troy Hull at 360-567-1806 (office) or 360-903-2784 (cell).

Sincerely,
Earth Engineers, Inc.

Troy Hull, P.E
Principal Geotechnical Engineer

Reviewed by:

Travis Willi

Travis Willis, P.E.
Principal Geotechnical Engineer

Exhibit 16 SUB18-02

Earth Engineers, Inc.

2411 Southeast 8th Avenue ● Camas ● WA 98607
Phone: 360-567-1806 ● Fax: 360-253-8624
www.earth-engineers.com

August 6, 2018

City of Camas
616 Northeast 4th Avenue
Camas, Washington 98607
Attention: Lauren Hollenbeck, Senior Planner

Phone: 360-817-1568, ext. 4253
E-mail: lhollenbeck@cityofcamas.us

Subject: **Geotechnical Peer Review #2**
Proposed Valley View Subdivision
Tax Lots 48 and 59
20109 Southeast 40th Street, Camas, Washington
EEI Report No. 18-132-2

Dear Ms. Hollenbeck:

Per your request, **Earth Engineers, Inc. (EEI)** has completed an updated geotechnical review of the project referenced above. EEI has previously issued a peer review report (dated July 23, 2018) for the Rapid Soil Solutions (RSS) geotechnical report dated May 1, 2018. Our previous peer review report recommended that RSS submit additional information.

PROJECT BACKGROUND INFORMATION

Our understanding of the project is based on the following information that has been provided to us.

- **May 1, 2018 report by RSS titled "Geotechnical Report, Valley View Sub-division, Camas, Washington."** The report was performed for Stan Firestone. It was originally issued April 30, 2014 (we do not have a copy of that report) and the version we have is an updated report.

- **August 2, 2018 revised report by RSS titled "Geotechnical Report, Valley View Sub-division, Camas, Washington."** This is a revision of the May 1, 2018 report referenced above that addresses the comments in our July 23 peer review report.

- **August 2, 2018 letter to Joel Sterling at Sterling Design summarizing the corrections/updates included in their August 2, 2018 geotechnical report.**

- **May 2018 drawing (Sheet 1 of 9, "Site Information") by Sterling Design titled "Valley View Estates, A Preliminary Subdivision within in a portion of the Ne ¼ of Sec. 8, T1N., R3E., W.M., Clark County, Washington."** This drawing shows a 36 lot subdivision development on the 9.26 acre property. There are also 8 designated tracts (A through H). Note that we have not been provided Sheets 2 through 9.

Briefly, we understand that the project consists of constructing a new residential subdivision, including streets and underground utilities on the property, which consists of 2 tax lots.

PURPOSE AND SCOPE OF SERVICES

The purpose of our geotechnical review was to assess the documents provided to us and provide a professional opinion on whether the geotechnical reports by RSS meet the geotechnical standard of care and Camas Municipal Code (CMC) Chapter 16.59.060—Critical Area Report Requirements for Geologically Hazardous Areas. It is our understanding that this site qualifies as a geologically hazardous area due to its steep slopes.

REVIEW COMMENTS

After reviewing the revised RSS report dated August 2, 2018, we find that the report has addressed all of our previous review comments and it also appears to comply with Camas Municipal Code (CMC) Chapter 16.59.060—Critical Area Report Requirements for Geologically Hazardous Areas. From a geotechnical standpoint, we are not recommending the City of Camas include any staff report conditions.

LIMITATIONS

This report has been prepared for the exclusive use of the City of Camas for the specific application to the proposed Valley View Estates Subdivision project located on tax lots 48 and 59 in Camas, Washington. EEI does not authorize the use of the advice herein nor the reliance upon the report by third parties without prior written authorization by EEI.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

We appreciate the opportunity to perform this geotechnical engineering evaluation. If you have any questions pertaining to this report, or if we may be of further service, please contact Troy Hull at 360-567-1806 (office) or 360-903-2784 (cell).

Sincerely,
Earth Engineers, Inc.

Troy Hull, P.E
Principal Geotechnical Engineer

Reviewed by:

Travis Willis, P.E.
Principal Geotechnical Engineer

Exhibit 17 SUB18-02

REPORT

Valley View Estates
Traffic Impact Study

March 16, 2018

H. Lee & Associates, PLLC

VALLEY VIEW ESTATES
TRAFFIC IMPACT STUDY

JEONG HANN LEE
43845

3/16/18

Prepared for:

Mr. Joel Stirling, P.E.
Sterling Design, Inc.
2208 E. Evergreen Boulevard
Vancouver, WA 98661

Prepared by:

H. Lee & Associates, PLLC
P.O. Box 1849
Vancouver, WA 98668
(360) 727-3119

March 16, 2018

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SECTION I
STUDY SUMMARY

INTRODUCTION

This traffic impact analysis has been prepared to assess transportation impacts related to the proposed Valley View Estates subdivision. The project site is located at 20109 SE 40th Street in Camas, Washington and is comprised of tax lots 125646-000 and 125635-000. Figure 1 shows the project vicinity.

Project Description

The proposed project will subdivide approximately 9.26 acres into 36 single-family detached lots. One single-family detached home exists on-site and will be demolished upon construction of the subdivision. Access to the proposed project will be from connections to SE 40th Street and NW Goodwin Street. Figure 2 shows the project site plan.

Scope of Traffic Impact Study

The scope of the traffic impact study was developed from known City of Camas traffic study requirements. From these requirements, the following intersections were analyzed:

- NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz Street
- NW Brady Road/NW 16th Avenue
- NW Brady Road/NW McIntosh Road
- SE Brady Road/SE Grand Ridge Drive
- SE 40th Street/Project Access

The remainder of this report presents the following analysis:

- Existing traffic conditions in the project study area.

- 2023 "Without Project" condition to establish the baseline condition by which the project impacts are determined.

- Trip generation estimates for the proposed development.

- 2023 "With Project" condition to determine project traffic impacts.

SUMMARY OF FINDINGS

Findings

The following are the findings from the traffic analysis:

- The proposed development is expected to generate 333 daily, 26 A.M. peak hour (7 in, 19 out), and 35 P.M. peak hour (22 in, 13 out) net new trips.
- All of the study area intersections are projected to meet the City of Camas' level of service standards in the 2023 "Without Project" and 2023 "With Project" condition.
- Turn lane warrants at the SE 40th Street/Project Access intersection were not conducted because a westbound left turn lane into the site will be constructed with the subdivision.
- Based on field measurements conducted by H. Lee & Associates, PLLC, the project access intersection should be able to meet the sight distance requirements as long as any vegetation within the sight distance triangles are properly maintained after construction and no obstructions are placed within the sight distance triangles that could impede a driver's vision. Because the access into the project site is not built, the corner sight distance should be re-verified in the final engineering/construction stages of development.

Recommendations

- Based on the traffic impact analysis documented in this report, no physical, off-site mitigation would be needed.

Valley View Estates TIA
Camas, WA

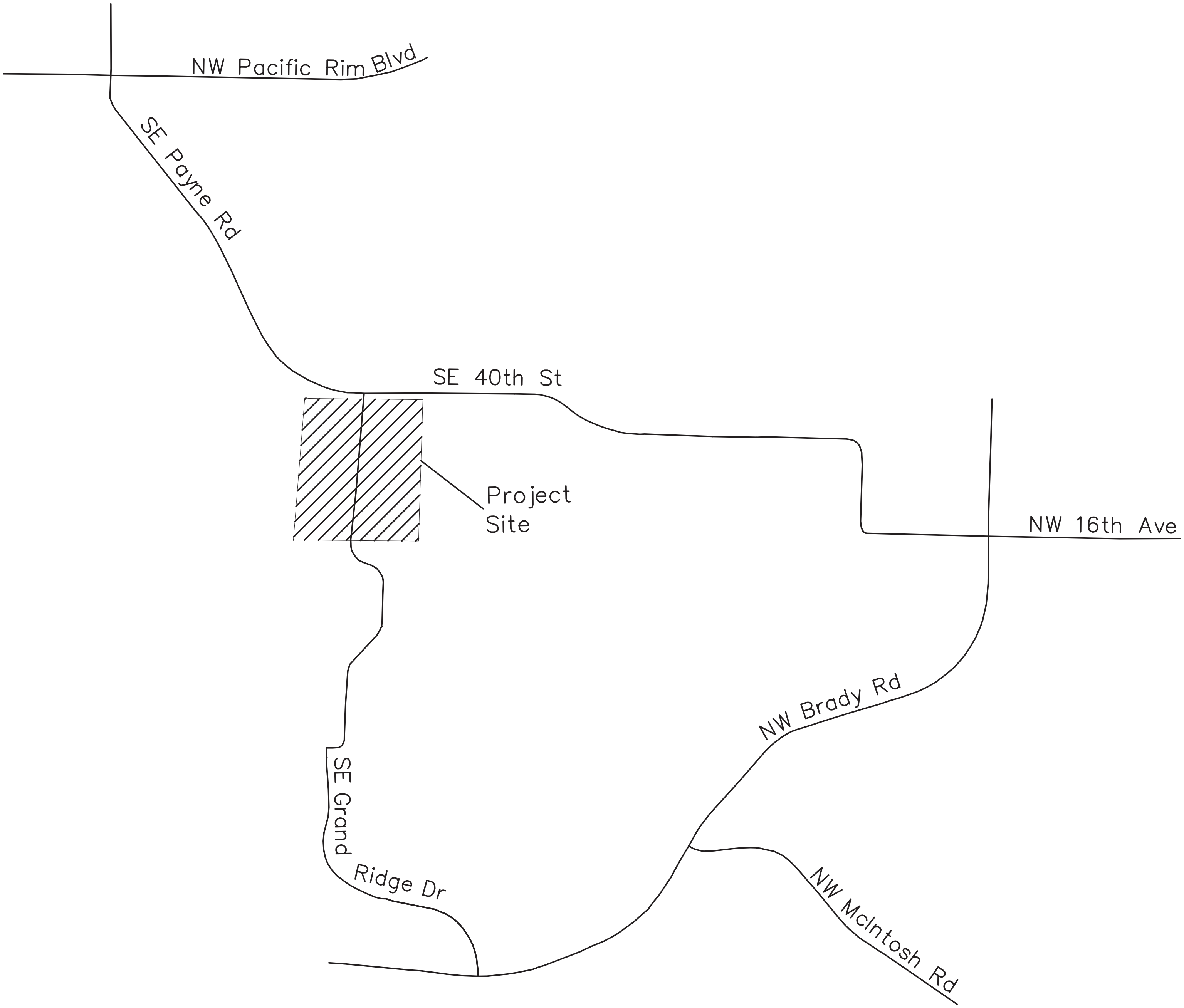


FIGURE 1
Site Vicinity Map

NOT TO SCALE

18006_Figures.Dwg

Valley View Estates TIA
Camas, WA

FIGURE 2
Site Plan

NOT TO SCALE

SECTION II
EXISTING CONDITIONS

SITE CONDITION AND ADJACENT LAND USE

One existing single-family detached home exists on-site and will be demolished upon construction of the subdivision.

TRANSPORTATION FACILITIES

The following provides a description of the existing street system in the study area.

SE Brady Road: SE Brady Road is a two-lane minor arterial roadway. A small section of sidewalk exists along the north side of the roadway east of SE Grand Ridge Drive. The posted speed limit is 40 mph.

NW Brady Road: NW Brady Road is a two-lane minor arterial roadway north of NW 16th Avenue with a posted speed limit of 35 mph. Between NW 16th Avenue and NW McIntosh Road, NW Brady road is a two-lane collector roadway with intermittent sidewalks along both sides of the roadway and a posted speed limit of 35 mph. South of NW McIntosh Road, NW Brady Road is a two-lane minor arterial roadway and has a posted speed limit of 40 mph.

SE Grand Ridge Drive: SE Grand Ridge Drive is a two-lane local roadway. Sidewalks exist along both sides of the roadway in developed areas. The posted speed limit is 25 mph.

NW McIntosh Road: NW McIntosh Road is a two-lane collector roadway. Intermittent sidewalks exist along both sides of the roadway. The posted speed limit is 35 mph.

NW Pacific Rim Boulevard: NW Pacific Rim Boulevard is a four lane minor arterial roadway with a center turn lane/median and additional turn lanes at major intersections. Sidewalks exist on both sides of the roadway. The posted speed limit is 40 mph.

SE Payne Road: SE Payne Road is a two-lane minor arterial roadway. Sidewalks exist along the west side of the roadway. The posted speed limit is 35 mph.

NW 16th Avenue: NW 16th Avenue is a two-to-three lane minor arterial roadway. Intermittent sidewalks exist along both sides of the roadway. The posted speed limit is 25 mph.

SE 40th Street: SE 40th Street is a two-lane collector roadway. A detached non-motorized pedestrian pathway exists along the south side of the roadway. The posted speed limit is 35 mph.

The scope of the traffic impact study was developed from known City of Camas traffic study requirements. From these requirements, the following intersections were analyzed:

- NW Pacific Rim Boulevard/SE Payne Road
- NW Brady Road/NW 16th Avenue
- NW Brady Road/NW McIntosh Road
- SE Brady Road/SE Grand Ridge Drive
- SE 40th Street/Project Access

All of the study area intersections are unsignalized and stop sign controlled. Figure 3 shows the existing lane configurations and traffic control at these intersections.

EXISTING TRAFFIC VOLUMES

A.M. and P.M. peak hour traffic counts were obtained at the study area intersections by HLA in June of 2017 and February 2018. Per the 2010 HCM[1], peak 15-minute traffic volumes were multiplied by four (4) to arrive at the peak hour traffic volumes. With this methodology of developing peak hour traffic volumes, the peak hour factor (PHF) is set to 1.00 because the peaking has already occurred by multiplying the peak 15-minute traffic volume by four (4). The existing condition traffic volumes are presented in Figure 4. The existing traffic counts can be referenced in Appendix A.

A speed study along SE 40th Street was conducted between 5:00 P.M. on March 7, 2018 and 5:00 P.M. on March 8, 2018. The 85th percentile speed eastbound was 40 mph. The 85th percentile westbound was 42 mph. The data can be referenced in Appendix A.

---

[1] 2010 Highway Capacity Manual (HCM), Volume 3, Transportation Research Board, 2010, page 18-2 and 18-3.

Valley View Estates TIA
Camas, WA

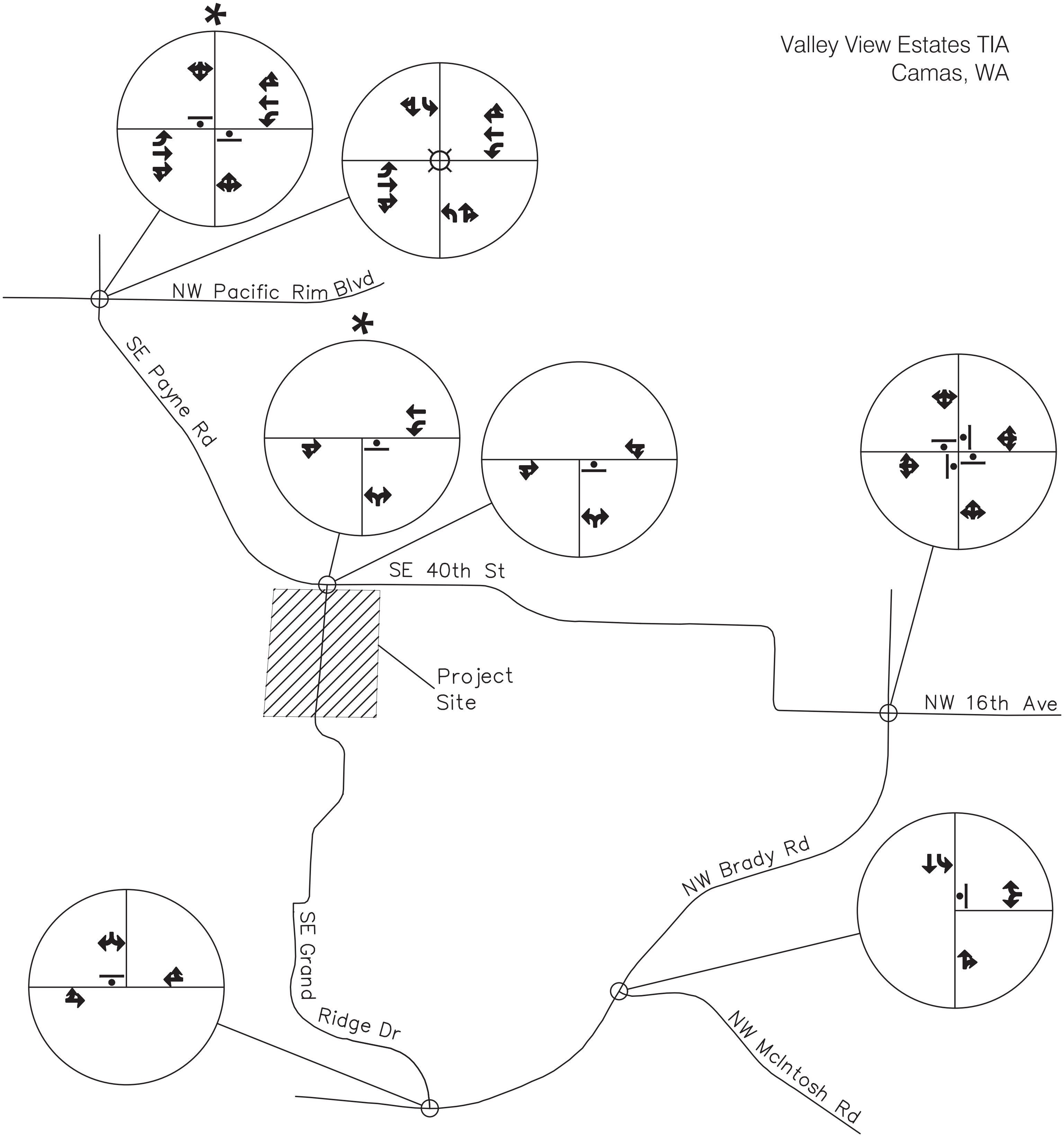


FIGURE 3
Existing Lane Configuration and Traffic Control

LEGEND

→ Lane Usage

⊗ Traffic Signal

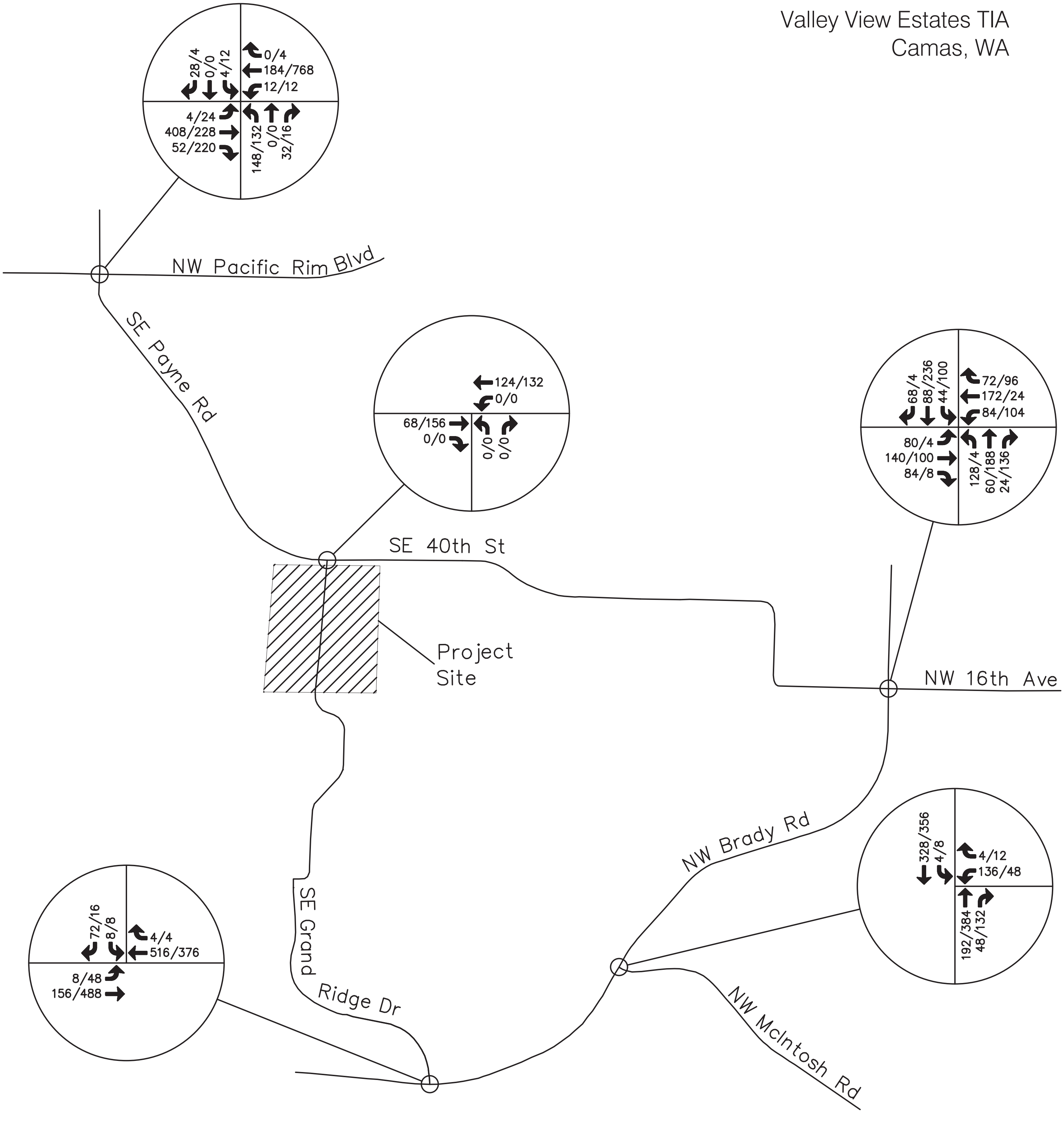
⊥ Stop Sign

* Future 2023 Lane Configuration and Traffic Control

NOT TO SCALE

18006_Figures.Dwg

Valley View Estates TIA
Camas, WA



LEGEND

128/200 A.M./P.M. Peak Hour Traffic Volume

NOT TO SCALE

FIGURE 4
Existing A.M. and P.M.
Peak Hour Traffic Volumes

18006_Figures.Dwg

EXISTING LEVEL OF SERVICE

Based on the traffic volumes in Figure 4 and the existing lane configurations presented in Figure 3, peak hour traffic operations were analyzed at the study area intersections using the methodologies outlined in the 2010 Highway Capacity Manual (HCM). According to the HCM, there are six levels of service (LOS) by which the operational performance of an intersection may be described. These levels of service range between LOS "A" which indicates a relatively free-flowing condition and LOS "F" which indicates operational breakdown.

LOS D is the City of Camas' adopted level of service standard for arterial/collector intersections. For non-arterial/collector intersections, LOS C is the adopted level of service standard.

Existing A.M. and P.M. peak hour levels of service at the study area intersections are summarized in Table 1. As shown in Table 1, all of the study area intersections are operating within the acceptable levels of service standards or better in the existing condition.

Table 1. Existing Levels of Service

	A.M. Peak Hour		P.M. Peak Hour	
All-Way Stop Intersection	LOS	Average Delay (sec)	LOS	Average Delay (sec)
NW Brady Road/NW 16th Avenue	B	14.0	B	13.0
Unsignalized Intersection				
NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz Street				
Eastbound Left	A	7.6	A	9.4
Westbound Left	A	8.4	A	8.3
Northbound Approach	C	19.0	D	29.2
Southbound Approach	A	9.4	C	20.7
NW Brady Road/NW McIntosh Road				
Westbound Approach	B	14.9	C	16.4
Southbound Left	A	7.7	A	8.5
SE Brady Road/SE Grand Ridge Road				
Eastbound Left	A	8.6	A	8.2
Southbound Approach	B	12.8	B	13.5
SE 40th Street/Project Access				
Westbound Left	A	0.0	A	0.0
Northbound Approach	A	0.0	A	0.0

ACCIDENT HISTORY

Accident data was obtained from the Washington State Department of Transportation (WSDOT) for the five year and two month period between January 1, 2013 and February 28, 2018. The data includes total accidents and accidents by severity (i.e. fatal, injury or property damage only). This accident data is summarized in Table 2. Appendix C contains the accident data.

As shown in Table 2, none of the study area intersections have accident rates above 1.00 accidents per million entering vehicles. Accident rates above 1.00 accident per million entering vehicles do not necessarily indicate there is a safety problem, but it is an indicator that further analysis should be conducted. Intersections with accident rates of less than 1.00 accidents per million entering vehicles are considered acceptable and therefore no further analysis is required.

It should be noted that there was a fatality at the NW Brady Road/NW 16th Avenue intersection on July 30, 2017. The crash involved a passenger car and motorcycle. The cause of accident was due to the passenger car running the stop sign and the motorcycle exceeding reasonable safe speed.

Table 2. Summary of Traffic Accident History in Study Area

	Average Annual Accidents				
Intersection	PDO[1]	Injury	Fatal	Total	acc/mev[2]
NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz St	1.2	0.6	0.0	1.8	0.28
NW Brady Road/NW 16th Avenue	1.0	0.2	0.2	1.4	0.31
NW Brady Road/NW McIntosh Road	0.6	0.2	0.0	0.8	0.19
SE Brady Road/SE Grand Ridge Drive	0.4	0.0	0.0	0.4	0.09
SE 40th Street/Project Access	0.0	0.0	0.0	0.0	0.00

[1] PDO = property damage only

[2] acc/mev = accidents per million entering vehicles

EXISTING PUBLIC TRANSIT SERVICE

C-Tran provides public transit service in the City of Camas. Currently there are no routes that provide service adjacent to the project site. The closest route to the project site is Route #37 (Mill Plain/Fisher’s), which is approximately 0.67 miles from the project site at the intersection of SE 192nd Avenue/SE 34th Street.

NON-MOTORIZED TRANSPORTATION

There is a detached non-motorized pedestrian path along the south side of SE 40th Street directly adjacent to the project site.

PLANNED TRANSPORTATION IMPROVEMENTS

There are seven known transportation improvement projects planned by the City of Camas in the project vicinity based on the City of Camas' 2018-2023 Six Year Transportation Program. These projects are listed below:

NW Brady Road – NW 16th Avenue to NW 25th Avenue
This project will widen the roadway and add bike lanes. Construction is anticipated to begin in 2019. This project has a priority number of 1.

NW Pacific Rim Boulevard at SE Payne Road
This project is the installation of a traffic signal. This project is in its design phase and has a priority number of 6.

NW Brady Road at NW 16th Avenue
This project is the installation of a traffic signal. This project is in its design phase and has a priority number of 7.

NW 18th Avenue – NW Whitman Street to NW Brady Road
This project will reconstruct the roadway and add bike lanes. Construction is anticipated to begin in 2022. This project has a priority number of 24.

NW 18th Avenue – NW Whitman Street to West to City Limits
This project will widen the roadway and add bike lanes. Construction is anticipated to begin in 2022. This project has a priority number of 25.

NW Brady Road – NW McIntosh Road to West City Limits
This project will improve bike and pedestrian facilities. Construction is anticipated to begin in 2023. The priority number for this project is 28.

NW McIntosh Road – NW Brady Road to NW 11th Avenue
This project will widen the roadway and add bike lanes. Construction is anticipated to begin in 2023. The priority number for this project is 32.

SECTION III
TRAFFIC IMPACT ANALYSIS

ANALYSIS METHODOLOGY

The A.M. and P.M. peak hour traffic impacts generated by the proposed Valley View Estates were analyzed as follows:

- The 2023 “Without Project” traffic volumes were established as the future baseline condition for the traffic analysis and to define a baseline by which project impacts are determined. The 2023 “Without Project” condition traffic volumes were derived by using a 2.0 percent annual, compounded growth factor and adding traffic generated by “in process” developments. The “in-process” traffic volumes were obtained from the City of Camas staff

- A.M., P.M., and daily trip generation were estimated for the proposed development using the rates in "Trip Generation, 10th Edition," (Institute of Transportation Engineers, 2017).

- Trip distribution of site-generated traffic was developed from existing count information, previous traffic studies, locations of major employment centers, and logical travel paths to and from major travel corridors.

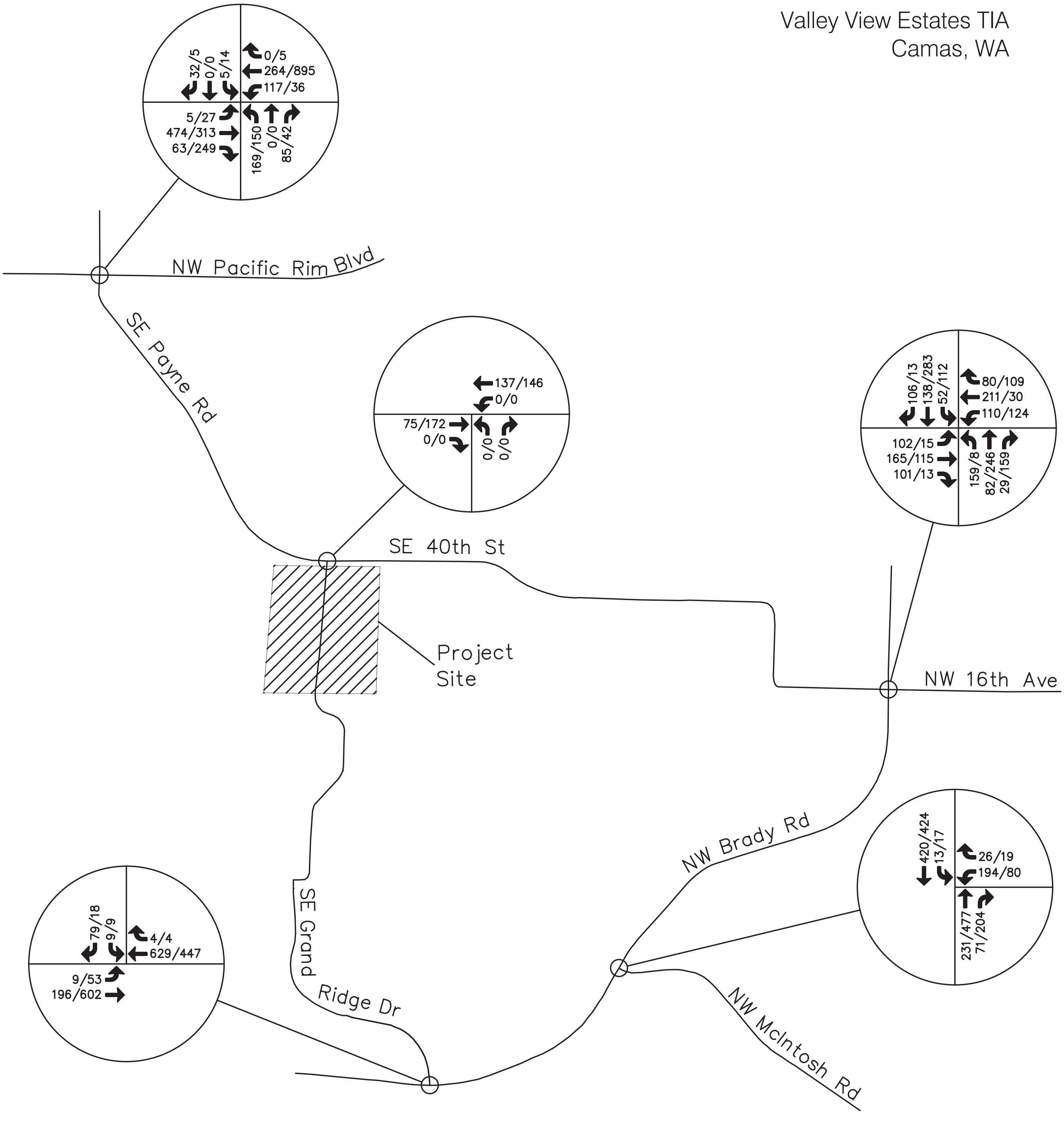
- Predicted A.M. and P.M. peak hour site-generated traffic from the proposed development was assigned to the roadway network and added to the 2023 “Without Project” traffic volumes to develop the 2023 “With Project” traffic volumes.

A detailed discussion of the methodology summarized above and the analysis results are contained in the remainder of this section.

2023 “WITHOUT PROJECT” TRAFFIC VOLUMES AND LEVELS OF SERVICE

The 2023 “Without Project” condition was analyzed as the future baseline condition for the traffic analysis and to define a baseline by which project impacts are determined. The 2023 “Without Project” condition traffic volumes were derived by using a 2.0 percent annual, compounded growth factor and adding traffic generated by “in process” developments. The “in-process” traffic volumes were obtained from the City of Camas staff and can be referenced in Appendix D. Figure 5 shows the 2023 “Without Project” traffic volumes.

Valley View Estates TIA
Camas, WA



LEGEND

128/200 A.M./P.M. Peak Hour Traffic Volume

NOT TO SCALE

FIGURE 5
2023 "Without Project"
A.M. and P.M. Peak Hour Traffic Volumes

Levels of service were calculated at the study area intersections with the 2023 “Without Project” traffic volumes shown in Figure 5 and the lane configurations shown earlier in Figure 3. Appendix E contains the level of service worksheets for the 2023 “Without Project” condition.

The 2023 “Without Project” A.M. and P.M. peak hour levels of service at the study area intersections are summarized in Table 3. As shown in Table 3, all of the study area intersections are projected to operate within the acceptable levels of service standards or better in the 2023 “Without Project” condition.

Table 3. 2023 “Without Project” Levels of Service

	A.M. Peak Hour		P.M. Peak Hour	
Signalized Intersection	LOS	Average Delay (sec)	LOS	Average Delay (sec)
NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz Street	B	13.0	B	12.3
All-Way Stop Intersection				
NW Brady Road/NW 16th Avenue	D	28.3	C	19.3
Unsignalized Intersection				
NW Brady Road/NW McIntosh Road				
Westbound Approach	C	22.5	C	24.6
Southbound Left	A	7.9	A	9.0
SE Brady Road/SE Grand Ridge Road				
Eastbound Left	A	9.0	A	8.4
Southbound Approach	B	14.6	C	15.6
SE 40th Street/Project Access				
Westbound Left	A	0.0	A	0.0
Northbound Approach	A	0.0	A	0.0

DEVELOPMENT PLANS

As previously stated, the proposed project will subdivide approximately 9.26 acres into 36 single-family detached lots. One single-family detached home exists on-site and will be demolished upon construction of the subdivision. Access to the proposed project will be from connections to SE 40th Street and NW Goodwin Street. As previously shown, Figure 2 shows the project site plan.

TRIP GENERATION

Estimates of daily, A.M. peak hour, and P.M. peak hour trips generated by the proposed project were developed from rates published in "Trip Generation, 10th Edition" (Institute of Transportation Engineers, 2017). The proposed development is expected to generate 333 daily, 26 A.M. peak hour (7 in, 19 out), and 35 P.M. peak hour (28 in, 16 out) net new trips. Table 4 summarizes the project's trip generation.

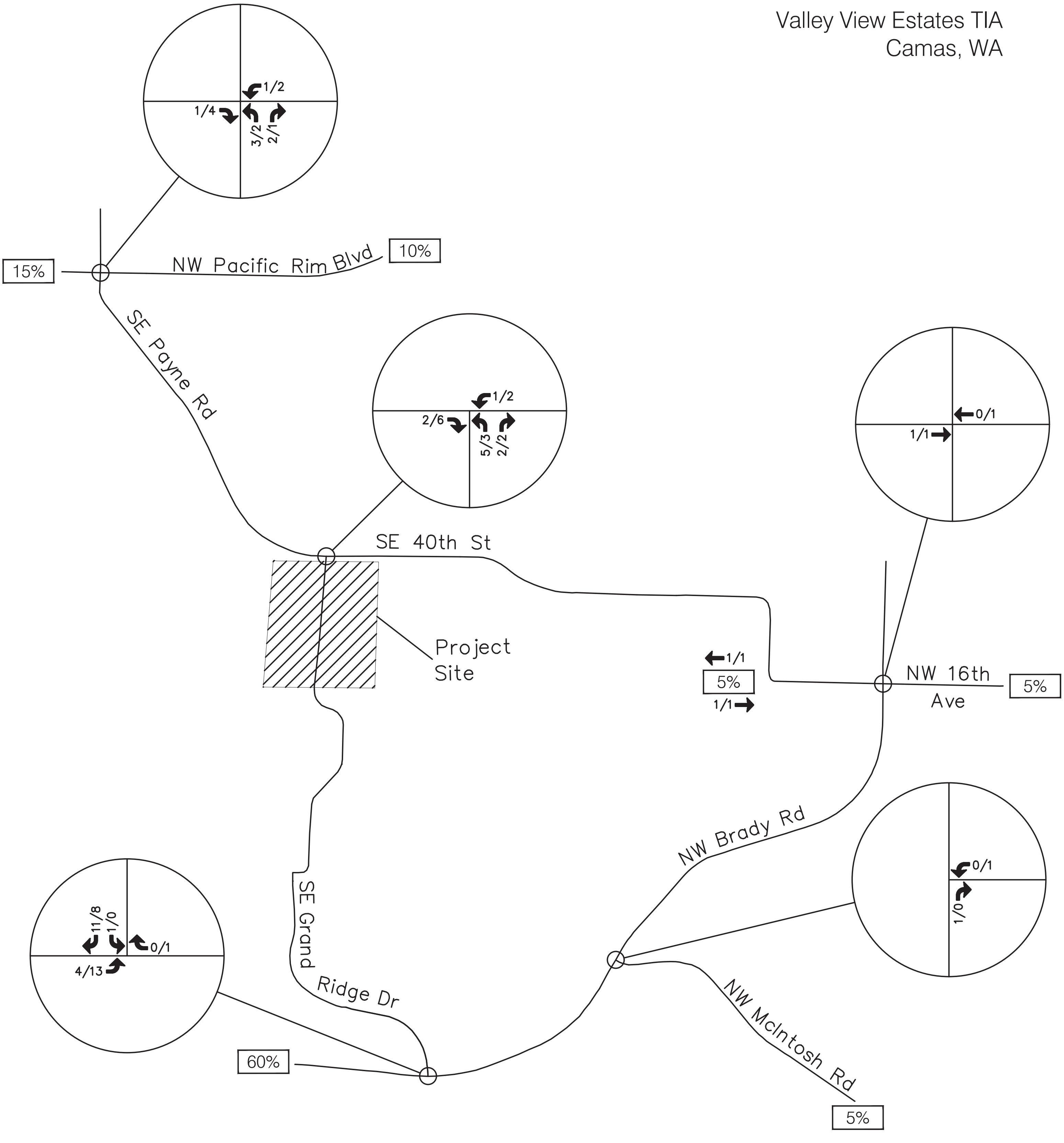
Table 4. Trip Generation Summary for Valley View Estates Subdivision

			A.M. Peak			P.M. Peak		
	Amount	Average Daily	In	Out	Total	In	Out	Total
Single-Family Detached Homes (ITE Code 210)								
Rate per dwelling Unit		9.52	0.19	0.56	0.75	0.63	0.37	1.00
Trips	36 units	343	7	20	27	23	13	36
Existing Single-Family Detached Home (ITE Code 210)								
Rate per dwelling Unit		9.52	0.19	0.56	0.75	0.63	0.37	1.00
Trips	1 unit	(10)	-	(1)	(1)	(1)	-	(1)
Net Total Trips		**333**	**7**	**19**	**26**	**22**	**13**	**35**

TRIP DISTRIBUTION AND ASSIGNMENT

A generalized trip distribution for the A.M. and P.M. peak hour was developed from the existing traffic counts, previous traffic studies, locations of major employment centers, and logical travel paths to and from major travel corridors. Figure 6 shows the resulting trip distribution pattern and assignment of project-generated trips.

Valley View Estates TIA
Camas, WA



LEGEND

128/200	A.M./P.M. Peak Hour Traffic Volume
10%	Peak Hour Trip Distribution

NOT TO SCALE

FIGURE 6
Trip Distribution and Assignment
Traffic Volumes

18006_Figures.Dwg

2023 "WITH PROJECT" TRAFFIC VOLUMES AND LEVELS OF SERVICE

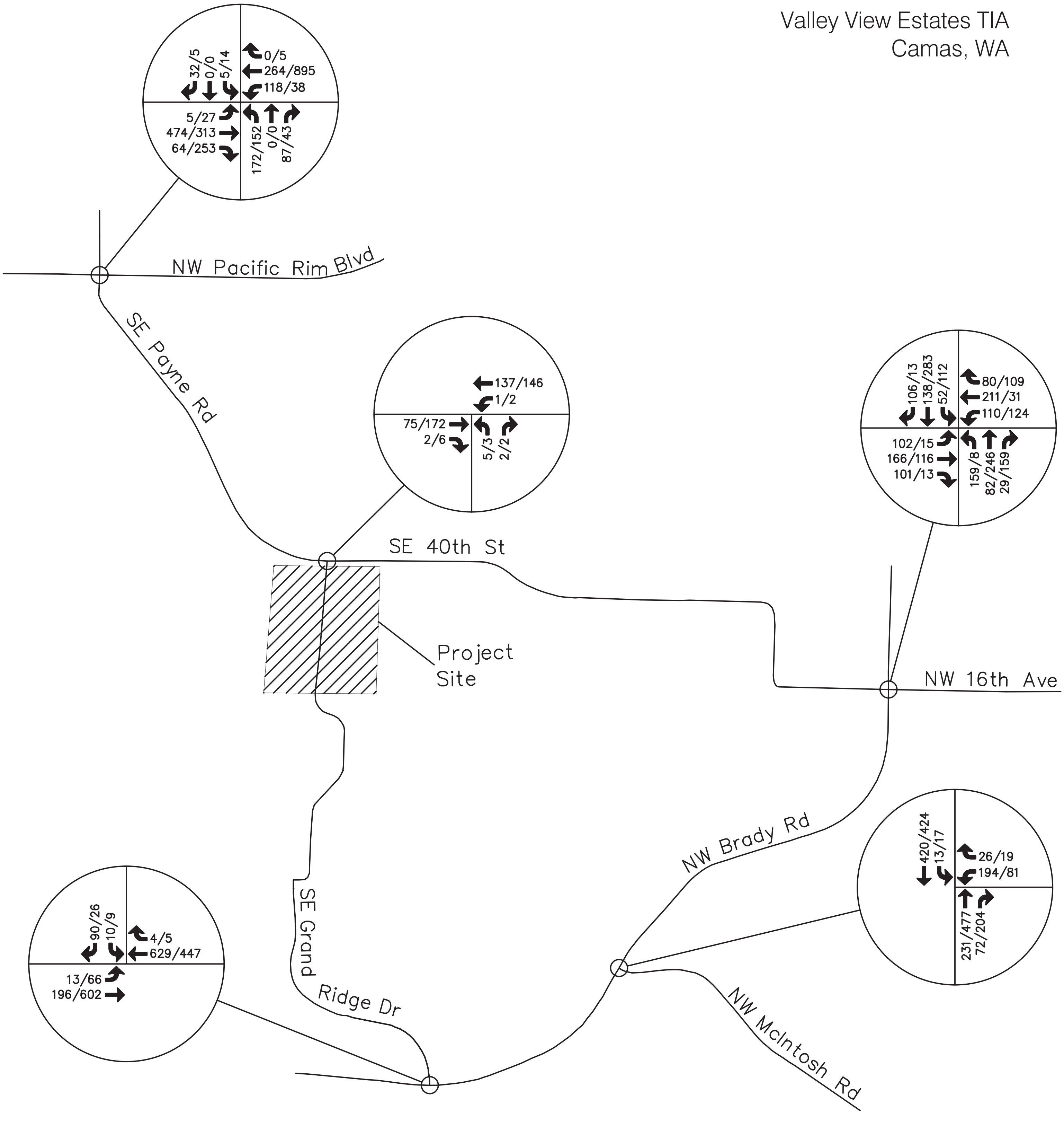
The traffic volumes shown in Figures 5 and 6 were combined to arrive at the 2023 "With Project" A.M. and P.M. peak hour traffic volumes. Figure 7 shows these traffic volumes. Levels of service were calculated for the 2023 "With Project" condition based on the traffic volumes shown in Figure 7 and the lane configurations previously shown in Figure 3. Appendix F contains the level of service worksheets for the 2023 "With Project" condition.

The 2023 "With Project" A.M. and P.M. peak hour levels of service at the study area intersections are summarized in Table 5a. As shown in Table 5, all of the study area intersections are projected to operate within the acceptable levels of service standards in the 2023 "With Project" condition.

Table 5. 2023 "With Project" Levels of Service

	A.M. Peak Hour		P.M. Peak Hour	
Signalized Intersection	LOS	Average Delay (sec)	LOS	Average Delay (sec)
NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz Street	B	13.0	B	12.3
All-Way Stop Intersection				
NW Brady Road/NW 16th Avenue	D	28.4	C	19.4
Unsignalized Intersection				
NW Brady Road/NW McIntosh Road				
Westbound Approach	C	22.5	C	24.8
Southbound Left	A	7.9	A	9.0
SE Brady Road/SE Grand Ridge Road				
Eastbound Left	A	9.0	A	8.4
Southbound Approach	B	14.9	C	15.1
SE 40th Street/Project Access				
Westbound Left	A	7.4	A	7.6
Northbound Approach	A	9.4	A	9.9

Valley View Estates TIA
Camas, WA



LEGEND

128/200 A.M./P.M. Peak Hour Traffic Volume

NOT TO SCALE

FIGURE 7
2023 "With Project"
A.M. and P.M. Peak Hour Traffic Volumes

18006_Figures.Dwg

CORNER SIGHT DISTANCE

The minimum corner sight distance was analyzed for the proposed Valley View Estates subdivision. The minimum corner sight distance required for the proposed SE 40th Street/Project Access intersection is based on the City of Camas' Design Standard Manual. Per the City of Camas' Design Standard Manual, public and private streets must comply with the sight distance requirements contained in the current "A Policy on Geometric Design on Highways and Streets," published by AASHTO (American Association of State Highway and Transportation Officials." The most recent edition of this reference is the 2011 – 6th Edition.

From AASHTO, the following intersection sight distances are relevant to the project's site access intersection:

- Case B1 – left turn from minor road
- Case B2 – right turn from minor road
- Case F – left from major road

The required sight distance for Case B1 based on a posted speed limit of 35 mph along SE 40th Street is 390 feet. This requirement can be found in Table 9-6 of the "A Policy on Geometric Design on Highways and Streets," page 9-38.

The required sight distance for Case B2 based on a posted speed limit of 35 mph along SE 40th Street is 335 feet. This requirement can be found in Table 9-8 of the "A Policy on Geometric Design on Highways and Streets," page 9-41.

The required sight distance for Case F based on a posted speed limit of 35 mph along SE 40th Street is 285 feet. This requirement can be found in Table 9-14 of the "A Policy on Geometric Design on Highways and Streets," page 9-52.

The corner sight distance at the proposed SE 40th Street/Project Access intersection was field measured and compared to the minimum acceptable AASHTO standards described above. Based on field measurements conducted by H. Lee & Associates, PLLC, all of the AASHTO sight distance requirements can be met at the proposed SE 40th Street/Project Access intersection as long as any vegetation within the sight distance triangles is properly maintained and no obstructions that obscure the driver's sight distance are located within the sight distance triangles. Since the intersection is not yet built, the intersection corner sight distance should be re-verified at the final engineering stage of the project.

LANE WARRANT ANALYSIS

Turn lane warrants at the SE 40th Street/Project Access intersection were not conducted because a westbound left turn lane into the site will be constructed with the subdivision.

CONCLUSIONS

Findings

The following are the findings from the traffic analysis:

- The proposed development is expected to generate 333 daily, 26 A.M. peak hour (7 in, 19 out), and 35 P.M. peak hour (22 in, 13 out) net new trips.

- All of the study area intersections are projected to meet the City of Camas' level of service standards in the 2023 "Without Project" and 2023 "With Project" condition.

- Turn lane warrants at the SE 40th Street/Project Access intersection were not conducted because a westbound left turn lane into the site will be constructed with the subdivision.

- Based on field measurements conducted by H. Lee & Associates, PLLC, the project access intersection should be able to meet the sight distance requirements as long as any vegetation within the sight distance triangles are properly maintained after construction and no obstructions are placed within the sight distance triangles that could impede a driver's vision. Because the access into the project site is not built, the corner sight distance should be re-verified in the final engineering/construction stages of development.

Recommendations

- Based on the traffic impact analysis documented in this report, no physical, off-site mitigation would be needed.

APPENDIX A

TRAFFIC COUNTS & SPEED STUDY

Intersection: NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz Street Date: 06/22/17

AM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
7:00 - 7:15 AM	3	0	1	0	0	51	0	1	1	0	13	1	4	141	0	0	214
7:15 - 7:30 AM	5	0	2	0	0	49	1	5	0	0	24	1	10	71	1	2	163
7:30 - 7:45 AM	5	0	0	0	1	43	0	0	5	0	21	0	8	88	2	3	173
7:45 - 8:00 AM	7	0	1	0	0	46	3	2	8	0	37	1	13	102	1	4	218
8:00 - 8:15 AM	5	0	1	0	0	46	6	0	5	0	20	0	10	69	1	1	163
8:15 - 8:30 AM	3	0	0	0	0	42	2	6	3	0	22	0	13	48	2	3	135
8:30 - 8:45 AM	3	2	1	1	0	50	3	2	6	0	42	2	11	50	2	6	170
8:45 - 9:00 AM	5	0	2	0	2	52	2	3	18	0	40	0	16	56	0	6	193
															Peak 15 Total		218
Hourly Total by 15 minutes																	
7:00 - 8:00 AM	20	0	4	0	1	189	4	8	14	0	95	3	35	402	4	9	768
7:15 - 8:15 AM	22	0	4	0	1	184	10	7	18	0	102	2	41	330	5	10	717
7:30 - 8:30 AM	20	0	2	0	1	177	11	8	21	0	100	1	44	307	6	11	689
7:45 - 8:45 AM	18	2	3	1	0	184	14	10	22	0	121	3	47	269	6	14	686
8:00 - 9:00 AM	16	2	4	1	2	190	13	11	32	0	124	2	50	223	5	16	661
Peak Hour 7:00 - 8:00 AM	20	0	4	0	1	189	4	8	14	0	95	3	35	402	4	9	768
Peak Hour Factor		0.75				0.95				0.61				0.76			0.88
Peak Hour % Trucks		0%				4%				3%				2%			
Peak 15 Min % Trucks		0%				4%				2%				3%			

Intersection: NW Pacific Rim Boulevard/SE Payne Road/NW Lorenz Street Date: 06/22/17

PM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
4:00 - 4:15 PM	4	0	0	0	2	123	2	2	4	0	34	1	39	49	5	2	262
4:15 - 4:30 PM	3	0	0	0	2	102	4	2	1	0	31	0	46	61	3	1	253
4:30 - 4:45 PM	1	0	1	0	0	121	4	3	2	0	23	0	34	52	4	3	242
4:45 - 5:00 PM	1	0	1	0	1	87	0	1	0	0	32	0	50	53	2	2	227
5:00 - 5:15 PM	1	0	3	0	1	192	3	2	4	0	33	0	55	57	6	1	355
5:15 - 5:30 PM	6	0	1	0	5	123	3	1	11	0	29	0	46	79	9	1	312
5:30 - 5:45 PM	4	0	0	0	2	92	3	2	5	0	29	0	43	60	4	1	242
5:45 - 6:00 PM	1	0	0	0	0	60	7	0	5	1	33	1	49	43	3	1	202
															Peak 15 Total		355
Hourly Total by 15 minutes																	
4:00 - 5:00 PM	9	0	2	0	5	433	10	8	7	0	120	1	169	215	14	8	984
4:15 - 5:15 PM	6	0	5	0	4	502	11	8	7	0	119	0	185	223	15	7	1,077
4:30 - 5:30 PM	9	0	6	0	7	523	10	7	17	0	117	0	185	241	21	7	1,136
4:45 - 5:45 PM	12	0	5	0	9	494	9	6	20	0	123	0	194	249	21	5	1,136
5:00 - 6:00 PM	12	0	4	0	8	467	16	5	25	1	124	1	193	239	22	4	1,111
Peak Hour	9	0	6	0	7	523	10	7	17	0	117	0	185	241	21	7	1,136
4:30 - 5:30 PM																	
Peak Hour Factor		0.54				0.69				0.84				0.83			0.80
Peak Hour % Trucks		0%				1%				0%				2%			
Peak 15 Min % Trucks		0%				1%				0%				1%			

Intersection: NW Brady Road/NW 16th Avenue Date: 02/13/18

AM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
7:00 - 7:15 AM	1	30	7	0	16	13	40	1	9	22	2	3	4	10	4	3	158
7:15 - 7:30 AM	2	39	8	1	25	8	53	2	13	24	0	4	0	7	4	0	183
7:30 - 7:45 AM	4	38	6	2	42	14	33	5	10	31	3	3	1	5	5	2	192
7:45 - 8:00 AM	8	31	18	0	25	17	36	1	12	35	5	1	7	9	9	1	212
8:00 - 8:15 AM	8	29	14	1	30	20	48	0	13	25	5	3	5	13	3	0	213
8:15 - 8:30 AM	7	27	6	2	27	15	41	4	16	23	7	5	1	5	1	0	176
8:30 - 8:45 AM	8	30	12	4	16	23	22	0	14	22	11	5	1	6	2	0	167
8:45 - 9:00 AM	17	22	11	1	18	43	21	2	6	15	32	2	21	35	20	7	261
															Peak 15 Total		261
Hourly Total by 15 minutes																	
7:00 - 8:00 AM	15	138	39	3	108	52	162	9	44	112	10	11	12	31	22	6	745
7:15 - 8:15 AM	22	137	46	4	122	59	170	8	48	115	13	11	13	34	21	3	800
7:30 - 8:30 AM	27	125	44	5	124	66	158	10	51	114	20	12	14	32	18	3	793
7:45 - 8:45 AM	31	117	50	7	98	75	147	5	55	105	28	14	14	33	15	1	768
8:00 - 9:00 AM	40	108	43	8	91	101	132	6	49	85	55	15	28	59	26	7	817
Peak Hour	40	108	43	8	91	101	132	6	49	85	55	15	28	59	26	7	817
8:00 - 9:00 AM																	
Peak Hour Factor		0.94				0.83				0.89				0.37			0.78
Peak Hour % Trucks		4%				2%				8%				6%			
Peak 15 Min % Trucks		2%				2%				4%				9%			

Intersection: NW Brady Road/NW 16th Avenue Date: 02/13/18

PM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
4:00 - 4:15 PM	6	23	25	3	25	21	26	0	26	28	1	0	7	33	7	0	228
4:15 - 4:30 PM	7	36	27	0	20	19	9	0	23	41	4	0	7	28	7	0	228
4:30 - 4:45 PM	8	25	23	1	24	13	23	1	26	27	2	0	25	20	4	0	220
4:45 - 5:00 PM	2	29	22	0	22	13	15	0	34	24	3	0	7	24	4	0	199
5:00 - 5:15 PM	1	59	25	2	24	6	26	0	34	47	1	0	2	25	1	0	251
5:15 - 5:30 PM	4	42	23	0	17	8	15	0	36	43	0	1	3	28	1	0	220
5:30 - 5:45 PM	4	31	32	0	20	12	30	0	34	42	1	1	5	27	0	0	238
5:45 - 6:00 PM	6	25	21	1	30	20	22	1	43	44	2	0	1	24	5	0	243
															Peak 15 Total		251
Hourly Total by 15 minutes																	
4:00 - 5:00 PM	23	113	97	4	91	66	73	1	109	120	10	0	46	105	22	0	875
4:15 - 5:15 PM	18	149	97	3	90	51	73	1	117	139	10	0	41	97	16	0	898
4:30 - 5:30 PM	15	155	93	3	87	40	79	1	130	141	6	1	37	97	10	0	890
4:45 - 5:45 PM	11	161	102	2	83	39	86	0	138	156	5	2	17	104	6	0	908
5:00 - 6:00 PM	15	157	101	3	91	46	93	1	147	176	4	2	11	104	7	0	952
Peak Hour	15	157	101	3	91	46	93	1	147	176	4	2	11	104	7	0	952
5:00 - 6:00 PM																	
Peak Hour Factor		0.80				0.80				0.92				0.95			0.95
Peak Hour % Trucks		1%				0%				1%				0%			
Peak 15 Min % Trucks		2%				0%				0%				0%			

Intersection: NW Brady Road/NW McIntosh Road Date: 02/13/18

AM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
7:00 - 7:15 AM	0	73	1	1	3	0	26	0	5	26	0	2	0	0	0	0	134
7:15 - 7:30 AM	0	101	0	0	4	0	27	1	8	31	0	5	0	0	0	0	171
7:30 - 7:45 AM	0	84	2	1	1	0	33	0	8	35	0	2	0	0	0	0	163
7:45 - 8:00 AM	0	82	1	2	1	0	34	0	12	48	0	3	0	0	0	0	178
8:00 - 8:15 AM	0	87	1	0	1	0	26	3	13	40	0	6	0	0	0	0	168
8:15 - 8:30 AM	0	71	2	1	2	0	29	0	7	38	0	5	0	0	0	0	149
8:30 - 8:45 AM	0	65	2	3	4	0	22	2	13	41	0	5	0	0	0	0	147
8:45 - 9:00 AM	0	75	2	3	7	0	35	0	9	28	0	3	0	0	0	0	156
															Peak 15 Total		178
Hourly Total by 15 minutes																	
7:00 - 8:00 AM	0	340	4	4	9	0	120	1	33	140	0	12	0	0	0	0	646
7:15 - 8:15 AM	0	354	4	3	7	0	120	4	41	154	0	16	0	0	0	0	680
7:30 - 8:30 AM	0	324	6	4	5	0	122	3	40	161	0	16	0	0	0	0	658
7:45 - 8:45 AM	0	305	6	6	8	0	111	5	45	167	0	19	0	0	0	0	642
8:00 - 9:00 AM	0	298	7	7	14	0	112	5	42	147	0	19	0	0	0	0	620
Peak Hour	0	354	4	3	7	0	120	4	41	154	0	16	0	0	0	0	680
7:15 - 8:15 AM																	
Peak Hour Factor		0.89				0.91				0.81				0.00			0.96
Peak Hour % Trucks		1%				3%				8%				0%			
Peak 15 Min % Trucks		2%				0%				5%				0%			

Intersection: NW Brady Road/NW McIntosh Road Date: 02/13/18

PM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
4:00 - 4:15 PM	0	52	3	1	3	0	16	1	25	54	0	0	0	0	0	0	153
4:15 - 4:30 PM	0	48	4	0	4	0	11	2	27	66	0	0	0	0	0	0	160
4:30 - 4:45 PM	0	60	2	0	2	0	17	0	22	51	0	0	0	0	0	0	154
4:45 - 5:00 PM	0	47	1	0	2	0	13	0	37	66	0	1	0	0	0	0	166
5:00 - 5:15 PM	0	89	2	3	3	0	12	0	33	96	0	1	0	0	0	0	235
5:15 - 5:30 PM	0	48	6	1	2	0	13	0	21	81	0	1	0	0	0	0	171
5:30 - 5:45 PM	0	66	1	0	2	0	14	2	33	75	0	1	0	0	0	0	191
5:45 - 6:00 PM	0	49	2	2	2	0	29	0	31	100	0	1	0	0	0	0	213
															Peak 15 Total		235
Hourly Total by 15 minutes																	
4:00 - 5:00 PM	0	207	10	1	11	0	57	3	111	237	0	1	0	0	0	0	633
4:15 - 5:15 PM	0	244	9	3	11	0	53	2	119	279	0	2	0	0	0	0	715
4:30 - 5:30 PM	0	244	11	4	9	0	55	0	113	294	0	3	0	0	0	0	726
4:45 - 5:45 PM	0	250	10	4	9	0	52	2	124	318	0	4	0	0	0	0	763
5:00 - 6:00 PM	0	252	11	6	9	0	68	2	118	352	0	4	0	0	0	0	810
Peak Hour 5:00 - 6:00 PM	0	252	11	6	9	0	68	2	118	352	0	4	0	0	0	0	810
Peak Hour Factor		0.72				0.62				0.90				0.00			0.86
Peak Hour % Trucks		2%				3%				1%				0%			
Peak 15 Min % Trucks		3%				0%				1%				0%			

Intersection: SE Brady Road/SE Grand Ridge Drive

Date: 02/13/18

AM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
7:00 - 7:15 AM	22	0	4	0	0	98	0	1	0	0	0	0	0	26	7	3	157
7:15 - 7:30 AM	18	0	2	0	1	129	0	0	0	0	0	0	0	39	2	4	191
7:30 - 7:45 AM	21	0	1	0	0	119	0	1	0	0	0	0	0	47	0	3	188
7:45 - 8:00 AM	12	0	2	0	3	112	0	2	0	0	0	0	0	53	0	2	182
8:00 - 8:15 AM	5	0	0	0	1	107	0	3	0	0	0	0	0	51	3	1	167
8:15 - 8:30 AM	13	0	2	0	0	98	0	1	0	0	0	0	0	40	6	5	159
8:30 - 8:45 AM	18	0	1	0	2	85	0	3	0	0	0	0	0	53	5	8	164
8:45 - 9:00 AM	5	0	0	0	1	104	0	2	0	0	0	0	0	38	4	4	152
															Peak 15 Total		191
Hourly Total by 15 minutes																	
7:00 - 8:00 AM	73	0	9	0	4	458	0	4	0	0	0	0	0	165	9	12	718
7:15 - 8:15 AM	56	0	5	0	5	467	0	6	0	0	0	0	0	190	5	10	728
7:30 - 8:30 AM	51	0	5	0	4	436	0	7	0	0	0	0	0	191	9	11	696
7:45 - 8:45 AM	48	0	5	0	6	402	0	9	0	0	0	0	0	197	14	16	672
8:00 - 9:00 AM	41	0	3	0	4	394	0	9	0	0	0	0	0	182	18	18	642
Peak Hour	56	0	5	0	5	467	0	6	0	0	0	0	0	190	5	10	728
7:15 - 8:15 AM																	
Peak Hour Factor		0.69				0.91				0.00				0.90			0.95
Peak Hour % Trucks		0%				1%				0%				5%			
Peak 15 Min % Trucks		0%				0%				0%				10%			

Intersection: SE Brady Road/SE Grand Ridge Drive Date: 02/13/18
PM Peak Hour Turning Movement Volumes

		SB				WB				NB				EB			
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
4:00 - 4:15 PM	5	0	0	1	1	64	0	3	0	0	0	0	0	79	8	2	157
4:15 - 4:30 PM	10	0	2	1	0	55	0	2	0	0	0	0	0	86	14	1	167
4:30 - 4:45 PM	7	0	0	1	4	72	0	1	0	0	0	0	0	78	5	1	166
4:45 - 5:00 PM	8	0	4	0	2	55	0	1	0	0	0	0	0	89	9	0	167
5:00 - 5:15 PM	4	0	2	0	1	94	0	2	0	0	0	0	0	122	12	1	235
5:15 - 5:30 PM	15	0	2	0	3	61	0	1	0	0	0	0	0	94	15	1	190
5:30 - 5:45 PM	9	0	0	0	0	72	0	2	0	0	0	0	0	113	12	3	206
5:45 - 6:00 PM	6	0	3	0	3	75	0	2	0	0	0	0	0	124	19	2	230
															Peak 15 Total		235
Hourly Total by 15 minutes																	
4:00 - 5:00 PM	30	0	6	3	7	246	0	7	0	0	0	0	0	332	36	4	657
4:15 - 5:15 PM	29	0	8	2	7	276	0	6	0	0	0	0	0	375	40	3	735
4:30 - 5:30 PM	34	0	8	1	10	282	0	5	0	0	0	0	0	383	41	3	758
4:45 - 5:45 PM	36	0	8	0	6	282	0	6	0	0	0	0	0	418	48	5	798
5:00 - 6:00 PM	34	0	7	0	7	302	0	7	0	0	0	0	0	453	58	7	861
Peak Hour 5:00 - 6:00 PM	34	0	7	0	7	302	0	7	0	0	0	0	0	453	58	7	861
Peak Hour Factor		0.60				0.81				0.00				0.89			0.92
Peak Hour % Trucks		0%				2%				0%				1%			
Peak 15 Min % Trucks		0%				2%				0%				1%			

Intersection: SE 40th Street/Project Access Date: 02/13/18
AM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
7:00 - 7:15 AM	0	0	0	0	0	21	0	1	0	0	0	0	0	2	0	2	23
7:15 - 7:30 AM	0	0	0	0	0	15	0	1	0	0	0	0	0	7	0	1	22
7:30 - 7:45 AM	0	0	0	0	0	29	0	1	0	0	0	0	0	7	0	0	36
7:45 - 8:00 AM	0	0	0	0	0	17	0	0	0	0	0	0	0	12	0	0	29
8:00 - 8:15 AM	0	0	0	0	0	14	0	0	0	0	0	0	0	13	0	1	27
8:15 - 8:30 AM	0	0	0	0	0	17	0	1	0	0	0	0	0	9	0	1	26
8:30 - 8:45 AM	0	0	0	0	0	21	0	0	0	0	0	0	0	16	0	0	37
8:45 - 9:00 AM	0	0	0	0	0	31	0	2	0	0	0	0	0	17	0	3	48
															Peak 15 Total		48
Hourly Total by 15 minutes																	
7:00 - 8:00 AM	0	0	0	0	0	82	0	3	0	0	0	0	0	28	0	3	110
7:15 - 8:15 AM	0	0	0	0	0	75	0	2	0	0	0	0	0	39	0	2	114
7:30 - 8:30 AM	0	0	0	0	0	77	0	2	0	0	0	0	0	41	0	2	118
7:45 - 8:45 AM	0	0	0	0	0	69	0	1	0	0	0	0	0	50	0	2	119
8:00 - 9:00 AM	0	0	0	0	0	83	0	3	0	0	0	0	0	55	0	5	138
Peak Hour 8:00 - 9:00 AM	0	0	0	0	0	83	0	3	0	0	0	0	0	55	0	5	138
Peak Hour Factor		0.00				0.67				0.00				0.81			0.72
Peak Hour % Trucks		0%				4%				0%				9%			
Peak 15 Min % Trucks		0%				6%				0%				18%			

Intersection: SE 40th Street/Project Access Date: 02/13/18

PM Peak Hour Turning Movement Volumes

	SB				WB				NB				EB				
Time	SBR	SBT	SBL	Trucks	WBR	WBT	WBL	Trucks	NBR	NBT	NBL	Trucks	EBR	EBT	EBL	Trucks	Total
15 Minute Totals																	
4:00 - 4:15 PM	0	0	0	0	0	33	0	0	0	0	0	0	0	39	0	0	72
4:15 - 4:30 PM	0	0	0	0	0	23	0	0	0	0	0	0	0	27	0	0	50
4:30 - 4:45 PM	0	0	0	0	0	28	0	0	0	0	0	0	0	34	0	0	62
4:45 - 5:00 PM	0	0	0	0	0	18	0	0	0	0	0	0	0	44	0	0	62
5:00 - 5:15 PM	0	0	0	0	0	9	0	0	0	0	0	0	0	28	0	0	37
5:15 - 5:30 PM	0	0	0	0	0	22	0	0	0	0	0	0	0	34	0	0	56
5:30 - 5:45 PM	0	0	0	0	0	22	0	0	0	0	0	0	0	50	0	0	72
5:45 - 6:00 PM	0	0	0	0	0	19	0	0	0	0	0	0	0	36	0	0	55
															Peak 15 Total		72
Hourly Total by 15 minutes																	
4:00 - 5:00 PM	0	0	0	0	0	102	0	0	0	0	0	0	0	144	0	0	246
4:15 - 5:15 PM	0	0	0	0	0	78	0	0	0	0	0	0	0	133	0	0	211
4:30 - 5:30 PM	0	0	0	0	0	77	0	0	0	0	0	0	0	140	0	0	217
4:45 - 5:45 PM	0	0	0	0	0	71	0	0	0	0	0	0	0	156	0	0	227
5:00 - 6:00 PM	0	0	0	0	0	72	0	0	0	0	0	0	0	148	0	0	220
Peak Hour 4:00 - 5:00 PM	0	0	0	0	0	102	0	0	0	0	0	0	0	144	0	0	246
Peak Hour Factor		0.00				0.77				0.00				0.82			0.85
Peak Hour % Trucks		0%				0%				0%				0%			
Peak 15 Min % Trucks		0%				0%				0%				0%			

SE 40th Street
Between SE201st St and NW Deer Fern St

A to B WB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
03/07/18	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	0	0	0	0	14	22	**15**	**7**	0	0	0	0	0	0	58	34-43	37
18:00	**1**	0	0	3	**21**	22	14	2	0	0	0	0	0	0	63	31-40	43
19:00	1	0	0	**4**	21	**32**	10	1	**1**	0	0	0	0	0	**70**	31-40	53
20:00	0	0	0	1	6	15	6	1	0	0	0	0	0	0	29	31-40	21
21:00	0	0	0	1	7	8	1	1	0	0	0	0	0	0	18	31-40	15
22:00	0	0	0	1	2	1	0	0	0	0	0	0	0	0	4	25-34	3
23:00	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3	35-44	3
Total	2	0	0	10	71	101	48	12	1	0	0	0	0	0	245		
Percent	0.8%	0.0%	0.0%	4.1%	29.0%	41.2%	19.6%	4.9%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak																	
Vol.																	
PM Peak	18:00			19:00	18:00	19:00	17:00	17:00	19:00						19:00		
Vol.	1			4	21	32	15	7	1						70		

H. LEE & ASSOCIATES, PLLC

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SE 40th Street
Between SE201st St and NW Deer Fern St

A to B WB

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
03/08/18	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
01:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	34-43	1
02:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	24-33	1
03:00	0	0	0	0	0	2	0	0	**1**	0	0	0	0	0	3	30-39	2
04:00	0	0	**1**	1	1	1	1	0	0	0	0	0	0	0	5	36-45	2
05:00	0	0	0	1	3	8	5	3	0	0	0	0	0	0	20	35-44	13
06:00	0	0	0	2	5	15	5	2	0	0	0	0	0	0	29	36-45	20
07:00	0	0	0	5	11	36	19	2	1	0	0	0	0	0	74	36-45	55
08:00	0	0	0	**7**	**22**	**44**	24	1	0	0	0	0	0	0	98	35-44	68
09:00	2	0	0	6	19	41	**26**	**7**	0	0	0	0	0	0	**101**	36-45	67
10:00	**5**	**1**	1	1	14	22	7	2	0	0	0	0	0	0	53	31-40	36
11:00	0	0	1	7	19	20	14	2	0	0	0	0	0	0	63	31-40	39
12 PM	1	0	0	**5**	11	24	10	1	**1**	0	0	0	0	0	53	31-40	35
13:00	1	**1**	**4**	4	14	18	**17**	1	0	0	0	0	0	0	60	36-45	35
14:00	1	0	1	1	20	22	13	2	0	0	0	0	0	0	60	31-40	42
15:00	0	0	2	4	**34**	**35**	12	**4**	1	**1**	0	0	0	0	**93**	31-40	69
16:00	**4**	0	1	2	22	33	14	1	0	1	0	0	0	0	78	31-40	55
17:00	0	0	0	2	0	1	0	0	0	0	0	0	0	0	3	20-29	2
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	14	2	11	49	196	322	168	28	4	2	0	0	0	0	796		
Percent	1.8%	0.3%	1.4%	6.2%	24.6%	40.5%	21.1%	3.5%	0.5%	0.3%	0.0%	0.0%	0.0%	0.0%			
AM Peak	10:00	10:00	04:00	08:00	08:00	08:00	09:00	09:00	03:00						09:00		
Vol.	5	1	1	7	22	44	26	7	1						101		
PM Peak	16:00	13:00	13:00	12:00	15:00	15:00	13:00	15:00	12:00	15:00					15:00		
Vol.	4	1	4	5	34	35	17	4	1	1					93		
Total	16	2	11	59	267	423	216	40	5	2	0	0	0	0	1041		
Percent	1.5%	0.2%	1.1%	5.7%	25.6%	40.6%	20.7%	3.8%	0.5%	0.2%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 31 MPH
50th Percentile : 36 MPH
85th Percentile : 42 MPH
95th Percentile : 44 MPH

Stats
10 MPH Pace Speed : 31-40 MPH
Number in Pace : 690
Percent in Pace : 66.3%
Number of Vehicles > 55 MPH : 2
Percent of Vehicles > 55 MPH : 0.2%
Mean Speed(Average) : 37 MPH

SE 40th Street
Between SE201st St and NW Deer Fern St

B to A EB

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		Pace	Number
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Speed	in Pace
03/07/18	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	0	0	**2**	8	**45**	**64**	21	**4**	1	0	0	0	0	0	**145**	31-40	109
18:00	**1**	0	1	**9**	37	41	**22**	1	0	0	0	0	0	0	112	31-40	78
19:00	1	0	0	7	39	30	11	2	**2**	0	0	0	0	0	92	31-40	69
20:00	0	0	0	5	19	18	10	0	1	0	0	0	0	0	53	31-40	37
21:00	0	0	1	3	17	21	6	2	0	0	0	0	0	0	50	31-40	38
22:00	0	0	0	2	2	5	2	1	0	0	0	0	0	0	12	36-45	7
23:00	0	0	0	0	1	4	3	1	0	0	0	0	0	0	9	35-44	7
Total	2	0	4	34	160	183	75	11	4	0	0	0	0	0	473		
Percent	0.4%	0.0%	0.8%	7.2%	33.8%	38.7%	15.9%	2.3%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak																	
Vol.																	
PM Peak	18:00		17:00	18:00	17:00	17:00	18:00	17:00	19:00						17:00		
Vol.	1		2	9	45	64	22	4	2						145		

SE 40th Street
Between SE201st St and NW Deer Fern St

B to A EB

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		Pace	Number
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Speed	in Pace
03/08/18	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	34-43	2
01:00	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	25-34	2
02:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	34-43	1
03:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	30-39	2
04:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	29-38	1
05:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	24-33	1
06:00	0	0	0	3	3	3	0	1	0	0	0	0	0	0	10	31-40	6
07:00	1	0	0	3	7	15	0	0	0	0	0	0	0	0	26	31-40	22
08:00	**2**	0	0	7	**19**	21	6	1	0	0	0	0	0	0	56	31-40	40
09:00	2	**1**	0	6	19	16	9	**4**	0	0	0	0	0	0	57	31-40	35
10:00	1	0	**4**	**10**	14	21	10	1	0	0	0	0	0	0	61	31-40	35
11:00	0	0	2	7	19	**29**	**11**	2	0	0	0	0	0	0	**70**	31-40	48
12 PM	1	0	1	7	21	30	12	1	**1**	0	0	0	0	0	74	31-40	51
13:00	0	0	0	6	22	20	12	2	1	0	0	0	0	0	63	31-40	42
14:00	1	0	0	**8**	27	22	**18**	2	0	0	0	0	0	0	78	31-40	49
15:00	0	**1**	1	8	**44**	42	17	2	0	0	0	0	0	0	115	31-40	86
16:00	**8**	1	**8**	8	38	**67**	13	**3**	0	0	0	0	0	0	**146**	31-40	105
17:00	0	0	1	2	0	0	0	0	0	0	0	0	0	0	3	20-29	3
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	16	3	17	75	236	290	110	19	2	0	0	0	0	0	768		
Percent	2.1%	0.4%	2.2%	9.8%	30.7%	37.8%	14.3%	2.5%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	08:00	09:00	10:00	10:00	08:00	11:00	11:00	09:00							11:00		
Vol.	2	1	4	10	19	29	11	4							70		
PM Peak	16:00	15:00	16:00	14:00	15:00	16:00	14:00	16:00	12:00						16:00		
Vol.	8	1	8	8	44	67	18	3	1						146		
Total	18	3	21	109	396	473	185	30	6	0	0	0	0	0	1241		
Percent	1.5%	0.2%	1.7%	8.8%	31.9%	38.1%	14.9%	2.4%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 30 MPH
50th Percentile : 35 MPH
85th Percentile : 40 MPH
95th Percentile : 44 MPH

Stats
10 MPH Pace Speed : 31-40 MPH
Number in Pace : 869
Percent in Pace : 70.0%
Number of Vehicles > 55 MPH : 0
Percent of Vehicles > 55 MPH : 0.0%
Mean Speed(Average) : 36 MPH

APPENDIX B

EXISTING LEVEL OF SERVICE

Lanes, Volumes, Timings

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✣			✣	
Traffic Volume (vph)	4	408	52	12	184	0	148	0	32	4	0	28
Future Volume (vph)	4	408	52	12	184	0	148	0	32	4	0	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115		0	135		0	220		0	30		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.983						0.976			0.882	
Flt Protected	0.950			0.950				0.961			0.994	
Satd. Flow (prot)	1752	3445	0	1736	3471	0	0	1747	0	0	1666	0
Flt Permitted	0.950			0.950				0.961			0.994	
Satd. Flow (perm)	1752	3445	0	1736	3471	0	0	1747	0	0	1666	0
Link Speed (mph)		40			40			35			25	
Link Distance (ft)		1779			1191			1505			543	
Travel Time (s)		30.3			20.3			29.3			14.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	2%	2%	2%	0%	0%	0%
Adj. Flow (vph)	4	408	52	12	184	0	148	0	32	4	0	28
Shared Lane Traffic (%)												
Lane Group Flow (vph)	4	460	0	12	184	0	0	180	0	0	32	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 36.4% ICU Level of Service A

Analysis Period (min) 15

HCM 2010 TWSC

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard 03/06/2018

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Traffic Vol, veh/h	4	408	52	12	184	0	148	0	32	4	0	28
Future Vol, veh/h	4	408	52	12	184	0	148	0	32	4	0	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	135	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	3	3	3	4	4	4	2	2	2	0	0	0
Mvmt Flow	4	408	52	12	184	0	148	0	32	4	0	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	184	0	0	460	0	0	558	650	230	420	676	92
Stage 1	-	-	-	-	-	-	442	442	-	208	208	-
Stage 2	-	-	-	-	-	-	116	208	-	212	468	-
Critical Hdwy	4.16	-	-	4.18	-	-	7.54	6.54	6.94	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.5	5.5	-
Follow-up Hdwy	2.23	-	-	2.24	-	-	3.52	4.02	3.32	3.5	4	3.3
Pot Cap-1 Maneuver	1381	-	-	1083	-	-	412	387	772	522	378	954
Stage 1	-	-	-	-	-	-	564	575	-	780	734	-
Stage 2	-	-	-	-	-	-	876	729	-	776	565	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1381	-	-	1083	-	-	396	382	772	495	373	954
Mov Cap-2 Maneuver	-	-	-	-	-	-	396	382	-	495	373	-
Stage 1	-	-	-	-	-	-	562	573	-	778	726	-
Stage 2	-	-	-	-	-	-	841	721	-	742	563	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.5	19	9.4
HCM LOS			C	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	434	1381	-	-	1083	-	-	855
HCM Lane V/C Ratio	0.415	0.003	-	-	0.011	-	-	0.037
HCM Control Delay (s)	19	7.6	-	-	8.4	-	-	9.4
HCM Lane LOS	C	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	2	0	-	-	0	-	-	0.1

Lanes, Volumes, Timings
2: NW Brady Road & NW 16th Street

03/06/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (vph)	80	140	84	84	172	72	128	60	24	44	88	68
Future Volume (vph)	80	140	84	84	172	72	128	60	24	44	88	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.963			0.970			0.985			0.954	
Flt Protected		0.987			0.987			0.971			0.989	
Satd. Flow (prot)	0	1657	0	0	1783	0	0	1747	0	0	1758	0
Flt Permitted		0.987			0.987			0.971			0.989	
Satd. Flow (perm)	0	1657	0	0	1783	0	0	1747	0	0	1758	0
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		1212			959			2307			902	
Travel Time (s)		33.1			26.2			44.9			17.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	9%	9%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Adj. Flow (vph)	80	140	84	84	172	72	128	60	24	44	88	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	304	0	0	328	0	0	212	0	0	200	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 56.8%		ICU Level of Service B
Analysis Period (min) 15		

Intersection	
Intersection Delay, s/veh	14
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	80	140	84	84	172	72	128	60	24	44	88	68
Future Vol, veh/h	80	140	84	84	172	72	128	60	24	44	88	68
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	9	9	9	2	2	2	4	4	4	2	2	2
Mvmt Flow	80	140	84	84	172	72	128	60	24	44	88	68
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	14.7	15.1	13.1	12.3
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	60%	26%	26%	22%
Vol Thru, %	28%	46%	52%	44%
Vol Right, %	11%	28%	22%	34%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	212	304	328	200
LT Vol	128	80	84	44
Through Vol	60	140	172	88
RT Vol	24	84	72	68
Lane Flow Rate	212	304	328	200
Geometry Grp	1	1	1	1
Degree of Util (X)	0.373	0.499	0.527	0.34
Departure Headway (Hd)	6.328	5.905	5.781	6.124
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	568	614	626	586
Service Time	4.374	3.917	3.794	4.172
HCM Lane V/C Ratio	0.373	0.495	0.524	0.341
HCM Control Delay	13.1	14.7	15.1	12.3
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.7	2.8	3.1	1.5

Lanes, Volumes, Timings

3: NW Brady Road & NW McIntosh Road

03/06/2018

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↑↱		↰	↑
Traffic Volume (vph)	136	4	192	48	4	328
Future Volume (vph)	136	4	192	48	4	328
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.996		0.973			
Flt Protected	0.954				0.950	
Satd. Flow (prot)	1805	0	1761	0	1770	1863
Flt Permitted	0.954				0.950	
Satd. Flow (perm)	1805	0	1761	0	1770	1863
Link Speed (mph)	35		40			35
Link Distance (ft)	1524		727			2307
Travel Time (s)	29.7		12.4			44.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	5%	5%	2%	2%
Adj. Flow (vph)	136	4	192	48	4	328
Shared Lane Traffic (%)						
Lane Group Flow (vph)	140	0	240	0	4	328
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 31.7% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↱		↰	↑
Traffic Vol, veh/h	136	4	192	48	4	328
Future Vol, veh/h	136	4	192	48	4	328
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	5	5	2	2
Mvmt Flow	136	4	192	48	4	328

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	552	216	0	0	240	0
Stage 1	216	-	-	-	-	-
Stage 2	336	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.12	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.218	-
Pot Cap-1 Maneuver	498	829	-	-	1327	-
Stage 1	825	-	-	-	-	-
Stage 2	728	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	496	829	-	-	1327	-
Mov Cap-2 Maneuver	496	-	-	-	-	-
Stage 1	825	-	-	-	-	-
Stage 2	726	-	-	-	-	-

Approach	WB		NB		SB	
HCM Control Delay, s	14.9		0		0.1	
HCM LOS	B					

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	502	1327	-
HCM Lane V/C Ratio	-	-	0.279	0.003	-
HCM Control Delay (s)	-	-	14.9	7.7	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.1	0	-

Lanes, Volumes, Timings
4: SE Brady Road /SE Brady Road & SE Grand Ridge Drive

03/06/2018

	↗	→	←	↖	↘	↙
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		⋎	
Traffic Volume (vph)	8	156	516	4	8	72
Future Volume (vph)	8	156	516	4	8	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.878	
Flt Protected		0.998			0.995	
Satd. Flow (prot)	0	1724	1898	0	1660	0
Flt Permitted		0.998			0.995	
Satd. Flow (perm)	0	1724	1898	0	1660	0
Link Speed (mph)		40	40		25	
Link Distance (ft)		978	3072		1011	
Travel Time (s)		16.7	52.4		27.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	10%	10%	0%	0%	0%	0%
Adj. Flow (vph)	8	156	516	4	8	72
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	164	520	0	80	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 39.0%		ICU Level of Service A
Analysis Period (min) 15		

HCM 2010 TWSC
4: SE Brady Road /SE Brady Road & SE Grand Ridge Drive

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		⇆	
Traffic Vol, veh/h	8	156	516	4	8	72
Future Vol, veh/h	8	156	516	4	8	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	10	10	0	0	0	0
Mvmt Flow	8	156	516	4	8	72

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	520	0	-	0	690	518
Stage 1	-	-	-	-	518	-
Stage 2	-	-	-	-	172	-
Critical Hdwy	4.2	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.29	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1007	-	-	-	414	562
Stage 1	-	-	-	-	602	-
Stage 2	-	-	-	-	863	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1007	-	-	-	410	562
Mov Cap-2 Maneuver	-	-	-	-	410	-
Stage 1	-	-	-	-	602	-
Stage 2	-	-	-	-	855	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	12.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1007	-	-	-	542
HCM Lane V/C Ratio	0.008	-	-	-	0.148
HCM Control Delay (s)	8.6	0	-	-	12.8
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.5

5: Project Access & SE 40th Street/SE 40th Street

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	↰↱	
Traffic Volume (vph)	68	0	0	124	0	0
Future Volume (vph)	68	0	0	124	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1610	0	1792	1792	1900	0
Flt Permitted						
Satd. Flow (perm)	1610	0	1792	1792	1900	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	1480			1830	2017	
Travel Time (s)	25.2			31.2	55.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	18%	18%	6%	6%	0%	0%
Adj. Flow (vph)	68	0	0	124	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	68	0	0	124	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 9.9% ICU Level of Service A

Analysis Period (min) 15

5: Project Access & SE 40th Street/SE 40th Street

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	↰↱	
Traffic Vol, veh/h	68	0	0	124	0	0
Future Vol, veh/h	68	0	0	124	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	18	18	6	6	0	0
Mvmt Flow	68	0	0	124	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	68	0	192	68
Stage 1	-	-	-	-	68	-
Stage 2	-	-	-	-	124	-
Critical Hdwy	-	-	4.16	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.254	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1508	-	801	1001
Stage 1	-	-	-	-	960	-
Stage 2	-	-	-	-	907	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1508	-	801	1001
Mov Cap-2 Maneuver	-	-	-	-	801	-
Stage 1	-	-	-	-	960	-
Stage 2	-	-	-	-	907	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	1508	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	0	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	-	-	-	0	-

Lanes, Volumes, Timings

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Traffic Volume (vph)	24	228	220	12	768	4	132	0	16	12	0	4
Future Volume (vph)	24	228	220	12	768	4	132	0	16	12	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115		0	135		0	220		0	30		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.926			0.999			0.985			0.966	
Flt Protected	0.950			0.950				0.957			0.964	
Satd. Flow (prot)	1787	3310	0	1787	3571	0	0	1791	0	0	1769	0
Flt Permitted	0.950			0.950				0.957			0.964	
Satd. Flow (perm)	1787	3310	0	1787	3571	0	0	1791	0	0	1769	0
Link Speed (mph)		40			40			35			25	
Link Distance (ft)		1779			1191			1505			543	
Travel Time (s)		30.3			20.3			29.3			14.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	24	228	220	12	768	4	132	0	16	12	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	24	448	0	12	772	0	0	148	0	0	16	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 37.8% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Traffic Vol, veh/h	24	228	220	12	768	4	132	0	16	12	0	4
Future Vol, veh/h	24	228	220	12	768	4	132	0	16	12	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	135	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	1	1	1	1	1	1	0	0	0	0	0	0
Mvmt Flow	24	228	220	12	768	4	132	0	16	12	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	772	0	0	448	0	0	794	1182	224	956	1290	386
Stage 1	-	-	-	-	-	-	386	386	-	794	794	-
Stage 2	-	-	-	-	-	-	408	796	-	162	496	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.21	-	-	2.21	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	845	-	-	1116	-	-	282	191	786	216	165	618
Stage 1	-	-	-	-	-	-	614	614	-	352	403	-
Stage 2	-	-	-	-	-	-	596	402	-	830	549	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	845	-	-	1116	-	-	272	184	786	205	159	618
Mov Cap-2 Maneuver	-	-	-	-	-	-	272	184	-	205	159	-
Stage 1	-	-	-	-	-	-	597	597	-	342	399	-
Stage 2	-	-	-	-	-	-	586	398	-	790	533	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	0.1	29.2	20.7
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	293	845	-	-	1116	-	-	246
HCM Lane V/C Ratio	0.505	0.028	-	-	0.011	-	-	0.065
HCM Control Delay (s)	29.2	9.4	-	-	8.3	-	-	20.7
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	2.7	0.1	-	-	0	-	-	0.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (vph)	4	100	8	104	24	96	4	188	136	100	236	4
Future Volume (vph)	4	100	8	104	24	96	4	188	136	100	236	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990			0.942			0.944			0.998	
Flt Protected		0.998			0.977			0.999			0.986	
Satd. Flow (prot)	0	1877	0	0	1749	0	0	1792	0	0	1833	0
Flt Permitted		0.998			0.977			0.999			0.986	
Satd. Flow (perm)	0	1877	0	0	1749	0	0	1792	0	0	1833	0
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		1212			959			2307			902	
Travel Time (s)		33.1			26.2			44.9			17.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Adj. Flow (vph)	4	100	8	104	24	96	4	188	136	100	236	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	112	0	0	224	0	0	328	0	0	340	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 66.2% ICU Level of Service C

Analysis Period (min) 15

Intersection	
Intersection Delay, s/veh	13
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	4	100	8	104	24	96	4	188	136	100	236	4
Future Vol, veh/h	4	100	8	104	24	96	4	188	136	100	236	4
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	2	2	2
Mvmt Flow	4	100	8	104	24	96	4	188	136	100	236	4
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.6	12	12.9	14.4
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	4%	46%	29%
Vol Thru, %	57%	89%	11%	69%
Vol Right, %	41%	7%	43%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	328	112	224	340
LT Vol	4	4	104	100
Through Vol	188	100	24	236
RT Vol	136	8	96	4
Lane Flow Rate	328	112	224	340
Geometry Grp	1	1	1	1
Degree of Util (X)	0.474	0.19	0.356	0.519
Departure Headway (Hd)	5.204	6.097	5.728	5.492
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	689	585	625	653
Service Time	3.263	4.175	3.794	3.549
HCM Lane V/C Ratio	0.476	0.191	0.358	0.521
HCM Control Delay	12.9	10.6	12	14.4
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.6	0.7	1.6	3

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↱		↰	↑
Traffic Volume (vph)	48	12	384	132	8	356
Future Volume (vph)	48	12	384	132	8	356
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.973		0.965			
Flt Protected	0.962				0.950	
Satd. Flow (prot)	1778	0	1815	0	1752	1845
Flt Permitted	0.962				0.950	
Satd. Flow (perm)	1778	0	1815	0	1752	1845
Link Speed (mph)	35		40			35
Link Distance (ft)	1524		727			2307
Travel Time (s)	29.7		12.4			44.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	1%	3%	3%
Adj. Flow (vph)	48	12	384	132	8	356
Shared Lane Traffic (%)						
Lane Group Flow (vph)	60	0	516	0	8	356
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 38.3% ICU Level of Service A

Analysis Period (min) 15

HCM 2010 TWSC
3: NW Brady Road & NW McIntosh Road

03/06/2018

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↑↱		↰	↑
Traffic Vol, veh/h	48	12	384	132	8	356
Future Vol, veh/h	48	12	384	132	8	356
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	1	1	3	3
Mvmt Flow	48	12	384	132	8	356

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	822	450	0	0	516	0
Stage 1	450	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	346	613	-	-	1045	-
Stage 1	647	-	-	-	-	-
Stage 2	702	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	343	613	-	-	1045	-
Mov Cap-2 Maneuver	343	-	-	-	-	-
Stage 1	647	-	-	-	-	-
Stage 2	697	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.4	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	376	1045	-
HCM Lane V/C Ratio	-	-	0.16	0.008	-
HCM Control Delay (s)	-	-	16.4	8.5	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.6	0	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰↑	↑↱		↰↱	
Traffic Volume (vph)	48	488	376	4	8	16
Future Volume (vph)	48	488	376	4	8	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.910	
Flt Protected		0.996			0.984	
Satd. Flow (prot)	0	1874	1861	0	1701	0
Flt Permitted		0.996			0.984	
Satd. Flow (perm)	0	1874	1861	0	1701	0
Link Speed (mph)		40	40		25	
Link Distance (ft)		978	3072		1011	
Travel Time (s)		16.7	52.4		27.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Adj. Flow (vph)	48	488	376	4	8	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	536	380	0	24	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 61.7% ICU Level of Service B

Analysis Period (min) 15

4: SE Brady Road /SE Brady Road & SE Grand Ridge Drive

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Vol, veh/h	48	488	376	4	8	16
Future Vol, veh/h	48	488	376	4	8	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	1	2	2	0	0
Mvmt Flow	48	488	376	4	8	16

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	380	0	-	0	962	378
Stage 1	-	-	-	-	378	-
Stage 2	-	-	-	-	584	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1184	-	-	-	286	673
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	561	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1184	-	-	-	270	673
Mov Cap-2 Maneuver	-	-	-	-	270	-
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	530	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	13.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1184	-	-	-	449
HCM Lane V/C Ratio	0.041	-	-	-	0.053
HCM Control Delay (s)	8.2	0	-	-	13.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2

Lanes, Volumes, Timings
5: Project Access & SE 40th Street/SE 40th Street

03/06/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	↰↱	
Traffic Volume (vph)	156	0	0	132	0	0
Future Volume (vph)	156	0	0	132	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1900	0	1900	1900	1900	0
Flt Permitted						
Satd. Flow (perm)	1900	0	1900	1900	1900	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	1480			1830	2017	
Travel Time (s)	25.2			31.2	55.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	156	0	0	132	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	156	0	0	132	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 11.5% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	Y	
Traffic Vol, veh/h	156	0	0	132	0	0
Future Vol, veh/h	156	0	0	132	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	156	0	0	132	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	156	0	288	156
Stage 1	-	-	-	-	156	-
Stage 2	-	-	-	-	132	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1436	-	707	895
Stage 1	-	-	-	-	877	-
Stage 2	-	-	-	-	899	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1436	-	707	895
Mov Cap-2 Maneuver	-	-	-	-	707	-
Stage 1	-	-	-	-	877	-
Stage 2	-	-	-	-	899	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	1436	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	0	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	-	-	-	0	-

APPENDIX C

ACCIDENT DATA

Washington State
Department of Transportation

Transportation Data, GIS & Modeling Office
7345 Linderson Way Sw, Fl 1
Tumwater, WA 98501

360-570-2464 / Fax 360-570-2449
TTY: 1-800-833-6388
www.wsdot.wa.gov

February 22, 2018

Grant Stonex
H. Lee & Associates, PLLC
PO Box 1849
Vancouver WA 98668

Dear Mr. Stonex:

In accordance with the Public Records Act, RCW 42.56, this letter acknowledges receipt of your request for records dated February 12, 2018 (Request Number PDR-18-0562).

We have prepared a history of officer reported crashes that occurred *at* or *in the vicinity of* the following intersections and road segment in the City of Camas for the period of 1/1/2013 – *available 2018*.

- 34th St / Pacific Rim Blvd @ Lorenz St / Payne Rd
- Brady Rd @ 16th Ave
- Brady Rd @ McIntosh Rd
- Brady Rd @ Grand Ridge Dr.
- Payne Rd / 40th St / 18th Ave from 201st Ave to Deerfern St

Federal law 23 United States Code Section 409 governs use of the data you requested. Under this law, data maintained for purposes of evaluating potential highway safety enhancements:

"*. . . shall not be subject to discovery or admitted into evidence in a federal or state court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data*." [Emphasis added.]

The Washington State Department of Transportation (WSDOT) is releasing this data to you with the understanding that you will not use this data contrary to the restrictions in Section 409, which means you will not use this data in discovery or as evidence at trial in any action for damages against the WSDOT, the State of Washington, or any other jurisdiction involved in the locations mentioned in the data. If you should attempt to use this data in an action for damages against WSDOT, the State of Washington, or any other jurisdiction involved in the locations mentioned in the data, these entities expressly reserve the right, under Section 409, to object to the use of the data, including any opinions drawn from the data.

With this package, your request for records is complete and closed.

If you have any further questions you may contact me at 360-570-2464.

Sincerely,

Julie Brown

Julie Brown
Transportation Planning Technician 3
Transportation Data, GIS & Modeling Office

OFFICER REPORTED CRASHES THAT OCCURRED *at* OR *in the vicinity of* THE FOLLOWING INTERSECTIONS & ROAD SEGMENT IN THE CITY OF CAMAS
34th ST / PACIFIC RIM BLVD @ LORENZ ST/ PAYNE RD
BRADY RD @ 16th AVE
BRADY RD @ MCINTOSH RD
BRADY RD @ GRAND RIDGE DR.
PAYNE RD / 40th ST / 18th AVE FROM 201st AVE TO DEERFERN ST

01/01/2013 - *available 2018*

JURISDICTION	PRIMARY TRAFFICWAY	BLOCK NUMBER	INTERSECTING TRAFFICWAY	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	MILEPOST	A / B	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	# PEDS	# BIKES	VEHICLE 1 TYPE	VEHICLE 2 TYPE	JUNCTION RELATIONSHIP	WEATHER	ROADWAY SURFACE CONDITION	LIGHTING CONDITION	FIRST COLLISION TYPE / OBJECT STRUCK	VEHICLE 1 ACTION	VEHICLE 2 ACTION	VEHICLE 1 COMPASS DIRECTION FROM	VEHICLE 1 COMPASS DIRECTION TO	VEHICLE 2 COMPASS DIRECTION FROM	VEHICLE 2 COMPASS DIRECTION TO	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	FIRST IMPACT LOCATION (City, County & Misc Trafficways - 2010 forward)	WA STATE PLANE SOUTH - X 2010 - FORWARD	WA STATE PLANE SOUTH - Y 2010 - FORWARD
City Street	NW 16TH AVE	4100	NW BRADY RD							E296456	#########	19:37	No Apparent Injury	0	0	2	0	0	Passenger Car	Passenger Car	At Intersection and Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	Entering at angle	Going Straight Ahead	Going Straight Ahead	West	East	South	North	None			Inattention			Lane of Primary Trafficway	#########	########
City Street	NW BRADY RD	1600	NW 16TH AVE							3711803	#########	17:23	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Snowing	Snow/Slush	Dark-Street Lights On	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped at Signal or Stop Sign	North	South	North	South	Exceeding Reas. Safe Speed			None			Lane of Primary Trafficway	#########	########
City Street	NW BRADY RD	1600	NW 16TH AVE							E298816	#########	06:55	No Apparent Injury	0	0	2	0	0	Passenger Car	Passenger Car	At Intersection and Related	Overcast	Wet	Dark-No Street Lights	Entering at angle	Going Straight Ahead	Going Straight Ahead	East	West	South	North	Inattention			Inattention			Lane of Primary Trafficway	#########	########
City Street	NW BRADY RD	0	NW 16TH AVE							E697830	#########	19:59	Died in Hospital	1	1	2	0	0	Motorcycle	Passenger Car	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Going Straight Ahead	Going Straight Ahead	North	South	West	East	Disregard Stop Sign - Flashing Red	Exceeding Reas. Safe Speed		None			Lane of Primary Trafficway	#########	########
City Street	NW BRADY RD	0	NW 16TH AVE							E708673	#########	22:21	Possible Injury	1	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	Entering at angle	Going Straight Ahead	Going Straight Ahead	West	East	North	South	None			Disregard Stop Sign - Flashing Red	Did Not Grant RW to Vehicle		Lane of Primary Trafficway	#########	########
City Street	NW BRADY RD	0	NW MCINTOSH RD							E673603	#########	16:55	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	East	South	North	South	None			None			Lane of Primary Trafficway	#########	98479.44
City Street	NW BRADY RD	2000		0.25	M	N	NW 16TH AVE			3720255	#########	00:12	No Apparent Injury	0	0	1	0	0	Passenger Car		Not at Intersection and Not Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	Vehicle overturned	Making Left Turn		North	South			Exceeding Stated Speed Limit	Inattention					Past the Outside Shoulder of Primary Trafficway	#########	########
City Street	NW BRADY RD	1700		400	F	N	NW 16TH AVE			3766664	#########	15:14	No Apparent Injury	0	0	1	0	0	Passenger Car		Not at Intersection and Not Related	Clear or Partly Cloudy	Dry	Daylight	Domestic animal other (cat, dog, etc)	Going Straight Ahead		North	South			Driver Not Distracted						Lane of Primary Trafficway	#########	########
City Street	NW BRADY RD	20800		0.1	M	NE	NW MCINTOSH RD			3711770	#########	13:28	Suspected Minor Injury	1	0	1	0	0	Passenger Car		Not at Intersection and Not Related	Overcast	Wet	Daylight	Vehicle overturned	Going Straight Ahead		North	Northeast			Unknown Driver Distraction	Exceeding Reas. Safe Speed					Past the Outside Shoulder of Primary Trafficway	#########	98885.99
City Street	NW BRADY RD	20800		225	F	NE	NW MCINTOSH RD			3711823	#########	22:00	No Apparent Injury	0	0	1	0	0	Truck (Flatbad,Van,etc)		Not at Intersection and Not Related	Clear or Partly Cloudy	Dry	Dark-No Street Lights	Vehicle overturned	Other*		Vehicle Backing	Vehicle Stopped			Other						Lane of Primary Trafficway	#########	98658.31
City Street	NW BRADY RD	20800		100	F	NE	NW MCINTOSH RD			3766665	#########	06:41	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	Not at Intersection and Not Related	Clear or Partly Cloudy	Dry	Dawn	Concrete Barrier/Jersey Barrier - Face	Going Straight Ahead	Going Straight Ahead	Southwest	Northeast	Northeast	Southwest	Apparently Asleep			Driver Not Distracted			Outside Shoulder of Primary Trafficway	#########	98565.23
City Street	NW PACIFIC RIM BLVD		SE PAYNE RD							3602250	#########	07:51	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Raining	Wet	Daylight	Entering at angle	Going Straight Ahead	Making Right Turn	West	East	South	East	None			Inattention			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							3673294	#########	08:56	Possible Injury	1	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Driver Distractions Outside Vehicle			Driver Not Distracted			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							3677001	#########	11:55	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Raining	Wet	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Did Not Grant RW to Vehicle			None			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							3711818	#########	15:42	No Apparent Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Did Not Grant RW to Vehicle			None			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							E290745	#########	17:51	No Apparent Injury	0	0	2	0	0	Passenger Car	Passenger Car	At Intersection and Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Did Not Grant RW to Vehicle			Driver Not Distracted			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							E303451	#########	15:13	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Raining	Wet	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Did Not Grant RW to Vehicle			Driver Not Distracted			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							E308237	#########	20:35	Suspected Serious Injury	3	0	3	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Overcast	Dry	Dark-Street Lights On	Entering at angle	Going Straight Ahead	Making Left Turn	West	East	South	West	Under Influence of Alcohol	Exceeding Reas. Safe Speed		None			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	6000	SE PAYNE RD							E466225	#########	17:13	Possible Injury	3	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Did Not Grant RW to Vehicle			None			Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	4600		133	F	E	SE PAYNE RD			3411793	#########	07:48	Died in Hospital	0	1	1	0	0	Passenger Car		Not at Intersection and Not Related	Fog or Smog or Smoke	Dry	Daylight	Tree or Stump (stationary)	Going Straight Ahead		West	East			Exceeding Stated Speed Limit	Exceeding Reas. Safe Speed					Past the Outside Shoulder of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	5700		0.25	M	E	SE PAYNE RD			3766630	#########	07:37	No Apparent Injury	0	0	1	0	0	Pickup,Panel Truck or Vanette under 10,000 lb		Not at Intersection and Not Related	Clear or Partly Cloudy	Dry	Daylight	Vehicle Strikes Deer	Going Straight Ahead		East	West			Driver Not Distracted						Lane of Primary Trafficway	#########	########
City Street	NW PACIFIC RIM BLVD	5600		0.2	M	E	SE PAYNE RD			E701328	#########	02:22	No Apparent Injury	0	0	1	0	0	Passenger Car		Not at Intersection and Not Related	Clear or Partly Cloudy	Dry	Dark-Street Lights On	Tree or Stump (stationary)	Going Straight Ahead		East	West			Operating Defective Equipment	Other	Exceeding Reas. Safe Speed				Past the Outside Shoulder of Primary Trafficway	#########	########
City Street	SE BRADY RD	19900		0.22	M	W	NW GRAND RIDGE DR			E723299	#########	17:55	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	Not at Intersection and Not Related	Raining	Wet	Dusk	From opposite direction - both going straight - sideswipe	Going Straight Ahead	Going Straight Ahead	North	South	South	North	Under Influence of Alcohol	Over Center Line		None			Lane of Primary Trafficway	#########	97840.76

OFFICER REPORTED CRASHES THAT OCCURRED *at* OR *in the vicinity of* THE FOLLOWING INTERSECTIONS & ROAD SEGMENT IN THE CITY OF CAMAS

34th ST / PACIFIC RIM BLVD @ LORENZ ST/ PAYNE RD
BRADY RD @ 16th AVE
BRADY RD @ MCINTOSH RD
BRADY RD @ GRAND RIDGE DR.
PAYNE RD / 40th ST / 18th AVE FROM 201st AVE TO DEERFERN ST

01/01/2013 - *available 2018*

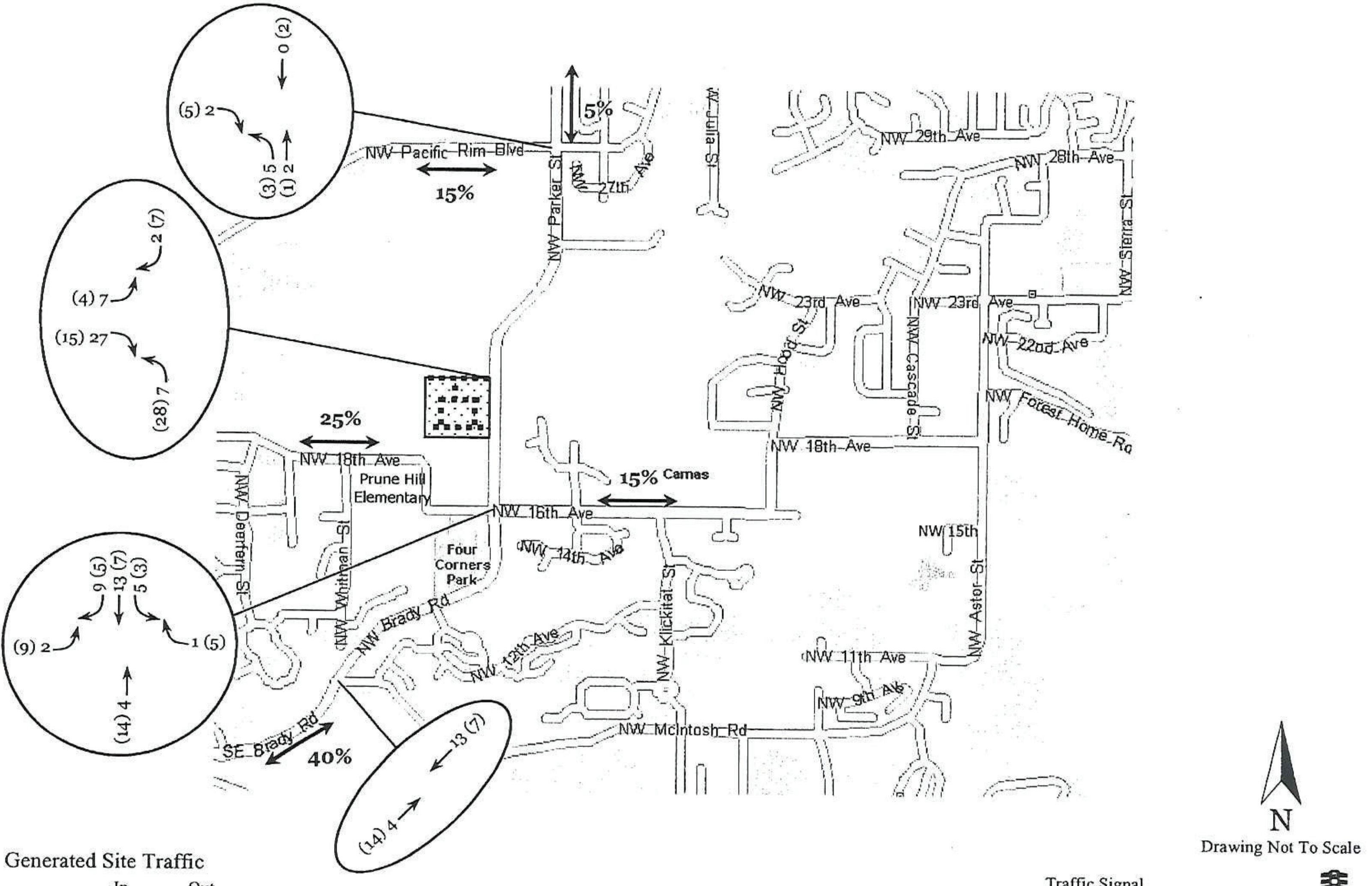
Under 23 U.S. Code § 409 and 23 U.S. Code § 148, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

JURISDICTION	PRIMARY TRAFFICWAY	BLOCK NUMBER	INTERSECTING TRAFFICWAY	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	MILEPOST	A / B	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	# PEDS	# BIKES	VEHICLE 1 TYPE	VEHICLE 2 TYPE	JUNCTION RELATIONSHIP	WEATHER	ROADWAY SURFACE CONDITION	LIGHTING CONDITION	FIRST COLLISION TYPE / OBJECT STRUCK	VEHICLE 1 ACTION	VEHICLE 2 ACTION	VEHICLE 1 COMPASS DIRECTION FROM	VEHICLE 1 COMPASS DIRECTION TO	VEHICLE 2 COMPASS DIRECTION FROM	VEHICLE 2 COMPASS DIRECTION TO	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 1)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 1 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 2 (UNIT 2)	MV DRIVER CONTRIBUTING CIRCUMSTANCE 3 (UNIT 2)	FIRST IMPACT LOCATION (City, County & Misc Trafficways - 2010 forward)	WA STATE PLANE SOUTH - X 2010 - FORWARD	WA STATE PLANE SOUTH - Y 2010 - FORWARD
City Street	SE BRADY RD	20300		203	F	W	SE GRAND RIDGE DR			3766554	#########	21:36	No Apparent Injury	0	0	1	0	0	Pickup,Panel Truck or Vanette under 10,000 lb		Not at Intersection and Not Related	Overcast	Dry	Dark-No Street Lights	Metal Sign Post	Going Straight Ahead		West	East			Under Influence of Alcohol						Past the Outside Shoulder of Primary Trafficway	1137753.8	97835.43
City Street	SE PAYNE RD		NW PACIFIC RIM BLVD							3673292	#########	09:15	No Apparent Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Clear or Partly Cloudy	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	South	West	West	East	Did Not Grant RW to Vehicle			Other			Lane of Primary Trafficway	#########	########
City Street	SE PAYNE ST	4000	SE 201ST ST							3766646	#########	00:15	No Apparent Injury	0	0	1	0	0	Passenger Car		At Intersection and Related	Raining	Wet	Dark-Street Lights On	Metal Sign Post	Making Right Turn		North	Southwest			Unknown Driver Distraction						Past the Outside Shoulder of Primary Trafficway	#########	########

APPENDIX D

IN-PROCESS INFORMATION

Figure 9: Weekday Peak Hour Traffic Volumes Generated By Parker Village



Generated Site Traffic

	In	Out
AM Peak	9	33
PM Peak	34	19

Traffic Signal 🚦

Stop Sign ●

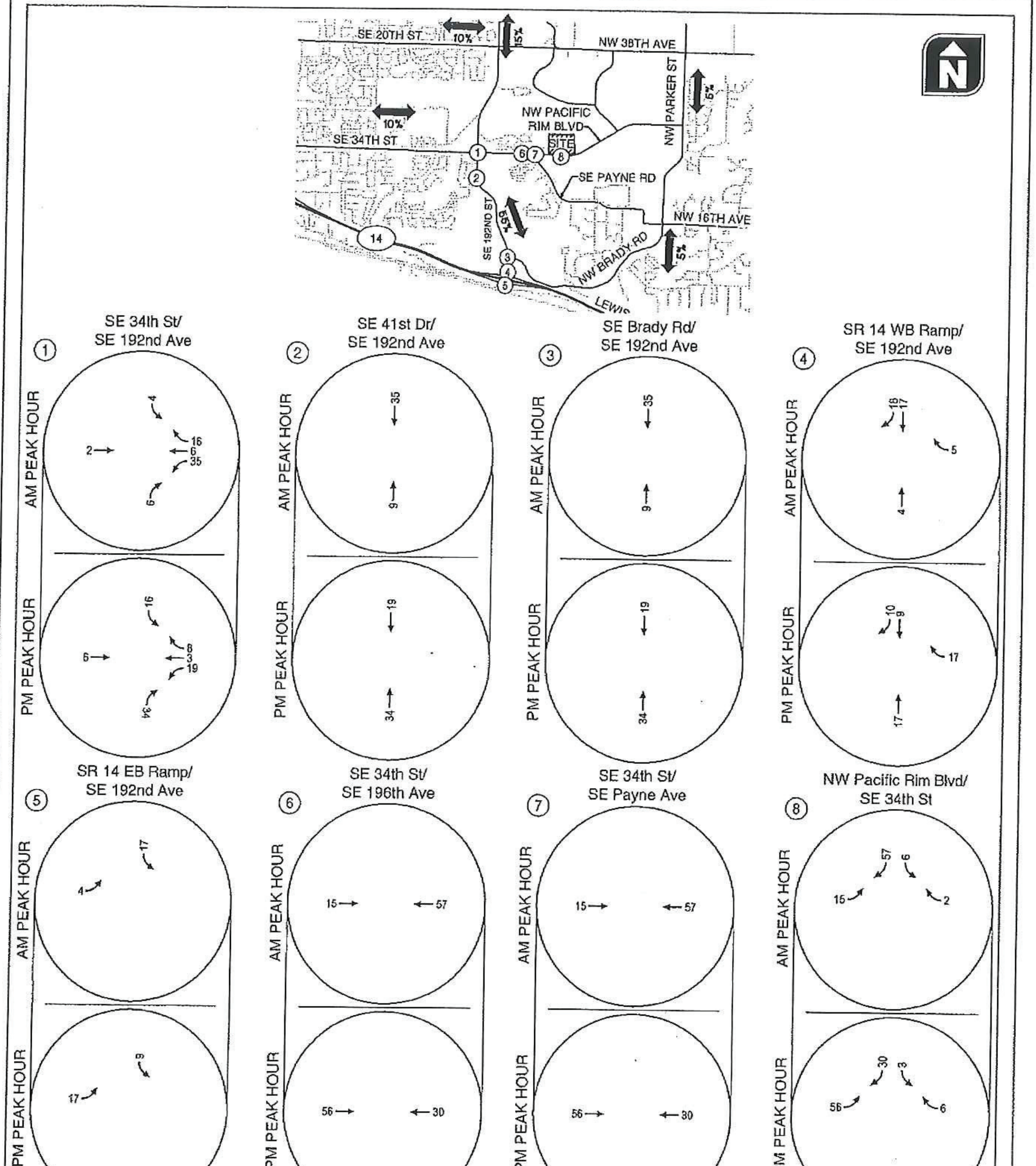
Proposed Site ▨

Proposed Roadway ■■■■

AM(PM) Peak Hour Volumes

OR04.093.T01 Parker Village

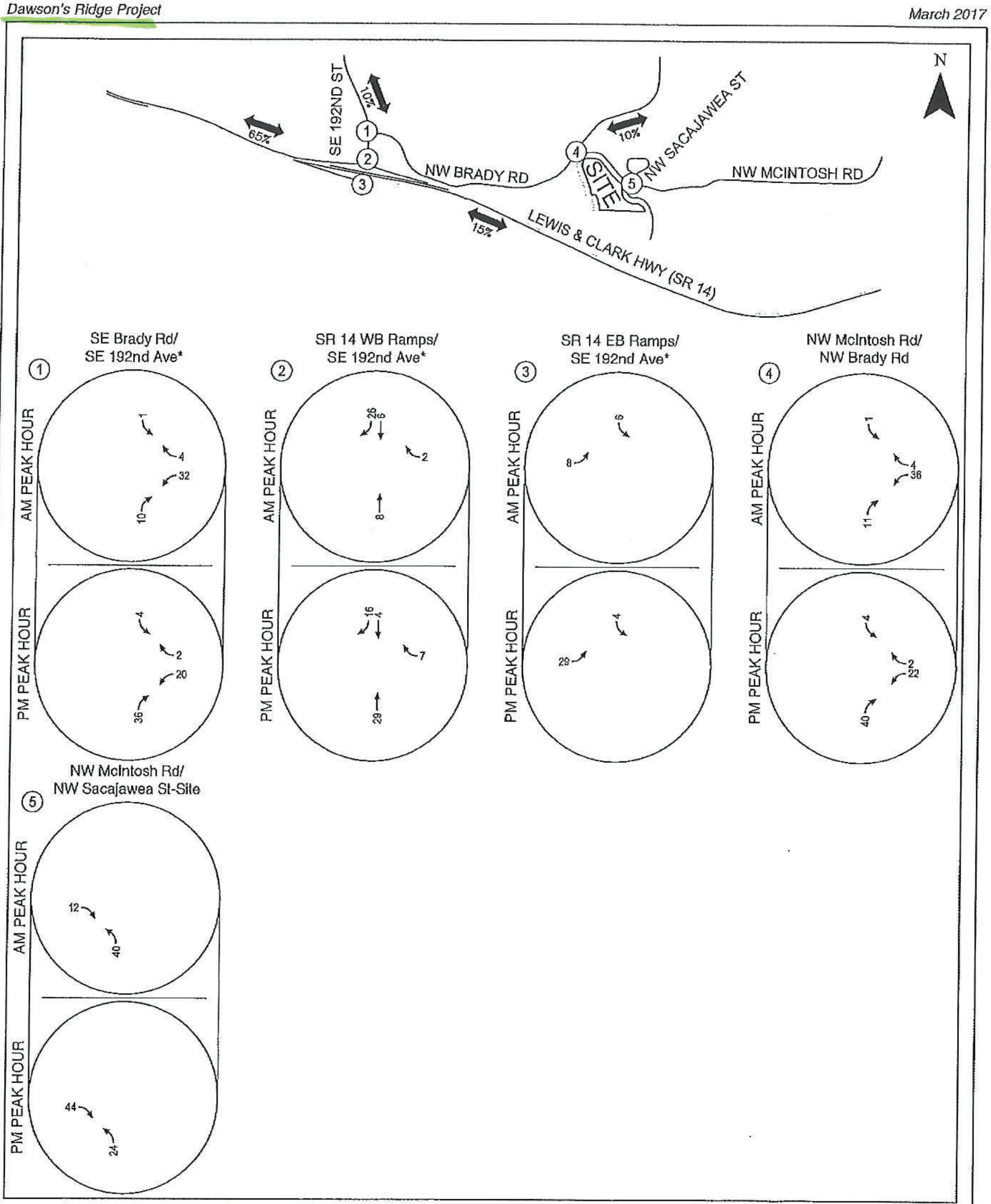
CTS Engineers



Site-Generated Trips
Weekday AM and PM Peak Hours
Camas, Washington

Figure
6

H:\projfile\20200 - Kate's Woods TIA\dwgs\figs\20200Figs_Report.dwg Jun 16, 2016 - 3:57pm - layala Layout Tab: Figure 6



Site-Generated Trips
Weekday AM and PM Peak Hours
Camas, Washington

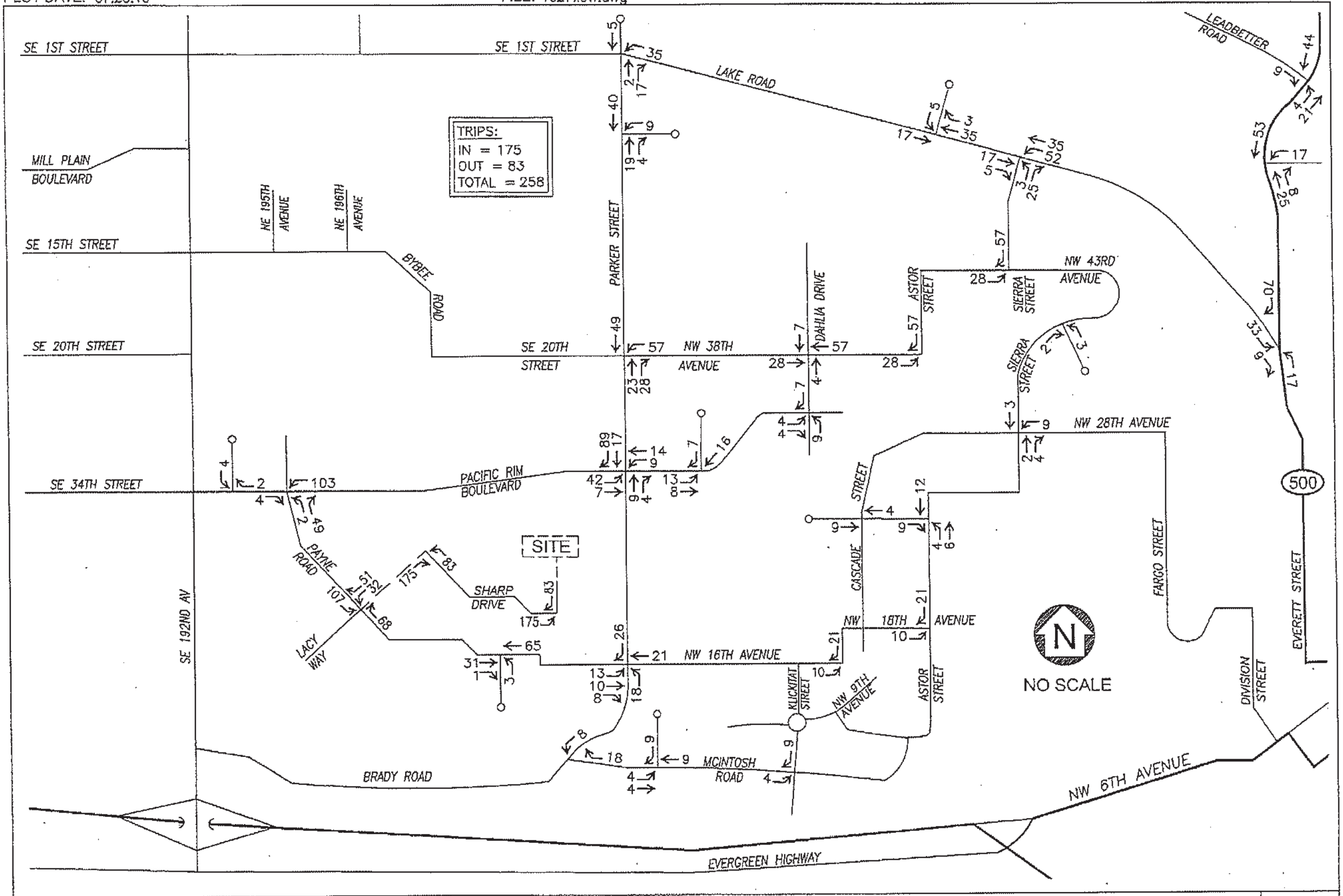
Figure
6

H:\proj\file\19693 - McIntosh Road PRD\dwgs\figs\19693_Figs.dwg Mar 10, 2017 - 3:32pm - kpurser Layout Tab: Figure 6

KITTELSON & ASSOCIATES

PLOT DATE: 07.25.16

FILE: 1627flow.dwg



TRIPS:
IN = 175
OUT = 83
TOTAL = 258

CHARBONNEAU ENGINEERING LLC

PROJECT: 16-27

NOTES: Trip generation based on High School (ITE 530) trip rates.

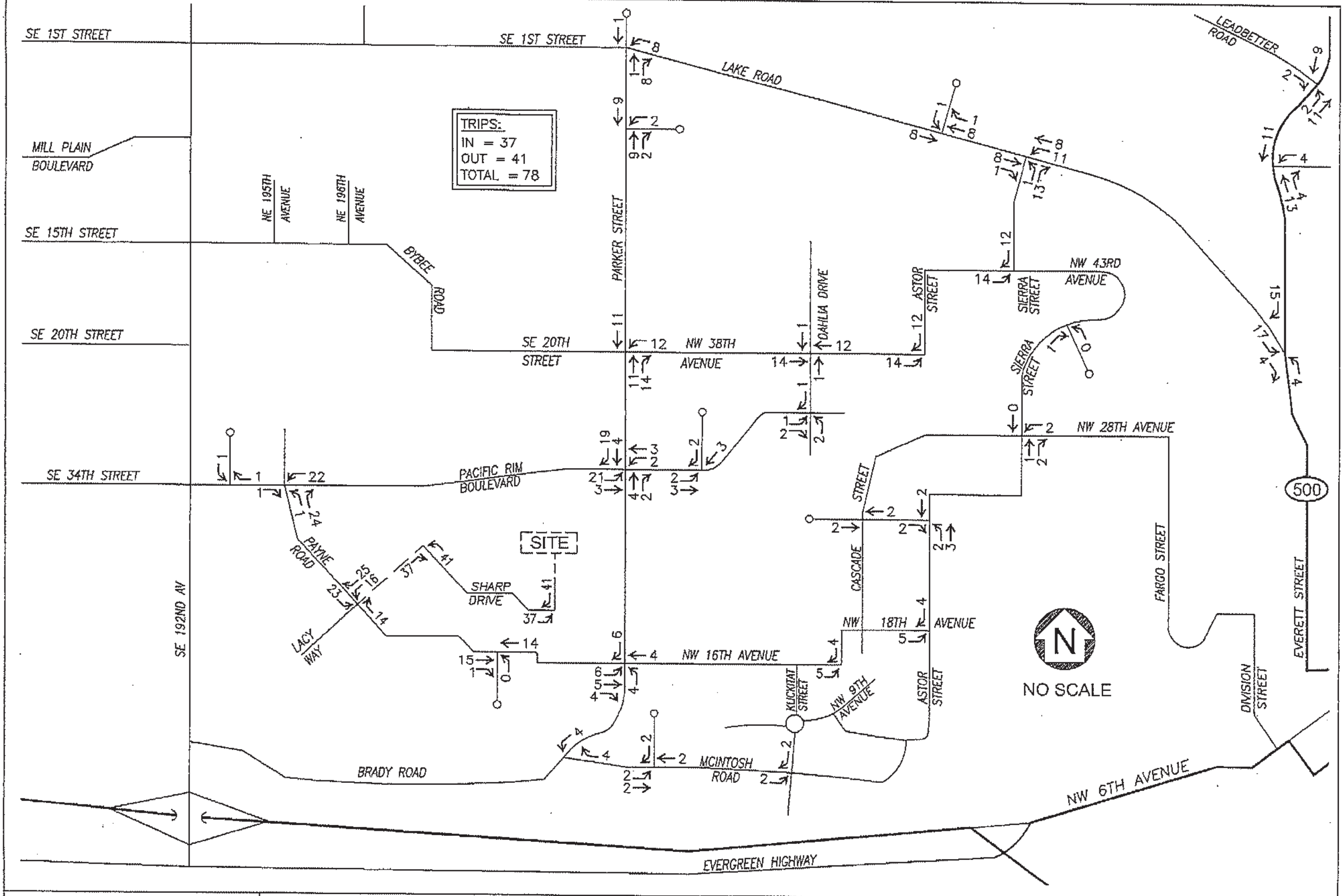
TRIP ASSIGNMENT
AM PEAK HOUR
CAMAS HIGH SCHOOL - SHARP DRIVE

FIGURE

6a

PLOT DATE: 07.25.16

FILE: 1627flow.dwg



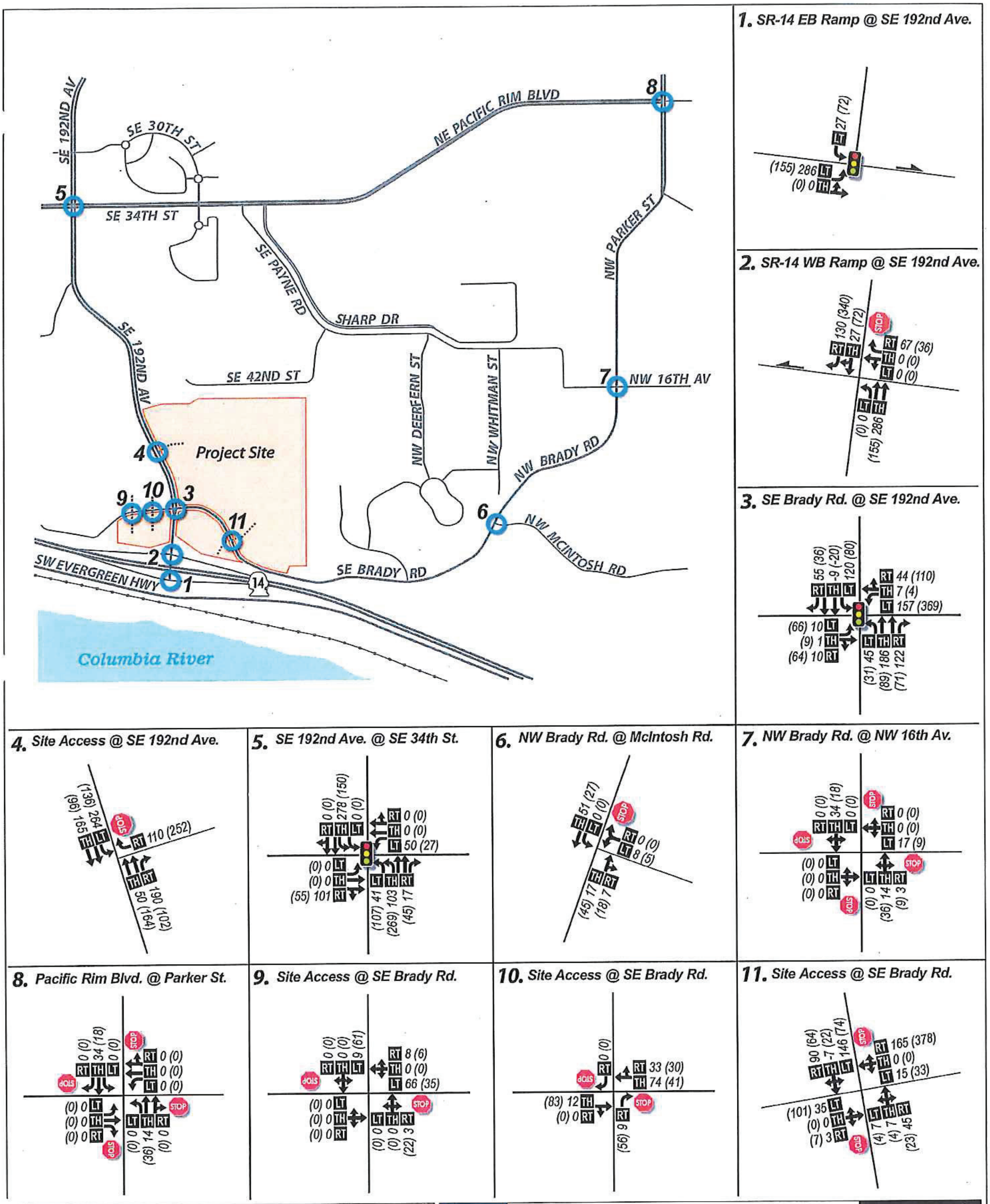
CHARBONNEAU ENGINEERING LLC

PROJECT: 16-27

NOTES: Trip generation based on High School (ITE 530) trip rates.

TRIP ASSIGNMENT
PM PEAK HOUR
CAMAS HIGH SCHOOL - SHARP DRIVE

FIGURE
6c



LEGEND

- Traffic Signal
- Stop Sign
- Lane Configuration
- Future Project Access

\# - Study Intersection

AM (PM) - Peak Hour Traffic Volumes

DKS

No Scale

Figure 3

Site-Generated Traffic Volumes Weekday AM & PM Peak Hours

Columbia Palisades

APPENDIX E

2023 “WITHOUT PROJECT” LEVEL OF SERVICE

Lanes, Volumes, Timings
1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

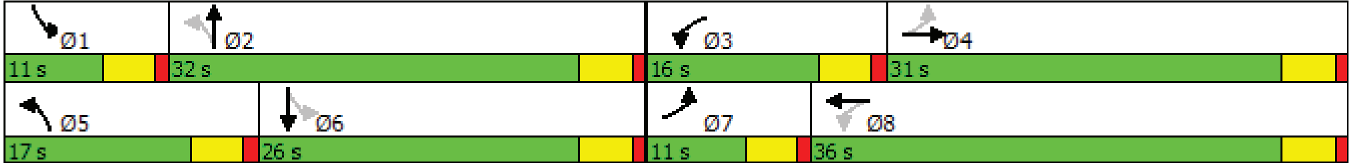
	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (vph)	5	474	63	117	264	0	169	0	85	5	0	32
Future Volume (vph)	5	474	63	117	264	0	169	0	85	5	0	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115		0	135		0	220		0	30		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.982						0.850			0.850	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	3442	0	1736	3471	0	1770	1583	0	1805	1615	0
Flt Permitted	0.589			0.295			0.489			0.702		
Satd. Flow (perm)	1087	3442	0	539	3471	0	911	1583	0	1334	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16						450			538	
Link Speed (mph)		40			40			35			25	
Link Distance (ft)		1779			1191			1505			543	
Travel Time (s)		30.3			20.3			29.3			14.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	2%	2%	2%	0%	0%	0%
Adj. Flow (vph)	5	474	63	117	264	0	169	0	85	5	0	32
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	537	0	117	264	0	169	85	0	5	32	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		9.5	22.5		9.5	22.5	
Total Split (s)	11.0	31.0		16.0	36.0		17.0	32.0		11.0	26.0	
Total Split (%)	12.2%	34.4%		17.8%	40.0%		18.9%	35.6%		12.2%	28.9%	
Maximum Green (s)	6.5	26.5		11.5	31.5		12.5	27.5		6.5	21.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	18.7	14.7		23.5	22.0		18.0	15.8		10.4	6.3	
Actuated g/C Ratio	0.36	0.29		0.46	0.43		0.35	0.31		0.20	0.12	
v/c Ratio	0.01	0.54		0.27	0.18		0.34	0.11		0.02	0.05	
Control Delay	8.4	19.4		10.1	10.9		15.9	0.3		14.4	0.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.4	19.4		10.1	10.9		15.9	0.3		14.4	0.1	
LOS	A	B		B	B		B	A		B	A	
Approach Delay		19.3			10.6			10.7			2.1	
Approach LOS		B			B			B			A	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 51.4
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.54
Intersection Signal Delay: 14.2 Intersection LOS: B
Intersection Capacity Utilization 48.9% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard



Queues

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

	↗	→	↙	←	↖	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	5	537	117	264	169	85	5	32
v/c Ratio	0.01	0.54	0.27	0.18	0.34	0.11	0.02	0.05
Control Delay	8.4	19.4	10.1	10.9	15.9	0.3	14.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.4	19.4	10.1	10.9	15.9	0.3	14.4	0.1
Queue Length 50th (ft)	1	81	21	24	38	0	1	0
Queue Length 95th (ft)	5	132	46	62	91	0	8	0
Internal Link Dist (ft)		1699		1111		1425		463
Turn Bay Length (ft)	115		135		220		30	
Base Capacity (vph)	505	1952	570	2201	604	1106	364	1057
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.28	0.21	0.12	0.28	0.08	0.01	0.03

Intersection Summary

HCM 2010 Signalized Intersection Summary
1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	5	474	63	117	264	0	169	0	85	5	0	32
Future Volume (veh/h)	5	474	63	117	264	0	169	0	85	5	0	32
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1827	1827	1900	1863	1863	1900	1900	1900	1900
Adj Flow Rate, veh/h	5	474	63	117	264	0	169	0	85	5	0	32
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	3	3	3	4	4	4	2	2	2	0	0	0
Cap, veh/h	482	866	115	440	1243	0	493	0	346	328	0	184
Arrive On Green	0.01	0.28	0.28	0.09	0.36	0.00	0.11	0.00	0.22	0.01	0.00	0.11
Sat Flow, veh/h	1757	3113	412	1740	3563	0	1774	0	1583	1810	0	1615
Grp Volume(v), veh/h	5	266	271	117	264	0	169	0	85	5	0	32
Grp Sat Flow(s),veh/h/ln	1757	1752	1772	1740	1736	0	1774	0	1583	1810	0	1615
Q Serve(g_s), s	0.1	5.7	5.7	1.9	2.3	0.0	3.4	0.0	1.9	0.1	0.0	0.8
Cycle Q Clear(g_c), s	0.1	5.7	5.7	1.9	2.3	0.0	3.4	0.0	1.9	0.1	0.0	0.8
Prop In Lane	1.00		0.23	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	482	488	493	440	1243	0	493	0	346	328	0	184
V/C Ratio(X)	0.01	0.55	0.55	0.27	0.21	0.00	0.34	0.00	0.25	0.02	0.00	0.17
Avail Cap(c_a), veh/h	730	1057	1069	745	2489	0	800	0	991	583	0	791
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.3	13.5	13.5	9.4	9.8	0.0	13.0	0.0	14.2	17.0	0.0	17.6
Incr Delay (d2), s/veh	0.0	1.0	1.0	0.3	0.1	0.0	0.4	0.0	0.4	0.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.9	2.9	0.9	1.1	0.0	1.7	0.0	0.9	0.1	0.0	0.4
LnGrp Delay(d),s/veh	11.3	14.4	14.5	9.7	9.9	0.0	13.4	0.0	14.5	17.1	0.0	18.0
LnGrp LOS	B	B	B	A	A		B		B	B		B
Approach Vol, veh/h		542			381			254			37	
Approach Delay, s/veh		14.4			9.8			13.8			17.9	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	4.8	14.1	8.3	16.7	9.4	9.5	4.8	20.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.5	27.5	11.5	26.5	12.5	21.5	6.5	31.5
Max Q Clear Time (g_c+I1), s	2.1	3.9	3.9	7.7	5.4	2.8	2.1	4.3
Green Ext Time (p_c), s	0.0	0.6	0.1	4.5	0.2	0.6	0.0	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.0
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (vph)	102	165	101	110	211	80	159	82	29	52	138	106
Future Volume (vph)	102	165	101	110	211	80	159	82	29	52	138	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.963			0.973			0.985			0.952	
Flt Protected		0.986			0.986			0.971			0.991	
Satd. Flow (prot)	0	1655	0	0	1787	0	0	1747	0	0	1757	0
Flt Permitted		0.986			0.986			0.971			0.991	
Satd. Flow (perm)	0	1655	0	0	1787	0	0	1747	0	0	1757	0
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		1212			959			2307			902	
Travel Time (s)		33.1			26.2			44.9			17.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	9%	9%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Adj. Flow (vph)	102	165	101	110	211	80	159	82	29	52	138	106
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	368	0	0	401	0	0	270	0	0	296	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 70.7% ICU Level of Service C
Analysis Period (min) 15

HCM 2010 AWSC
2: NW Brady Road & NW 16th Street

03/06/2018

Intersection	
Intersection Delay, s/veh	28.3
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	102	165	101	110	211	80	159	82	29	52	138	106
Future Vol, veh/h	102	165	101	110	211	80	159	82	29	52	138	106
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	9	9	9	2	2	2	4	4	4	2	2	2
Mvmt Flow	102	165	101	110	211	80	159	82	29	52	138	106
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	30.5	34.7	22	22.5
HCM LOS	D	D	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	59%	28%	27%	18%
Vol Thru, %	30%	45%	53%	47%
Vol Right, %	11%	27%	20%	36%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	270	368	401	296
LT Vol	159	102	110	52
Through Vol	82	165	211	138
RT Vol	29	101	80	106
Lane Flow Rate	270	368	401	296
Geometry Grp	1	1	1	1
Degree of Util (X)	0.594	0.761	0.811	0.623
Departure Headway (Hd)	7.916	7.443	7.281	7.579
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	454	486	497	474
Service Time	5.995	5.468	5.306	5.657
HCM Lane V/C Ratio	0.595	0.757	0.807	0.624
HCM Control Delay	22	30.5	34.7	22.5
HCM Lane LOS	C	D	D	C
HCM 95th-tile Q	3.8	6.6	7.7	4.2

Lanes, Volumes, Timings
3: NW Brady Road & NW McIntosh Road

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↱		↰	↑
Traffic Volume (vph)	194	26	231	71	13	420
Future Volume (vph)	194	26	231	71	13	420
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.984		0.968			
Flt Protected	0.958				0.950	
Satd. Flow (prot)	1791	0	1752	0	1770	1863
Flt Permitted	0.958				0.950	
Satd. Flow (perm)	1791	0	1752	0	1770	1863
Link Speed (mph)	35		40			35
Link Distance (ft)	1524		727			2307
Travel Time (s)	29.7		12.4			44.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	5%	5%	2%	2%
Adj. Flow (vph)	194	26	231	71	13	420
Shared Lane Traffic (%)						
Lane Group Flow (vph)	220	0	302	0	13	420
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 41.1% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	5.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↱		↰	↑
Traffic Vol, veh/h	194	26	231	71	13	420
Future Vol, veh/h	194	26	231	71	13	420
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	5	5	2	2
Mvmt Flow	194	26	231	71	13	420

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	713	267	0	0	302	0
Stage 1	267	-	-	-	-	-
Stage 2	446	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.12	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.218	-
Pot Cap-1 Maneuver	401	777	-	-	1259	-
Stage 1	782	-	-	-	-	-
Stage 2	649	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	397	777	-	-	1259	-
Mov Cap-2 Maneuver	397	-	-	-	-	-
Stage 1	782	-	-	-	-	-
Stage 2	642	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.5	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	421	1259	-
HCM Lane V/C Ratio	-	-	0.523	0.01	-
HCM Control Delay (s)	-	-	22.5	7.9	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	2.9	0	-

Lanes, Volumes, Timings

4: SE Brady Road /SE Brady Road & SE Grand Ridge Drive

03/06/2018

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		⅄	
Traffic Volume (vph)	9	196	629	4	9	79
Future Volume (vph)	9	196	629	4	9	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.879	
Flt Protected		0.998			0.995	
Satd. Flow (prot)	0	1724	1898	0	1662	0
Flt Permitted		0.998			0.995	
Satd. Flow (perm)	0	1724	1898	0	1662	0
Link Speed (mph)		40	40		25	
Link Distance (ft)		978	3072		1011	
Travel Time (s)		16.7	52.4		27.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	10%	10%	0%	0%	0%	0%
Adj. Flow (vph)	9	196	629	4	9	79
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	205	633	0	88	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 45.4%	ICU Level of Service A
Analysis Period (min) 15	

4: SE Brady Road /SE Brady Road & SE Grand Ridge Drive

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Vol, veh/h	9	196	629	4	9	79
Future Vol, veh/h	9	196	629	4	9	79
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	10	10	0	0	0	0
Mvmt Flow	9	196	629	4	9	79

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	633	0	-	0	845	631
Stage 1	-	-	-	-	631	-
Stage 2	-	-	-	-	214	-
Critical Hdwy	4.2	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.29	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	913	-	-	-	336	485
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	826	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	913	-	-	-	332	485
Mov Cap-2 Maneuver	-	-	-	-	332	-
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	817	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	14.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	913	-	-	-	463
HCM Lane V/C Ratio	0.01	-	-	-	0.19
HCM Control Delay (s)	9	0	-	-	14.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.7

Lanes, Volumes, Timings
5: Project Access & SE 40th Street/SE 40th Street

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	Y	
Traffic Volume (vph)	75	0	0	137	0	0
Future Volume (vph)	75	0	0	137	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1610	0	1792	1792	1900	0
Flt Permitted						
Satd. Flow (perm)	1610	0	1792	1792	1900	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	1480			1830	2017	
Travel Time (s)	25.2			31.2	55.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	18%	18%	6%	6%	0%	0%
Adj. Flow (vph)	75	0	0	137	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	75	0	0	137	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 10.5% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	Y	
Traffic Vol, veh/h	75	0	0	137	0	0
Future Vol, veh/h	75	0	0	137	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	18	18	6	6	0	0
Mvmt Flow	75	0	0	137	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	75	0	212	75
Stage 1	-	-	-	-	75	-
Stage 2	-	-	-	-	137	-
Critical Hdwy	-	-	4.16	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.254	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1499	-	781	992
Stage 1	-	-	-	-	953	-
Stage 2	-	-	-	-	895	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1499	-	781	992
Mov Cap-2 Maneuver	-	-	-	-	781	-
Stage 1	-	-	-	-	953	-
Stage 2	-	-	-	-	895	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	1499	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	0	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	-	-	-	0	-

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (vph)	27	313	249	36	895	5	150	0	42	14	0	5
Future Volume (vph)	27	313	249	36	895	5	150	0	42	14	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115		0	135		0	220		0	30		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.934			0.999			0.850			0.850	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	3338	0	1787	3571	0	1805	1615	0	1805	1615	0
Flt Permitted	0.194			0.389			0.499			0.730		
Satd. Flow (perm)	365	3338	0	732	3571	0	948	1615	0	1387	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		249			1			548			229	
Link Speed (mph)		40			40			35			25	
Link Distance (ft)		1779			1191			1505			543	
Travel Time (s)		30.3			20.3			29.3			14.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	27	313	249	36	895	5	150	0	42	14	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	27	562	0	36	900	0	150	42	0	14	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings
1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		9.5	22.5		9.5	22.5	
Total Split (s)	10.0	40.0		10.0	40.0		14.0	30.0		10.0	26.0	
Total Split (%)	11.1%	44.4%		11.1%	44.4%		15.6%	33.3%		11.1%	28.9%	
Maximum Green (s)	5.5	35.5		5.5	35.5		9.5	25.5		5.5	21.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	22.3	20.6		22.3	20.6		16.6	14.8		10.2	6.1	
Actuated g/C Ratio	0.45	0.41		0.45	0.41		0.33	0.30		0.20	0.12	
v/c Ratio	0.08	0.37		0.08	0.61		0.32	0.05		0.04	0.01	
Control Delay	7.4	7.1		7.4	14.8		17.0	0.1		16.4	0.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	7.4	7.1		7.4	14.8		17.0	0.1		16.4	0.0	
LOS	A	A		A	B		B	A		B	A	
Approach Delay		7.1			14.5			13.3			12.1	
Approach LOS		A			B			B			B	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 49.9

Natural Cycle: 65

Control Type: Actuated-Uncoordinated

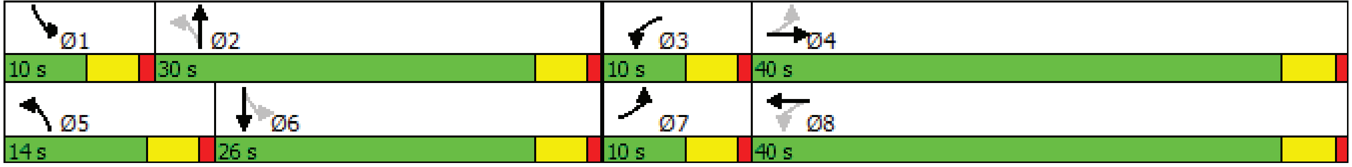
Maximum v/c Ratio: 0.61

Intersection Signal Delay: 11.9 Intersection LOS: B

Intersection Capacity Utilization 52.4% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard



Queues

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

	↗	→	↙	←	↖	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	27	562	36	900	150	42	14	5
v/c Ratio	0.08	0.37	0.08	0.61	0.32	0.05	0.04	0.01
Control Delay	7.4	7.1	7.4	14.8	17.0	0.1	16.4	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.4	7.1	7.4	14.8	17.0	0.1	16.4	0.0
Queue Length 50th (ft)	4	28	6	98	25	0	2	0
Queue Length 95th (ft)	13	72	16	196	93	0	16	0
Internal Link Dist (ft)		1699		1111		1425		463
Turn Bay Length (ft)	115		135		220		30	
Base Capacity (vph)	336	2502	455	2605	516	1152	334	890
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.22	0.08	0.35	0.29	0.04	0.04	0.01

Intersection Summary

	↰	→	↱	↰	←	↱	↰	↑	↱	↰	↓	↱
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	27	313	249	36	895	5	150	0	42	14	0	5
Future Volume (veh/h)	27	313	249	36	895	5	150	0	42	14	0	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1881	1900	1881	1881	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	27	313	249	36	895	5	150	0	42	14	0	5
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	0	0	0
Cap, veh/h	340	787	612	461	1526	9	456	0	289	310	0	159
Arrive On Green	0.03	0.41	0.41	0.04	0.42	0.42	0.10	0.00	0.18	0.02	0.00	0.10
Sat Flow, veh/h	1792	1916	1489	1792	3644	20	1810	0	1615	1810	0	1615
Grp Volume(v), veh/h	27	291	271	36	439	461	150	0	42	14	0	5
Grp Sat Flow(s),veh/h/ln	1792	1787	1618	1792	1787	1878	1810	0	1615	1810	0	1615
Q Serve(g_s), s	0.4	5.8	6.0	0.6	9.6	9.6	3.6	0.0	1.1	0.4	0.0	0.1
Cycle Q Clear(g_c), s	0.4	5.8	6.0	0.6	9.6	9.6	3.6	0.0	1.1	0.4	0.0	0.1
Prop In Lane	1.00		0.92	1.00		0.01	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	340	734	665	461	748	786	456	0	289	310	0	159
V/C Ratio(X)	0.08	0.40	0.41	0.08	0.59	0.59	0.33	0.00	0.15	0.05	0.00	0.03
Avail Cap(c_a), veh/h	478	1247	1129	585	1247	1310	616	0	809	473	0	682
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.9	10.6	10.6	8.2	11.4	11.4	16.6	0.0	17.6	20.0	0.0	20.8
Incr Delay (d2), s/veh	0.1	0.3	0.4	0.1	0.7	0.7	0.4	0.0	0.2	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	2.9	2.7	0.3	4.8	5.0	1.8	0.0	0.5	0.2	0.0	0.1
LnGrp Delay(d),s/veh	9.0	10.9	11.0	8.3	12.1	12.1	17.0	0.0	17.9	20.1	0.0	20.8
LnGrp LOS	A	B	B	A	B	B	B		B	C		C
Approach Vol, veh/h		589			936			192			19	
Approach Delay, s/veh		10.9			12.0			17.2			20.3	
Approach LOS		B			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.4	13.6	6.5	25.4	9.5	9.5	6.1	25.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	25.5	5.5	35.5	9.5	21.5	5.5	35.5
Max Q Clear Time (g_c+I1), s	2.4	3.1	2.6	8.0	5.6	2.1	2.4	11.6
Green Ext Time (p_c), s	0.0	0.2	0.0	10.2	0.1	0.2	0.0	9.7

Intersection Summary	
HCM 2010 Ctrl Delay	12.3
HCM 2010 LOS	B

Lanes, Volumes, Timings

2: NW Brady Road & NW 16th Street

03/06/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (vph)	15	115	13	124	30	109	8	246	159	112	283	13
Future Volume (vph)	15	115	13	124	30	109	8	246	159	112	283	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988			0.944			0.948			0.996	
Flt Protected		0.995			0.977			0.999			0.986	
Satd. Flow (prot)	0	1868	0	0	1752	0	0	1799	0	0	1829	0
Flt Permitted		0.995			0.977			0.999			0.986	
Satd. Flow (perm)	0	1868	0	0	1752	0	0	1799	0	0	1829	0
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		1212			959			2307			902	
Travel Time (s)		33.1			26.2			44.9			17.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Adj. Flow (vph)	15	115	13	124	30	109	8	246	159	112	283	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	143	0	0	263	0	0	413	0	0	408	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 81.1% ICU Level of Service D

Analysis Period (min) 15

Intersection	
Intersection Delay, s/veh	19.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	15	115	13	124	30	109	8	246	159	112	283	13
Future Vol, veh/h	15	115	13	124	30	109	8	246	159	112	283	13
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	2	2	2
Mvmt Flow	15	115	13	124	30	109	8	246	159	112	283	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.9	15.6	20.6	22.6
HCM LOS	B	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	10%	47%	27%
Vol Thru, %	60%	80%	11%	69%
Vol Right, %	38%	9%	41%	3%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	413	143	263	408
LT Vol	8	15	124	112
Through Vol	246	115	30	283
RT Vol	159	13	109	13
Lane Flow Rate	413	143	263	408
Geometry Grp	1	1	1	1
Degree of Util (X)	0.678	0.281	0.48	0.701
Departure Headway (Hd)	5.91	7.062	6.575	6.184
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	607	506	544	583
Service Time	3.974	5.147	4.647	4.247
HCM Lane V/C Ratio	0.68	0.283	0.483	0.7
HCM Control Delay	20.6	12.9	15.6	22.6
HCM Lane LOS	C	B	C	C
HCM 95th-tile Q	5.2	1.1	2.6	5.6

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↑↱		↰	↑
Traffic Volume (vph)	80	19	477	204	17	424
Future Volume (vph)	80	19	477	204	17	424
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.974		0.960			
Flt Protected	0.961				0.950	
Satd. Flow (prot)	1778	0	1806	0	1752	1845
Flt Permitted	0.961				0.950	
Satd. Flow (perm)	1778	0	1806	0	1752	1845
Link Speed (mph)	35		40			35
Link Distance (ft)	1524		727			2307
Travel Time (s)	29.7		12.4			44.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	1%	3%	3%
Adj. Flow (vph)	80	19	477	204	17	424
Shared Lane Traffic (%)						
Lane Group Flow (vph)	99	0	681	0	17	424
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 49.8% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↱		↰	↑
Traffic Vol, veh/h	80	19	477	204	17	424
Future Vol, veh/h	80	19	477	204	17	424
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	1	1	3	3
Mvmt Flow	80	19	477	204	17	424

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1037	579	0	0	681	0
Stage 1	579	-	-	-	-	-
Stage 2	458	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	258	519	-	-	907	-
Stage 1	564	-	-	-	-	-
Stage 2	641	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	253	519	-	-	907	-
Mov Cap-2 Maneuver	253	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	629	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	24.6	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	281	907	-
HCM Lane V/C Ratio	-	-	0.352	0.019	-
HCM Control Delay (s)	-	-	24.6	9	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	1.5	0.1	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Volume (vph)	53	602	447	4	9	18
Future Volume (vph)	53	602	447	4	9	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.910	
Flt Protected		0.996			0.984	
Satd. Flow (prot)	0	1874	1861	0	1701	0
Flt Permitted		0.996			0.984	
Satd. Flow (perm)	0	1874	1861	0	1701	0
Link Speed (mph)		40	40		25	
Link Distance (ft)		978	3072		1011	
Travel Time (s)		16.7	52.4		27.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Adj. Flow (vph)	53	602	447	4	9	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	655	451	0	27	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 71.7% ICU Level of Service C

Analysis Period (min) 15

4: SE Brady Road /SE Brady Road & SE Grand Ridge Drive

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Vol, veh/h	53	602	447	4	9	18
Future Vol, veh/h	53	602	447	4	9	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	1	2	2	0	0
Mvmt Flow	53	602	447	4	9	18

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	451	0	-	0	1157	449
Stage 1	-	-	-	-	449	-
Stage 2	-	-	-	-	708	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1115	-	-	-	219	614
Stage 1	-	-	-	-	647	-
Stage 2	-	-	-	-	492	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1115	-	-	-	203	614
Mov Cap-2 Maneuver	-	-	-	-	203	-
Stage 1	-	-	-	-	647	-
Stage 2	-	-	-	-	457	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	15.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1115	-	-	-	367
HCM Lane V/C Ratio	0.048	-	-	-	0.074
HCM Control Delay (s)	8.4	0	-	-	15.6
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2

5: Project Access & SE 40th Street/SE 40th Street

03/06/2018

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	↰↱	
Traffic Volume (vph)	172	0	0	146	0	0
Future Volume (vph)	172	0	0	146	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1900	0	1900	1900	1900	0
Flt Permitted						
Satd. Flow (perm)	1900	0	1900	1900	1900	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	1480			1830	2017	
Travel Time (s)	25.2			31.2	55.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	172	0	0	146	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	172	0	0	146	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 12.4%	ICU Level of Service A
Analysis Period (min) 15	

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	Y	
Traffic Vol, veh/h	172	0	0	146	0	0
Future Vol, veh/h	172	0	0	146	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	172	0	0	146	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	172	0	318	172
Stage 1	-	-	-	-	172	-
Stage 2	-	-	-	-	146	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1417	-	679	877
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	886	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1417	-	679	877
Mov Cap-2 Maneuver	-	-	-	-	679	-
Stage 1	-	-	-	-	863	-
Stage 2	-	-	-	-	886	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	1417	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	0	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	-	-	-	0	-

APPENDIX F

2023 “WITH PROJECT” LEVEL OF SERVICE

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (vph)	5	474	64	118	264	0	172	0	87	5	0	32
Future Volume (vph)	5	474	64	118	264	0	172	0	87	5	0	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115		0	135		0	220		0	30		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.982						0.850			0.850	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	3442	0	1736	3471	0	1770	1583	0	1805	1615	0
Flt Permitted	0.589			0.294			0.489			0.701		
Satd. Flow (perm)	1087	3442	0	537	3471	0	911	1583	0	1332	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17						450			536	
Link Speed (mph)		40			40			35			25	
Link Distance (ft)		1779			1191			1505			543	
Travel Time (s)		30.3			20.3			29.3			14.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	3%	3%	4%	4%	4%	2%	2%	2%	0%	0%	0%
Adj. Flow (vph)	5	474	64	118	264	0	172	0	87	5	0	32
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	538	0	118	264	0	172	87	0	5	32	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		9.5	22.5		9.5	22.5	
Total Split (s)	11.0	31.0		16.0	36.0		17.0	32.0		11.0	26.0	
Total Split (%)	12.2%	34.4%		17.8%	40.0%		18.9%	35.6%		12.2%	28.9%	
Maximum Green (s)	6.5	26.5		11.5	31.5		12.5	27.5		6.5	21.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	18.7	14.8		23.5	22.0		18.0	15.8		10.4	6.4	
Actuated g/C Ratio	0.36	0.29		0.46	0.43		0.35	0.31		0.20	0.12	
v/c Ratio	0.01	0.54		0.27	0.18		0.34	0.11		0.02	0.05	
Control Delay	8.4	19.4		10.2	10.9		16.0	0.3		14.4	0.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.4	19.4		10.2	10.9		16.0	0.3		14.4	0.1	
LOS	A	B		B	B		B	A		B	A	
Approach Delay		19.3			10.6			10.7			2.1	
Approach LOS		B			B			B			A	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 51.5

Natural Cycle: 65

Control Type: Actuated-Uncoordinated

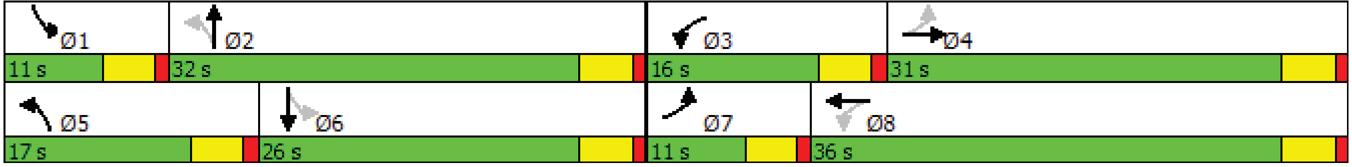
Maximum v/c Ratio: 0.54

Intersection Signal Delay: 14.2 Intersection LOS: B

Intersection Capacity Utilization 49.1% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard



Queues

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

	↗	→	↙	←	↖	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	5	538	118	264	172	87	5	32
v/c Ratio	0.01	0.54	0.27	0.18	0.34	0.11	0.02	0.05
Control Delay	8.4	19.4	10.2	10.9	16.0	0.3	14.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.4	19.4	10.2	10.9	16.0	0.3	14.4	0.1
Queue Length 50th (ft)	1	81	21	25	39	0	1	0
Queue Length 95th (ft)	5	132	46	62	93	0	8	0
Internal Link Dist (ft)		1699		1111		1425		463
Turn Bay Length (ft)	115		135		220		30	
Base Capacity (vph)	505	1951	569	2198	604	1105	363	1056
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.28	0.21	0.12	0.28	0.08	0.01	0.03

Intersection Summary

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	5	474	64	118	264	0	172	0	87	5	0	32
Future Volume (veh/h)	5	474	64	118	264	0	172	0	87	5	0	32
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1827	1827	1900	1863	1863	1900	1900	1900	1900
Adj Flow Rate, veh/h	5	474	64	118	264	0	172	0	87	5	0	32
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	3	3	3	4	4	4	2	2	2	0	0	0
Cap, veh/h	481	864	116	439	1243	0	495	0	348	326	0	183
Arrive On Green	0.01	0.28	0.28	0.09	0.36	0.00	0.11	0.00	0.22	0.01	0.00	0.11
Sat Flow, veh/h	1757	3106	417	1740	3563	0	1774	0	1583	1810	0	1615
Grp Volume(v), veh/h	5	267	271	118	264	0	172	0	87	5	0	32
Grp Sat Flow(s),veh/h/ln	1757	1752	1771	1740	1736	0	1774	0	1583	1810	0	1615
Q Serve(g_s), s	0.1	5.7	5.8	2.0	2.3	0.0	3.4	0.0	2.0	0.1	0.0	0.8
Cycle Q Clear(g_c), s	0.1	5.7	5.8	2.0	2.3	0.0	3.4	0.0	2.0	0.1	0.0	0.8
Prop In Lane	1.00		0.24	1.00		0.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	481	488	493	439	1243	0	495	0	348	326	0	183
V/C Ratio(X)	0.01	0.55	0.55	0.27	0.21	0.00	0.35	0.00	0.25	0.02	0.00	0.17
Avail Cap(c_a), veh/h	728	1053	1065	742	2480	0	797	0	988	581	0	788
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.3	13.5	13.6	9.5	9.8	0.0	13.0	0.0	14.2	17.1	0.0	17.7
Incr Delay (d2), s/veh	0.0	1.0	1.0	0.3	0.1	0.0	0.4	0.0	0.4	0.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.9	2.9	1.0	1.1	0.0	1.7	0.0	0.9	0.1	0.0	0.4
LnGrp Delay(d),s/veh	11.3	14.5	14.5	9.8	9.9	0.0	13.5	0.0	14.6	17.1	0.0	18.1
LnGrp LOS	B	B	B	A	A		B		B	B		B
Approach Vol, veh/h		543			382			259			37	
Approach Delay, s/veh		14.5			9.9			13.8			18.0	
Approach LOS		B			A			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	4.8	14.2	8.3	16.8	9.5	9.5	4.8	20.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.5	27.5	11.5	26.5	12.5	21.5	6.5	31.5
Max Q Clear Time (g_c+I1), s	2.1	4.0	4.0	7.8	5.4	2.8	2.1	4.3
Green Ext Time (p_c), s	0.0	0.6	0.1	4.5	0.2	0.6	0.0	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	13.0
HCM 2010 LOS	B

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (vph)	102	166	101	110	211	80	159	82	29	52	138	106
Future Volume (vph)	102	166	101	110	211	80	159	82	29	52	138	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.963			0.973			0.985			0.952	
Flt Protected		0.986			0.986			0.971			0.991	
Satd. Flow (prot)	0	1655	0	0	1787	0	0	1747	0	0	1757	0
Flt Permitted		0.986			0.986			0.971			0.991	
Satd. Flow (perm)	0	1655	0	0	1787	0	0	1747	0	0	1757	0
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		1212			959			2307			902	
Travel Time (s)		33.1			26.2			44.9			17.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	9%	9%	9%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Adj. Flow (vph)	102	166	101	110	211	80	159	82	29	52	138	106
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	369	0	0	401	0	0	270	0	0	296	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 70.7% ICU Level of Service C

Analysis Period (min) 15

Intersection	
Intersection Delay, s/veh	28.4
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	102	166	101	110	211	80	159	82	29	52	138	106
Future Vol, veh/h	102	166	101	110	211	80	159	82	29	52	138	106
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	9	9	9	2	2	2	4	4	4	2	2	2
Mvmt Flow	102	166	101	110	211	80	159	82	29	52	138	106
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	30.7	34.8	22	22.5
HCM LOS	D	D	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	59%	28%	27%	18%
Vol Thru, %	30%	45%	53%	47%
Vol Right, %	11%	27%	20%	36%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	270	369	401	296
LT Vol	159	102	110	52
Through Vol	82	166	211	138
RT Vol	29	101	80	106
Lane Flow Rate	270	369	401	296
Geometry Grp	1	1	1	1
Degree of Util (X)	0.594	0.763	0.812	0.624
Departure Headway (Hd)	7.922	7.447	7.287	7.585
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	454	487	497	474
Service Time	6.003	5.473	5.311	5.664
HCM Lane V/C Ratio	0.595	0.758	0.807	0.624
HCM Control Delay	22	30.7	34.8	22.5
HCM Lane LOS	C	D	D	C
HCM 95th-tile Q	3.8	6.6	7.8	4.2

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↱		↰	↑
Traffic Volume (vph)	194	26	231	72	13	420
Future Volume (vph)	194	26	231	72	13	420
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.984		0.968			
Flt Protected	0.958				0.950	
Satd. Flow (prot)	1791	0	1752	0	1770	1863
Flt Permitted	0.958				0.950	
Satd. Flow (perm)	1791	0	1752	0	1770	1863
Link Speed (mph)	35		40			35
Link Distance (ft)	1524		727			2307
Travel Time (s)	29.7		12.4			44.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	5%	5%	2%	2%
Adj. Flow (vph)	194	26	231	72	13	420
Shared Lane Traffic (%)						
Lane Group Flow (vph)	220	0	303	0	13	420
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 41.1% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	5.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↱		↰	↑
Traffic Vol, veh/h	194	26	231	72	13	420
Future Vol, veh/h	194	26	231	72	13	420
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	5	5	2	2
Mvmt Flow	194	26	231	72	13	420

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	713	267	0	0	303	0
Stage 1	267	-	-	-	-	-
Stage 2	446	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.12	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.218	-
Pot Cap-1 Maneuver	401	777	-	-	1258	-
Stage 1	782	-	-	-	-	-
Stage 2	649	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	397	777	-	-	1258	-
Mov Cap-2 Maneuver	397	-	-	-	-	-
Stage 1	782	-	-	-	-	-
Stage 2	642	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.5	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	421	1258	-
HCM Lane V/C Ratio	-	-	0.523	0.01	-
HCM Control Delay (s)	-	-	22.5	7.9	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	2.9	0	-

	↗	→	←	↖	↘	↙
Lane Group	**EBL**	**EBT**	**WBT**	**WBR**	**SBL**	**SBR**
Lane Configurations		↰	↱		⅄	
Traffic Volume (vph)	13	196	629	4	10	90
Future Volume (vph)	13	196	629	4	10	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.878	
Flt Protected		0.997			0.995	
Satd. Flow (prot)	0	1722	1898	0	1660	0
Flt Permitted		0.997			0.995	
Satd. Flow (perm)	0	1722	1898	0	1660	0
Link Speed (mph)		40	40		25	
Link Distance (ft)		978	3072		1011	
Travel Time (s)		16.7	52.4		27.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	10%	10%	0%	0%	0%	0%
Adj. Flow (vph)	13	196	629	4	10	90
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	209	633	0	100	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 46.1% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Vol, veh/h	13	196	629	4	10	90
Future Vol, veh/h	13	196	629	4	10	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	10	10	0	0	0	0
Mvmt Flow	13	196	629	4	10	90

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	633	0	-	0	853	631
Stage 1	-	-	-	-	631	-
Stage 2	-	-	-	-	222	-
Critical Hdwy	4.2	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.29	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	913	-	-	-	332	485
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	820	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	913	-	-	-	327	485
Mov Cap-2 Maneuver	-	-	-	-	327	-
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	807	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	14.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	913	-	-	-	463
HCM Lane V/C Ratio	0.014	-	-	-	0.216
HCM Control Delay (s)	9	0	-	-	14.9
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.8

5: Project Access & SE 40th Street/SE 40th Street

	→	↘	↙	←	↖	↗
Lane Group	**EBT**	**EBR**	**WBL**	**WBT**	**NBL**	**NBR**
Lane Configurations	↱		↰	↑	Y	
Traffic Volume (vph)	75	2	1	137	5	2
Future Volume (vph)	75	2	1	137	5	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.996				0.961	
Flt Protected			0.950		0.966	
Satd. Flow (prot)	1604	0	1703	1792	1764	0
Flt Permitted			0.950		0.966	
Satd. Flow (perm)	1604	0	1703	1792	1764	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	1480			1830	2017	
Travel Time (s)	25.2			31.2	55.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	18%	18%	6%	6%	0%	0%
Adj. Flow (vph)	75	2	1	137	5	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	77	0	1	137	7	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 17.2% ICU Level of Service A

Analysis Period (min) 15

5: Project Access & SE 40th Street/SE 40th Street

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	Y	
Traffic Vol, veh/h	75	2	1	137	5	2
Future Vol, veh/h	75	2	1	137	5	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	18	18	6	6	0	0
Mvmt Flow	75	2	1	137	5	2

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	77	0	215	76
Stage 1	-	-	-	-	76	-
Stage 2	-	-	-	-	139	-
Critical Hdwy	-	-	4.16	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.254	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1497	-	778	991
Stage 1	-	-	-	-	952	-
Stage 2	-	-	-	-	893	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1497	-	777	991
Mov Cap-2 Maneuver	-	-	-	-	777	-
Stage 1	-	-	-	-	952	-
Stage 2	-	-	-	-	892	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	828	-	-	1497	-
HCM Lane V/C Ratio	0.008	-	-	0.001	-
HCM Control Delay (s)	9.4	-	-	7.4	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (vph)	27	313	253	38	895	5	152	0	43	14	0	5
Future Volume (vph)	27	313	253	38	895	5	152	0	43	14	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115		0	135		0	220		0	30		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.933			0.999			0.850			0.850	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	3335	0	1787	3571	0	1805	1615	0	1805	1615	0
Flt Permitted	0.194			0.386			0.499			0.729		
Satd. Flow (perm)	365	3335	0	726	3571	0	948	1615	0	1385	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		253			1			548			229	
Link Speed (mph)		40			40			35			25	
Link Distance (ft)		1779			1191			1505			543	
Travel Time (s)		30.3			20.3			29.3			14.8	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	27	313	253	38	895	5	152	0	43	14	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	27	566	0	38	900	0	152	43	0	14	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings
1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

03/06/2018

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5		9.5	22.5		9.5	22.5		9.5	22.5	
Total Split (s)	10.0	40.0		10.0	40.0		14.0	30.0		10.0	26.0	
Total Split (%)	11.1%	44.4%		11.1%	44.4%		15.6%	33.3%		11.1%	28.9%	
Maximum Green (s)	5.5	35.5		5.5	35.5		9.5	25.5		5.5	21.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	22.3	20.6		22.3	20.6		16.6	14.8		10.2	6.1	
Actuated g/C Ratio	0.45	0.41		0.45	0.41		0.33	0.30		0.20	0.12	
v/c Ratio	0.08	0.37		0.08	0.61		0.32	0.05		0.04	0.01	
Control Delay	7.4	7.1		7.5	14.8		17.1	0.1		16.4	0.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	7.4	7.1		7.5	14.8		17.1	0.1		16.4	0.0	
LOS	A	A		A	B		B	A		B	A	
Approach Delay		7.1			14.5			13.3			12.1	
Approach LOS		A			B			B			B	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 49.9

Natural Cycle: 65

Control Type: Actuated-Uncoordinated

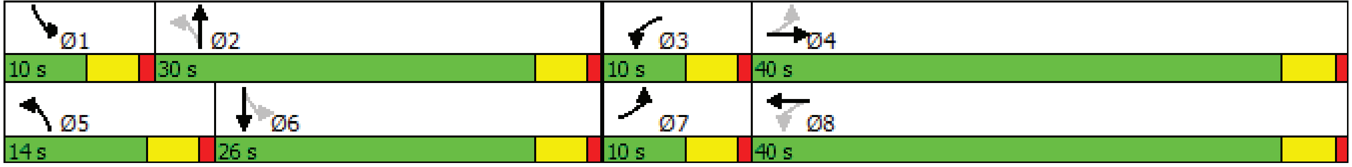
Maximum v/c Ratio: 0.61

Intersection Signal Delay: 11.8 Intersection LOS: B

Intersection Capacity Utilization 54.2% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard



Queues

1: SE Payne Road/NW Lorenz Street & NW Pacific Rim Boulevard

	↗	→	↙	←	↖	↑	↘	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	27	566	38	900	152	43	14	5
v/c Ratio	0.08	0.37	0.08	0.61	0.32	0.05	0.04	0.01
Control Delay	7.4	7.1	7.5	14.8	17.1	0.1	16.4	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.4	7.1	7.5	14.8	17.1	0.1	16.4	0.0
Queue Length 50th (ft)	4	28	6	98	25	0	2	0
Queue Length 95th (ft)	13	72	17	196	94	0	16	0
Internal Link Dist (ft)		1699		1111		1425		463
Turn Bay Length (ft)	115		135		220		30	
Base Capacity (vph)	336	2501	453	2605	516	1152	334	890
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.23	0.08	0.35	0.29	0.04	0.04	0.01

Intersection Summary

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	27	313	253	38	895	5	152	0	43	14	0	5
Future Volume (veh/h)	27	313	253	38	895	5	152	0	43	14	0	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1881	1900	1881	1881	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	27	313	253	38	895	5	152	0	43	14	0	5
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	1	1	1	1	1	0	0	0	0	0	0
Cap, veh/h	340	778	614	460	1526	9	457	0	290	309	0	158
Arrive On Green	0.03	0.41	0.41	0.04	0.42	0.42	0.10	0.00	0.18	0.02	0.00	0.10
Sat Flow, veh/h	1792	1902	1502	1792	3644	20	1810	0	1615	1810	0	1615
Grp Volume(v), veh/h	27	294	272	38	439	461	152	0	43	14	0	5
Grp Sat Flow(s),veh/h/ln	1792	1787	1616	1792	1787	1878	1810	0	1615	1810	0	1615
Q Serve(g_s), s	0.4	5.9	6.1	0.6	9.7	9.7	3.6	0.0	1.1	0.4	0.0	0.1
Cycle Q Clear(g_c), s	0.4	5.9	6.1	0.6	9.7	9.7	3.6	0.0	1.1	0.4	0.0	0.1
Prop In Lane	1.00		0.93	1.00		0.01	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	340	731	661	460	748	786	457	0	290	309	0	158
V/C Ratio(X)	0.08	0.40	0.41	0.08	0.59	0.59	0.33	0.00	0.15	0.05	0.00	0.03
Avail Cap(c_a), veh/h	477	1243	1125	580	1243	1306	615	0	807	472	0	681
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.0	10.7	10.7	8.3	11.4	11.4	16.6	0.0	17.6	20.1	0.0	20.8
Incr Delay (d2), s/veh	0.1	0.4	0.4	0.1	0.7	0.7	0.4	0.0	0.2	0.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	2.9	2.8	0.3	4.9	5.1	1.8	0.0	0.5	0.2	0.0	0.1
LnGrp Delay(d),s/veh	9.1	11.0	11.1	8.3	12.2	12.1	17.0	0.0	17.9	20.2	0.0	20.9
LnGrp LOS	A	B	B	A	B	B	B		B	C		C
Approach Vol, veh/h		593			938			195			19	
Approach Delay, s/veh		11.0			12.0			17.2			20.4	
Approach LOS		B			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.4	13.7	6.6	25.4	9.6	9.5	6.1	25.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	25.5	5.5	35.5	9.5	21.5	5.5	35.5
Max Q Clear Time (g_c+I1), s	2.4	3.1	2.6	8.1	5.6	2.1	2.4	11.7
Green Ext Time (p_c), s	0.0	0.2	0.0	10.3	0.1	0.2	0.0	9.7

Intersection Summary	
HCM 2010 Ctrl Delay	12.3
HCM 2010 LOS	B

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (vph)	15	116	13	124	31	109	8	246	159	112	283	13
Future Volume (vph)	15	116	13	124	31	109	8	246	159	112	283	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988			0.944			0.948			0.996	
Flt Protected		0.995			0.977			0.999			0.986	
Satd. Flow (prot)	0	1868	0	0	1752	0	0	1799	0	0	1829	0
Flt Permitted		0.995			0.977			0.999			0.986	
Satd. Flow (perm)	0	1868	0	0	1752	0	0	1799	0	0	1829	0
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		1212			959			2307			902	
Travel Time (s)		33.1			26.2			44.9			17.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%	2%
Adj. Flow (vph)	15	116	13	124	31	109	8	246	159	112	283	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	144	0	0	264	0	0	413	0	0	408	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 81.2%	ICU Level of Service D
Analysis Period (min) 15	

Intersection	
Intersection Delay, s/veh	19.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	15	116	13	124	31	109	8	246	159	112	283	13
Future Vol, veh/h	15	116	13	124	31	109	8	246	159	112	283	13
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	2	2	2
Mvmt Flow	15	116	13	124	31	109	8	246	159	112	283	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13	15.7	20.7	22.7
HCM LOS	B	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	10%	47%	27%
Vol Thru, %	60%	81%	12%	69%
Vol Right, %	38%	9%	41%	3%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	413	144	264	408
LT Vol	8	15	124	112
Through Vol	246	116	31	283
RT Vol	159	13	109	13
Lane Flow Rate	413	144	264	408
Geometry Grp	1	1	1	1
Degree of Util (X)	0.679	0.283	0.483	0.702
Departure Headway (Hd)	5.921	7.07	6.583	6.194
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	607	505	544	579
Service Time	3.986	5.157	4.655	4.26
HCM Lane V/C Ratio	0.68	0.285	0.485	0.705
HCM Control Delay	20.7	13	15.7	22.7
HCM Lane LOS	C	B	C	C
HCM 95th-tile Q	5.2	1.2	2.6	5.6

	↙	↖	↑	↗	↘	↓
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰↱		↱		↰	↑
Traffic Volume (vph)	81	19	477	204	17	424
Future Volume (vph)	81	19	477	204	17	424
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.974		0.960			
Flt Protected	0.961				0.950	
Satd. Flow (prot)	1778	0	1806	0	1752	1845
Flt Permitted	0.961				0.950	
Satd. Flow (perm)	1778	0	1806	0	1752	1845
Link Speed (mph)	35		40			35
Link Distance (ft)	1524		727			2307
Travel Time (s)	29.7		12.4			44.9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	1%	3%	3%
Adj. Flow (vph)	81	19	477	204	17	424
Shared Lane Traffic (%)						
Lane Group Flow (vph)	100	0	681	0	17	424
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 49.8% ICU Level of Service A

Analysis Period (min) 15

HCM 2010 TWSC
3: NW Brady Road & NW McIntosh Road

03/06/2018

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↱		↰	↑
Traffic Vol, veh/h	81	19	477	204	17	424
Future Vol, veh/h	81	19	477	204	17	424
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	1	1	3	3
Mvmt Flow	81	19	477	204	17	424

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1037	579	0	0	681	0
Stage 1	579	-	-	-	-	-
Stage 2	458	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	258	519	-	-	907	-
Stage 1	564	-	-	-	-	-
Stage 2	641	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	253	519	-	-	907	-
Mov Cap-2 Maneuver	253	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	629	-	-	-	-	-

Approach	WB		NB		SB	
HCM Control Delay, s	24.8		0		0.3	
HCM LOS	C					

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	280	907	-
HCM Lane V/C Ratio	-	-	0.357	0.019	-
HCM Control Delay (s)	-	-	24.8	9	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	1.6	0.1	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Volume (vph)	66	602	447	5	9	26
Future Volume (vph)	66	602	447	5	9	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.900	
Flt Protected		0.995			0.987	
Satd. Flow (prot)	0	1872	1861	0	1688	0
Flt Permitted		0.995			0.987	
Satd. Flow (perm)	0	1872	1861	0	1688	0
Link Speed (mph)		40	40		25	
Link Distance (ft)		978	3072		1011	
Travel Time (s)		16.7	52.4		27.6	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	1%	1%	2%	2%	0%	0%
Adj. Flow (vph)	66	602	447	5	9	26
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	668	452	0	35	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 72.5% ICU Level of Service C

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Vol, veh/h	66	602	447	5	9	26
Future Vol, veh/h	66	602	447	5	9	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	1	1	2	2	0	0
Mvmt Flow	66	602	447	5	9	26

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	452	0	-	0	1184	450
Stage 1	-	-	-	-	450	-
Stage 2	-	-	-	-	734	-
Critical Hdwy	4.11	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1114	-	-	-	211	613
Stage 1	-	-	-	-	647	-
Stage 2	-	-	-	-	478	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1114	-	-	-	192	613
Mov Cap-2 Maneuver	-	-	-	-	192	-
Stage 1	-	-	-	-	647	-
Stage 2	-	-	-	-	435	-

Approach	EB		WB		SB
HCM Control Delay, s	0.8		0		15.1
HCM LOS					C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1114	-	-	-	392
HCM Lane V/C Ratio	0.059	-	-	-	0.089
HCM Control Delay (s)	8.4	0	-	-	15.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Lanes, Volumes, Timings

5: Project Access & SE 40th Street/SE 40th Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	↰↱	
Traffic Volume (vph)	172	6	2	146	3	2
Future Volume (vph)	172	6	2	146	3	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	100		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.995				0.946	
Flt Protected			0.950		0.971	
Satd. Flow (prot)	1890	0	1805	1900	1745	0
Flt Permitted			0.950		0.971	
Satd. Flow (perm)	1890	0	1805	1900	1745	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	1480			1830	2017	
Travel Time (s)	25.2			31.2	55.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	172	6	2	146	3	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	178	0	2	146	5	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 19.4% ICU Level of Service A

Analysis Period (min) 15

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↰	↑	Y	
Traffic Vol, veh/h	172	6	2	146	3	2
Future Vol, veh/h	172	6	2	146	3	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	172	6	2	146	3	2

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	178	0	325	175
Stage 1	-	-	-	-	175	-
Stage 2	-	-	-	-	150	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1410	-	673	874
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	883	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1410	-	672	874
Mov Cap-2 Maneuver	-	-	-	-	672	-
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	882	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	9.9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	740	-	-	1410	-
HCM Lane V/C Ratio	0.007	-	-	0.001	-
HCM Control Delay (s)	9.9	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Exhibit 18 SUB18-02

ECOLOGICAL LAND SERVICES, INC.

Stan Firestone
P.O. Box 61928
Vancouver, Washington 98666

Re: SE 40th Street (Valley View Estates Subdivision) Wetland Determination Addendum

Dear Mr. Firestone,

Ecological Land Services, Inc. (ELS) prepared a wetland determination detailing onsite conditions at the Valley View Estates Subdivision (Clark County Parcel Numbers 125646-000, 125634-000, and 125635-000) in October 2007 (*Wetland Determination Report for the Southeast 40th Site*). Onsite wetland conditions have not changed since the 2007 site investigation; there are no wetlands onsite. This addendum addresses off-site conditions within 300 feet of the property boundaries and meets the requirement for a critical areas report pursuant to CMC 16.53.030 as described in the June 27, 2013 pre-application summary.

One wetland is located offsite to the southwest. The northern boundary of the wetland is approximately 120 feet from the southern property boundary. A residential subdivision is under construction in the buffer of the wetland. The wetland was rated based on observations from your property and aerial photography using the *Wetland Rating Form for Western Washington* (Hruby; attached). The wetland appears to be a Category IV slope wetland. The City of Camas assigns a maximum 50-foot regulatory buffer to Category IV wetlands.

The buffer of the offsite wetland is estimated to be 50 feet. Because the wetland boundary is approximately 120 feet from the property boundary, no wetlands or wetland buffers extend onto your property from offsite.

If you have any questions, please contact me at lisa@eco-land.com or (360) 835-9082.

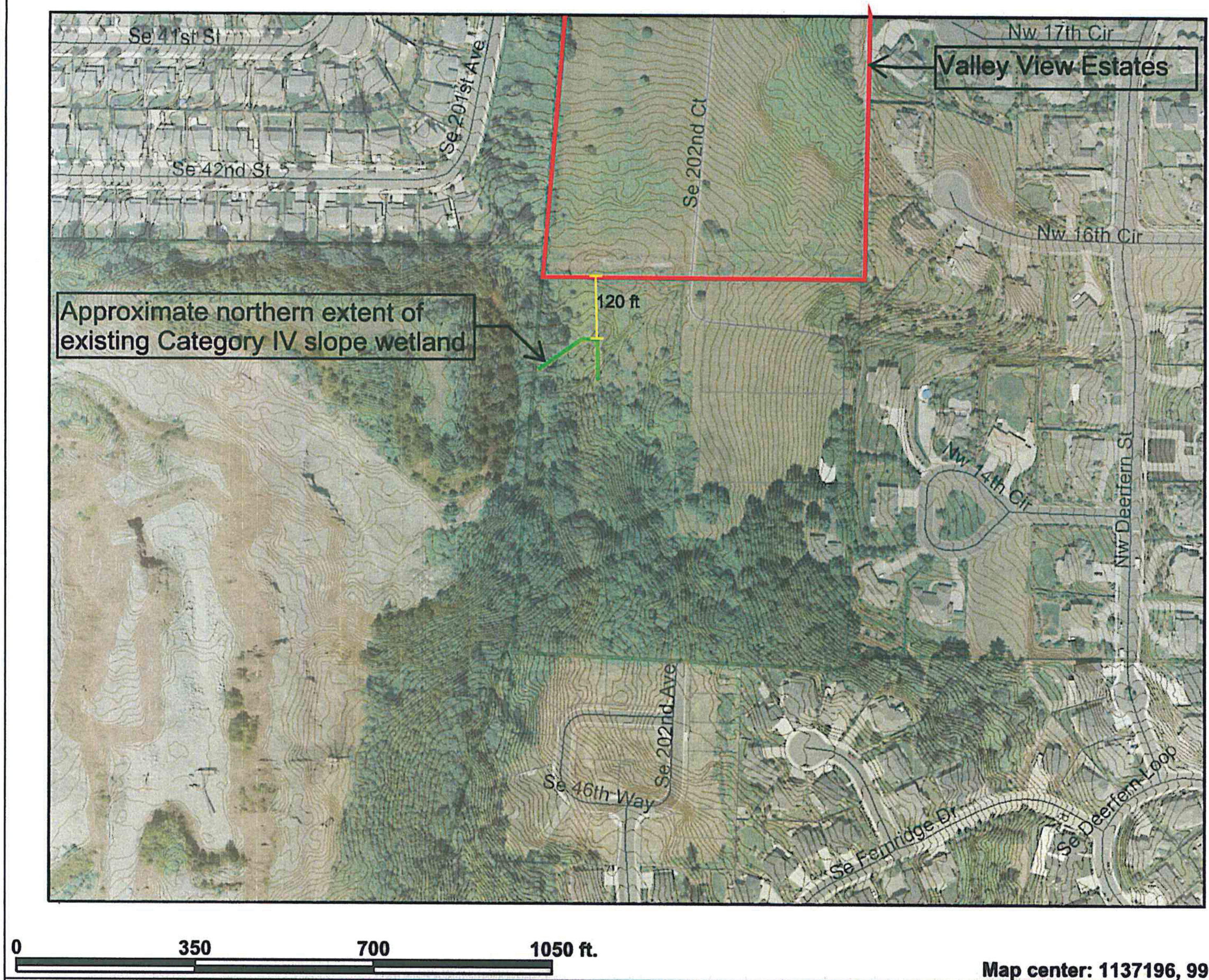
Sincerely,

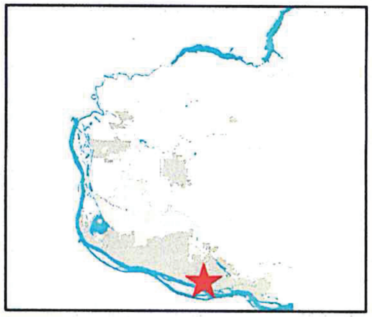
Lisa F. Willis

Lisa F. Willis
Professional Biologist

Figure 1

Valley View Estates Subdivision Adjacent Wetlands





Legend

- ☐ Parcels
- Roads
  - Alley
  - Arterial
  - DNR
  - DNR (Private Land)
  - Driveway
  - Interstate
  - Interstate Ramp
  - Primary Arterial
  - Private Roads
  - Private Roads w/o Names
  - Public Roads
  - SR Ramp
  - State Route
- 2 Foot Contours
- 🟦 Waterbodies
- Rural Centers
- City Boundaries
- Urban Growth Boundaries
- County Boundary

Map center: 1137196, 99654

Scale: 1:3,735

Wetland rating based on observations from the project site and aerial photography using the Wetland Rating Form for Western Washington (revised)

Wetland name or number_____

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 – Updated July 2006 to increase accuracy and reproducibility among users
Updated Oct 2008 with new WDFW definitions for priority habitats

Name of wetland (if known): Offsite___________ Date of site visit:_____10/3/13__

Rated by M.McGraw Trained by Ecology? Yes ☒ No ☐ Date of Training: ______2006

SECTION: 8 TWNSHIP: 1N RNGE: 3E Is S/T/R in Appendix D? Yes☐No☒

Map of wetland unit: Figure 1 Estimated size unknown

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I ☐ II ☐ III ☐ IV ☒

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	8
Score for Hydrologic Functions	2
Score for Habitat Functions	9
TOTAL Score for functions	**19**

Category based on SPECIAL CHARACTERISTICS of wetland

I ☐ II ☐ Does not Apply ☒

Final Category **(choose the "highest" category from above)** IV

Summary of basic information about the wetland unit

Wetland Unit has Special Characteristics		**Wetland HGM Class used for Rating**	
Estuarine	☐	**Depressional**	☐
Natural Heritage Wetland	☐	**Riverine**	☐
Bog	☐	**Lake-fringe**	☐
Mature Forest	☐	**Slope**	☒
Old Growth Forest	☐	**Flats**	☐
Coastal Lagoon	☐	**Freshwater Tidal**	☐
Interdunal	☐		
None of the above	☐	Check if unit has multiple HGM classes present	☐

Does the wetland being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That May Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland been documented as a habitat for any Federally listed Threatened or Endangered **animal** or **plant** species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.	☐	☒
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered **animal** species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category 1 Natural Heritage Wetlands (see p. 19 of data form).	☐	☒
SP3. *Does the wetland contain individuals of Priority species listed by the WDFW for the state?*	☐	☒
SP4. *Does the wetland have a local significance in addition to its functions*? For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.	☐	☒

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands into those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Classification of Wetland Units in Western Washington

Wetland name or number_____

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?

☒NO – go to 2 ☐**YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? ☐ **YES – Freshwater Tidal Fringe** ☐**NO – Saltwater Tidal Fringe (Estuarine)**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is rated as an* ***Estuarine*** *wetland.* Wetlands that were called estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p.).

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☒NO – go to 3 ☐**YES** – The wetland class is **Flats**

If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the wetland **meet both** of the following criteria?

☐ The vegetated part of the wetland is on the shores of a body of open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;

☐ At least 30% of the open water area is deeper than 6.6 ft (2 m)?

☒NO – go to 4 ☐**YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the wetland **meet all** of the following criteria?

☒ The wetland is on a slope (*slope can be very gradual*),

☒ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.

☒ The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*

☐NO - go to 5 ☒**YES** – The wetland class is **Slope**

5. Does the entire wetland unit **meet all** of the following criteria?

☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river

☐ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

☒NO - go to 6 ☐ **YES** – The wetland class is **Riverine**

6. Is the wetland in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year. *This means that any outlet, if present, is higher than the interior of the wetland.*

☒NO – go to 7 ☐**YES** – The wetland class is **Depressional**

7. Is the entire wetland located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☒NO – go to 8 ☐ **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

D	**Depressional and Flats Wetlands** **WATER QUALITY FUNCTION – Indicators that the wetland unit functions to improve water quality**	**Points** **(only 1 score per box)**
D	**D 1. Does the wetland have the <u>potential</u> to improve water quality?**	***(see p.38)***
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted, permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(if ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	**Figure_____**
D	D 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class): Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	**Figure_____**
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	**Figure_____**
D	**Total for D 1** *Add the points in the boxes above*	
D	**D 2. Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☐ Untreated stormwater discharges to wetland ☐ Tilled fields or orchards within 150 ft of wetland ☐ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ☐ Residential, urban areas, golf courses are within 150 ft of wetland ☐ Wetland is fed by groundwater high in phosphorus or nitrogen ☐ Other _____ ☐ **YES** multiplier is **2** ☐ **NO** multiplier is **1**	***(see p.44)*** multiplier _____
D	**<u>TOTAL</u> - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that wetland functions to reduce flooding and stream degradation	**Points**
	D 3. Does the wetland have the potential to reduce flooding and erosion?	***(see p.46)***
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is “flat” depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as “intermittently flowing”)* Unit has an unconstricted, or slightly constricted, surface outlet (permanently flowing) points = 0	**Figure__**
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a “headwater” wetland”points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	**Figure__**
D	D 3.3 Contribution of wetland to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	**Figure__**
D	**Total for D 3** *Add the points in the boxes above*	
D	**D 4. Does the wetland have the opportunity to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity it provides, helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* ☐ Wetland is in a headwater of a river or stream that has flooding problems ☐ Wetland drains to a river or stream that has flooding problems ☐ Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems ☐ Other _____ ☐**YES** multiplier is **2** ☐**NO** multiplier is **1**	***(see p.49)*** multiplier _____
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 ***Add score to table on p. 1***	

R Riverine and Freshwater Tidal Fringe Wetlands

Points

WATER QUALITY FUNCTIONS - Indicators that wetland functions to improve water quality

R **R 1. Does the wetland have the <u>potential</u> to improve water quality?** *(see p.52)*

R R 1.1 Area of surface depressions within the riverine wetland that can trap sediments during a flooding event: **Figure__**

Depressions cover > 3/4 area of wetland	points = 8
Depressions cover > 1/2 area of wetland	points = 4
If depressions >1/2 of area of unit draw polygons on aerial photo or map	
Depressions present but cover < 1/2 area of wetland	points = 2
No depressions present	points = 0

R R 1.2 Characteristics of the vegetation in the unit (areas with >90% cover at person height): **figure__**

Trees or shrub > 2/3 the area of the unit	points = 8
Trees or shrub > 1/3 area of the unit	points = 6
Ungrazed, herbaceous plants > 2/3 area of unit	points = 6
Ungrazed, herbaceous plants > 1/3/ area of unit	points = 3
Trees, shrubs, and ungrazed herbaceous < 1/3 area of unit	points = 0

Aerial photo or map showing polygons of different vegetation types

R *Add the points in the boxes above*

R **R 2. Does the wetland have the <u>opportunity</u> to improve water quality?** *(see p. 53)*

Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.*

- ☐ Grazing in the wetland or within 150 ft
- ☐ Untreated stormwater discharges to wetland
- ☐ Tilled fields or orchards within 150 feet of wetland
- ☐ A stream or culvert discharges into wetland that drains developed areas,_residential areas, farmed fields, roads, or clear-cut logging
- ☐ Residential, urban areas, golf courses are within 150 ft of wetland
- ☐ The river or stream linked to the wetland has a contributing basin where human activities have raised levels of sediment, toxic compounds or nutrients in the river water above standards for water quality
- ☐ Other _____

☐**YES** multiplier is **2** ☐**NO** multiplier is **1**

multiplier ______

R **<u>TOTAL</u> - Water Quality Functions** Multiply the score from R1 by R2
Add score to table on p. 1

R	**Riverine and Freshwater Tidal Fringe Wetlands** HYDROLOGIC FUNCTIONS - Indicators that wetland functions to reduce flooding and stream erosion	**Points** **(only 1 score per box))**
R	**R 3. Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	***(see p. 54)***
R	R 3.1 Characteristics of the overbank storage the wetland provides: *Estimate the average width of the wetland perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of unit)/(width of stream between banks).* If the ratio is more than 20 points = 9 If the ratio is between 10-20 points = 6 If the ratio is 5- <10 points = 4 If the ratio is 1- <5 points = 2 If the ration is <1 points = 1 Aerial photo or map showing polygons of different vegetation types	**Figure__**
R	R 3.2 Characteristics vegetation that slow down water velocities during floods: *Treat large woody debris as "forest or shrub". Choose the points appropriate for the best description.* Forest or shrub for >1/3 area OR herbaceous plants >2/3 area points = 7 Forest or shrub > 1/10 area OR herbaceous plants >1/3 area points = 4 Vegetation does not meet above criteria points = 0 Aerial photo or map showing polygons of different vegetation types	**Figure__**
R	*Add the points in the boxes above*	
R	**R 4. Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the wetland is in a location in the watershed where the flood storage, or reduction in water velocity it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. *Note which of the following conditions apply.* ☐ There are human structures and activities downstream (roads, buildings, bridges, farms) that can be damaged by flooding. ☐ There are natural resources downstream (e.g. salmon redds) that can be damaged by flooding ☐ Other _____ *(Answer NO if the major source of water to the wetland is controlled by a reservoir or the wetland is tidal fringe along the sides of a dike.)* ☐**YES** multiplier is **2** ☐**NO** multiplier is **1**	***(see p. 57)*** multiplier _____
R	**TOTAL – Hydrologic Functions** Multiply the score from R3 by R4 ***Add score to table on p. 1***	

Comments

L **Lake-Fringe Wetlands**

WATER QUALITY FUNCTIONS - Indicators that wetland functions to improve water quality

Points **(only 1 score per box)**

L **L 1. Does the wetland have the potential to improve water quality?** *(see p. 59)*

L L 1.1 Average width of vegetation along the lakeshore: **Figure__**

Vegetation is more than 33ft (10m) wide points = 6
Vegetation is more than 16 (5m) wide and <33ft points = 3
Vegetation is more than 6ft (2m) wide and <16 ft points = 1
Vegetation is less than 6 ft wide points = 0

L L 1.2 Characteristics of the vegetation in the wetland: *choose the appropriate description that results in the highest points, and do not include any open water in your estimate of coverage. In this case the herbaceous plants can be either the dominant form or forest community .These are not Cowardin classes. Area of Cover is total cover in the unit, but can be in patches. Note: Herbaceous does not include aquatic bed.* **Figure__**

Cover of herbaceous plants cover >90% of the vegetated area points = 6
Cover of herbaceous plants cover >2/3 of the vegetated area points = 4
Cover of herbaceous plants cover >1/3 of the vegetated area points = 3
Other vegetation that is not aquatic bed in > 2/3 vegetated area points = 3
Other vegetation that is not aquatic bed in > 1/3 vegetated area points = 1
Aquatic bed vegetation and open water cover > 2/3 of the vegetated area points = 0

Map with polygons of different vegetation types

L *Add the points in the boxes above*

L **L 2. Does the wetland have the opportunity to improve water quality?** *(see p. 61)*

Answer YES if you know or believe there are pollutants in the lake water, or polluted surface water flowing through the unit to the lake. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity*

☐ Wetland is along the shores of a lake or reservoir that does not meet water quality standards
☐ Grazing in the wetland or within 150ft
☐ Polluted water discharges to wetland along upland edge
☐ Tilled fields or orchards within 150 feet of wetland
☐ Residential or urban areas are within 150 ft of wetland
☐ Parks with grassy areas that are maintained, ballfields, golf courses (all within 150 ft. of lake shore)
☐ Power boats with gasoline or diesel engines use the lake
☐ Other _____

☐**YES** multiplier is **2** ☐**NO** multiplier is **1**

multiplier

______

L **TOTAL - Water Quality Functions** Multiply the score from L1 by L2
Add score to table on p. 1

Comments

L	**Lake-Fringe Wetlands** HYDROLOGIC FUNCTIONS - Indicators that wetland unit functions to reduce shoreline erosion	**Points** **(only 1 score per box)**
L	**L 3. Does the wetland have the potential to reduce shoreline erosion?**	***(see p. 62)***
L	L 3 Distance along shore and average width of Cowardin classes along the lakeshore (**do not** include aquatic bed): (*choose the highest scoring description that matches conditions in the wetland*): >¾ of distance is shrubs or forest at least 33 ft (10m) wide points = 6 >¾ of distance is shrubs or forest at least 6 ft. (2m) wide points = 4 >¼ of distance is shrubs or forest at least 33 ft (10m) wide points = 4 Vegetation is at least 6 ft (2m) wide (any type except aquatic bed) points = 2 Vegetation is less than 6 ft (2m) wide (any type except aquatic bed) points = 0 Aerial photo or map with Cowardin vegetation classes	**Figure__**
L	*Record the points from the box above*	
L	**L 4. Does the wetland unit have the opportunity to reduce erosion?** Are there features along the shore which will be impacted if the shoreline erodes? *Note which of the following conditions apply.* ☐ There are human structures and activities along the upland edge of the wetland (buildings, fields) that can be damaged by erosion. ☐ There are undisturbed natural resources along the upland edge of the wetland (e.g. mature forests other than wetland) that can be damaged by shoreline erosion ☐ Other _____ ☐**YES** multiplier is **2** ☐**NO** multiplier is **1**	***(see p. 63)*** multiplier _____
L	**TOTAL – Hydrologic Functions** Multiply the score from L 3 by L 4 ***Add score to table on p. 1***	

Comments

S	**Slope Wetlands** **WATER QUALITY FUNCTIONS - Indicators that wetland unit functions to improve water quality**	**Points** **(only 1 score per box)**
S	**S 1. Does the wetland have the potential to improve water quality?**	*(see p. 64)*
S	S 1.1 Characteristics of average slope of wetland: Slope is 1% or less *(a 1% slope has a 1 foot vertical drop in elevation for every 100 ft horizontal distance)* ....points = 3 Slope is 1% - 2% points = 2 Slope is 2% - 5% points = 1 Slope is greater than 5% points = 0	1
S	S 1.2 The soil 2 inches below the surface (or duff layer) is clay organic*(use NRCS definitions)* YES = 3 points NO = 0 points	0
S	S 1.3 Characteristics of the vegetation in the wetland that traps sediments and pollutants: *Choose the points appropriate for the description that best fits the vegetation in the wetland. Dense vegetation means you have trouble seeing the soil surface. (<75% cover), and uncut means not grazed or mowed and plants are higher than 6 inches.* Dense, ungrazed, herbaceous vegetation > 90% of wetland area points = 6 Dense, ungrazed, herbaceous vegetation > ½ of area points = 3 Dense, woody vegetation > ½ of area points = 2 Dense, ungrazed, herbaceous vegetation > ¼ of area points = 1 Does not meet any of the criteria above for vegetation points = 0 Aerial photo or map with vegetation polygons	**Figure__** 3
S	**Total for S 1** *Add the points in the boxes above*	4
S	**S 2. Does the wetland have the opportunity to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants A unit may have pollutants coming form several sources, but any single source would qualify as opportunity..* ☐ Grazing in the wetland or within 150 ft ☐ Untreated stormwater discharges to wetland ☐ Tilled fields or orchards within 150 feet of wetland ☒ Residential, urban areas, or golf courses are within 150 ft upslope of wetland ☐ Other _____ ☐ **YES** multiplier is **2** ☐ **NO** multiplier is **1**	*(see p. 67)* multiplier 2
S	**TOTAL - Water Quality Functions** Multiply the score from S1 by S2 *Add score to table on p. 1*	8

Comments

S	**Slope Wetlands** **HYDROLOGIC FUNCTIONS - Indicators that wetland unit functions to reduce flooding and stream erosion**	**Points** **(only 1 score per box)**
S	**S 3. Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	***(see p. 68)***
S	S 3.1 Characteristics of vegetation that reduce the velocity of surface flows during storms. *Choose the points appropriate for the description that best fit conditions in the wetland. (stems of plants should be thick enough (usually> 1/8 in), or dense enough, to remain erect during surface flows)* Dense, uncut, **rigid** vegetation covers >90% of area of the wetland. points = 6 Dense, uncut, **rigid** vegetation >1/2 area of wetland points = 3 Dense, uncut, **rigid** vegetation >1/4 area of wetland points = 1 More than 3/4 of area is grazed, mowed, tilled or vegetation is not rigid points = 0	**1**
S	S 3.2 Characteristics of slope wetland that holds back small amounts of flood flows: The slope wetland has small surface depressions that can retain water over at least 10% of its area. YES points = 2 NO points = 0	**0**
S	*Add the points in the boxes above*	**1**
S	**S 4. Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Is the wetland in a landscape position where the reduction in water velocity it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows? *Note which of the following conditions apply.* ☒ Wetland has surface runoff that drains to a river or stream that has flooding problems ☐ Other _____ *Answer NO if the major source of water is controlled by a reservoir (e.g. wetland is a seep that is on the downstream side of a dam.)* ☒**YES** multiplier is **2** ☐**NO** multiplier is **1**	*(see p. 70)* multiplier **<u>2</u>**
S	**TOTAL - Hydrologic Functions** Multiply the score from S 3 by S 4 ***Add score to table on p. 1***	**2**

Comments

These questions apply to wetlands of all HGM classes

Points (only 1 score per box)

HABITAT FUNCTIONS – Indicators that wetland functions to provide important habitat

H 1. Does the wetland have the <u>potential</u> to provide habitat for many species?

H 1.1 <u>Vegetation structure</u> ***(see p. 72)***

Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.

☐ Aquatic bed
☒ Emergent plants
☐ Scrub/shrub (areas where shrubs have >30% cover)
☒ Forested (areas where trees have >30% cover)

If the unit has a forested class check if:

☐ Forested areas have 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon

Add the number of vegetation types that qualify. If you have:

4 types or more	points = 4
3 types	points = 2
2 types	points = 1
1 type	points = 0

Map of Cowardin vegetation classes

Figure__

1

H 1.2 <u>Hydroperiods</u> ***(see p. 73)***

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (See text for description of hydroperiods.)

☐ Permanently flooded or inundated
☒ Seasonally flooded or inundated
☐ Occasionally flooded or inundated
☒ Saturated only
☐ Permanently flowing stream or river in, or adjacent to, the wetland
☐ Seasonally flowing stream or river in, or adjacent to, the wetland
☐ ***Lake-fringe wetland* = 2 points**
☐ ***Freshwater tidal wetland* = 2 points**

4 or more types present	points = 3
3 types present	points = 2
2 types present	points = 1

Figure__

1

H 1.3 <u>Richness of Plant Species</u> ***(see p. 75)***

Count the number of plant species in the wetland that cover at least 10 ft^2. *(Different patches of the same species can be combined to meet the size threshold.)*

You do not have to name the species.

Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle.

If you counted:

> 19 species	points = 2
5 - 19 species	points = 1
<5 species	points = 0

List species below if you want to:

2

Total for page: 4

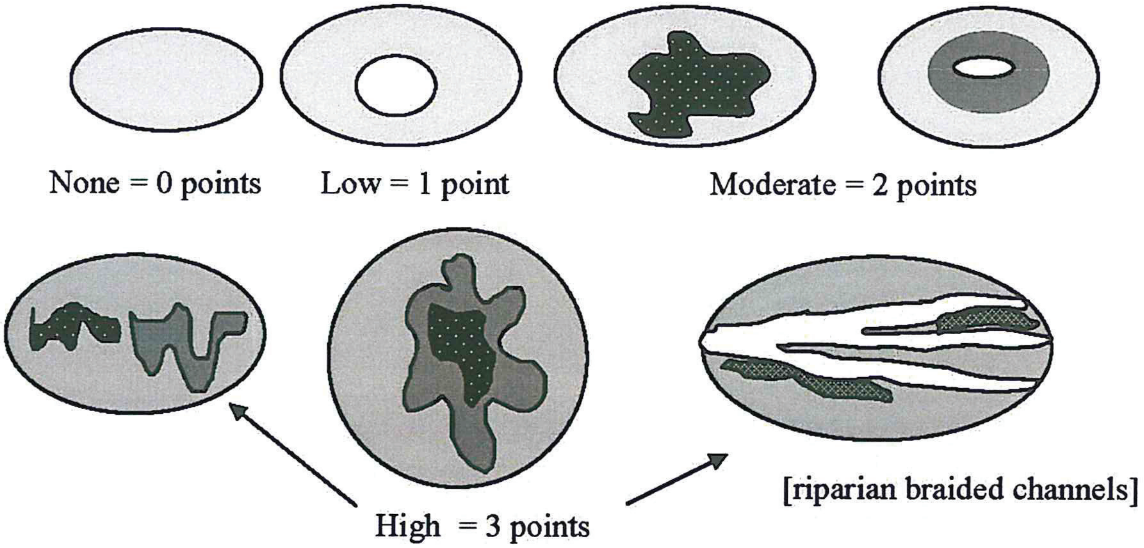
Wetland name or number_____

H 1.4 <u>Interspersion of habitats</u> ***(see p. 76)***

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.

Figure__

1



NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". Use map of Cowardin vegetation classes

H 1.5 <u>Special Habitat Features:</u> ***(see p. 77)***

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

☐ Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).
☐ Standing snags (diameter at bottom >4 inches) in the wetland
☐ Undercut banks are present for at least 6.6 ft. (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)
☐ Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*
☐ At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)*
☒ Invasive plants cover less than 25% of the wetland area in each stratum of plants
Note: The 20% stated in early printings of the manual on page 78 is an error

1

H 1. TOTAL Score – potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5

6

Comments:

H 2. Does the wetland have the opportunity to provide habitat for many species?)	
H 2.1 Buffers ***(see p. 80)*** *Choose the description that best represents condition of buffer of wetland. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."* ☐ 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% of circumference. No structures are within the undisturbed part of buffer. (relatively undisturbed also means no grazing, no landscaping, no daily human use) **Points = 5** ☐ 100 m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water >50% circumference. **Points = 4** ☐ 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **Points = 4** ☐ 100 m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >25% circumference. **Points = 3** ☐ 50 m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference. **Points = 3** **If buffer does not meet any of the three criteria above** ☒ No paved areas (except paved trails) or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. **Points = 2** ☐ No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing or lawns are OK **Points = 2** ☐ Heavy grazing in buffer. **Points = 1** ☐ Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland) **Points = 0** ☐ Buffer does not meet any of the criteria above. **Points = 1** Aerial photo showing buffers	**Figure__** **2**
H 2.2 Corridors and Connections ***(see p. 81)*** H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft wide, has at least 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).* ☐YES = **4 points** (*go to H 2.3*) ☒NO = go to H 2.2.2 H 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR** a **Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? ☐YES = **2 points** (*go to H 2.3*) ☒NO = H 2.2.3 H 2.2.3 Is the wetland: within 5 mi (8km) of a brackish or salt water estuary OR within 3 mi of a large field or pasture (>40 acres) OR within 1 mi of a lake greater than 20 acres? ☐YES = **1 point** ☒NO = **0 points**	**0**

Total for page: 2

H 2.3 Near or adjacent to other priority habitats listed by WDFW ***(see new and complete descriptions of WDFW priority habitats, and the counties in which they can be found, in the PHS report http://wdfw.wa.gov/hab/phslist.htm)***

Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*

- ☐ **Aspen Stands:** Pure or mixed stands of aspen greater than 0.4 ha (1 acre).
- ☐ **Biodiversity Areas and Corridors:** Areas of habitat that are relatively important to various species of native fish and wildlife *(full descriptions in WDFW PHS report p. 152).*
- ☐ **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.
- ☐ **Old-growth/Mature forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age. (Mature forests) Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less than 100%; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest.
- ☐ **Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important *(fill descriptions in WLDFW PHS report p. 158).*
- ☒ **Riparian:** The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.
- ☐ **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie *(full descriptions in WDFW PHS report p. 161).*
- ☐ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.
- ☐ **Nearshore:** Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. *(full descriptions of habitats and the definition of relatively undisturbed are in WDFW report.' pp. 167-169 and glossary in Appendix A).*
- ☐ **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.
- ☐ **Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft.
- ☐ **Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.
- ☐ **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 51 cm (20 in) in western Washington and are > 2 m (6.5 ft) in height. Priority logs are > 30 cm (12 in) in diameter at the largest end, and > 6 m (20 if) long.

If wetland has **3 or more** priority habitats = **4 points**
If wetland has **2** priority habitats = **3 points**
If wetland has **1** priority habitat = **1 point** No habitats = 0 points

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)

1

H 2.4 <u>Wetland Landscape</u> *(choose the* ***one*** *description of the landscape around the wetland that best fits)* ***(see p. 84)*** ☐There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 ☐The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 ☐There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 ☐The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 3 ☐There is at least 1 wetland within ½ mile. points = 2 ☒There are no wetlands within ½ mile. points = 0	**0**
H 2. TOTAL Score -opportunity for providing habitat *Add the scores in the column above*	**3**
TOTAL for H 1 from page 14	**6**
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	**9**

Wetland name or number_____

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

Wetland Type *Check off any criteria that apply to the wetland. Select the appropriate Category (from dropdown menu in Category column) when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt. ☐YES = Go to SC 1.1 ☒NO	
SC 1.1 Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐YES = Category I ☒NO go to SC 1.2	Cat. I
SC 1.2 Is the wetland at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	Cat. I Cat. II Dual rating I/II

SC 2.0 Natural Heritage Wetlands *(see p. 87)*

Cat. I

Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species.

SC 2.1 Is the wetland being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)*

S/T/R information from Appendix D ☐ or accessed from WNHP/DNR web site ☒

YES ☐ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO ☒

SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species?

☐YES = Category I ☐NO__not in a Heritage Wetland

SC 3.0 Bogs *(see p. 87)*

Does the wetland unit (**or part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.***

1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)
   Yes ☐ - go to Q. 3 No ☒ go to Q. 2
2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond?
   Yes ☐ - go to Q. 3 No ☒ - Is not a bog for purpose of rating
3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)?
   Yes ☐– Is a bog for purpose of rating No ☐-go to Q. 4
   NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog.
4. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?*
   YES ☐ = Category I NO ☐ Is not a bog for purpose of rating

Cat. I

SC 4.0 Forested Wetlands ***(see p. 90)***

Does the wetland unit have at least 1 acre of forest that meets one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.*

☐ **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more.

NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter.

☐ **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth.

☐YES = Category I ☒ NO not a forested wetland with special characteristics

Cat. I

SC 5.0 Wetlands in Coastal Lagoons ***(see p. 91)***

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

☐ The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

☐ YES = Go to SC 5.1 NO ☒ not a wetland in a coastal lagoon

SC 5.1 Does the wetland meet all of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74).

☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

☐ The wetland is larger than 1/10 acre (4350 square feet)

YES ☐= Category I NO ☐= Category II

Cat. I

Cat. II

SC 6.0 Interdunal Wetlands *(see p. 93)* Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ☐ YES = Go to SC 6.1 ☒NO -- not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula – lands west of SR103 • Grayland-Westport- lands west of SR 105 • Ocean Shores-Copalis- lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is one acre or larger? ☐ YES = Category II ☐ NO go to SC 6.2 SC 6.2 Is the wetland between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre,? ☐ YES = Category III	**Cat.II** **Cat.III**
Category of wetland based on Special Characteristics *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p. 1.	**N/A**

Comments

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A. Signature
X Lucy Anderson
☒ Agent
☐ Addressee

B. Received by *(Printed Name)* Lucy Anderson

C. Date of Delivery 7/3/18

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

NDER: *COMPLETE THIS SECTION*

omplete items 1, 2, and 3.
rint your name and address on the reverse
o that we can return the card to you.
ttach this card to the back of the mailpiece,
r on the front if space permits.

rticle Addressed to:
onFederated Tribes
o Warm Springs
O Box 460
arm Springs OR 97761

9590 9402 3383 7227 1188 69

rticle Number *(Transfer from service label)*
18 0360 0001 0149 0530

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X
☐ Agent
☐ Addressee

B. Received by *(Printed Name)*
Jennifer Doney

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

orm 3811, July 2015 PSN 7530-02-000-9053
Domestic Return Receipt

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:
Cowlitz Indian Tribe
PO Box 2547
Longview WA
98632-8594

9590 9402 3383 7227 1188 76

2. Article Number *(Transfer from service label)*
7018 0360 0001 0149 0547

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X
☐ Agent
☐ Addressee

B. Received by *(Printed Name)*
Cathy [illegible]

C. Date of Delivery
6/27/18

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053
Domestic Return Receipt

NDER: *COMPLETE THIS SECTION*

Complete items 1, 2, and 3.
Print your name and address on the reverse
so that we can return the card to you.
Attach this card to the back of the mailpiece,
or on the front if space permits.

Article Addressed to:
onFederated Tribes &
and of the Yakima
ndian NATION
O Box 151
oppenish WA 98948

9590 9402 3383 7227 1188 38

Article Number *(Transfer from service label)*
018 0360 0001 0149 0509

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Terri Benson
☐ Agent
☐ Addressee

B. Received by *(Printed Name)*
Terri Benson

C. Date of Delivery
6/27/18

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

JUN 27 2018

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☑ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

Form 3811, July 2015 PSN 7530-02-000-9053
Domestic Return Receipt

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:
Umatilla Indian Nation
46411 Timine Way
Pendleton OR 97801-9467

9590 9402 3383 7227 1188 52

2. Article Number *(Transfer from service label)*
7018 0360 0001 0149 0523

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X
☒ Agent
☐ Addressee

B. Received by *(Printed Name)*
Avary McKay

C. Date of Delivery
6/28/18

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☑ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053
Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Confederate Tribes of
Grande Ronde
9615 Grande Ronde Rd
Grande Ronde OR
97347-9712

9590 9402 3383 7227 1188 45

2. Article Number (Transfer from service label)

7018 0360 0001 0149 0516

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X AWhite ☐ Agent ☐ Addressee

B. Received by (Printed Name) A WHITE

C. Date of Delivery 6/27/18

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

USPS TRACKING #

9590 9402 3383 7227 1188 45

First-Class
Postage & F
USPS
Permit No. (

United States
Postal Service

• Sender: Please print your name, address, and ZIP+4® in this bo

Grande Ronde

STERLING DESIGN, INC.
2208 E. EVERGREEN BLVD.
VANCOUVER, WA 98661

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

SnoalwaterBay Tribe
PO Box 130
Tokeland WA 98590

9590 9402 3383 7227 1188 83

2. Article Number (Transfer from service label)

7018 0360 0001 0149 0554

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) Brandt Ellighas

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

-431708

USPS TRACKING #

9590 9402 3383 7227 1188 83

First-Class Ma
Postage & Fe
USPS
Permit No. G-

United States
Postal Service

• Sender: Please print your name, address, and ZIP+4® in this box

Snoalwater

STERLING DESIGN, INC.
2208 E. EVERGREEN BLVD.
VANCOUVER, WA 98661

Exhibit 20 SUB18-02

City of Camas WASHINGTON

Community Development Department

Notice of Application

Valley View Estates Subdivision

File No. SUB18-02

"NOTICE IS HEREBY GIVEN" that an application for "Valley View Estates Subdivision" a 36 lot single-family detached residential subdivision development requesting preliminary plat approval was received on May 18, 2018, and deemed technically complete on July 6, 2018. A public hearing is required for the Subdivision, and will be scheduled at a later time. A separate public notice for the public hearing will be mailed to all property owners within 300-feet of the subject development and published in the Post Record.

LOCATION: The 9.26 acre site is zoned single-family residential (R-7.5) and located in the NE ¼ quarter of Section 8, Township 1 North, Range 3 East of the Willamette Meridian; Camas, WA. Parcel Number includes 125646-000, and 125635-000.

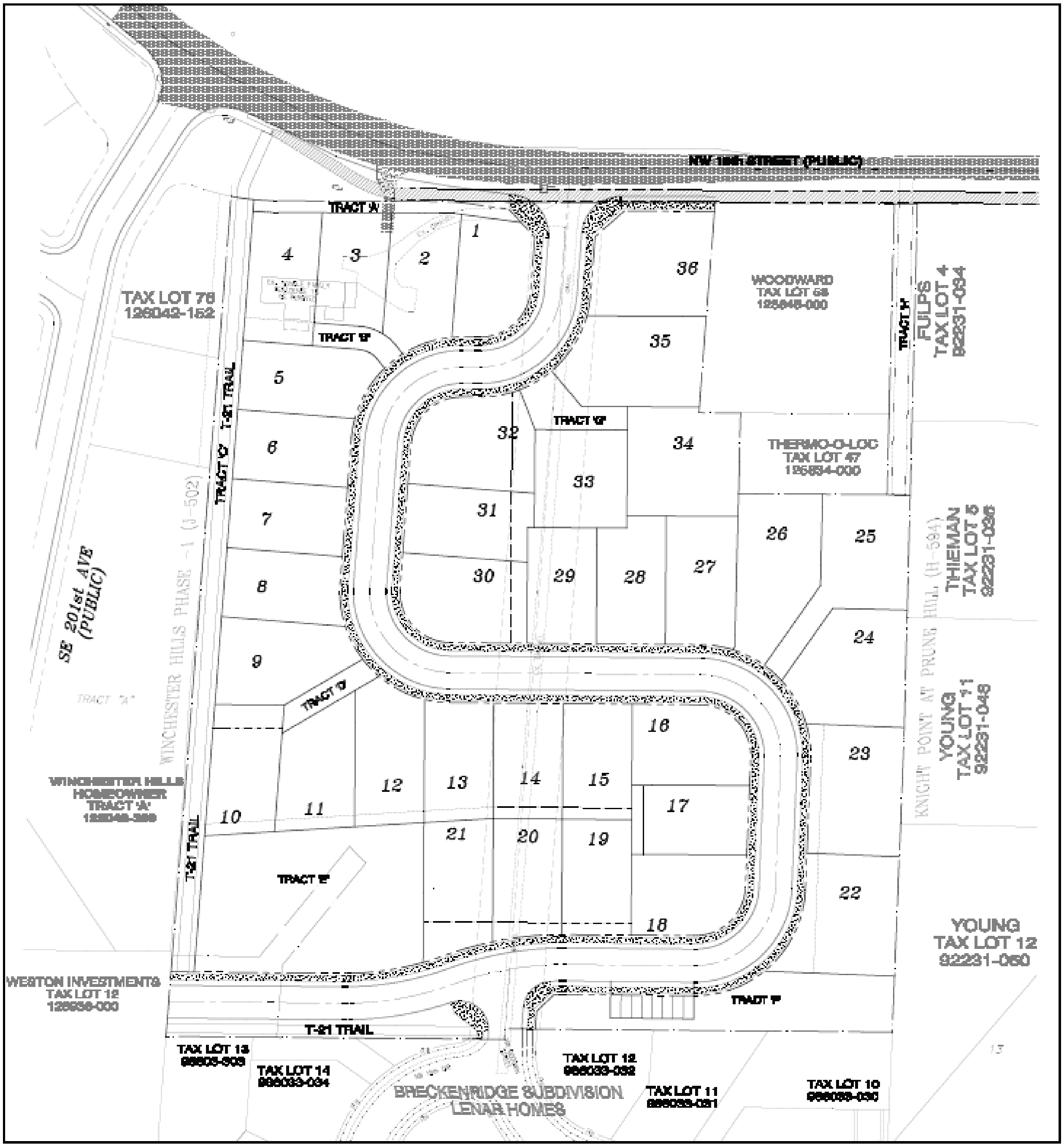
APPLICATION MATERIALS: The application included the following: project narrative; preliminary plan set; geotechnical report; traffic report; critical areas report; archaeological report*; preliminary storm water report; State Environmental Policy Act (SEPA) checklist; and other required submittal documents. These documents are available for viewing at the Community Development Department (616 NE 4th Avenue, Camas, WA) during regular business hours Monday – Friday 8am-5pm.

Questions/Comments: For questions related to this application, please contact Lauren Hollenbeck, Senior Planner, at (360) 817-1568 ext. 4253 or by email at communitydevelopment@cityofcamas.us.

*Consistent with RCW 42.56.300, Archaeological information is exempt from public disclosure.

Published in the Post Record on July 12, 2018 Legal publication No. 610375
Posted on bulletin boards at Camas City Hall and the Camas Library and on the City's website.
Mailed to property owners within 300-feet on July 11, 2018

Excerpt from Preliminary Plat Application
Valley View Subdivision (File #18-02)



Published in the Post Record on July 12, 2018 Legal publication No. 610375

Posted on bulletin boards at Camas City Hall and the Camas Library and on the City's website.

Mailed to property owners within 300-feet on July 11, 2018

Exhibit 21 SUB18-02

COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

June 13, 2018

Joel Stirling
Sterling Design, Inc.
2208 E. Evergreen Blvd.
Vancouver, WA 98661

RE: Valley View Estates Subdivision (SUB18-02)

Dear Mr. Stirling,

Thank you for your application submittal for the Valley View Estates Subdivision. There are items that remain to be addressed with your application. The purpose of this letter is to inform you that the above application submitted on May 18, 2018, has been deemed incomplete in accordance with Camas Municipal Code (CMC) Section 18.55.130. You have 180 days from the date of application to submit the missing information pursuant to CMC 18.55.130.C. If the below requested information is submitted, staff will again verify whether the application is complete.

Items necessary for completeness:

1. The signature page submitted with the SEPA checklist is from an old form. The signature page should contain the language "under the penalty of perjury". The current SEPA checklist is on the city website. Please resign and resubmit (via email is ok).
2. Per CMC 17.11.030.B.13, a narrative addressing the preliminary plat approval criteria in CMC 17.11.030.D (1-10).
3. Per CMC 16.31.160, provide proof of mailing or emailing the archaeological predetermination report to the tribes.
4. The following information shall be addressed on the site and development plans pursuant to CMC 17.11.030.B.6:
    a. The following standards in CMC Section 17.01.050 shall be included on the preliminary plat map:
        i. Critical areas (i.e. streams and steep slopes) and existing buildings per CMC 17.01.050.A.2;
        ii. Legal description of the boundaries per CMC 17.01.050.A.4;
        iii. Tract C should be included as recreational open space per CMC 17.01.050.B.3.g;
    c. Lines marking the boundaries of the existing lot(s) (any existing lot to be eliminated should be a dashed line and so noted). For example, is Tax Lot 48 proposed to be removed?
    j. Provide recorded documents of the nature and extent of existing easements (i.e. 30-ft. easements adjacent to existing gravel road).
    m. Location of any critical areas and critical area buffers (i.e. steep slopes) to indicate compliance with all applicable provisions of critical areas legislation.
5. Revise and resubmit the TIR to comply with the 2014 SWMMWW, not the 2005 SWMMWW manual.

Other preliminary project issues noted by staff to be addressed:

1. Do not reference Clark County Stormwater O&M Manual in your reports. Only reference the City of Camas and/or Ecology Stormwater Manuals.
2. Proposed retaining walls will need to comply with CMC 18.17.060.

Please note, additional comments will be provided during further review of your application. If you have any questions, please contact me at (360) 817-7253.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck
Senior Planner

Exhibit 22 SUB18-02

City of Camas
WASHINGTON

COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

July 6th, 2018

Joel Sterling
Sterling Design, Inc.
2208 E. Evergreen Blvd.
Vancouver, WA 98661
Sent via email Mail@SterlingDesign.biz

RE: Valley View Estates (SUB18-02)

Dear Joel Sterling,

The purpose of this letter is to inform you that the above application submitted on May 24th, 2018 has been deemed complete in accordance with Camas Municipal Code (CMC) Section 18.55.130. Staff will begin reviewing the application and contact you should we have questions/comments.

If you have any questions, please contact me at (360) 817-7253.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck
Senior Planner

Cc: Robert Maul, Planning Manager
Anita Ashton, Engineering Project Manager

Exhibit 23 SUB18-02

City of Camas
WASHINGTON

COMMUNITY DEVELOPMENT DEPARTMENT
616 NE 4th Avenue
Camas, WA 98607
www.ci.camas.wa.us

August 24, 2018

Joel Sterling
Sterling Design, Inc.
2208 E. Evergreen Blvd.
Vancouver, WA 98661
Sent via email Mail@SterlingDesign.biz

RE: Valley View Estates (SUB18-02)

Dear Joel Sterling,

The below comments are based on the City's review (**except Engineering which will be provided at a later date**) of the Preliminary Plat application materials submitted May 18, 2018, revised materials resubmitted May 24 and June 25, 2018 for the Valley View Estates Subdivision:

1. Per the City Parks Manager, the T-21 trail designation was used in the 2006 PROS plan and has since changed to T-24 per the current 2014 Parks, Recreation and Open Space Plan.
2. Is the segment of the trail running east/west part of Tract C?
3. Lot 1 building envelope should be reduced to comply with the required 20-ft. building setback from the tract per CMC 17.19.030.D.6.d
4. Lot 30 building envelope may be extended per the 5-foot corner lot rear yard setback requirement pursuant to CMC 18.09.040.
5. Land inventory should be corrected on sheet 2 of 9. Site area and developed acreage should be the same. The infrastructure acreage should only include the stormwater tracts.
6. The setbacks table should also include "corner lot rear yard" on sheet 2 of 9.
7. Lots 1, 19, 23, 24, 26, 27 and 32: Walls in front yards cannot exceed 42-inches in height per CMC 18.17.050.C.2.
8. Provide a cross-section for the walls surrounding lots 24-26. Retaining walls shall comply with CMC 18.17.060.
9. Lots 1 and 2: A minimum 4 or 6-ft. wall is permitted per double frontage standards CMC17.19.030.D.6.b.ii.
10. Recommend landscaping on sides of entry into Tract G.
11. Submit proof of mailing archaeological predetermination report to tribes.

Please note, additional comments will be provided during further review of your application. If you have any questions, please contact me at (360) 817-7253.

Respectfully,

Lauren Hollenbeck

Lauren Hollenbeck
Senior Planner

Exhibit 24 SUB18-02

City of Camas
WASHINGTON

Notice of Public Hearing

Valley View Estate Subdivision

File No. SUB18-02

A public hearing for the "Valley View Estates Subdivision" will be held on **October 18th, 2018, at 5:00 p.m**. or soon thereafter, at City Hall, 616 NE 4th Avenue, Camas, WA.

The Valley View Estates Subdivision was submitted by Sterling Design, Inc. for the owner, Stan Firestone, on May 24th, 2018 and was deemed technically complete on July 6th, 2018. The applicant requests approval of a 36-lot subdivision. The proposed project is located at 20109 NE 40th Street, on 9.26 acres [*Tax Parcel: 125646-000, 125636-000]*. The project area is zoned Single-family Residential 7,500 (R-7.5).

APPLICATION MATERIALS: The Valley View Estates preliminary plat (subdivision) application included the following: Application form and fees; Developer GIS packet; Mailing Labels; Project Narrative; Preliminary Plans; Pre-Application meeting notes; SEPA checklist, Preliminary Storm water Plan and Report; Geotechnical Report; Traffic Study; Environmental Report; and Archaeological Predetermination*. These documents are available for viewing at the Community Development Department (616 NE 4th Avenue, Camas, WA) during regular business hours Monday – Friday 8am-5pm.

Participate: All citizens are entitled to have equal access to the services, benefits and programs of the City of Camas. Please contact the City Clerk at (360) 834-6864 for special accommodations if needed. The City will provide translators for non-English speaking persons who request assistance at least three working days prior to a public meeting.

Public comments and questions are encouraged, and there are several opportunities available to interested citizens*. It is preferable that written comments be received two days prior to the public hearing, in order to be available with the online agenda and materials.* With that said, comments can also be accepted during the public hearing. The public hearing will follow the quasi-judicial process described within Camas Municipal Code §18.55.180. Comments related to this development may be submitted as follows: (1) In person by testifying at the public hearing; (2) by regular mail to Planning Division staff, Lauren Hollenbeck, Senior Planner, at the Camas City Hall, 616 NE 4th Avenue, Camas, WA 98607; (3) by email to: communitydevelopment@cityofcamas.us; or (4) by phone (360) 817-7253. **For questions related to this application, please contact Lauren Hollenbeck, Senior Planner, at (360) 817-7253 or communitydevelopment@cityofcamas.us.**

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*Consistent with RCW 42.56.300, Archaeological information is exempt from public disclosure.

Published in the Post Record on October 4, 2018 [Legal Publication # 43310]
Posted at Camas City Hall, Camas Library, City of Camas web site at: http://www.cityofcamas.us
Mailed to property owners within 300-feet on October 3, 2018

Excerpt from Preliminary Plat Application
Valley View Estates Subdivision (File #SUB18-02)

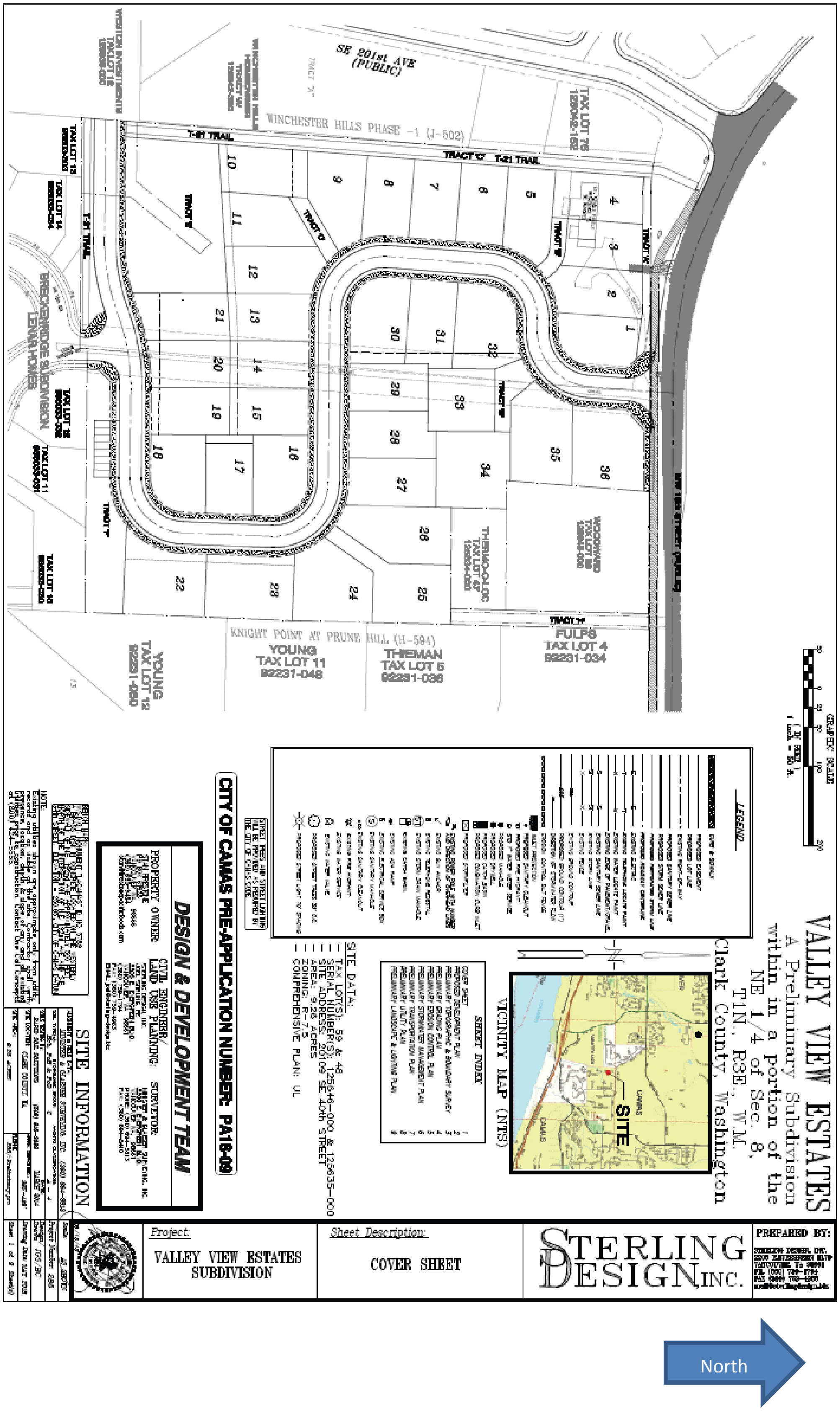


Exhibit 25 SUB18-02

Date Published: October 4th, 2018

To Whom It May Concern:

Please find enclosed a Mitigated Determination of Non-Significance (MDNS) for the **Valley View Estates Subdivision (SEPA18-15)** that was issued pursuant to the State Environmental Policy Act (SEPA) Rules, Chapter 197-11, Washington Administrative Code. The enclosed review comments reflect evaluation of the environmental checklist by the lead agency as required by WAC 197-11-330(1)(a)(i).

The following materials were submitted with the initial application:

Application Form
Narrative
Preliminary Plans
Mailing Labels
SEPA Checklist
Stormwater Plan and Report
Geotechnical Report
Traffic Impact Study
Archeological Pre-Determination Report
Environmental Report

The application materials are available for review upon request from the Community Development Department.

Written comments may be submitted on this determination within fourteen (14) days of its issuance, after which the MDNS will be reconsidered in light of the comments received.

Please address all correspondence to:

City of Camas, SEPA Official
Community Development Department
616 NE Fourth Avenue
Camas, Washington 98607
communitydevelopment@cityofcamas.us

Distribution:

Bureau of Indian Affairs
C-Tran
Camas School District
Camas City Administrator, Peter Capell
Camas Building Official, Bob Cunningham
Camas Community Development Director, Phil Bourquin
Camas Engineering Department Managers and Staff
Camas Fire Department, Randy Miller
Camas Finance Director, Cathy Huber Nickerson
Camas Mayor and City Council Members
Camas Parks and Recreation, Jerry Acheson
Camas Parks Commission Chair, Randy Curtis
Camas Hearings Examiner
Camas Planning Manager and Staff
Camas Police Chief, Mitch Lackey
Camas Public Works Director, Steve Wall
Camas Public Library, Connie Urquhart
Camas-Washougal Post Record
Chinook Indian Nation
Cultural Resource Program, Cowlitz Indian Tribe
Cultural Resource Program, Yakama Indian Nation
Clark County Department of Environmental Services
Clark County Public Works – Development Engineering Program
Clark County Department of Transportation
Clark County Natural Resources Council
Clark Public Utilities
Department of Ecology
Department of Fish and Wildlife, Region 5
Department of Natural Resources, SEPA Center
Southwest Clean Air Agency
US Army Corps of Engineers
Vancouver-Clark Parks and Recreation
Washington Office of Archaeology & Historic Preservation
Washington State Department of Transportation
Washington State Parks and Recreation Commission, Environmental Program
Property Owners within 300 feet
Joel Sterling

Exhibit 26 SUB18-02

City of Camas
WASHINGTON

State Environmental Policy Act
Mitigated Determination of Non-Significance

CASE NO: SEPA 18-15 Valley View Estates Subdivision

APPLICANT:
Sterling Design, Inc.
Joel Sterling
2208 East Evergreen Blvd
Vancouver, WA 98661

REQUEST: To subdivide 9.26 acres into 36 single-family residential lots

---

Location: 20109 SE 40th Street Camas, WA 98607.

Legal Description: The property is located in the NW ¼ of Section 8, Township 1 North, Range 3 East, of the Willamette Meridian; and described as tax parcels 125646-000 and 125635-000.

SEPA Determination: Mitigated Determination of Non-Significance (MDNS)

Comment Deadline: **Thursday, October 18th, 2018, at 5:00 p.m.**

As lead agency under the State Environmental Policy Act (SEPA) Rules [Chapter 197-11, Washington Administrative Code (WAC)], the City of Camas must determine if there are possible significant adverse environmental impacts associated with this proposal. The options include the following:

- DS = Determination of Significance (The impacts cannot be mitigated through conditions of approval and, therefore, requiring the preparation of an Environmental Impact Statement (EIS).
- MDNS = Mitigated Determination of Non-Significance (The impacts can be addressed through conditions of approval), or;

- DNS = Determination of Non-Significance (The impacts can be addressed by applying the Camas Municipal Code).

Published in the Post Record on October 4th, 2018
Legal Publication # 44510
Posted on bulletin boards at Camas City Hall, Camas Library and the City of Camas web site at: http://www.cityofcamas.us
Mailed to property owners within 300-feet on October 3rd, 2018

Determination:

Mitigated Determination of Non-Significance (MDNS). The City of Camas, as lead agency for review of this proposal, has determined that this proposal does not have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(e). This decision was made after review of a completed environmental checklist, and other information on file with the City of Camas.

Date of Publication & Comment Period:

Publication date of this MDNS is **October 4th, 2018**, and is issued under WAC 197-11-350. The lead agency will not act on this proposal until the close of the 14-day comment period, which ends on **October 18th, 2018**. Comments may be sent by email to communitydevelopment@cityofcamas.us.

SEPA Appeal Process:

An appeal of any aspect of this decision, including the SEPA determination and any required mitigation, must be filed with the Community Development Department within fourteen (14) calendar days from the date of the decision notice. The letter of appeal should contain the following information.

1. The case number designated by the City of Camas and the name of the applicant; and,
2. The name and signature of each person or group (petitioners) and a statement showing that each petitioner is entitled to file an appeal as described under Title 16 of the Camas Municipal Code. If multiple parties file a single petition for review, the petition shall designate one party as the contact representative with the City Planner. All contact with the City Planner regarding the petition, including notice, shall be with this contact person.

The appeal request and appropriate fee of **$369** must be submitted to the Community Development Department between 8:00 a.m., and 5:00 p.m., Monday through Friday, at the address listed below:

Appeal to the City of Camas SEPA Official
Community Development Department
616 NE Fourth Avenue
Camas, Washington 98607

Responsible Official: Robert Maul (360) 817-1568

Robert Maul, Planning Manager and Responsible Official

October 4th, 2018
Date of publication

Published in the Post Record on October 4th, 2018 Legal Publication # 44510
Posted on bulletin boards at Camas City Hall, Camas Library and the City of Camas web site at: http://www.cityofcamas.us
Mailed to property owners within 300-feet on October 3rd, 2018

SEPA Mitigation Measures for Valley View Estates (SEPA18-15)

The following measures are based on general policies and regulatory provisions, which are consistent with Camas 2035, the city's comprehensive plan document, and with the Camas Municipal Code.

B) ENVIRONMENTAL ELEMENTS

1) Earth

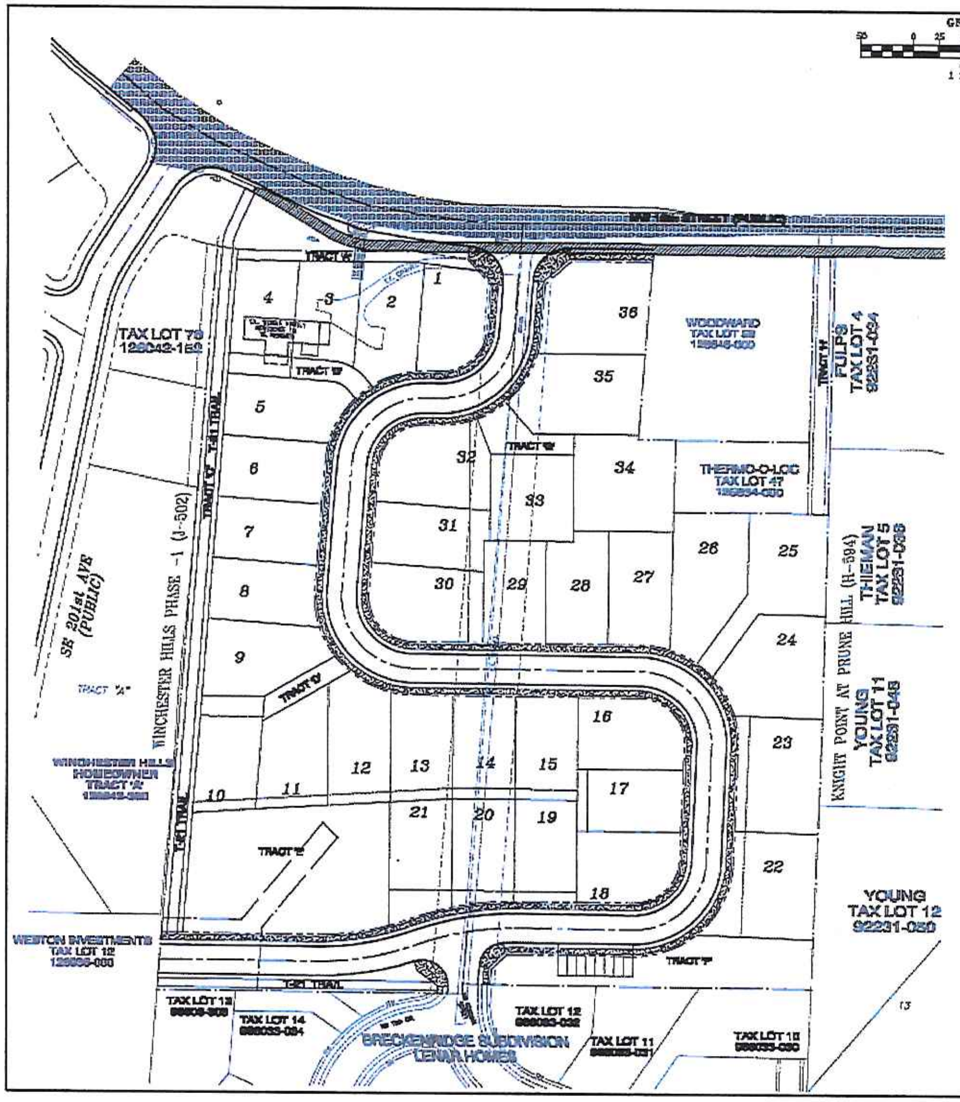
a. Clearing and grading including utility and road construction activities shall be allowed only from May 1st to October 1st of each year. The City may extend or shorten the dry season on a case-by-case basis depending on actual weather conditions.

3) Water

a. All on-site LID options and requirements, per Ecology's latest edition of the Stormwater Management for Western Washington, shall be incorporated into the project such that stormwater shall not leave the site unless it is determined that all LID measures are infeasible.

b. Prior to final Engineering approval, stormwater runoff from adjacent properties to the east, Tax Lots 125645-000 and 125634-000, shall be addressed in order to alleviate potential impacts to Valley View lots.

Published in the Post Record on October 4th, 2018 Legal Publication # 44510
Posted on bulletin boards at Camas City Hall, Camas Library and the City of Camas web site at: http://www.cityofcamas.us
Mailed to property owners within 300-feet on October 3rd, 2018



GRAPHIC SCALE

(IN FEET)
1 inch = 60 ft.

VALLEY VIEW ESTATES

A Preliminary Subdivision within in a portion of the NE 1/4 of Sec. 8, T1N., R3E., W.M. Clark County, Washington

VICINITY MAP (NTS)

LEGEND

- CURB & SIDEWALK
- PROPOSED EASEMENT
- PROPOSED LOT LINE
- EXISTING RIGHT-OF-WAY
- PROPOSED SANITARY SEWER LINE
- PROPOSED STORM SEWER LINE
- PROPOSED PERFORATED STORM LINE
- PROPOSED ROADWAY CENTERLINE
- EXISTING ELECTRIC
- EXISTING TELEPHONE LOCATE PAINT
- EXISTING WATER LOCATE PAINT
- EXISTING EDGE OF PAVEMENT/GRAVEL
- EXISTING SANITARY SEWER LINE
- EXISTING STORM LINE
- EXISTING FENCE
- EXISTING GROUND CONTOUR
- PROPOSED GROUND CONTOUR (1')
- DIRECTION OF STORMWATER FLOW
- EROSION CONTROL SILT FENCE
- INLET PROTECTION
- PROPOSED SANITARY CLEANOUT
- PROPOSED FIRE HYDRANT
- 5/8 1" WATER METER SERVICE
- PROPOSED MANHOLE
- PROPOSED DRYWELL
- PROPOSED CATCH BASIN
- PROPOSED COMBINATION CURB INLET
- PROPOSED STORMFILTER
- EXISTING POWER POLE WITH NUMBER AND DIRECTION OF OVERHEAD LINES
- EXISTING GUY ANCHOR
- EXISTING TELEPHONE PEDESTAL
- EXISTING STORM DRAIN MANHOLE
- EXISTING CATCH BASIN
- EXISTING ADA RAMP
- EXISTING ELECTRICAL SERVICE BOX
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY CLEANOUT
- EXISTING FIRE HYDRANT
- EXISTING WATER SERVICE
- EXISTING WATER VALVE
- PROPOSED STREET TREES 30' O.C.
- PROPOSED STREET LIGHT 70' SPACING

STREET TREES AND STREET LIGHTING WILL BE PROVIDED AS REQUIRED BY THE CITY OF CAMAS CODE.

SHEET INDEX

SITE DATA:

- TAX LOT(S): 59 & 48
- SERIAL NUMBER(S): 125646-000 & 125635-000
- SITE ADDRESS: 20109 SE 40th STREET
- AREA: 9.26 ACRES
- ZONING: R-7.5
- COMPREHENSIVE PLAN: UL

CITY OF CAMAS PRE-APPLICATION NUMBER: PA18-09

DESIGN & DEVELOPMENT TEAM

PROPERTY OWNER:
STAN FIRESTONE
PO BOX 61939
VANCOUVER WA. 98666
(360) 693-9494
stan@firestonepacificfoods.com

CIVIL ENGINEER/
LAND USE PLANNING:
STERLING DESIGN, INC.
JOEL STIRLING, PE
2208 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
(360) 759-1794
FAX: (360) 759-4883
EMAIL: joel@sterling-design.biz

SURVEYOR:
MINISTER & GLAESER SURVEYING, INC.
2200 E. EVERGREEN BLVD.
VANCOUVER WA. 98661
PHONE: (360) 694-3313
FAX: (360) 694-8410

BENCH MARK:
W.S.D.O.T. MONUMENT "LACAMAS" ID NO. 5789
A BRASS DISK IN CONCRETE LOCATED ON THE WESTERLY SIDEWALK OF N.E. 192nd AVE APPROXIMATELY 500 FEET NORTH OF THE INTERSECTION OF N.E. 192nd AVE AND S.E. 34th STREET. ELEVATION = 250.65', CITY OF CAMAS DATUM

NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424-5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313

SOIL TYPE(S): [illegible] HYDROLOGIC GROUP: C AASHTO CLASSIFICATION: A - 4

SOILS TYPED BY: [illegible] DATE: MARCH 2014

SITE LOCATION: CLARK COUNTY, WA

SITE AREA: 9.26 ACRES

FILENAME: 286/Preliminary.pro

PREPARED BY:
STERLING DESIGN, INC.
2208 E. EVERGREEN BLVD.
VANCOUVER, WA 98661
TEL (360) 759-1794
FAX (360) 759-4883

STERLING DESIGN, INC.

Sheet Description: COVER SHEET

Project: VALLEY VIEW ESTATES SUBDIVISION

05/18/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JCS/BC
Drawing Date: MAY 2019
Sheet 1 of 9 Sheet(s)

Exhibit 27 SUB18-02

WETLAND DETERMINATION REPORT

FOR THE

SOUTHEAST 40TH SITE

Prepared for:
Firestone Pacific Developing
C/O Stan Firestone
P.O. Box 61928
Vancouver, WA 98666
360-772-3445

Prepared by:
Ecological Land Services, Inc.
1157 3rd Avenue, Suite 220
Longview, WA 98632
360-578-1371

October 18, 2007

ELS Project Number 1543.02

SIGNATURE PAGE

The information and data in this report were compiled and prepared under the supervision and direction of the undersigned.

Amanda Castro

Amanda Castro
Biologist

AA for —
KW

Kelsey Woods
Biologist

Andrea Aberle

Andrea Aberle
Biologist/ Project Manager

TABLE OF CONTENTS

INTRODUCTION

Ecological Land Services, Inc. (ELS) has completed a wetland determination for Firestone Pacific Developing on an approximately 11-acre site located at 20305 S.E. 40th Street in the City of Camas, Clark County, Washington (Figure 1). The site consists of four parcels (tax parcel numbers 125646-000, 125645-000, 125634-000, and 125635-000) located in the Northwest 1/4 of Section 8, Township 1 North, Range 3 East of the Willamette Meridian. The site was investigated for the presence of critical areas on October 5, 2007 in accordance with Camas Municipal Code (CMC 16.50). the property boundaries have not been professionally surveyed.

SITE DESCRIPTION

Much of the subject site is pastureland with a few scattered trees. Site topography generally slopes south and west, with the lowest point being a man-made ditch in the southwestern region of the site. A single family residence is located in the northwestern region of the site (Figure 2). Surrounding land uses include residential homes to the east and west, NE 40th Street to the north and a functionally isolated wetland to the south. The residence is accessed by a paved driveway from Southeast 40th Street and a gravel driveway off of 202nd Court. A private road, 202nd Court, bisects the property and runs the entire length of the property from north to south. An above-ground water conveyance pipe, located near the southern property boundary in the eastern parcel, transports water draining from a neighboring development to the east. The pipe is approximately 320 feet long on-site, extending from the eastern property boundary to 202nd Court.

METHODS

The wetland determination completed by ELS followed the Routine Determination Method for delineating wetlands according to the U.S. Army Corps of Engineers, *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the Washington State Department of Ecology, *Washington State Wetlands Identification and Delineation Manual* (1997).

The Routine Determination Method examines three parameters—vegetation, hydrology, and soils—to determine if wetlands exist in a given area. Hydrology is critical in determining what is wetland but is often difficult to assess because hydrologic conditions can change periodically (hourly, daily, or seasonally). Consequently, it is necessary to determine if hydrophytic vegetation and hydric soils are present, which would indicate that water is present for long enough duration to support a wetland plant community. By definition, wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands are regulated as "Waters of the United States" by the U.S. Army Corps of Engineers (USACE), as "Waters of the State" by the Department of Ecology (DOE), and locally by Clark County.

ELS evaluated the property for wetlands on October 5, 2007. Vegetation, hydrology, and soil data were collected from six test plots. Test plots were chosen randomly throughout the property in order to verify the absence of wetland hydrology, soils, and vegetation.

VEGETATION

Dominant vegetation observed within the perimeter of test plots are listed below. The indicator status, following the common and scientific names, indicates how likely a species is to be found in wetlands. Listed from most-likely to least-likely to be found in wetlands, the categories are:

- **OBL** (obligate wetland) - occur almost always (estimated probability >99%) under natural conditions in wetlands.
- **FACW** (facultative wetland) - usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
- **FAC** (facultative) - equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
- **FACU** (facultative upland) - usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%).
- **UPL** (obligate upland) - occur almost always (estimated probability >99%) under natural conditions in non-wetlands.
- **NI** (no indicator) - insufficient data to assign to an indicator category.
- A positive (+) or negative (-) sign, when used with indicators, attempts to more-specifically define the frequency of occurrence in wetlands. The positive sigh indicates "slightly more frequently found in wetlands: and the negative sign indicates "slightly less-frequently found in wetlands".

On-site vegetation included tall fescue (*Festuca arundinacea*, FAC-), velvet grass (*Holcus lanatus*, FAC), English plantain (*Plantago lanceolata var. lanceolata*, FAC), northern bentgrass (*Agrostis borealis,* FACU).

SOILS

On-site soil types are mapped as Hesson clay loam, 0-8 percent slopes (HcB), Olympic stony clay loam, 3-30 percent slopes (OmE) and Powell silt loam, 8-20 percent slopes (PoD; Figure 3). Hesson clay loam is a well drained soil occurring on high ridges along mountain foot slopes. Olympic stony clay loam is a well drained soil that occurs on ridgetops, on long side slopes, and on short slopes along drainage. Powell silt loam is a somewhat poorly drained soil that occurs on long, smooth side slopes below ridges and on foot slopes (NRCS 2006). None of the soils mapped on-site by the NRCS are listed as hydric in Clark County.

Soils observed on-site generally agreed with the mapped soil series. No hydric soils were located on-site during site investigation.

Mapped hydric soils do not necessarily mean that the area is a wetland; hydrology, wetland vegetation, and hydric soils must all be present to classify an area as a wetland. Conversely, wetlands may be found in areas where the soils are not mapped as hydric.

HYDROLOGY

Soils on the subject site did not display primary or secondary hydric soil indicators above 10 inches below ground surface (BGS) as described in the USACE 1987 Wetlands Delineation Manual. Significant redoximorphic features, including oxidized root channels and/or Iron or

Manganese concretions were not observed in test holes to a depth of 16 inches BGS. Site topography generally sloped to the south with few or no depressional areas to trap water. Mottles were observed in some test plots; however, they are likely relic due to the absence of evidence of recent hydrology in the form of oxidized channels of living roots.

A Type N (non fish-bearing) stream is mapped off-site to the south by Washington Department of Natural Resources Stream Type Mapping (Figure 6). As mapped, the stream originates off-site to the east from the current location of a single family residence. This discrepancy is likely due to a mapping error An above-ground pipe was located on-site near the southern property boundary and drains beneath 202nd Court into a man-made ditch in the western region of the property. DNR Stream Type maps are created on a large scale and can be inaccurate due to a lack of ground-truthing. There is an adjacent wetland south of parcel 125635-000 with a functionally isolated buffer, due to the existing gravel road. No wetland buffer will extend onto the site.

NATIONAL AND LOCAL WETLANDS INVENTORIES

The National Wetlands Inventory (NWI) map did not show any wetlands on or adjacent to the subject site. ELS agrees that no wetlands are located on-site (Figure 4). As a cautionary note, National Wetlands Inventory map information should be used with discretion because they are used to gather general wetland information about a regional area; therefore, they are limited in accuracy for smaller sites because of their large scale.

The Clark County Wetland Inventory maps does not show any wetlands on or adjacent to the subject site. ELS agrees no wetland were located on-site (Figure 5).

CLARK COUNTY CRITICAL AREAS MAPPING

The Clark County Priority Species-Habitat map shows a Riparian Habitat Conservation Area designated within the buffer of the mapped stream (Figure 5). ELS does not concur with the location of the mapped stream as shown encroaching within the site boundary. It is possible that a type Ns stream is located south of the site; ELS has not conducted field reconnaissance outside the site boundaries.

CONCLUSIONS

ELS found no jurisdictional wetlands on the subject site. The upland areas investigated were dominated by facultative (FAC) and facultative upland (FACU) herbaceous vegetation. There were no hydrologic indicators present within 10 inches BGS in the form of redoximorphic features, oxidized root channels, and/or concretions. The soils mapped and observed on-site were not hydric.

Buffers

No wetlands or streams are present on-site. The wetland and stream located south of the subject site are functionally isolated by a gravel road. CMC states that pre-existing roads are excluded from the buffer, terminating the buffer to the south (CMC 16.60.040 (B)(4)(b)(i)).

LIMITATIONS

We base the above listed determinations and conclusions on standard scientific methodology and best professional judgment. In our opinion, the conclusions should agree with local, state, and federal regulatory agencies. However, it should be considered a Preliminary Jurisdictional Determination and used at your own risk until it has been reviewed and approved in writing by the appropriate regulatory agencies.

REFERENCES

Camas Municipal Code. http://bpc.iserver.net/codes/camas/index.htm. Accessed October 2007.

Clark County Geographic Information System website. http://gis.clark.wa.gov/applications/gishome/index.cfm. Accessed October 2007.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Waterways Experiment Station, Vicksburg, Mississippi.

Hruby, T. 2006. Washington State Wetland Rating System for Western Washington – Revised. Washington State Department of Ecology Publication #04-06-025.

Soils Conservation Service. 2006. Hydric Soils for Washington. Online document<http://soils.usda.gov/soils_use/hydric/states/wa.htm>. Accessed October 2007.

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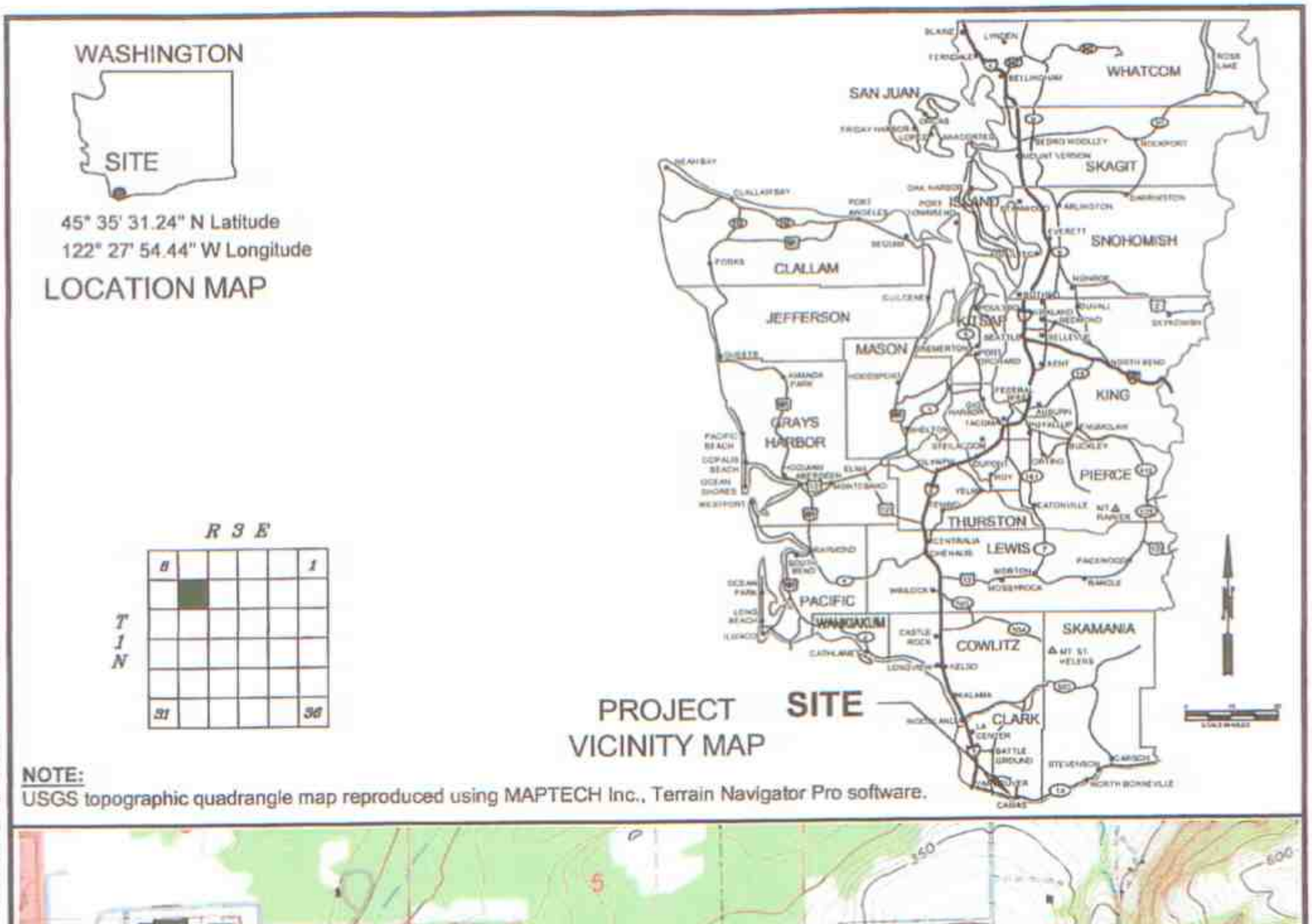
Appendix A

Figures



NOTE:
USGS topographic quadrangle map reproduced using MAPTECH Inc., Terrain Navigator Pro software.

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Ave., Suite 220 Longview, WA 98632
(360) 578-1371 Fax: (360) 414-9305

DATE: 10/10/07
DWN: KLM
REQ. BY: AC
PRJ. MGR: AA
CHK:
APPR:
PROJ.#: 1543.02

Figure 1
VICINITY MAP
SE 40th Street
Stan Firestone
City of Camas, Clark County, Washington
Section 8, Township 1N, Range 3E, W.M.

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NOTE: Base map from Google Earth™, 2007.

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APPR:
PROJ.#: 1543.02

Figure 2
AERIAL SITE MAP
SE 40th Street
Stan Firestone
City of Camas, Clark County, Washington
Section 8, Township 1N , Range 3E, W.M.

PoB - Powell silt loam, 0 to 8 percent slopes. Not hydric.
PoD - Powell silt loam, 8 to 20 percent slopes. Not hydric.
PoE - Powell silt loam, 20 to 30 percent slopes. Not hydric.
HcB - Hesson clay loam, 8 to 20 percent slopes. Not hydric.
OmE - Olympic stony clay loam, 3 to 30 percent slopes. Not hydric.

0 300 600
SCALE IN FEET

NOTE: Map provided on-line by NRCS at web address: *www.wa.nrcs.usda.gov/pnw_soil/wa_reports.html*

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PROJ.#: 1543.02

Figure 3
SOIL SURVEY MAP
SE 40th Street
Stan Firestone
City of Camas, Clark County, Washington
Section 8, Township 1N, Range 3E, W.M.

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No mapped wetlands indicated on site by US Fish & Wildlife Service.

NOTES:
1. Map provided on-line by US Fish & Wildlife Service at web address: *http://www.wetlandsfws.er.usgs.gov/NWI/index.html*
2. Map not to scale. Property boundary location and size is approximate.

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(360) 578-1371 Fax: (360) 414-9305

DATE: 10/18/07
DWN: KLM
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PRJ. MGR: AA
CHK:
APPR:
PROJ.#: 1543.02

Figure 4
NATIONAL WETLANDS INVENTORY MAP
SE 40th Street
Stan Firestone
City of Camas, Clark County, Washington
Section 8, Township 1N, Range 3E, W.M.

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Clark County Wetland and Hydric Soils Inventory

No Wetlands Mapped On-site

🟩 Wetlands

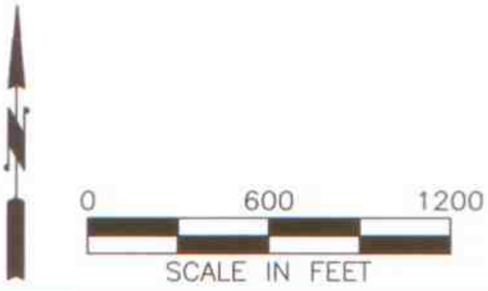
═ Hydric Soils

Clark County Species-Habitat

🟦 Riparian Habitat Conservation Area

Clark County Topography

▨ Topographic Contours



NOTE: Map provided on-line by Clark County, Washington at web address: *http://gis.clark.wa.gov/gishome/property*

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Figure 5
SENSITIVE & HABITAT AREAS MAP
SE 40th Street
Stan Firestone
City of Camas, Clark County, Washington
Section 8, Township 1N, Range 3E, W.M.

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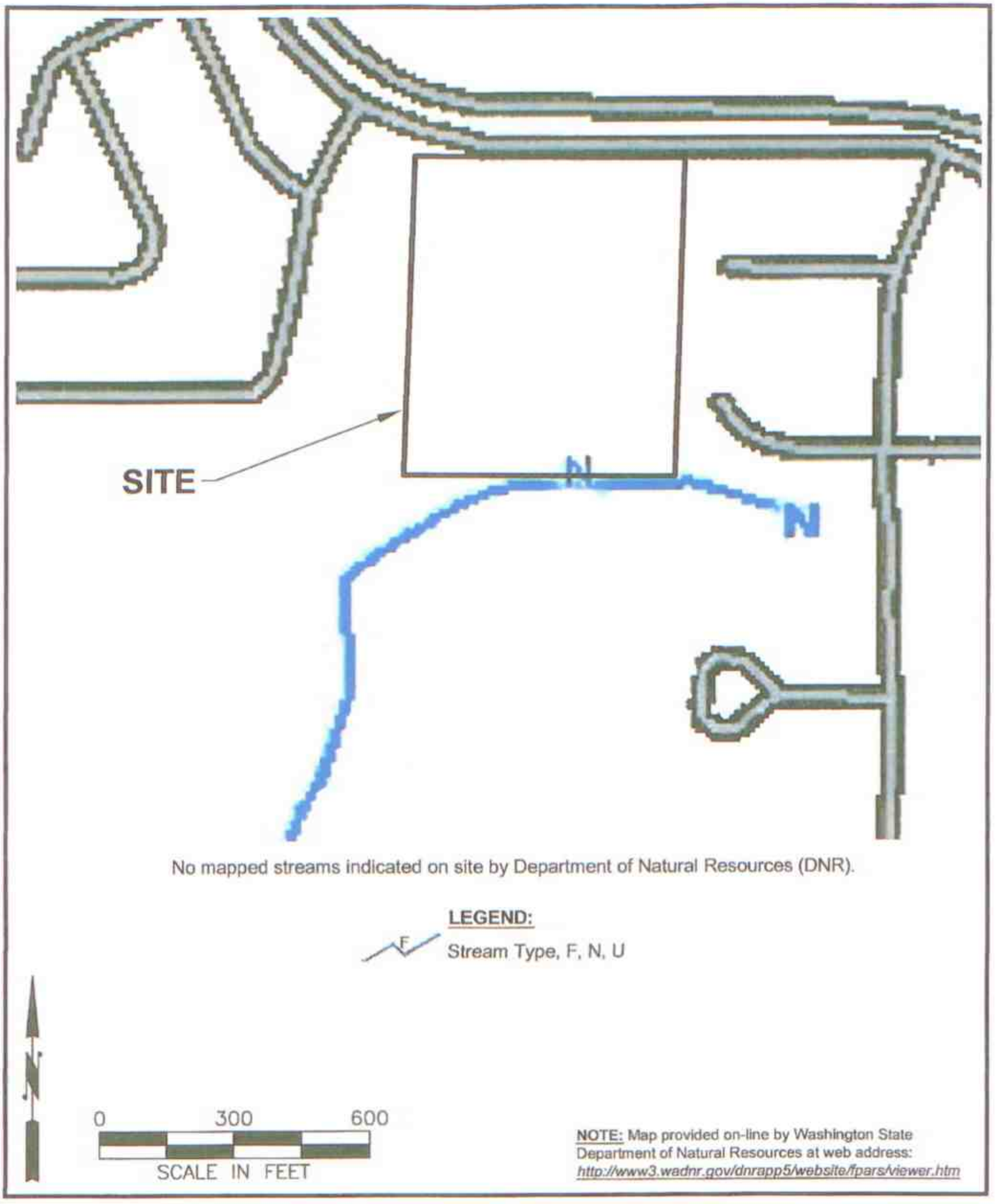

No mapped streams indicated on site by Department of Natural Resources (DNR).

NOTE: Map provided on-line by Washington State Department of Natural Resources at web address: *http://www3.wadnr.gov/dnrapp5/website/fpars/viewer.htm*

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1157 3rd Ave., Suite 220 Longview, WA 98632
(360) 578-1371 Fax: (360) 414-9305

DATE: 10/10/07
DWN: KLM
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PRJ. MGR: AA
CHK:
APPR:
PROJ.#: 1543.02

Figure 6
DNR STREAM TYPING MAP
SE 40th Street
Stan Firestone
City of Camas, Clark County, Washington
Section 8, Township 1N, Range 3E, W.M.

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Appendix B

Routine On-site Wetland Determination Data Forms

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Avenue, Suite 220, Longview, Washington 98632
(360)578-1371 FAX (360)414-9305

DATA FORM – Routine Onsite Wetland Determination
1987 COE Wetlands Delineation Manual
1997 Washington State Delineation Manual

Project Site: SE 40th St	**Date:** 10/5/07	**Project # :** 1543.02
Applicant/Owner: Stan Firestone	**County/State:** Clark, WA	
Test Plot Location: E of SE 202nd Ct.in southern region	**Sec/Town/Range:** S08, T1N, R3E	

Do normal circumstances exist at the site?	☒Yes	☐No	**Plot ID:** TP1
Is the site significantly disturbed (atypical situation)?	☐Yes	☒No	**Community ID:** --
Is the site a potential problem area?	☐Yes	☒No	**Transect ID:** --

VEGETATION (Strata: tree, sapling, shrub, woody vine, herb)

Dominant Plant Species

Common Name	Scientific Name	Strata	% Cover	Indicator Status
1. Trailing blackberry*	*Rubus ursinus*	Herb	20	FACU
2. Tall fescue	*Festuca arundinacea*	Herb	10	FAC-
3. Velvet grass*	*Holcus lanatus*	Herb	20	FAC
4. Northern bentgrass*	*Agrostis borealis*	Herb	40	FACU
5. Canadian thistle	*Cirsium arvense*	Herb	10	FACU+
6.		-		-
7.		-		-
8.		-		-

Other species present:English plantain trace

% of dominant species OBL, FACW, FACW-, FAC+, FAC 33% **(more than 50% required)**

Remarks: * = dominant species per the 50/20 rule.

Vegetation Criteria Met? ☐Yes ☒No

HYDROLOGY

Recorded data available? ☐ Yes ☒ No
Is it the growing season? ☐ Yes ☒ No
Is site inundated? ☐ Yes ☒ No

Depth of surface water: N/A
Depth to free water in pit: N/A
Depth to saturated soils: N/A

Type(s): --

Wetland Hydrology Indicators

Primary Indicators	**Secondary Indicators (2 required)**
☐ Inundated	☐ Oxidized Root Channels < 12in. bgs
☐ Saturated < 12 in.	☐ Local Soil Survey Data
☐ Water Marks	☐ Water Stained Leaves
☐ Drift Lines	☐ FAC-Neutral Test
☐ Sediment Deposits	☐ Other (Explain in remarks)
☐ Drainage Patterns in wetlands	

Hydrology Criteria Met? ☐Yes ☒No

Remarks:

SOILS:

Map Unit Name: Hesson clay loam (HcB)
(Series and Phase)
Taxonomy (Subgroup): Clayey, kaolinitic, mesic Xeric Palehumults

Field observations confirm mapped soil type? ☒Yes ☐No

Drainage Class:
- ☐ Excessively Drained
- ☐ Somewhat Excessively Drained
- ☒ Well Drained
- ☐ Moderately Well Drained
- ☐ Somewhat Poorly Drained
- ☐ Poorly Drained
- ☐ Very Poorly Drained

Profile Description

Depth (inches)	Horizon	Matrix color	Mottle Color	Mottle Abundance (few, common, many)	Mottle Size (fine, med, coarse)	Texture
0-12"	-	10YR 3/3	-	-	-	silt loam

Hydric Soil Indicators

- ☐ Histosol (-ists)
- ☐ Histic Epipedon (8-16")
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low Chroma Colors
- ☐ Mn or Fe Concretions
- ☐ High Organic Content in Layer of Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Organic Pans
- ☐ Listed on Local Hydric Soils List
- ☐ Other (explain in remarks)

Remarks:charcoal observed throughout 0-12"

Soils Criteria Met? ☐Yes ☒No

WETLAND DETERMINATION

Hydrophytic Vegetation Dominant?	☐Yes	☒No
Wetland Hydrology Present?	☐Yes	☒No
Hydric Soil Present?	☐Yes	☒No

Remarks: Wetland criteria not met

Is test plot within a wetland? ☐Yes ☒No

Name: Amanda Castro & Kelsey Woods

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Avenue, Suite 220, Longview, Washington 98632
(360)578-1371 FAX (360)414-9305

DATA FORM – Routine Onsite Wetland Determination
1987 COE Wetlands Delineation Manual
1997 Washington State Delineation Manual

Project Site: SE 40th St.	**Date:** 10/5/07	**Project # :** 1543.02
Applicant/Owner: Stan Firestone	**County/State:** Clark, WA	
Test Plot Location: East Central of SE 202nd Ct.	**Sec/Town/Range:** S08, T1N, R3E	

Do normal circumstances exist at the site?	☒Yes	☐No	**Plot ID:** TP2
Is the site significantly disturbed (atypical situation)?	☐Yes	☒No	**Community ID:** --
Is the site a potential problem area?	☐Yes	☒No	**Transect ID:** --

VEGETATION **(Strata: tree, sapling, shrub, woody vine, herb)**

Dominant Plant Species

Common Name	Scientific Name	Strata	% Cover	Indicator Status
1. Velvet grass*	*Holcus lanatus*	Herb	50	FAC
2. Soft rush*	*Juncus effusus*	Herb	40	FACW
3. Evergreen blackberry*	*Rubus laciniatus*	Shrub	5	FACU
4. Himalayan blackberry*	*Rubus armeniacus*	Shrub	5	FACU
5.		-		-
6.		-		-
7.		-		-
8.		-		-

Other species present:Reed canary grass-trace, Canadian thistle-trace

% of dominant species OBL, FACW, FACW-, FAC+, FAC 50% **(more than 50% required)**

Remarks: * = dominant species per the 50/20 rule.

Vegetation Criteria Met? ☐Yes ☒No

HYDROLOGY

Recorded data available? ☐ Yes ☒ No
Is it the growing season? ☐ Yes ☒ No
Is site inundated? ☐ Yes ☒ No

Depth of surface water: N/A
Depth to free water in pit: N/A
Depth to saturated soils: N/A

Type(s): --

Wetland Hydrology Indicators

Primary Indicators	**Secondary Indicators (2 required)**
☐ Inundated	☐ Oxidized Root Channels < 12in. bgs
☐ Saturated < 12 in.	☐ Local Soil Survey Data
☐ Water Marks	☐ Water Stained Leaves
☐ Drift Lines	☐ FAC-Neutral Test
☐ Sediment Deposits	☐ Other (Explain in remarks)
☐ Drainage Patterns in wetlands	

Hydrology Criteria Met? ☐Yes ☒No

Remarks:

SOILS:

Map Unit Name: Powell silt loam (PoB)
(Series and Phase)
Taxonomy (Subgroup): Fine silty, mixed, mesic Typic Fragiochrepts

Field observations confirm mapped soil type? ☒Yes ☐No

Drainage Class:
☐ Excessively Drained
☐ Somewhat Excessively Drained
☐ Well Drained
☐ Moderately Well Drained
☒ Somewhat Poorly Drained
☐ Poorly Drained
☐ Very Poorly Drained

Profile Description

Depth (inches)	Horizon	Matrix color	Mottle Color	Mottle Abundance (few, common, many)	Mottle Size (fine, med, coarse)	Texture
0-14"	-	10YR 3/4	10YR 4/6	common	medium	silt loam

Hydric Soil Indicators

☐ Histosol (-ists)	☐ Reducing Conditions	☐ Organic Streaking in Sandy Soils
☐ Histic Epipedon (8-16")	☐ Gleyed or Low Chroma Colors	☐ Organic Pans
☐ Sulfidic Odor	☐ Mn or Fe Concretions	☐ Listed on Local Hydric Soils List
☐ Aquic Moisture Regime	☐ High Organic Content in Layer of Sandy Soils	☐ Other (explain in remarks)

Remarks:charcoal observed throughout 0-14"

Soils Criteria Met? ☐Yes ☒No

WETLAND DETERMINATION

Hydrophytic Vegetation Dominant?	☐Yes	☒No
Wetland Hydrology Present?	☐Yes	☒No
Hydric Soil Present?	☐Yes	☒No

Remarks: Wetland criteria not met

Is test plot within a wetland? ☐Yes ☒No

Name: Amanda Castro & Kelsey Woods

Sheet2 of 6

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Avenue, Suite 220, Longview, Washington 98632
(360)578-1371 FAX (360)414-9305

DATA FORM – Routine Onsite Wetland Determination
1987 COE Wetlands Delineation Manual
1997 Washington State Delineation Manual

Project Site: SE 40th St.	**Date:** 10/5/07	**Project # :** 1543.02
Applicant/Owner: Stan Firestone	**County/State:** Clark, WA	
Test Plot Location: Northeast of SE 202nd Ct.	**Sec/Town/Range:** S08, T1N, R3E	

Do normal circumstances exist at the site?	☒Yes	☐No	**Plot ID:** TP3
Is the site significantly disturbed (atypical situation)?	☐Yes	☒No	**Community ID:** --
Is the site a potential problem area?	☐Yes	☒No	**Transect ID:** --

VEGETATION **(Strata: tree, sapling, shrub, woody vine, herb)**
Dominant Plant Species

Common Name	**Scientific Name**	**Strata**	**% Cover**	**Indicator Status**
1. Tall fescue*	*Festuca arundinacea*	Herb	100	FAC-
2.		-		-
3.		-		-
4.		-		-
5.		-		-
6.		-		-
7.		-		-
8.		-		-

Other species present:velvet grass trace
% of dominant species OBL, FACW, FACW-, FAC+, FAC 0% **(more than 50% required)**
Remarks: * = dominant species per the 50/20 rule.

Vegetation Criteria Met? ☐Yes ☒No

HYDROLOGY
Recorded data available? ☐ **Yes** ☒ **No**
Is it the growing season? ☐ **Yes** ☒ **No**
Is site inundated? ☐ **Yes** ☒ **No**

Depth of surface water: N/A
Depth to free water in pit: N/A
Depth to saturated soils: N/A

Type(s): --

Wetland Hydrology Indicators

Primary Indicators
- ☐ **Inundated**
- ☐ **Saturated < 12 in.**
- ☐ **Water Marks**
- ☐ **Drift Lines**
- ☐ **Sediment Deposits**
- ☐ **Drainage Patterns in wetlands**

Secondary Indicators (2 required)
- ☐ **Oxidized Root Channels < 12in. bgs**
- ☐ **Local Soil Survey Data**
- ☐ **Water Stained Leaves**
- ☐ **FAC-Neutral Test**
- ☐ **Other (Explain in remarks)**

Hydrology Criteria Met? ☐Yes ☒No

Remarks:

SOILS:
Map Unit Name: Powell silt loam (PoB)
(Series and Phase)
Taxonomy (Subgroup): Fine silty, mixed, mesic Typic Fragiochrepts

Field observations confirm mapped soil type? ☒Yes ☐No

Drainage Class:
- ☐ **Excessively Drained**
- ☐ **Somewhat Excessively Drained**
- ☐ **Well Drained**
- ☐ **Moderately Well Drained**
- ☒ **Somewhat Poorly Drained**
- ☐ **Poorly Drained**
- ☐ **Very Poorly Drained**

Profile Description

Depth (inches)	**Horizon**	**Matrix color**	**Mottle Color**	**Mottle Abundance** (few, common, many)	**Mottle Size** (fine, med, coarse)	**Texture**
0-15"	-	10YR 3/2	-	-	-	silt loam
15-16"	-	10YR 4/3	10YR 4/6	common	medium	silt loam

Hydric Soil Indicators
- ☐ **Histosol (-ists)**
- ☐ **Histic Epipedon (8-16")**
- ☐ **Sulfidic Odor**
- ☐ **Aquic Moisture Regime**
- ☐ **Reducing Conditions**
- ☐ **Gleyed or Low Chroma Colors**
- ☐ **Mn or Fe Concretions**
- ☐ **High Organic Content in Layer of Sandy Soils**
- ☐ **Organic Streaking in Sandy Soils**
- ☐ **Organic Pans**
- ☐ **Listed on Local Hydric Soils List**
- ☐ **Other (explain in remarks)**

Remarks:charcoal observed throughout 0-16"

Soils Criteria Met? ☐Yes ☒No

WETLAND DETERMINATION
Hydrophytic Vegetation Dominant? ☐Yes ☒No
Wetland Hydrology Present? ☐Yes ☒No
Hydric Soil Present? ☐Yes ☒No
Remarks: Wetland criteria not met

Is test plot within a wetland? ☐Yes ☒No

Name: Amanda Castro & Kelsey Woods

Sheet3 of 6

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Avenue, Suite 220, Longview, Washington 98632
(360)578-1371 FAX (360)414-9305

DATA FORM – Routine Onsite Wetland Determination
1987 COE Wetlands Delineation Manual
1997 Washington State Delineation Manual

Project Site: SE 40th St	**Date:** 10/5/07	**Project # :** 1543.02
Applicant/Owner: Stan Firestone	**County/State:** Clark, WA	
Test Plot Location: Northwest of SE 202nd Ct.	**Sec/Town/Range:** S08, T1N, R3E	

Do normal circumstances exist at the site?	☒Yes	☐No	**Plot ID:** TP4
Is the site significantly disturbed (atypical situation)?	☐Yes	☒No	**Community ID:** --
Is the site a potential problem area?	☐Yes	☒No	**Transect ID:** --

VEGETATION **(Strata: tree, sapling, shrub, woody vine, herb)**

Dominant Plant Species

Common Name	Scientific Name	Strata	% Cover	Indicator Status
1. Himalayan blackberry	*Rubus armeniacus*	Shrub	5	FACU
2. English hawthorne*	*Crataegus monogyna*	Shrub	40	FAC
3. Tall fescue	*Festuca arundinacea*	Herb	10	FAC-
4. Northern bentgrass*	*Agrostis borealis*	Herb	75	FACU
5. Lance-leaf plantain	*Plantago lanceolata*	Herb	10	FAC
6.		-		-
7.		-		-
8.		-		-

Other species present:

% of dominant species OBL, FACW, FACW-, FAC+, FAC 50% **(more than 50% required)**

Remarks: * = dominant species per the 50/20 rule.

Vegetation Criteria Met? ☐Yes ☒No

HYDROLOGY

Recorded data available? ☐ Yes ☒ No
Is it the growing season? ☐ Yes ☒ No
Is site inundated? ☐ Yes ☒ No

Depth of surface water: N/A
Depth to free water in pit: N/A
Depth to saturated soils: N/A

Type(s): --

Wetland Hydrology Indicators

Primary Indicators	**Secondary Indicators (2 required)**
☐ Inundated	☐ Oxidized Root Channels < 12in. bgs
☐ Saturated < 12 in.	☐ Local Soil Survey Data
☐ Water Marks	☐ Water Stained Leaves
☐ Drift Lines	☐ FAC-Neutral Test
☐ Sediment Deposits	☐ Other (Explain in remarks)
☐ Drainage Patterns in wetlands	

Hydrology Criteria Met? ☐Yes ☒No

Remarks:

SOILS:

Map Unit Name: Powell silt loam (PoB)
(Series and Phase)
Taxonomy (Subgroup): Fine silty, mixed, mesic Typic Fragiochrepts

Field observations confirm mapped soil type? ☒Yes ☐No

Drainage Class:
- ☐ Excessively Drained
- ☐ Somewhat Excessively Drained
- ☐ Well Drained
- ☐ Moderately Well Drained
- ☒ Somewhat Poorly Drained
- ☐ Poorly Drained
- ☐ Very Poorly Drained

Profile Description

Depth (inches)	Horizon	Matrix color	Mottle Color	Mottle Abundance (few, common, many)	Mottle Size (fine, med, coarse)	Texture
0-16"	-	10YR 3/3	-	-	-	silt loam

Hydric Soil Indicators

- ☐ Histosol (-ists)
- ☐ Histic Epipedon (8-16")
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low Chroma Colors
- ☐ Mn or Fe Concretions
- ☐ High Organic Content in Layer of Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Organic Pans
- ☐ Listed on Local Hydric Soils List
- ☐ Other (explain in remarks)

Remarks: charcoal observed throughout 0-12"

Soils Criteria Met? ☐Yes ☒No

WETLAND DETERMINATION

Hydrophytic Vegetation Dominant? ☐Yes ☒No
Wetland Hydrology Present? ☐Yes ☒No
Hydric Soil Present? ☐Yes ☒No

Remarks: Wetland criteria not met

Is test plot within a wetland? ☐Yes ☒No

Name: Amanda Castro & Kelsey Woods

Sheet 4 of 6

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Avenue, Suite 220, Longview, Washington 98632
(360)578-1371 FAX (360)414-9305

DATA FORM – Routine Onsite Wetland Determination
1987 COE Wetlands Delineation Manual
1997 Washington State Delineation Manual

Project Site: SE 40th St	**Date:** 10/5/07	**Project # :** 1543.02
Applicant/Owner: Stan Firestone	**County/State:** Clark, WA	
Test Plot Location: Northwest of SE 202nd Ct.	**Sec/Town/Range:** S08, T1N, R3E	

Do normal circumstances exist at the site?	☒Yes	☐No	**Plot ID:** TP5
Is the site significantly disturbed (atypical situation)?	☐Yes	☒No	**Community ID:** --
Is the site a potential problem area?	☐Yes	☒No	**Transect ID:** --

VEGETATION (Strata: tree, sapling, shrub, woody vine, herb)

Dominant Plant Species

Common Name	Scientific Name	Strata	% Cover	Indicator Status
1. Himalayan blackberry*	*Rubus armeniacus*	Shrub	15	FACU
2. Tall fescue	*Festuca arundinacea*	Herb	15	FAC-
3. Pearly everlasting	*Anaphalis margaritacea*	Herb	5	NI
4. Northern bentgrass*	*Agrostis borealis*	Herb	40	FACU
5. Lance-leaf plantain*	*Plantago lanceolata*	Herb	25	FAC
6.		-		-
7.		-		-
8.		-		-

Other species present:

% of dominant species OBL, FACW, FACW-, FAC+, FAC 33% **(more than 50% required)**

Remarks: * = dominant species per the 50/20 rule.

Vegetation Criteria Met? ☐Yes ☒No

HYDROLOGY

Recorded data available?	☐ Yes	☒ No
Is it the growing season?	☐ Yes	☒ No
Is site inundated?	☐ Yes	☒ No

Depth of surface water: N/A
Depth to free water in pit: N/A
Depth to saturated soils: N/A

Type(s): --

Wetland Hydrology Indicators

Primary Indicators	**Secondary Indicators (2 required)**
☐ **Inundated**	☐ **Oxidized Root Channels < 12in. bgs**
☐ **Saturated < 12 in.**	☐ **Local Soil Survey Data**
☐ **Water Marks**	☐ **Water Stained Leaves**
☐ **Drift Lines**	☐ **FAC-Neutral Test**
☐ **Sediment Deposits**	☐ **Other (Explain in remarks)**
☐ **Drainage Patterns in wetlands**	

Hydrology Criteria Met? ☐Yes ☒No

Remarks:

SOILS:

Map Unit Name: Hesson clay loam (HcB)
(Series and Phase)
Taxonomy (Subgroup): Clayey, kaolinitic, mesic Xeric Palehumults

Field observations confirm mapped soil type? ☒Yes ☐No

Drainage Class:
☐ **Excessively Drained**
☐ **Somewhat Excessively Drained**
☒ **Well Drained**
☐ **Moderately Well Drained**
☐ **Somewhat Poorly Drained**
☐ **Poorly Drained**
☐ **Very Poorly Drained**

Profile Description

Depth (inches)	Horizon	Matrix color	Mottle Color	Mottle Abundance (few, common, many)	Mottle Size (fine, med, coarse)	Texture
0-10"	-	10YR 3/3	-	-	-	silt loam
11-13"	-	10YR 4/4	-	-	-	silt loam

Hydric Soil Indicators

☐ **Histosol (-ists)**	☐ **Reducing Conditions**	☐ **Organic Streaking in Sandy Soils**
☐ **Histic Epipedon (8-16")**	☐ **Gleyed or Low Chroma Colors**	☐ **Organic Pans**
☐ **Sulfidic Odor**	☐ **Mn or Fe Concretions**	☐ **Listed on Local Hydric Soils List**
☐ **Aquic Moisture Regime**	☐ **High Organic Content in Layer of Sandy Soils**	☐ **Other (explain in remarks)**

Remarks: charcoal observed throughout 0-13"

Soils Criteria Met? ☐Yes ☒No

WETLAND DETERMINATION

Hydrophytic Vegetation Dominant?	☐Yes	☒No
Wetland Hydrology Present?	☐Yes	☒No
Hydric Soil Present?	☐Yes	☒No

Remarks: Wetland criteria not met

Is test plot within a wetland? ☐Yes ☒No

Name: Amanda Castro & Kelsey Woods

Sheet 5 of 6

ECOLOGICAL LAND SERVICES, INC.

1157 3rd Avenue, Suite 220, Longview, Washington 98632
(360)578-1371 FAX (360)414-9305
DATA FORM – Routine Onsite Wetland Determination
1987 COE Wetlands Delineation Manual
1997 Washington State Delineation Manual

Project Site: SE 40th St	**Date:** 10/5/07	**Project # :** 1543.02
Applicant/Owner: Stan Firestone	**County/State:** Clark, WA	
Test Plot Location: Southwest of SE 202nd Ct.	**Sec/Town/Range:** S08, T1N, R3E	

Do normal circumstances exist at the site?	☒Yes	☐No	**Plot ID:** TP6
Is the site significantly disturbed (atypical situation)?	☐Yes	☒No	**Community ID:** --
Is the site a potential problem area?	☐Yes	☒No	**Transect ID:** --

VEGETATION (Strata: tree, sapling, shrub, woody vine, herb)

Dominant Plant Species

Common Name	Scientific Name	Strata	% Cover	Indicator Status
1. Soft rush	*Juncus effusus*	Herb	10	FACW
2. Tall fescue*	*Festuca arundinacea*	Herb	30	FAC-
3. Velvet grass*	*Holcus lanatus*	Herb	30	FAC
4. Northern bentgrass*	*Agrostis borealis*	Herb	30	FACU
5.		-		-
6.		-		-
7.		-		-
8.		-		-

Other species present:Robert's geranium trace

% of dominant species OBL, FACW, FACW-, FAC+, FAC 33% **(more than 50% required)**

Remarks: * = dominant species per the 50/20 rule.

Vegetation Criteria Met? ☐Yes ☒No

HYDROLOGY

Recorded data available? ☐ Yes ☒ No
Is it the growing season? ☐ Yes ☒ No
Is site inundated? ☐ Yes ☒ No

Depth of surface water: N/A
Depth to free water in pit: N/A
Depth to saturated soils: N/A

Type(s): --

Wetland Hydrology Indicators

Primary Indicators	**Secondary Indicators (2 required)**
☐ Inundated	☐ Oxidized Root Channels < 12in. bgs
☐ Saturated < 12 in.	☐ Local Soil Survey Data
☐ Water Marks	☐ Water Stained Leaves
☐ Drift Lines	☐ FAC-Neutral Test
☐ Sediment Deposits	☐ Other (Explain in remarks)
☐ Drainage Patterns in wetlands	

Hydrology Criteria Met? ☐Yes ☒No

Remarks:

SOILS:

Map Unit Name: Hesson clay loam (HcB)
(Series and Phase)
Taxonomy (Subgroup): Clayey, kaolinitic, mesic Xeric Palehumults

Field observations confirm mapped soil type? ☒Yes ☐No

Drainage Class:
- ☐ Excessively Drained
- ☐ Somewhat Excessively Drained
- ☒ Well Drained
- ☐ Moderately Well Drained
- ☐ Somewhat Poorly Drained
- ☐ Poorly Drained
- ☐ Very Poorly Drained

Profile Description

Depth (inches)	Horizon	Matrix color	Mottle Color	Mottle Abundance (few, common, many)	Mottle Size (fine, med, coarse)	Texture
0-16"	-	10YR 3/2	-	-	-	silt loam

Hydric Soil Indicators

☐ Histosol (-ists)	☐ Reducing Conditions	☐ Organic Streaking in Sandy Soils
☐ Histic Epipedon (8-16")	☐ Gleyed or Low Chroma Colors	☐ Organic Pans
☐ Sulfidic Odor	☐ Mn or Fe Concretions	☐ Listed on Local Hydric Soils List
☐ Aquic Moisture Regime	☐ High Organic Content in Layer of Sandy Soils	☐ Other (explain in remarks)

Remarks:

Soils Criteria Met? ☐Yes ☒No

WETLAND DETERMINATION

Hydrophytic Vegetation Dominant? ☐Yes ☒No
Wetland Hydrology Present? ☐Yes ☒No
Hydric Soil Present? ☐Yes ☒No
Remarks: Wetland criteria not met

Is test plot within a wetland? ☐Yes ☒No

Name: Amanda Castro & Kelsey Woods

Sheet6 of 6

Exhibit 28 SUB18-02

PROPERTY BOUNDARY LEGAL DESCRIPTION(s)

TAX LOT 48 (ASSESSORS PARCEL NUMBER 125635-000):

That parcel of land located in a portion of the Joel Knight D.L.C. No. 41 and in a portion of the Northwest Quarter of the Northeast Quarter and the Northeast Quarter of the Northwest Quarter of Section 8, Township 1 North, Range 3 East, Willamette Meridian, City of Camas, Clark County, Washington, described as follows;

BEGINNING at the Northwest corner of the Plat of "Breckenridge" as recorded in Book 311 of Plats, at Page 715, Clark County, Washington, plat records;

Thence South 89°29'23" East, along the North line of said Plat of "Breckenridge" for a distance of 95.97 feet;

Thence leaving said North line, North 04°25'46" East, parallel with the West line of the Joel Knight D.L.C. No. 41, for a distance of 62.70 feet;

Thence North 39°16'12" East, for a distance of 114.49 feet to the beginning of a 96.00 foot radius non-tangent curve to the left;

Thence along the arc of a 96.00 foot radius non-tangent curve to the right, for an arc distance of 20.15 feet, through a central angle of 12°01'29", the radius of which bears North 39°16'12" East, the long chord of which bears North 44°43'03" West, for a chord distance of 20.11 feet;

Thence South 39°16'12" West, for a distance of 123.30 feet;

Thence North 89°29'23" West, parallel with the North line of said Plat of "Breckenridge", for a distance of 75.68 feet to the West line of the Joel Knight D.L.C. No. 41;

Thence South 04°25'46" West, along said West line, for a distance of 70.00 feet to the POINT OF BEGINNING;

CONTAINING: 9,000 square feet of land, more or less.

TAX LOT 59 (ASSESSORS PARCEL NUMBER 125646-000):

That parcel of land located in a portion of the Joel Knight D.L.C. No. 41 and in a portion of the Northwest Quarter of the Northeast Quarter and the Northeast Quarter of the Northwest Quarter of Section 8, Township 1 North, Range 3 East, Willamette Meridian, City of Camas, Clark County, Washington, described as follows;

BEGINNING at the Northeast corner of the Plat of "Breckenridge" as recorded in Book 311 of Plats, at Page 715, Clark County, Washington, plat records;

Thence North 89°29'23" West, along the North line of said Plat of "Breckenridge", for a distance of 335.14 feet;

Thence continuing along said North line, South 04°25'46" West, for a distance of 9.20 feet;

Thence continuing along said North line, North 89°29'23" West, for a distance of 197.07 feet;

Thence leaving said North line, North 04°25'46" East, for a distance of 62.70 feet;

Thence North 39°16'12" East, for a distance of 114.49 feet to the beginning of a 96.00 foot radius non-tangent curve to the right;

Thence along the arc of a 96.00 foot radius non-tangent curve to the right, for an arc distance of 20.15 feet, through a central angle of 12°01'29", the radius of which bears North 39°16'12" East, the long chord of which bears North 44°43'03" West, for a chord distance of 20.11 feet;

Thence South 39°16'12" West, for a distance of 123.30 feet;

Thence North 89°29'23" West, for a distance of 75.68 feet to the West line of the Joel Knight D.L.C. No. 41;

Thence North 04°25'46" East, along the West line of said Joel Knight D.L.C. No. 41, for a distance of 659.58 feet to the South Right of Way line of SE 40th Street and the beginning of a 220.99 foot radius non-tangent curve to the left;

Thence leaving said West line, along said South Right of Way line, along the arc of a 220.99 foot radius non-tangent curve to the left, for an arc distance of 40.96 feet, through a central angle of 10°37'07", the radius of which bears North 10°55'53" East, the long chord of which bears South 84°22'41" East, for a chord distance of 40.90 feet;

Thence continuing along said South Right of Way line, South 89°41'15" East, for a distance of 378.44 feet to the Northwest corner of Tax Lot 58, as described and recorded under Clark County, Washington, Auditor's File Number #4919758 D;

Thence leaving said South Right of Way line, South 04°25'46" West, along the West line of said Tax Lot 58, for a distance of 181.97 feet to the Southwest corner thereof;

Thence leaving said West line, South 89°41'15" East, along the South line of said Tax Lot 58, for a distance of 36.14 feet to the Northwest corner of Tax Lot 47 as described and recorded under Clark County, Washington, Auditor's File Number #5108393 D;

Thence leaving said South line, South 01°26'14" West, along the West line of said Tax Lot 47, for a distance of 70.01 feet to the Southwest corner thereof;

Thence leaving said West line, South 89°41'15" East, along the South line of said Tax Lot 47, for a distance of 128.57 feet to the Southeas

PROPOSED DEVELOPMENT PLAN:

TOTAL LOTS: 36
MINIMUM LOT AREA: 5,900 sq.ft.
MAXIMUM LOT AREA: 9,000 sq.ft.
AVERAGE LOT AREA: 7,042 sq.ft.

TRACT PURPOSE	AREA	OWNED & MAINTAINED
TRACT 'A' - LANDSCAPE	2,268 sf	HOA
TRACT 'B' - ACCESS & UTILITY	1,541 sf	HOA
TRACT 'C' - RECREATIONAL OPEN SPACE	13,438 sf	CITY
TRACT 'D' - ACCESS & UTILITY	1,752 sf	HOA
TRACT 'E' - STORM FACILITY	23,887 sf	HOA
TRACT 'F' - STORM FACILITY	10,405 sf	HOA
TRACT 'G' - ACCESS & UTILITY	2,630 sf	HOA
TRACT 'H' - ACCESS & UTILITY	5,034 sf	HOA
TRACT 'I' - LANDSCAPE & SIGNAGE	1,315 sf	HOA

TABLE 18.09.040

MINIMUM SETBACKS:	
FRONT:	20'
SIDE STREET:	20'
SIDE INTERIOR:	5'
REAR:	25'
MAX. LOT COVERAGE:	40%
MAX. BLDG. HEIGHT:	35'

LAND INVENTORY

TOTAL SITE AREA:	9.26 ACRES
TOTAL DEVELOPED ACREAGE:	7.29 ACRES
TOTAL LOT AREA:	5.85 ACRES
TOTAL INFRASTRUCTURE ACREAGE:	2.79 ACRES
TOTAL TRACT AREA(MINUS STORM TRACTS):	0.61 ACRES
TOTAL ACREAGE OF CRITICAL AREAS:	NONE
TOTAL ACREAGE OF REC. OPENSPACE	0.31 ACRES

ALL PROPOSED BUILDING ENVELOPES ARE LARGE ENOUGH TO FIT A 40 FOOT x 40 FOOT BUILDING FOOT PRINT.

NOTE:
Existing utilities shown are approximate only from utility records and as visible at the site. Contractor shall verify presence, location, depth & slope of any and all existing utilities prior to construction. Contact One Call Concepts at (800) 424-5555.

SITE INFORMATION

ALIGNMENT & FIELD DATA: MINISTER & GLAESER SURVEYING, INC. (360) 694-3313
SOIL TYPE(s): Hcb, PoB & PoD HYDROLOGIC GROUP: C AASHTO CLASSIFICATION: A - 4
SOILS TESTING BY: RAPID SOIL SOLUTIONS (503) 816-3689 DATE: MARCH 2014
SITE LOCATION: CLARK COUNTY, WA APPROX. SURFACE ELEV.: 385'-468'
SITE AREA: 9.26 ACRES FILENAME 286/:Preliminary.pro

PREPARED BY:
STERLING DESIGN, INC.
2208 E.EVERGREEN BLVD
VANCOUVER, WA 98661
PH. (360) 759-1794
FAX (360) 759-4983
mail@sterlingdesign.biz

STERLING DESIGN, INC.

Sheet Description: PROPOSED DEVELOPMENT PLAN

Project: VALLEY VIEW ESTATES SUBDIVISION

JOEL GREGORY STIRLING
STATE OF WASHINGTON
36524
REGISTERED PROFESSIONAL ENGINEER
10/09/18

Scale: AS SHOWN
Project Number: 286
Design/Drawn JGS/BC
Drawing Date: OCT 2018
Sheet 2 of 9 Sheet(s)

STAFF REPORT

Valley View Estates Subdivision

File No. SUB18-02 (consolidated files: SEPA18-15, ARCH18-08, CA18-08)

Type III

Staff Report Date: October 11, 2018

TO	Hearings Examiner	**HEARING DATE**	October 18, 2018
PROPOSAL	To subdivide 9.2 acres into 36 detached single-family residential lots.		
LOCATION	The site is located at 20109 SE 40th Street in the NE ¼ of Section 8, Township 1 North, Range 3 East, of the Willamette Meridian; and described as tax parcels 125646-000 and 125635-000.		
APPLICANT	Sterling Design, Inc. 2208 E. Evergreen Blvd. Vancouver, WA 98661	**CONTACT**	Joel Stirling (360) 759-1794
APPLICATION SUBMITTED	May 24, 2018; Resubmitted June 25, 2018	**APPLICATION COMPLETE**	July 6, 2018
SEPA	The City issued a SEPA Mitigated Determination of Non-significance (MDNS) October 4, 2018, with a comment and appeal period that ends on October 18, 2018. The SEPA MDNS was mailed to property owners October 3, 2018 and published in the Post Record on October 4, 2018. Legal publication #45510.		
PUBLIC NOTICES	Notice of Application was mailed to property owners within 300 feet of the site on July 11, 2018, and published in the Post Record on July 12, 2018. Legal publication #610375. Notice of public hearing was mailed to property owners within 300 feet of the site on October 3, 2018, and published in the Post Record October 4, 2018. Legal publication #43310.		

APPLICABLE LAW: The application was submitted on May 18, 2018 and the applicable codes are those codes that were in effect at the date of application. Camas Municipal Code (CMC) Title 16 Environment, Title 17 Land Development, and Title 18, specifically (but not limited to): Chapter 18.11 - Parking, Chapter 18.13 - Landscaping, Chapter 18.18 - Site Plan Review, Chapter 18.19 Design Review, and Chapter 18.55 Administrative Procedures.

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SUMMARY

Application has been made to the City of Camas for preliminary plat approval for a 36-lot single-family residential subdivision located at 20109 SE 40th Street in the R-7.5 single-family residential zone. The preliminary plat proposal would segregate 9.2 acres into 36 lots ranging in size from 5,900 square feet to 9,000 square feet. The proposal includes tracts for a trail, private access roads, parking, and stormwater detention facilities.

The subject property is bordered to the west by the Winchester Hills subdivision, which is located within unincorporated Clark County. The southwest corner of the site is abutted by City of Vancouver property planned for a mixed use development. To the south is the Breckenridge subdivision zoned single-family residential (R-7.5) and to the west is Knight Point subdivision zoned single-family residential (R-15) both within the City of Camas city limits. SE 40th Street and NW 18th Avenue abuts the site to the north. The road name changes approximately mid-way along the site's frontage. The north side of SE 40th Street / NW 18th Avenue is the location of the Camas School District Pacific Rim Campus. The site is accessed from north via SE 40th Street / NW 18th Avenue and the south via NW Goodwin Street.

The site slopes downwards from 5% to 25% towards the SE corner of the parcel. The entire project site is open and grassy, with large areas of blackberries and a few scattered trees.

The proposed preliminary plat does or can comply with the applicable standards of the Camas Municipal Code (CMC) and Revised Code of Washington (RCW).

FINDINGS

Title 16 Environment

STATE ENVIRONMENTAL POLICY ACT (SEPA18-15) CMC CHAPTER 16.07

A SEPA checklist was submitted and a Mitigated Determination of Non Significance (MDNS) was issued October 4, 2018 as the proposed development includes more than ten residential dwelling units per CMC 16.07.020.A.1. The mitigation measures identified in the SEPA MDNS will need to be complied with (See Exhibit 26). The comment and appeal period ends October 18, 2018. As of the writing of this staff report, no SEPA comments were received.

> **FINDING:** Staff finds the mitigation measures identified in the SEPA MDNS will need to be complied with.

ARCHAEOLOGICAL RESOURCE PRESERVATION (ARCH18-08) CMC CHAPTER 16.31

The applicant provided an archaeological predetermination report that is consistent with CMC 16.31.090. Based on the report, no further archaeological work is necessary at this time. The report and findings are not subject to the open public records act and as such, the city cannot disclose the results. A note should be added to the face of the final plat that includes inadvertent discovery language as required by the State Department of Archaeology & Historic Preservation.

> **FINDING:** Staff finds if potential artifacts are discovered during the course of construction, work must immediately cease and both State Department of Archaeological and Historic Preservation and the City shall be notified.

CRITICAL AREAS (CA18-08) CMC CHAPTER 16.51

CMC Chapter 16.53 Wetlands and CMC 16.61 Fish and Wildlife Habitat Conservation Areas-
Clark County GIS mapping identified the subject property with a stream along the southern boundary. The 2007 Wetland Determination Report prepared by Ecological Land Services, Inc. (ELS) did not concur with the location of the mapped stream within the site boundary based on ELS's field investigation (See Exhibit 27). In 2013 a follow up on-site field investigation was performed by ELS, Inc. and confirmed the onsite wetland conditions have not changed; there are no wetlands onsite. A Category IV off-site wetland was identified but located approximately 120-feet south from the subject property boundary (See Exhibit 18).

> **FINDING:** Staff finds the project to be developable based on the findings in the environmental reports.

CMC Chapter 16.59.060(C) Geotechnical Evaluation and Assessment-
Clark County GIS mapping identified the subject property within an area of geologically hazardous areas (i.e. steep slopes). As such, the applicant submitted a Geotechnical Report prepared by Rapid Soil Solutions (RSS) (revised August 2, 2018), which identified slopes up to 25% in the southeast corner of the property. At page 7 of the report, RSS found no signs of land slide hazards or slope stability during their site reconnaissance and concluded "the development of the site will not impact any geological hazards on the site as well as the surrounding areas" (See Exhibit 14). The City's geotechnical consultant Earth Engineers, Inc. (EEI), performed a peer review of the geotechnical report and concurred the report is in compliance with CMC 16.59.060 (See Exhibits 15 & 16).

> **FINDINGS:** Staff finds the property to be developable based on the findings and recommendations in the geotechnical report. The applicant should comply with the geotechnical report recommendations to minimize any potential hazards associated with construction.

Title 17 Land Development

SUBDIVISIONS (SUB18-02) CMC CHAPTER 17.11

CMC Chapter 17.11.030(D) Criteria for Preliminary Plat Approval:
The hearings examiner decision on application for preliminary plat approval shall be based on the following criteria:

1. The proposed subdivision is in conformance with the Camas Comprehensive Plan, Parks and Open Space Comprehensive Plan, Neighborhood Traffic Management Plan, and any other City adopted plans.

Comprehensive Plan

The subject property is designated as Single-Family Medium in the City's Comprehensive Plan, which includes the Single-Family Residential (R-7.5) zone designation. Citywide Housing Goal H-1 states, "Maintain the strength, vitality, and stability of all neighborhoods and promotes the development of a variety of housing choices that meet the needs of all members of the community." To facilitate alternative housing choices, affordable housing and ageing readiness within the City of Camas, accessory dwelling units (ADU's) are an allowed use within the residential zones under CMC 18.07.040 Table 2 and should not be precluded in CC&R's.

Further, Neighborhood Goal LU-3 states, "Create vibrant, stable and livable neighborhoods with a variety of housing choices that meet all stages in the life cycle and a range of affordability." The side building elevations on corner lots are highly visible from the street and should exhibit architectural variation similar to the front of the building façade, including landscaping, in order to avoid blank walls thereby supporting the city's goal of creating vibrant and livable neighborhoods in Camas.

The Natural Environment Comprehensive Plan Policy NE-1.7 states, "Limit clearing, grading, and soil disturbance outside building footprints in order to maintain the natural hydrologic functions of the site." Due to the steep slopes, multiple retaining walls are utilized throughout the site to create flat lots, and therefore site grading should be minimized to retain the natural contours of the land.

Overall, the 2035 City of Camas Comprehensive Plan supports the subdivision through a number of land use and transportation policies such as the following:

- LU Policy 1.3: Maintain compatible use and design with the surrounding built and natural environments when considering new development or redevelopment.
- LU Policy 1.4: Ensure the park and recreation opportunities are distributed equitably throughout the City and work to achieve park and continuous trail corridors from Green Mountain to the Columbia River.
- LU Policy 3.3: Encourage connectivity between neighborhoods (vehicular and pedestrian) to support citywide connectivity and pedestrian access.
- LU Policy 3.4: Camas residents are protective of the small-town ambiance and family-friendliness of the community. Discourage exclusive neighborhoods, privacy walls, and gated communities.
- LU Policy 3.5: Where neighborhoods adjoin natural areas or trails, ensure connections through neighborhoods to enhance access to recreation amenities.
- LU Goal 4: Develop an interconnected network of parks, trails, and open space to support wildlife corridors and natural resources and enhance the quality of life for Camas residents and visitors.
- LU Policy 4.3: Encourage regional trail connectivity and increased access throughout the City to support multi-modal transportation and physical activity.
- T Policy 1.3: Construct streets that are interconnected and avoid long cul-de-sacs or dead ends.
- T Policy 2.1: Enhance travel choices and provide pedestrian and bicycle routes designed especially for them, not simply along routes designed for cars. Route planning should seek shortcuts and other opportunities that give walking or biking advantages over the automobile.
- T Policy 2.5: Coordinate with schools and the community to designate safe pedestrian and bicycle routes between residential areas, schools and public facilities.

Parks and Open Space Comprehensive Plan

The City of Camas adopted and updated the Parks, Recreation, and Opens Space (PROS) plan in 2014. The subject site is located in an area identified by the PROS plan as requiring a trail connection, in particularly the T-24 trail which connects to the north and south of the site. Per the PROS plan at page 4-5, "Proposed segments of the trail system are generalized to make connections or follow the direction of natural corridors. Final alignments are subject to change due to environmental conditions, development or alternate routes." Further, trails should be off-street as much as possible per Objective 4A of the PROS plan.

The applicant presented a conceptual trail connection to the Parks Ad Hoc Committee for feedback on July 25, 2018 and followed up with a site visit on July 31, 2018. The applicant and the Parks Ad Hoc Committee agreed the following general public accessible trail connection will be provided as shown on Preliminary Site Plan, Sheet 1 (Exhibit 4); a north-south trail through proposed Tract C connecting the existing T-24 trail alongside SE 40th Street / NW 18th Avenue to the sidewalk in NE Goodwin Street of the Breckenridge Subdivision development. The Parks Ad Hoc Committee further concurred the applicant should provide the following trail features; 1) landscaping along both sides of the trail 2) directional signage to the Breckenridge trail and a bench to be located near the intersection with NW Goodwin Street.

The placement of the trail should avoid the removal of existing healthy trees. The trail should be a 10-foot wide paved surface consistent with the existing T-24 trail located along the south side of SE 40th Street / NW 18th Avenue and to be constructed prior to final plat approval. Proposed Tract C will need to be owned and maintained by the City.

The T-24 trail is a 10-foot wide shared use trail for pedestrians and bicyclists. The applicant has not proposed any additional road widening that would allow for a separate bike lane on SE 40th Street / NW 18th Avenue. As such, staff finds that the applicant should extend the west end of the trail to match up with the existing curb and sidewalk on the east side of the intersection on SE 201st Avenue and SE 40th Street.

> **FINDING:** Staff finds that as conditioned the applicant can and will provide an open space network and trail system consistent with the City's 2014 Parks, Recreation and Open Space Comprehensive Plan.

Neighborhood Traffic Management Plan

The City has a Neighborhood Traffic Management Plan (NTM). The NTM plan identifies the need for installation of acceptable traffic calming features when a proposed development will create 700 Average Daily Trips (ADT) or more. The submitted Transportation Impact Study (TIS) from H. Lee & Associates, PLLC, dated March, 2018, found the project is expected to generate approximately 333 Average Daily Trips (ADT) with 36 new AM peak hour trips and 35 PM peak hour trips.

> **FINDING:** Staff finds that this proposed project is not subject to the requirements for traffic calming as noted in the City's NTM plan.

Traffic Impact Analysis

A Transportation Impact Study (TIS) was submitted by H. Lee & Associates, PLLC, dated March 16, 2018. The study assessed transportation impacts related to the proposed project located at 20109 SE 40th Street. The report evaluated existing traffic conditions in the study area; the 2035 "without project" condition in order to establish a baseline condition by which project impacts are determined; estimated trip generations; and the 2023 "with project" condition to determine project traffic impacts.

The findings in the TIS were as follows:

- The proposed development is expected to generate 333 daily, 26 AM peak hour (7 in, 19 out), and 35 PM peak hour (22 in, 13 out) net new trips.
- All the study area intersections are projected to meet the City of Camas' level of service standards in the 2023 "Without Project" and the 2023 "With Project" condition.
- Turn lane warrants at the SE 40th Street / NW 18th Street project access intersection were not conducted because a westbound left-turn lane into the site will be constructed with the subdivision.
- Based on field measurements conducted by H. Lee & Associates, PLLC, the project access intersection should be able to meet the sight distance requirements as long as any vegetation within the sight distance triangles are properly maintained after construction and no obstructions are placed within the sight distance triangles that could impede a driver's vision. Because the access into the project site is not built, the corner sight distance should be re-verified in the final engineering/construction stages of development.
- Staff finds that the applicant should submit a sight distance analysis at the access to SE 40th Street / NW 18th Avenue prior to final approval of engineering plans.

Recommendations were as follows:

- Based on the traffic impact analysis, documented in the report, no physical, off-site mitigation would be needed.

  FINDINGS: Staff finds that the applicant should provide a sight distance analysis at the SE 40th Street / NW 18th Avenue access prior to final approval of the engineering plans. The applicant will need to install a left-turn lane from NW 18th Avenue into the development site, per the TIA.

2. Provisions have been made for water, storm drainage, erosion control and sanitary sewage disposal for the subdivision that are consistent with current standards and plans as adopted in the Camas Design Standard Manual.

Water: There are three existing water mains located on the north, south, and southwest boundaries of the proposed project. There is an existing 12-inch ductile iron water main located in SE 40th Street / NW 18th Avenue located at the northern boundary, an existing 8-inch water main that is stubbed to the southern boundary from the Breckenridge subdivision, and an existing 12-inch water main that was recently stubbed to the southwest corner from the Columbia Palisades development. The applicant has proposed to install an 8-inch water main that is shown to connect to the southern and northern water mains.

Staff finds that the applicant should upsize the proposed 8-inch waterline to a 12-inch waterline from Columbia Palisades north to the 12-inch waterline located in SE 40th Street / NW 18th Avenue. This would provide for a looped system from SE 40th Street / NW 18th Avenue to Columbia Palisades. Staff supports the reducing to the proposed 8-inch waterline connection south to NW Goodwin Street. Water pressure from the 12-inch main located in SE 40th Street / NW 18th Avenue is sufficient to supply water to the 36 proposed lots.

The current water main design for Valley View indicates that a blowoff is proposed at the southwest end of the proposed thru road into Columbia Palisades. As part of the Columbia Palisades development, a 12-inch water main was installed and stubbed near the east end of the future road extension into the applicant's proposed development. Water for the Columbia Palisades development is provided by the City of Camas. Staff finds that the applicant should connect the proposed Valley View water system to the existing Columbia Palisades 12-inch waterline and work with the City's Utility Manager to evaluate water pressure and the potential need for a pressure reducing station.

Individual water services will be provided to each lot with meter boxes located in the proposed planter strips. Fire hydrants will also be installed in accordance with Camas Design Standards Manual (CDSM) and Fire Department requirements. Irrigation service(s) may also be installed to provide irrigation for landscaping needs of open space tracts, stormwater detention facilities, etc. Any irrigation meters proposed will be required to be privately maintained by the HOA and will require acceptable back flow prevention devices. The water lines, irrigation service(s), water services and fire hydrants will be located in both public and private streets that will serve the proposed lots.

Staff finds that the applicant will be conditioned to provide adequate access and utility easements to the City over the private street tracts at the time of final platting for the inspection, maintenance and operation of said public water lines.

The applicant will also be required to provide acceptable back flow device(s) (BFD) and yearly backflow testing for any private HOA irrigation service(s) proposed. Prior to occupancy of each home with an irrigation system, the builder should submit acceptable BFD testing for each irrigation meter installed and provide said testing results to the city.

> **FINDINGS:** Staff finds that as conditioned the applicant can and will provide water system improvements consistent with the City's standards.

<u>Storm Drainage</u>:
[Stormwater Facilities]: The applicant is proposing to construct two detention ponds, Tract E located in the southwest corner and Tract F located in the southeast corner. Both facilities are bordered on all four sides with vertical retaining walls that range in height from 5-ft. to 20-ft. for the Tract E facility and 6-ft. to 12-ft. for the Tract F facility and include fencing on top of the walls as shown on the Preliminary Stormwater Plan, Sheet 6 (Exhibit 4). Access for both facilities is via a combination of a 12-ft. wide access road and ladders attached to the interior of the retaining walls. Ecology's Stormwater Maintenance Manual for Western Washington (SWMMWW), Volume III, section 3.2 has an option that allows deviating from the 25% vegetated slopes requirement and allows for storm facilities to have 100% of the perimeter to be vertical walls with the following requirements:

a) Walls are constructed of reinforced concrete per Section 3.2.3, Material;
b) A fence is provided along the top of the wall;
c) The entire pond perimeter may be retaining walls …;
d) The design is stamped by a licensed engineer with structural expertise. If the entire pond is to be retaining walls, ladders should be provided on the walls for safety reasons.

Staff finds that the proposed design meets the guidelines as outlined in the 2014 SWMMWW. However, the facilities do not meet the guidelines as set forth in the Camas Stormwater Design Standards Manual.

The applicant has stated that the storm facility retaining walls will comply with CMC 18.17.060. However, the storm facility retaining walls do not meet the requirements of the Camas Stormwater Design Standards Manual, Chapter 4 for side slopes and setbacks.

Chapter 4.05, Side slopes states the following:

1. Interior side slopes shall be 3:1 or flatter, or constructed with retaining walls.
2. Exterior side slopes steeper than 3:1 are allowed if it is demonstrated that the facility can be adequately maintained. Long-term erosion control shall be provided and an approved maintenance plan is required.
3. Use of retaining walls in stormwater facilities taller than four feet requires approval of the Director. The height of the wall shall be measured from the bottom of the footing to the top of the wall.

4. The City may grant a deviation from the side slope standards when the Director determines that the safety, health, and welfare of the public will not be compromised.

Chapter 4.05, Setbacks states the following:

1. Per CMC 17.19.030.F from streets and accessory structures.
2. At least 10-feet from neighboring property lines.

The storm facility located on Tract E is proposing retaining walls that range in height from 5-ft. to 20-ft. and are located on the property lines along Lots 10-12 and Lot 21. These walls do not meet either the setback requirement for 10-feet from neighboring property line nor the side slope requirements for walls not exceeding 4-ft. in height.

The storm facility located on Tract F is proposing retaining walls that range in height from 6-ft. to 12-ft. The walls for this facility do not meet either the setback requirement for 10-feet from the neighboring property line nor the side slope requirements for walls not exceeding 4-ft. in height.

Staff finds that the storm facilities located on Tract E and Tract F be conditioned to meet the requirements of the Camas Stormwater Design Standards Manual, Chapter 4.05 Side Slopes and Setbacks, prior to final engineering plan approval.

Maintenance of the stormwater facilities is the responsibility of the HOA. Reasonable access for maintenance activities is to be provided, including 12-foot wide ramps for accessing inlet and outlet pipes. Staff finds that the applicant should provide reasonable accessibility for maintenance activities.

CMC 17.19.030.F.6 requires that storm drainage facilities be setback a minimum of 30-feet from any street or accessory structure and be landscaped in accordance with the Camas Design Standards Manual. The proposed storm facilities located in Tract E and Tract F meet the minimum setback requirement from the right-of-way, however the preliminary landscape plan does not indicate any landscaping on these tracts. Staff finds that the applicant should be required to include landscaping, screening, and fencing acceptable to the City prior to final engineering plan approval.

[Stormwater discharge]: The Knights Pointe subdivision, located on the east side of the proposed development, has historically had stormwater discharged into a series of 36-inch diameter storm pipe, that traveled overland across the Firestone property, and into a culvert, and then ultimately into the seasonal creek on the west side of Breckenridge. The applicant has proposed to construct an underground collection and conveyance system that will take the stormwater from Knights Pointe, route it around the southern end of the proposed development, thru a series of storm manholes, and discharge it into the seasonal creek that flows thru the wetlands along the western boundary of Breckenridge subdivision. Staff does not take exception to the proposed design as the pipe conveyance system mimics the existing route that the stormwater currently takes.

The applicant has stated that there aren't any wetlands on the property or immediately adjacent to the property. However, the stormwater from this development will discharge into a seasonal creek located within the off-site wetland approximately 160-ft. south of Tract E. The storm facilities located in Tracts E and F will both discharge into an existing stormwater manhole that is located at the northern boundary between the proposed development and Breckenridge. Staff finds that the applicant should provide documentation to the effect that any discharge of stormwater into wetlands, is to be consistent with Ecology's SWMMWW Appendix 1-D: Guidelines for Wetlands When Managing Stormwater criteria.

[Offsite Analysis]: The preliminary stormwater report, which was submitted by Joel Sterling on June 2018, discussed the offsite analysis that was performed. A site visit was conducted that followed the downstream flow route to a point in the receiving water, approximately ¼ mile from the site, in order the analyze existing conditions and potential impacts from this development. The proposed design conveys all the stormwater from the site to a public storm manhole that was installed at the northern boundary of the Breckenridge subdivision. This portion of the Breckenridge conveyance system, then discharges into the seasonal creek that runs along the western boundary of Breckenridge. Per the offsite analysis, the stormwater flows from the proposed development will continue to follow historical flow routes and will not be rerouted to another drainage basin. Staff finds that the applicant should submit a final stormwater report (TIS) to the City for review and approval, prior to final engineering plan approval.

Stormwater facilities are to be owned and maintained by the HOA, with a right-of-entry granted to the City of Camas for inspections.

> **FINDINGS:** Staff finds that as conditioned the applicant can and will make adequate provisions for stormwater control, detention, conveyance, and water quality treatment.

Erosion Control: Adequate erosion control measures can or will be provided during the site improvements contemplated for this subdivision in accordance with adopted city standards. The Erosion Sediment Control (ESC) plans will ultimately be submitted to the City for review and approval prior to any ground disturbance. The applicant will be required to provide an Erosion Control Bond, per CMC 17.21.050.B.3, prior to final approval engineering plan approval.

Additionally, the applicant will provide a copy of both their Stormwater Pollution Prevention Plan (SWPPP), which is a part of their application for their NPDES General Construction Stormwater Permit (GCSWP) that is required through the Washington State Department of Ecology for ground disturbances of over one acre, and their NPDES GCSWP, prior to approval of the engineering plans.

> **FINDINGS:** Staff finds that adequate provisions for erosion control can or will be made.

Sanitary Sewage Disposal: The applicant is proposing to tie into the existing 8-inch PVC sanitary sewer system that was stubbed north from the Breckenridge development located south of the proposed development. The effluent flows from this development would be routed to the existing Grand Ridge pump station, located in the Grand Ridge subdivision, with the solids retained in individual tanks located on the individual lots. As such, staff finds that the applicant should be conditioned to perform a sewer basin analysis to quantify the existing and proposed sewer flows that will be conveyed to the existing pump station prior to final engineering approval.

Staff finds that the applicant should be conditioned to conduct a capacity analysis of the existing pump station that evaluates the existing flows from Grand Ridge, Breckenridge, and future Valley View flows. The analysis should include but not be limited to evaluation of pump sizes, pumping rates, and condition of existing structures, etc. The analysis is to evaluate the effects on the downstream facilities, from the Grand Ridge pump station to the Brady Road pump station and in to the STEP transmission main in NW Brady Road, to determine if there is adequate capacity to serve the existing and proposed new flows.

Staff finds that the applicant will be responsible for appropriate mitigation of any identified and necessary pump station or system upgrades to serve the proposed development.

The applicant is proposing the installation of a Septic Tank Effluent Filter (STEF) sewer system to serve the proposed lots. The system will consist of individual underground Roth STEF Tanks to be installed at the time of home construction on each lot. The tanks will retain the solids and the effluent will gravity flow out of the tank and into the STEF mainline where the flow will then be conveyed to the existing pump station. The City will maintain the individual STEF tank systems once home construction is completed. The individual lot owners will be responsible for the cost and installation of the individual systems at the time of home construction. A right-of-entry will also be granted to the City for the maintenance and repair of said STEF tanks.

Existing wells, septic tanks and septic drain fields: CMC 17.19.020 (A 3) requires abandonment of existing wells, septic tanks and septic drain fields. Existing water wells should be properly abandoned in accordance with State and County guidelines prior to final plat approval for the phase they may be located in.

> **FINDINGS:** Staff finds that adequate provisions can or will be made as conditioned for water, storm drainage, erosion control and sanitary sewage disposal which are consistent with the Camas Municipal Code and the Camas Design Standard Manual.

3. Provisions have been made for road, utilities, street lighting, street trees and other improvements that are consistent with the Six-Year Street Plan, the Camas Design Standards Manual and other State adopted standards and plans;

Roads: The proposed development is located on the south side of the convergence between SE 40th Street and NW 18th Avenue. NW 18th Avenue / SE 40th Street is designated as an existing 2-lane collector. The applicant is proposing to extend a public road, currently un-improved SE 202nd Avenue, through the project in order to connect SE 40th Street / NW 18th Avenue to NW Goodwin Street to the south and Street 'E' to the southwest. Street 'E', at the southwest corner of the subject property is located within the City of Vancouver city limits. Street 'E' is a public road and constructed as part of the Columbia Palisades mixed use project.

The applicant is proposing public roads that would provide connectivity between the City of Vancouver's Columbia Palisades development, the City of Camas Breckenridge subdivision, and the Camas School District Pacific Rim Campus. The public street section proposed for the interior streets to the site, is consistent with the public street section 17.19.040.B.8 Table 17.19.040-2 Minimum Public Street Standards, which includes a 52-foot width right-of-way, a 28-foot paved surface, a 5-foot detached sidewalk on both sides with planter strips, and no parking restricted on one side. The proposed street section is the minimum allowable and requires approval from the City Engineer. The City Engineer supports the proposed street standards as shown.

NW 40th Street / NW 18th Avenue is classified as an existing 2-lane collector. As such, the minimum driveway setback from a collector road is 110-feet. A restricted access is required for Lots 1 and 36 to ensure that the driveway locations for these two lots meet or exceed the minimum access setback requirement.

Tracts B, D, and G are private streets providing access to four or less dwelling units. Per CMC 17.19.040.B.8 private streets are to meet the minimum private street standards per Table 17.19.040-2 with a 20-foot tract width and a 12-foot paved surface, optional sidewalk and no parking on both sides.

Staff finds that as a bike lane is not being constructed on SE 40th Street / NW 18th Avenue, the applicant should provide adequate improvements and necessary adjustments for the existing multi-use pedestrian trail (aka T-24). Improvements should include a 10-ft. minimum path width from the existing landing on the northeast corner of SE 201st Avenue east to the eastern boundary of the applicant's site. The existing 10-ft. wide path should be preserved to the extent possible.

The proposed street section for SE 40th Street / NW 18th Avenue does not meet the public street sections as indicated in Table 17.19040-2. A half-street improvement is not proposed, however there is an existing 10-ft. wide multi-use pedestrian T-24 trail. A deviation from the public street standards in CMC 17.19.040 may be permitted with a recommendation from the City Engineer. The City Engineer supports the deviation.

Additionally, staff finds that the curb ramps at SE 40th Street / NW 18th Avenue and the site entrance should align both vertically and horizontally with the shared use path along SE 40th Street / NW 18th Avenue and shall meet Public Right-of-Way Accessibility Guidelines (PROWAG).

A Geotechnical investigation and analysis of the existing roadway (SE 40th Street / NW 18th Avenue) has not been provided. Staff finds that the applicant should provide a Geotechnical report with an analysis to determine if the existing street section meets the half-street improvement requirements of the Camas Design Standards Manual.

In accordance with the provisions of CMC 17.19.040 (A7) homes accessed from a private street require automatic fire sprinklers installed per NFPA 13D or 13R and the applicant will need to provide for adequate parking enforcement in the CC&R's at the time of final platting.

Utilities, Street Lighting, Street Trees, and Other Improvements:
[Street lighting]: LED Street lighting will be installed along all street frontages in accordance with the Camas Design Standards Manual (CDSM). Street light locations are to be shown on the construction plans. Draft electrical plans are to be submitted for review by the City prior to submittal to Clark Public Utilities.

[Street trees and Landscaping]: CMC 17.19.030 (F 1) requires one 2-inch diameter street tree in the planter strip of the right-of-way for each dwelling unit. The proposed street tree locations are shown on the Preliminary Landscape Plan, Sheet 9 (Exhibit 4) in compliance with this requirement. The applicant will also be required to provide acceptable fencing and landscaping behind lots 1-4 in accordance with CMC17.19.030.D.6 as further discussed under criterion 5 below. Additionally, prior to final engineering approval, the applicant is to show proposed driveway locations for each lot to ensure that street trees are not impacted.

The street tree plantings and other landscaping as discussed throughout this report, should be included on the landscaping plans with final engineering plan submittal for the site improvements. All landscaping should be installed or bonded for prior to final plat acceptance.

[Storm Facility Landscaping]: CMC 17.19.030.F.6 requires that storm drainage facilities be setback a minimum of 30-feet from any street or accessory structure and be landscaped in accordance with the Camas Design Standards Manual. The proposed storm facilities located in Tract E and Tract F meet the minimum setback requirement, however the preliminary landscape plan does not indicate any landscaping on these tracts. Staff finds the applicant should include on the final landscaping plans the landscaping and fencing for the stormwater facilities located on Tract E and Tract F.

[Parking]: The proposed average lot size falls below 7,400 square feet and as such, the applicant has provided 8 parking stalls within Tract F in compliance with this requirement in CMC 17.19.040.B.10.e. Subject to the requirements of CMC 18.13.060.A and E, parking areas are to be landscaped at all perimeters and provide a minimum 5-foot width of planting space.

> **FINDING:** Staff finds that the applicant can or will make adequate provisions for roads, utilities, street lighting, street trees, and other improvements that are consistent with the six-year street plan, the Camas Design Standard Manual and other state adopted standards and plans.

4. Provisions have been made for dedications, easements and reservations;

The applicant's submittal does not include any of the proposed private easements for storm, sewer or water lines and does not show existing easements of record on adjacent parcels. The applicant should be required to provide said easements on the construction drawings and the final plat.

The applicant is proposing to provide an internal public road to serve the development, with private driveways/roadways that will provide access to several flag lots. Proposed Tracts B, D & G are identified as private roadways/driveways on the preliminary plat. Public water and sewer services will also be located within these private roadways, as such the applicant is proposing to provide a blanket access and utility maintenance easement over the proposed private roads to the City of Camas at the time of final platting.

The applicant will also be required to provide a right-of-entry to the city for inspection and maintenance of the individual S.T.E.F. systems.

Tract H provides access to tax lots 58 and 47, which are not part of this proposed development and should not be under the ownership of the homeowner's association of this subdivision. Prior to final plat approval, the applicant will need to accomplish one of the following: 1) Add a note to the final plat that the developer will own and maintain Tract H, 2) quit claim deed Tract H to the property owners of tax lots 58 and 47 or 3) submit to the city for review and approval a boundary line adjustment between Tract H and tax lots 58 and 47.

A homeowner's association (HOA) will be required and a copy of the CC&R's for the development will need to be submitted to the City for review and approval. Specifically, the applicant will need to make provisions in the CC&R's for ownership and maintenance of the storm drainage systems, fencing, walls, landscaping, irrigation, private roads, and tracts or easements outside of the City's right-of-way if applicable. Further, all necessary easements and dedications should be noted on the final plat.

> **FINDING:** Staff finds that adequate provisions for dedications, easements and reservations can or will be made by the applicant at the time of final platting.

5. The design, shape and orientation of the proposed lots are appropriate to the proposed use.

Lot sizes: Proposed Tract C on the preliminary plat contains a proposed trail connection, which is identified on the Parks, Recreation, and Open Space (PROS) plan as the T-24 trail. The applicant has the ability to utilize the density transfer provisions per CMC 18.09.060.C when land is set aside in a tract that is approved as a recreational area (i.e. trails).

The density transfer provisions in the R-7.5 single-family residential zone requires a minimum lot size of 5,250 square feet and a maximum lot size of 9,000 square feet CMC 18.09.040 Table 1. As such, the proposed lots are between 5,900-9,000 square feet in size. Further, CMC 18.09.080.B requires new lots along the common property boundary needs to be the maximum size allowed of the zone designation with the development if adjacent to a lower density zone. In compliance with this requirement, lots 22-25 are 9,000 square feet in size as they abut the existing Knight Point subdivision which is located in a higher density residential zone (R-15).

Lot dimensions: The proposed lots meet the required minimum width of 60-feet and depth of 80-feet and density of the overall site is below the maximum allowed at 5.8 du/acre. CMC 18.09.040.C- Table 2 specifies that "Setbacks are based on average lot sizes (not zone specific)". The average lot size for the proposed development falls under the R-7.5 density range which requires a minimum 20-foot front yard setback, a 25-foot front minimum rear yard setback, a 5-foot minimum side yard and corner rear yard setback and a 20-foot minimum side yard flanking a street setback. A minimum 40x40 building envelope and building setbacks should be shown on the final plat.

Double-frontage lots: The preliminary plat proposed double frontage lots at Lots 1-4 adjacent to SE 40th Street. *"Double Frontage lots shall be avoided"* per CMC 17.19.030.D.6 except where the lots are adjacent to an arterial or collector; SE 40th Street / NW 18th Avenue is a Collector Road. Consistent with CMC 17.19.030.D.6.a, the applicant has provided a 10-ft. wide landscape tract (Tract A) along the rear property lines of Lots 1-4. The landscape tract should include a minimum 2-inch caliper tree every thirty feet on center, three-foot tall shrubs that form a continuous screen and groundcover plants that fully cover the remainder of the landscaped area per CMC 17.19.030.D.6.a. A 4-foot sight obscuring fence or masonry wall should be located at the line that separates the lot from the 10-foot tract per CMC Figure 17.19-1 and include columns or physical indentations every fifty lineal feet per CMC 17.19.030.D.6.b. Subject to CMC 17.19.030.D.6.d, a 20-foot setback is required from the property line separating the lot from the tract. As such, Lot 1 building envelope should be reduced to comply with the required 20-foot building setback from the tract. The rear building elevations facing SW 40th Street should maintain the architectural design of the front building façade to avoid blank walls per CMC 17.09.030.D.6.c.

> **FINDINGS:** The proposed lot sizes and dimensions conform to the density transfer provisions of the R-7.5 zone for single-family residential lots. Building envelopes and setbacks should be shown on the final plat. Lots 1-4 will need to comply with the development standards for double frontage lots in CMC 17.19.030.D.6(a-d).

6. The subdivision complies with the relevant requirements of the Camas land development and zoning codes, and all other relevant local regulations;

CMC Section 17.19.030.A Environmental Regulations:
Relates to the preservation of significant trees and states, "*In addition to meeting the requirement of CMC Chapter 18.31, Tree Regulations, every reasonable effort shall be made to preserve existing significant trees and vegetation, and integrate them into the land use design.*" CMC 18.31.080.B further states, *"To the extent practical, existing healthy significant trees shall be retained. Preservation of groups of significant trees, rather than individual trees shall be preferred."* The applicant's narrative states few scattered trees are located on the property but not significant trees as defined by CMC 18.31.080. However, the applicant should submit an arborist report and tree survey for City review and approval prior to engineering plan approval.

CMC Section 15.50.090 Clearing and Grading Standards:
CMC 15.50.090.A requires clearing and grading activities be conducted as to minimize potential adverse impacts to the vegetation, drainage and other natural features of the land. Clearing and grading should be conducted in a manner to preserve and enhance the city of Camas aesthetic character to include the preservation of unique landforms and natural features per CMC 15.50.090.E. Further, CMC 15.50.100.B requires the minimization of clearing and grading on slopes greater than 15%. Residential land development projects with steep slopes often include retaining walls for flatter lots. The proposed subdivision includes several walls up to 10-feet in height for lot design. To minimize clearing and grading and to further highlight the existing aesthetic landscape character of Camas, a revised clearing and grading plan should be submitted in compliance with CMC 18.17.060 *Retaining walls* prior to final engineering plan approval.

> **FINDING:** As stated in the responses to criteria in this staff report and as conditioned herein, this proposal can or will meet all relevant codes, regulations, ordinances and other requirements as identified herein.

7. Appropriate provisions are made to address all impacts identified by the transportation impact study;
The applicant was notified by staff at the pre-application meeting that a Traffic Impact Study (TIS) would be required for this project. The applicant's traffic engineer, Hann Lee & Associates, submitted a TIS with the application materials dated March 16, 2018.

The TIS indicated that adequate site distance was available at the site access points as long as any vegetation within the sight distance triangles are properly maintained after construction and no obstructions are placed within the sight distance triangles that could impede a driver's vision. Additionally, all off site intersections within the study area were evaluated for, and met the Level of Service (LOS) standards in the 2013 "Without Project" and the 2023 "With Project" conditions. The study concluded that the area roadways will have adequate capacity for the proposed traffic that this development will generate.

Turn-lane warrants were not conducted at the project access intersection off SE 40th Street / NW 18th Avenue, as a left-turn lane into the project site will be designed prior to final engineering approval and constructed with this development.

Staff finds that there are no impacts needing mitigation associated with this developments traffic impacts to the area roadways based on the applicant's TIS.

See detailed comments under the approval criteria number 3 above, within this Section.

8. Appropriate provisions for maintenance of commonly owned private facilities have been made;
A Homeowner's Association will be required for this development including Conditions, Covenants, and Restrictions (CC&R's) to ensure there are adequate and appropriate measures in place for the perpetual maintenance of trails, fencing, landscaping, parking stalls, private roads and the stormwater detention/treatment systems.

> **FINDING:** Staff find the applicant be required to place a note on the face of the plat that identifies the specific ownership and maintenance responsibilities for all tracts. The applicant should also submit to the City for review and approval a copy of the CC&R's.

9. Appropriate provisions in accordance with RCW 58.17.110, are made for (a) the public health, safety, and general welfare, and (b)The public use and interest will be served by the platting of such subdivision and dedication;

The applicant is proposing privately owned and maintained tracts for a public trail, landscaping, a stormwater facility and private roads. Furthermore, the applicant is providing adequate and appropriate utilities for stormwater, water, and sanitary sewer that will be dedicated to the public. The applicant will also provide sidewalks with the proposed street construction for adequate pedestrian mobility.

> **FINDINGS:** As discussed throughout this report, staff finds that the subdivision can be conditioned to provide the appropriate provisions for public health, safety, general welfare, and assure safe walking conditions for pedestrians.

10. The application and plans shall be consistent with the applicable regulations of the adopted comprehensive plans, shoreline master plan, state and local environmental acts and ordinances in accordance with RCW36.70B.030.

> **FINDINGS:** Staff concurs that the proposed subdivision can or will meet the requirements of RCW 58.17 and other applicable state and local laws that are in at the time of final platting. The final plat will be processed in accordance with the requirements of CMC 17.21.060.

PUBLIC COMMENTS

As of the writing of this staff report, staff has not received written public comments.

CONCLUSION

Based on the above findings and discussion provided in this staff report, staff concludes that Valley View Estates Subdivision (SUB18-02) should be approved, because it does comply with the applicable standards if all of the conditions of approval are met.

RECOMMENDATION

Staff recommends APPROVAL of the preliminary plat of Valley View Estates Subdivision (SUB18-02) subject to the following conditions of approval *in addition to* the conditions of the SEPA (SEPA18-15) permit:

CONDITIONS OF APPROVAL

Standard Conditions:

1. All construction plans will be prepared in accordance with City of Camas standards. The plans will be prepared by a licensed civil engineer in Washington State and submitted to the City for review and approval.
2. A 3% construction plan review and inspection fee shall be required for this development. The fee will be based on an engineer's estimate or construction bid. The specific estimate will be submitted to the City's engineering department for review and approval. The fee will be paid prior to the construction plans being signed and released to the applicant. Under no circumstances will the applicant be allowed to begin construction prior to approval of the construction plans.
3. Existing water wells, septic tanks and septic drain fields shall be properly abandoned in accordance with State and County guidelines prior to final plat approval.
4. Any entrance structures or signs proposed or required for this project will be reviewed and approved by the City. All designs will be in accordance with applicable City codes. The maintenance of the entrance structure will be the responsibility of the homeowners.
5. The applicant will be responsible for ensuring that private utilities; underground power, telephone, gas, CATV, street lights, and associated appurtenances are installed.
6. A 6-foot private utility easement (PUE) shall be located outside of the right-of-way on public streets and outside of the tracts on private streets.
7. A draft street lighting plan shall be submitted for review prior to final plan submittal to Clark Public Utility.
8. The applicant will be required to purchase all permanent traffic control signs, street name signs, street lighting and traffic control markings and barriers for the improved subdivision.
9. A homeowner's association (HOA) will be required and a copy of the CC&R's for the development will need to be submitted to the City for review and approval. Specifically, the applicant will need to make provisions in the CC&R's for ownership and maintenance of the storm drainage systems, fencing, walls, landscaping, irrigation, private roads, and tracts or easements outside of the City's right-of-way if applicable. Further, all necessary easements and dedications should be noted on the final plat.
10. Final plat and final as-built construction drawing submittals shall meet the requirements of the CMC 17.11.060, CMC 17.01.050 and the Camas Design Standards Manual for engineering as-built submittals.
11. The applicant shall remove all temporary erosion prevention and sediment control measures from the site at the end of the two-year warranty period, unless otherwise directed by the Public Works Director.
12. Street names shall be reviewed and approved by the Building Department prior to final plat approval.

13. Building permits shall not be issued until this subdivision has been granted Final Acceptance and the final plat is recorded and approved by the Planning, Engineering, Building and Fire Departments.

Special Conditions:

14. The SEPA MDNS mitigation measures shall be complied with (SEPA18-15).
15. The applicant shall comply with the geotechnical report recommendations to minimize any potential hazards associated with construction.
16. Accessory dwelling units shall not be precluded from CC&R's.
17. On corner lots, the side façade elevation facing the street shall provide architectural variation similar with the front building façade. Additional landscaping shall be provided along the street side façade but shall not impede necessary vision clearance requirements.
18. The T-24 public access trail shall be generally located within Tract C as shown on the preliminary plat and installed in a manner to avoid the removal of existing healthy trees.
19. The applicant shall provide the following trail features:
    - A 10-foot wide trail with landscaping along both sides of the trail
    - Directional signage to the Breckenridge trail and a bench located near the intersection of NW Goodwin Street
20. The trail shall be constructed prior to final plat approval and owned and maintained by the City.
21. Prior to engineering plan approval, a sight distance analysis shall be provided at the SE 40th Street / NW 18th Avenue access.
22. The applicant shall install a left-turn lane from NW 18th Avenue into the development site per the TIA.
23. The applicant shall upsize the proposed 8-inch waterline to a 12-inch waterline from Columbia Palisades north to the 12-inch waterline located in SE 40th Street / NW 18th Avenue.
24. The applicant shall connect the proposed Valley View water system to the existing Columbia Palisades 12-inch waterline and work with the City's Utility Manager to evaluate water pressure and the potential need for a pressure reducing station.
25. The applicant shall provide adequate access and utility easements to the City over the private street tracts at the time of final platting for the inspection, maintenance and operation of said public water lines.
26. The applicant shall provide acceptable back flow device(s) (BFD) and yearly backflow testing for any private HOA irrigation service(s) proposed. Prior to occupancy of each home with an irrigation system, the builder shall submit acceptable BFD testing for each irrigation meter installed and provide said testing results to the city.
27. Prior to engineering plan approval, the storm facilities located on Tract E and Tract F shall meet the requirements of the Camas Stormwater Design Standards Manual, Chapter 4.05 Side Slopes and Setbacks.
28. The applicant shall provide reasonable accessibility for maintenance activities of the stormwater facilities.
29. The applicant shall provide documentation demonstrating compliance with Ecology's SWMMWW Appendix 1-D: Guidelines for Wetlands When Managing Stormwater criteria for any discharge of stormwater into the off-site wetlands.
30. Prior to engineering plan approval, the applicant shall submit a final stormwater report (TIS) to the City for review and approval.

31. Stormwater facilities shall be owned and maintained by the HOA, with a right-of-entry granted to the City of Camas for inspections.
32. Prior to final engineering approval, the applicant shall perform a sewer basin analysis to quantify the existing and proposed sewer flows that will be conveyed to the existing pump station.
33. The applicant shall conduct a capacity analysis of the existing pump station that evaluates the existing flows from Grand Ridge, Breckenridge, and future Valley View flows. The analysis shall include but not be limited to evaluation of pump sizes, pumping rates, and condition of existing structures, etc.
34. The applicant shall be responsible for appropriate mitigation of any identified and necessary pump station or system upgrades to serve the proposed development.
35. The individual lot owners shall be responsible for the cost and installation of the individual STEF systems at the time of home construction. A right-of-entry will also be granted to the City for the maintenance and repair of said STEF tanks.
36. A restricted access is required for Lots 1 and 36 to ensure that the driveway locations for these two lots meet or exceed the minimum 110-foot access setback requirement from a collector road.
37. The applicant shall provide adequate improvements and necessary adjustments for the existing multi-use T-24 trail alongside SE 40th Street / NW 18th Avenue to include:
    - a 10-ft. minimum path width from the existing landing on the northeast corner of SE 201st Avenue east to the eastern boundary of the applicant's site.
    - curb ramps at SE 40th Street / NW 18th Avenue and the site entrance that align both vertically and horizontally with the shared use path along SE 40th Street / NW 18th Avenue and shall meet Public Right-of-Way Accessibility Guidelines (PROWAG).
38. Prior to engineering plan approval, the applicant shall provide a Geotechnical report with an analysis to determine if the existing street section meets the half-street improvement requirements of the Camas Design Standards Manual.
39. Automatic fire sprinklers installed per NFPA 13D or 13R shall be required in all new residential structures.
40. Provisions for parking enforcement acceptable to the Fire Marshal shall be included in the CC&R's at the time of final platting.
41. Prior to the Building Department issuing a Certificate of Occupancy, street trees shall be located within the planter strip as approved on the final plat. Trees shall be a minimum of two-inch diameter at breast height.
42. Required trees shall be maintained in good health, and shall be promptly replaced (within six months) if damaged or in poor health, and a note to this effect shall be on the final plat document.
43. Prior to final engineering plan approval, the applicant shall submit a landscape plan for City review and approval that details the location, plant species, planting, irrigation and fencing notes and associated details for all required landscaping including but not limited to the stormwater facilities located on Tract E and F.
44. All landscaping shall be installed or bonded for prior to final plat acceptance.
45. Prior to final engineering approval, the applicant shall show proposed driveway locations for each lot to ensure that street trees are not impacted.
46. Off-street parking lot areas shall be landscaped at all perimeters and provide a minimum 5-foot width of planting space.

47. The applicant shall provide private easements for storm and, sewer and water lines. These easements shall be shown on the construction drawings and the final plat for recording.
48. The applicant shall grant an access and utility easement to the City of Camas for access, inspection and maintenance of the water and S.T.E.F. sanitary sewer systems.
49. Prior to final plat approval, the applicant shall accomplish one of the following: 1) add a note to the final plat that the developer will own and maintain Tract H, 2) quit claim deed Tract H to the property owners of tax lots 58 and 47 or 3) submit to the city for review and approval a boundary line adjustment application between Tract H and tax lots 58 and 47.
50. All building envelopes and setbacks shall be shown on the final plat.
51. Lots 1-4 shall comply with the development standards for double frontage lots in CMC 17.19.030.D.6(a-d).
52. Prior to engineering plan approval, the applicant shall submit the arborist report and tree survey for City review and approval.
53. Prior to engineering plan approval, a revised clearing and grading plan shall be submitted in compliance with CMC 18.17.060 *Retaining walls*.

Proposed Plat Notes

1. A homeowner's association (H.O.A) will be required for this development. Copies of the CC&R's shall be submitted and on file with the City of Camas.
2. The homeowner's association is responsible for maintaining all private roads and associated infrastructure in this subdivision, including but not limited to the pavement, curbs, sidewalks, landscaping, street lights and storm drainage utilities.
3. All costs associated with the installation of the step systems for individual lots will be the responsibility of said individual lot owners.
4. An access and utility maintenance easement is provided to the City over the private street tracts for the inspection, maintenance and operation of said public water lines.
5. A right of entry is hereby granted to the City of Camas for the repair and maintenance of the individual S.T.E.F systems located on the lots within the plat.
6. The following setbacks shall apply: Front yard 20-feet, Rear yard 25-feet, Side yard 5-feet, Corner rear yard 5-feet, Side yard flanking a street 20-feet.
7. No further short platting or subdividing will be permitted once the final plat has been recorded.
8. A final occupancy permit will not be issued by the Building Department until all subdivision improvements are completed and accepted by the City.
9. The lots in this subdivision are subject to traffic impact fees, school impact fees, and park/open space impact fees. Each new dwelling unit will be subject to the payment of appropriate impact fees at the time of building permit issuance or as otherwise provided by the city.
10. Prior to the Building Department issuing a Certificate of Occupancy, each lot shall install a minimum of one 2" caliper tree to be located in the planter strip as specified on the plat. Specified trees shall be maintained in good health, and damaged or dying trees shall be promptly replaced (within six months) by the homeowner.
11. Automatic fire sprinkler systems designed and installed in accordance with NFPA 13D are required in all structures.
12. Illegally parked vehicles may be subject to towing or other private parking enforcement measures in accordance with the provisions outlined in the HOA documents.

13. Should archaeological materials (e.g. cones, shell, stone tools, beads, ceramics, old bottles, hearth, etc.) be observed during project activities, all work in the immediate vicinity should stop and the State Department of Archaeology and Historic Preservation (360-586-3065), the City planning office, and the affected Tribe(s) should be contacted immediately. If any human remains are observed, all work should cease and the immediate area secured. Local law enforcement, the county medical examiner (360-397-8405), State Physical Anthropologist, Department of Archaeology and Historic Preservation (360-586-3534), the City planning office, and the affected Tribe(s) should be contacted immediately. Compliance with all applicable laws pertaining to archaeological resources (RCW 27.53, 27.44 and WAC 25-48) and human remains (RCW 68.50) is required. Failure to comply with this requirement could constitute a Class C Felony.
14. Prior to occupancy for each home with an irrigation system, the builder shall submit acceptable back flow device (BFD) testing for each irrigation meter installed and provide said testing results to the City.
15. A restricted access is required for Lots 1 and 36 to ensure that the driveway locations meet or exceed the minimum 110-foot access setback requirement from SE 40th Street / NW 18th Avenue.
16. Tract “A” is a landscape area to be owned and maintained by the homeowner’s association.
17. Tract “C” is a public access trail to be owned and maintained by the City of Camas.
18. Tracts “B”, “D” and “G” are hereby conveyed to the homeowner’s association (HOA) upon the recording of this final plat for pedestrian and vehicle access and utilities. Parking shall not be allowed in the tracts. The HOA shall be responsible for the maintenance of the tract and the access improvements therein.
19. Tract “E” is a stormwater area to be owned and maintained by the homeowner’s association (HOA). An easement for access and inspection shall be granted to the City of Camas with this plat.
20. Tract “F” is a parking area and stormwater area to be owned and maintained by the homeowner’s association (HOA). An easement for access and inspection to the stormwater facility shall be granted to the City of Camas with this plat.
21. Tract “I” is a monument sign and landscape area to owned and maintained by the homeowner’s association.

EXHIBIT 30
SUB18-02

Valley View Estates Subdivision
Public Hearing October 18th, 2018

Will storm water run off from Valley View Estates be addressed to alleviate potential impact to adjacent property to the west tax lot 12642-150

What existing tree's if any will be removed from the proposed Valley View Estates subdivision

Fir Tree on proposed T 24 along Tax Lot 126042-150 is dead, will it be removed prior to any weather that could potentially cause property damage. (Both tree's along the Failed septic system of the recently demolished home have died)

Requesting the existing Common Snowball Viburnum tree located on the fence line of Tax lot #12642-150 not to be removed and remain part of the landscape.

Will a fence be installed on both sides of the walk path/public access T 24 at tax
Lots #126042-152 and 126042-150

Thank you,
Don & Kris Good
#126042-150

Valley View Estates Subdivision SUB18-02

Document List
10/18/2018

Exhibit	Title	Date
1	Application	5/18/2018
2	Narrative	6/25/2018
3	Preliminary Plans May 18, 2018	5/18/2018
4	Updated Preliminary Plans June 25, 2018	6/25/2018
5	GIS Packet w/ Vicinity Map	3/26/2018
6	Notice of Development Sign	7/24/2018
7	SEPA Checklist	5/17/2018
8	300 Foot Mailing Labels	3/26/2018
9	Pre-Application Report	1/18/2018
10	Breckenridge Trail	5/18/2018
11	Stormwater Plan	5/18/2018
12	Stormwater Report	6/25/2018
13	Geotechnical Report	5/1/2018
14	Revised Geotechnical Report	8/2/2018
15	EEI Geotechnical Peer Review #1	7/23/2018
16	EEI Geotechnical Peer Review #2	8/6/2018
17	Traffic Study	3/16/2018
18	Environmental Report	5/18/2018
19	Tribal Certified Mailings	6/27/2018
20	Notice of Application	6/27/2018
21	Incompleteness Review Letter	6/13/2018
22	Completeness Review Letter	7/6/2018
23	City Review Letter	8/24/2018
24	Notice of Public Hearing	10/4/2018
25	MDNS Cover Letter SEPA18-15	10/4/2018
26	MDNS Determination SEPA18-15	10/4/2018
27	Wetland Determination Report October 18, 2007	10/9/2018
28	Revised Preliminary Plat October 9, 2018	10/9/2018
29	Staff Report SUB18-02	10/11/2018
30	Don and Kris Good comment letter	10/12/2018