Sunrise Terrace

A Residential Subdivision
City of La Center

Application for Preliminary Subdivision

Applicant: RK Land Development, LLC
1520 SW Eaton Blvd
Battle Ground WA 98604

Prepared by: Ed Greer, Land Use Planning
8002 NE Hwy 99 #546
Vancouver WA 98665
ed@ed-greer.net

Civil Engineer: Jeff Whitten, Wolfe Group, LLC
2401 West Main St Suite 210
Battle Ground WA 98604
jeff@wolfe-group.com

Table of Contents

DEVELOPMENT REVIEW APPLICATION FORM

419 E. Cedar Avenue, Suite 201
La Center, Washington 98629
T/360.263.7661 F/360.263.7666

File #	
Planner	

PROJECT INFORMATION

Project Name:
Sunrise Terrace

Type(s) of Application: (see attached)
Preliminary Subdivision Plat, Type III

Description of Proposal: *Subdivide 34.4 acres into 120 residential lots*

APPLICATION FEES
submitted to:
date paid:

PROCEDURE
- ☐ Type I
- ☐ Type II
- ☒ Type III
- ☐ Type IV

APPLICANT INFORMATION

Name of Applicant: *RK Land Development, LLC*	Address: *1520 SW Eaton Blvd Battle Ground WA 98604*
E-mail address: *huntergina06@gmail.com*	Phone: *360.608.3991* Fax:
Name of Property Owner: (list multiple owners on a separate sheet) *John & Sandy Perrott P.O. Box 128 La Center WA 98629 Lee Norden 727 Third St Woodland WA 98674*	Address:
E-mail address:	Phone: Fax:
Contact Person Name: (list if not same as applicant) *Ed Greer, Land Use Planner*	Address: *8002 NE Hwy 99 #546 Vancouver WA 98665*
E-mail address: *ed@ed-greer.net*	Phone: *360.904.4964* Fax:

PROJECT SITE INFORMATION

Site Address: *1908 NE Lockwood Creek Road*	**Cross Street:** *E 18th Place*

Comp Plan Designation: *UL*	Base Zone & Overlay Zone: *LDR-7.5*	Assessor's Serial #: *209047-000 209062-000, 986027-188, 986027-189*
Township, Range, 1/4 of Section: *NE ¼ Sec 2, T4N, R1E*	Legal Description: *Refer to Legal Descriptions*	Acreage of Parcels: *Total 34.4*

AUTHORIZATION

The undersigned hereby certifies that this application has been made with the consent of the lawful property owner(s) and that all information submitted with this application is complete and correct. False statements, errors, and/or omissions may be sufficient cause for denial of the request. This application gives consent to the City to enter the properties listed above.

Authorized Signature

7.7.15
Date

Owner Authorization

We are the record owners of land located at 2219 NE 339th Street in the City of La Center, said parcels are also known as Clark County tax lot numbers 986027-188, 986027-189 and a portion of 209062-000.

We hereby authorize Ed Greer, Land Use Planner, to sign land development applications as required by the City of La Center.

Date 11.12.14

John S. Perrott

Date 11.12.14

Sandy D. Perrott

Narrative for Sunrise Terrace

Project Location

The proposed project is situated on 34.4 acres located north of NE Lockwood Creek Road, bounded on the north by NE 339th Street and on the east by NE 24th Avenue. Clark County tax serial numbers are 209047-000, 986027-188, 986027-189, and a portion of 209062-000. The current property owner will retain approximately 9.5 acres located at the southwest corner of NE 339th Street and NE 24th Avenue.

Proposed Project

The project proposes to subdivide 34.4 acres into 120 residential lots for new detached homes. All proposed lots comply with LMC 18.130.020 as follows:

All lots exceed 7,500 square feet in area, except Lot numbers 35 through 38, and Lot number 114, that are less than 7,500 square feet, however exceed 6,750 square feet in area. Net density is 4.6 lots per acre.

Building setbacks: 20' front yard, 20' rear yard, 7.5' side yard. 10' street side yard.

Building lot coverage and impervious surface areas cannot be calculated until new home footprints are determined at the time of building permit applications.

The site is zoned LDR-7.5. The project properties are currently in Urban Holding. The applicant hereby requests removal from the urban holding zoning overlay.

All proposed lots exceed the minimum width of 60 feet and the minimum depth of 90 feet, per LMC 18.130.090.

The Circulation Plan indicates how adjacent properties can be effectively designed to utilize the stub streets of Sunrise Terrace, and the Plan also indicates a potential plan for the northeast area of tax lot 209062-000 that is being retained by the owners, and is not a portion of this project.

Phasing: The project is proposed to be constructed in up to 4 phases. A Phasing Plan is included in this application. Phases may be combined depending upon market demands.

Legal Lot Determination

Tax lots 209062-000, 986027-188 and 986027-189 were created by the Perrott Short Plat recorded in book 3 page 905, in Clark County records, therefore all three are legal lots. A deed history for tax lot number 209047-000 is included in this application to provide proof of a legal parcel.

Boundary Line Adjustment

A Boundary Line Adjustment procedure will be accomplished to adjust the boundaries of Lot 1 of the Perrott Short Plat, the area not included in this project.

Streets and Circulation

Existing NE Lockwood Creek Road is classified as a Rural Major Collector requiring 30' of right of way from centerline to the north right of way, which currently is existing.

Existing NE 339th Street and NE 24th Avenue are classified as Rural Minor Collectors, requiring 28' of right of way from the centerline to the south and west right of way.

All new interior streets shall be classified as Local Access requiring 50' right of ways.

Spacing for all proposed streets is designed to comply with the intent of Section 2, Chapter 1, 2.01, with overall spacing less than an average of 500'. The Area Circulation Plan, Exhibit B, indicates how adjacent properties can be effectively designed to utilize the stubbed streets from Sunrise Terrace.

A turnaround is not required for the west end of St B, as it serves only one lot and is less than 200 feet in length, per Section 2, Chapter 1, 2.12 B. of the City of La Center Engineering Standards.

The design of proposed Ave A intersecting NE Lockwood Creek Road complies with Section 2, Chapter 2, 2.14 C, of the City of La Center Engineering Standards, by providing an intersection angle of 81 degrees (code min 75 degrees) and a tangent length of 25 feet (code min 25').

Minimum centerline spacing along collectors is 300 feet, per Section 2, Chapter 2, 2.14 E of the City of La Center Engineering Standards. Proposed Ave A is placed as far to the east as practical providing a distance of 280 feet from existing E 18th Place, which is within 93% of the code length. The Applicant hereby requests an administrative adjustment to allow the proposed location of Ave A.

Sight distance: Exhibit D indicates a profile of NE 24th Avenue where proposed Street E intersects to show that adequate sight distance exists both north and south.

Sanitary Sewer

The nearest existing sewer line is located in E 18th Place, approximately 60 feet south of the centerline of NE Lockwood Creek Road. An 8" line will be extended to proposed Ave A, then extended into the new streets of the project.

A Sewer Analysis Report was prepared by Rob VanderZanden, Project Managing Engineer, with Harper Houf Peterson and Righellis, Inc, an engineering firm in Vancouver Washington. His Report is included in this application package.

In summary, the Report recommends upgrades to Pump Stations No. 2 and 3, and construction of a 6" force main from PS2 to the gravity main 620' to the west.

Any existing septic systems located on the site will be properly decommissioned.

Water

The project will be served by Clark Public Utilities. Existing 8" water lines are located in the three adjoining existing streets. New 8" water lines will be constructed in the new streets within the project.

Clark Public Utilities is requiring an upgrade to their existing water system. The Sunrise Terrace developer will construct a new 10" water line, connecting at the end of the existing 8" water in the easterly cul-de-sac of E. 24th Circle, extending easterly and connecting to the north end of the existing 8" water line in NE 14th Avenue.

Any existing wells located on the site will be properly decommissioned.

Stormwater

A Preliminary Stormwater Plan and Report was prepared by Jeff Whitten, Licensed Professional Engineer, Wolfe Group LLC, and is included in this application.

Parks and Trails

There are no requirements to provide parks or trails for this project.

SEPA

The proposed project is subject to the State Environmental Policy Act (SEPA). A completed SEPA Checklist is included with this application.

Geotechnical Study and Report

A complete Geotechnical Investigation Report was prepared by Columbia West Engineering, Inc, and is included in this application.

Traffic Analysis Report

A complete Traffic Analysis Report was prepared by Lancaster Engineering, Traffic Engineers, and is included in this application.

Archaeological

An Archaeological Predetermination was performed by Archaeological Consulting Services, and is included in this application.

Supplementary Development Standards, LCMC 18.245

Fences and Hedges, LCMC 18.245.020

No fences or hedges are currently planned for this project, however, if the developer or future lot owners elect to install fences or hedges, they shall comply with the requirements of this code section.

Noise, LCMC 18.245.050

Any work on the project site shall comply with the standards of this section.

Solid Waste, LCMC 18.245.030
Lighting, LCMC 18.245.040
Landscaping, LCMC 18.245.060

The above three sections are not applicable to this project.

Signs, LCMC 18.275

No signs are proposed for this project.

Off-street Parking, LCMC 18.280

Each new home on every proposed lot will provide a minimum of 2 spaces in the garage and 2 spaces in the driveway.

Critical Areas, LCMC 18.300

A Critical Areas Assessment Report and a Technical Memorandum was prepared by Cascadia Ecological Services.
The Reports concludes that no City of La Center regulated wetlands exist on the site or within 200 feet of the project boundary.

The Department of Natural Resources (FPARS) indicates possible class N streams crossing the southeast area and the northeast corner of tax lot number 209062-000. The Critical Areas Assessment Report indicates that no class N streams exist on the site or within 200 feet of the project boundary.

A man made drainage ditch is located just south of the site's south property line. This ditch was apparently constructed to intercept flows from the north and along the west side of NE 24th Avenue to protect the tree farm from excess water. Drainage is carried westerly for approximately 600 feet, then drains southerly onto adjacent property.

The Report concludes that the site contains no critical areas and a critical areas permit is not required.

Streets and Sidewalks, Title 12, LCMC

The developer shall comply with the requirements of Title 12, by constructing new streets and adding improvements to applicable existing streets, and constructing sidewalks where required by the City of La Center.

Building Code and Specialty Code, LCMC 15.05

All new homes constructed in this project shall comply with the requirements of Title 15, LCMC.

School Impact Fees, LCMC 15.35

School impact fees shall be paid at the time of application for each building permit.

State Platting Standards, RCW 58.17

The proposed project will make appropriate provisions for public health, safety, and the general welfare of the community, by providing adequate water and sewer services, and proper management of stormwater runoff, and protecting the supply and integrity of groundwater.

AGREEMENT TO PAY PROFESSIONAL REVIEW EXPENSES RELATED TO LAND USE APPLICATIONS

THIS AGREEMENT is entered into by and between the City of La Center, a Washington municipal corporation ("City") and RK Development, LLC ("Applicant") concerning the following Project:

Project address: 1908 NE Lockwood Creek Road, La Center, WA Parcel Numbers 209047-000, 209062-000, 986027-188 and 986027-189

Project/permit review: Sunrise Terrace Subdivision

Applicant recognizes that the City is obligated by state law and the La Center Municipal Code to provide a complete review of land use and development applications, including all technical support documents, to determine compliance with all applicable approval standards. The City is also authorized to recover from applicants the actual cost of performing land use and technical plan and project reviews, including engineering, project inspections, planning and legal peer review. To recover its actual costs, the City will provide Applicant an estimate of the cost of internal and outsourced review for this project within 10 days after receiving technical support documents, which is due and payable by the Applicant as part of a complete application. The City's costs of internal and outsourced review will be charged on an actual time and materials basis plus administrative fees as approved by City Council Resolution No. 13-372.

Applicant hereby agrees to pay the City's actual (time and materials) cost recovery of project and plan review for the above-mentioned project. The Applicant further agrees to any delay in the issuance of a final decision on the Project until the Applicant has paid all of the City's review costs as provided herein.

Any dispute that arises over the interpretation or application of this Agreement shall be resolved by the City Council through a public hearing process. The City Council's decision in such a matter shall be final.

IT IS SO AGREED:

Applicant

By: _____

Title: (Member) RK Development

Date: 5/27/2015

City of La Center

By: _____

Title: Public Works Director

Date: 5/28/2015

A. BACKGROUND

1. Name of proposed project, if applicable:

   Sunrise Terrace

2. Name of applicant: *RK Land Development, LLC 1520 SW Eaton Blvd*
   Battle Ground WA 98604 360.608.3991

3. Address and phone number of ~~applicant and~~ contact person:

   Ed Greer, Land Use Planning 360.904.4964
   8002 NE Hwy 99 #546 Vancouver WA 98665

4. Date checklist prepared:

   July 7, 2015

5. Agency requesting checklist:

   City of La Center, Washington

6. Proposed timing or schedule (including phasing, if applicable):

   Phase 1 (& possibly Phase 2) – Summer 2016.
   Phase 3 & 4 – Summer 2017.

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 Critical Areas Assessment Report was prepared by Cascadia Ecological Services, concluding that no wetlands or habitat areas exist on the site or within 100 feet of the site.

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.

   None known

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

    Preliminary Plat, Civil Engineering Plans, Final Plat

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. (Lead agencies may modify this form to include additional specific information on project description.)

    The proposed residential subdivision contains 34.4 acres and proposes 120 lots for detached homes and 2 tracts for stormwater management facilities, to be developed in up to 4 phases.

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. *Location: 1908 NE Lockwood Creek Road, La Center WA, bordered on the north by NE 339th Street and bordered on the east by NE 24th Avenue. NE 1/4 of Section 2, T4N, R1E, WM. Tax lots 209047-000, 986027-188, 986027-189, & a portion of 209027-000.*

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)?

16%

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. *Gee Silt Loam* *No prime farmland*

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. *No*

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill. *Grading for the new streets and lots will be extensive. Earth work will balance on site. Quantities are unknown at present.*

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

Yes, erosion can occur during clearing and grading.

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

Approx 30% of the site will be covered in impervious surfaces.

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

Contractor shall comply with City approved Civil Engineering Plans Plans and all governmental agencies erosion control codes.

2. 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.

During construction: Some emissions from construction equipment.
After completion: Minor amount of emissions from automobiles.

b. Are there any offsite 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 proposed.

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,

No

describe type and provide names. If appropriate, state what stream or river it flows into.

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.

No

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.

None

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 flood plain? 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 groundwater be withdrawn, or will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No

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 storm water):

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.

Runoff from lots and streets will be collected in catch basins and piped to stormwater management facilities, then piped to an existing drainage course south of NE Lockwood Creek Road.

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

No

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

Refer to c.1) above

4. Plants

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

X Deciduous tree: Alder, (maple), aspen, other
X Evergreen tree: (Fir), cedar, pine, other
__ Shrubs
X Grass
X 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 field grasses and all (approx. 13) existing trees will be removed.

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:

New homeowners will landscape their yards to enhance vegetation on each lot.

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: *None*
Fish: Bass, salmon, trout, herring, shellfish, other: *None*

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.

Yes, Pacific Flyway

d. Proposed measures to preserve or enhance wildlife, if any:

See 4 d. above

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.

Electricity and natural gas will be used for general household uses.

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:

None

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

1) Describe special emergency services that might be required.

None

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

None necessary

b. Noise

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

None, very little traffic exists in this area.

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.

Short term: Some noise from construction equipment. Long term: Automobiles. Construction would occur during permitted daylight hours.

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

Contractors shall comply with all noise codes of the City of La Center.

8. Land and shoreline use

a. What is the current use of the site and adjacent properties?

Site: Residence and shop, mostly vacant. North & east of NE 339th St & NE 24th Ave: Residences and vacant. South and west: Residences and mostly vacant. North & east adjacent to site: Residence and out buildings.

b. Has the site been used for agriculture? If so, describe.

No

c. Describe any structures on the site.

Residence & shop

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

Yes, both structures will be removed.

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

LDR – 7.5

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

LDR

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

Not applicable

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?

310 people would reside.

j. Approximately how many people would the completed project?

Two people would be displaced.

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:

Builder will comply with all applicable codes & regulations.

9. Housing

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

120 new homes for middle & high income buyers.

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

One eliminated, middle income.

c. Proposed measures to reduce or control housing impacts, if any:

Project proposes single family homes, and will comply with all City codes and regulations.

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?

New homes will be 2 stories maximum. Materials unknown.

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?

Some glare may occur from street lights during evening hours.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No

c. What existing offsite sources of light or glare may affect your proposal?

None

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?

La Center High School

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:

None

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.

None known

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None known

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

None

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.

Existing streets providing access: NE Lockwood Creek Road, NE 24th Avenue & NE 339th Street. Refer to Preliminary Plat for access to existing streets.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

No, nearest C-trans stop approx. 1 mile

c. How many parking spaces would the completed project have? How many would the project eliminate? *Parking spaces: Min 2 car garage and 2 spaces in the driveway, plus on street parking, total unknown. None eliminated.*

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). *The project requires fully improved new interior streets. The 3 existing streets bordering the project will require half street improvements.*

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

1160 trips per day. Peak hours are generally from 7 to 9 am & 4 to 6 pm.

g. Proposed measures to reduce or control transportation impacts, if any:

Improved streets per City standards.

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, an increase in all services.

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

Builders will pay impact fees for building permits.

16. Utilities

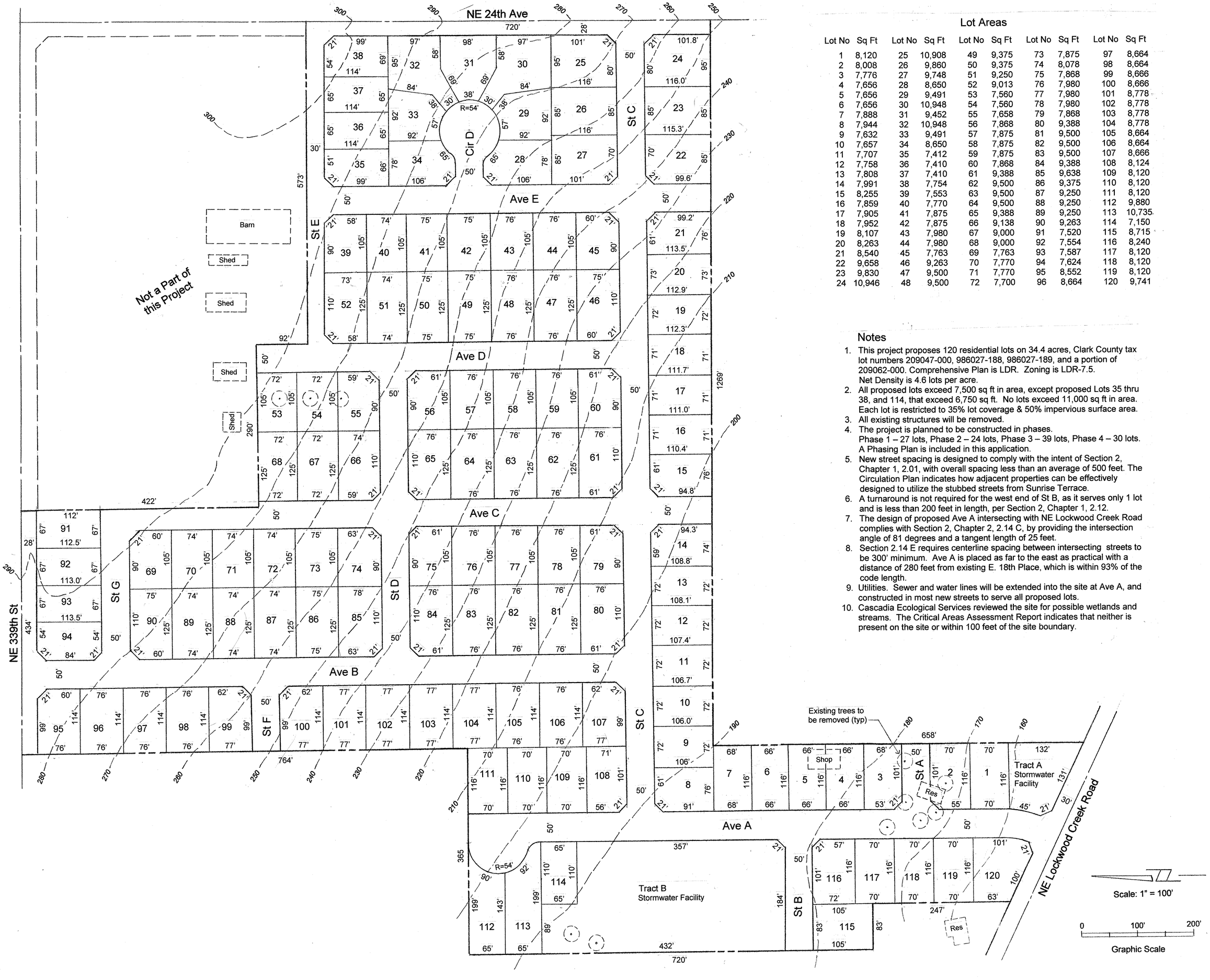
a. Circle utilities currently available at the site: Electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

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. *Sewer: City of La Center; Water & Electricity: Clark Public Utilities; Natural Gas: Northwest Natural; Refuse: Waste Connections; Telephone: Centurylink*

C. SIGNATURE

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: _____ Date Submitted: 7.7.15



Lot Areas

Lot No	Sq Ft	Lot No	Sq Ft	Lot No	Sq Ft	Lot No	Sq Ft	Lot No	Sq Ft
1	8,120	25	10,908	49	9,375	73	7,875	97	8,664
2	8,008	26	9,860	50	9,375	74	8,078	98	8,664
3	7,776	27	9,748	51	9,250	75	7,868	99	8,666
4	7,656	28	8,650	52	9,013	76	7,980	100	8,666
5	7,656	29	9,491	53	7,560	77	7,980	101	8,778
6	7,656	30	10,948	54	7,560	78	7,980	102	8,778
7	7,888	31	9,452	55	7,658	79	7,868	103	8,778
8	7,944	32	10,948	56	7,868	80	9,388	104	8,778
9	7,632	33	9,491	57	7,875	81	9,500	105	8,664
10	7,657	34	8,650	58	7,875	82	9,500	106	8,664
11	7,707	35	7,412	59	7,875	83	9,500	107	8,666
12	7,758	36	7,410	60	7,868	84	9,388	108	8,124
13	7,808	37	7,410	61	9,388	85	9,638	109	8,120
14	7,991	38	7,754	62	9,500	86	9,375	110	8,120
15	8,255	39	7,553	63	9,500	87	9,250	111	8,120
16	7,859	40	7,770	64	9,500	88	9,250	112	9,880
17	7,905	41	7,875	65	9,388	89	9,250	113	10,735
18	7,952	42	7,875	66	9,138	90	9,263	114	7,150
19	8,107	43	7,980	67	9,000	91	7,520	115	8,715
20	8,263	44	7,980	68	9,000	92	7,554	116	8,240
21	8,540	45	7,763	69	7,763	93	7,587	117	8,120
22	9,658	46	9,263	70	7,770	94	7,624	118	8,120
23	9,830	47	9,500	71	7,770	95	8,552	119	8,120
24	10,946	48	9,500	72	7,700	96	8,664	120	9,741

Notes

1. This project proposes 120 residential lots on 34.4 acres, Clark County tax lot numbers 209047-000, 986027-188, 986027-189, and a portion of 209062-000. Comprehensive Plan is LDR. Zoning is LDR-7.5. Net Density is 4.6 lots per acre.
2. All proposed lots exceed 7,500 sq ft in area, except proposed Lots 35 thru 38, and 114, that exceed 6,750 sq ft. No lots exceed 11,000 sq ft in area. Each lot is restricted to 35% lot coverage & 50% impervious surface area.
3. All existing structures will be removed.
4. The project is planned to be constructed in phases. Phase 1 – 27 lots, Phase 2 – 24 lots, Phase 3 – 39 lots, Phase 4 – 30 lots. A Phasing Plan is included in this application.
5. New street spacing is designed to comply with the intent of Section 2, Chapter 1, 2.01, with overall spacing less than an average of 500 feet. The Circulation Plan indicates how adjacent properties can be effectively designed to utilize the stubbed streets from Sunrise Terrace.
6. A turnaround is not required for the west end of St B, as it serves only 1 lot and is less than 200 feet in length, per Section 2, Chapter 1, 2.12.
7. The design of proposed Ave A intersecting with NE Lockwood Creek Road complies with Section 2, Chapter 2, 2.14 C, by providing the intersection angle of 81 degrees and a tangent length of 25 feet.
8. Section 2.14 E requires centerline spacing between intersecting streets to be 300' minimum. Ave A is placed as far to the east as practical with a distance of 280 feet from existing E. 18th Place, which is within 93% of the code length.
9. Utilities. Sewer and water lines will be extended into the site at Ave A, and constructed in most new streets to serve all proposed lots.
10. Cascadia Ecological Services reviewed the site for possible wetlands and streams. The Critical Areas Assessment Report indicates that neither is present on the site or within 100 feet of the site boundary.

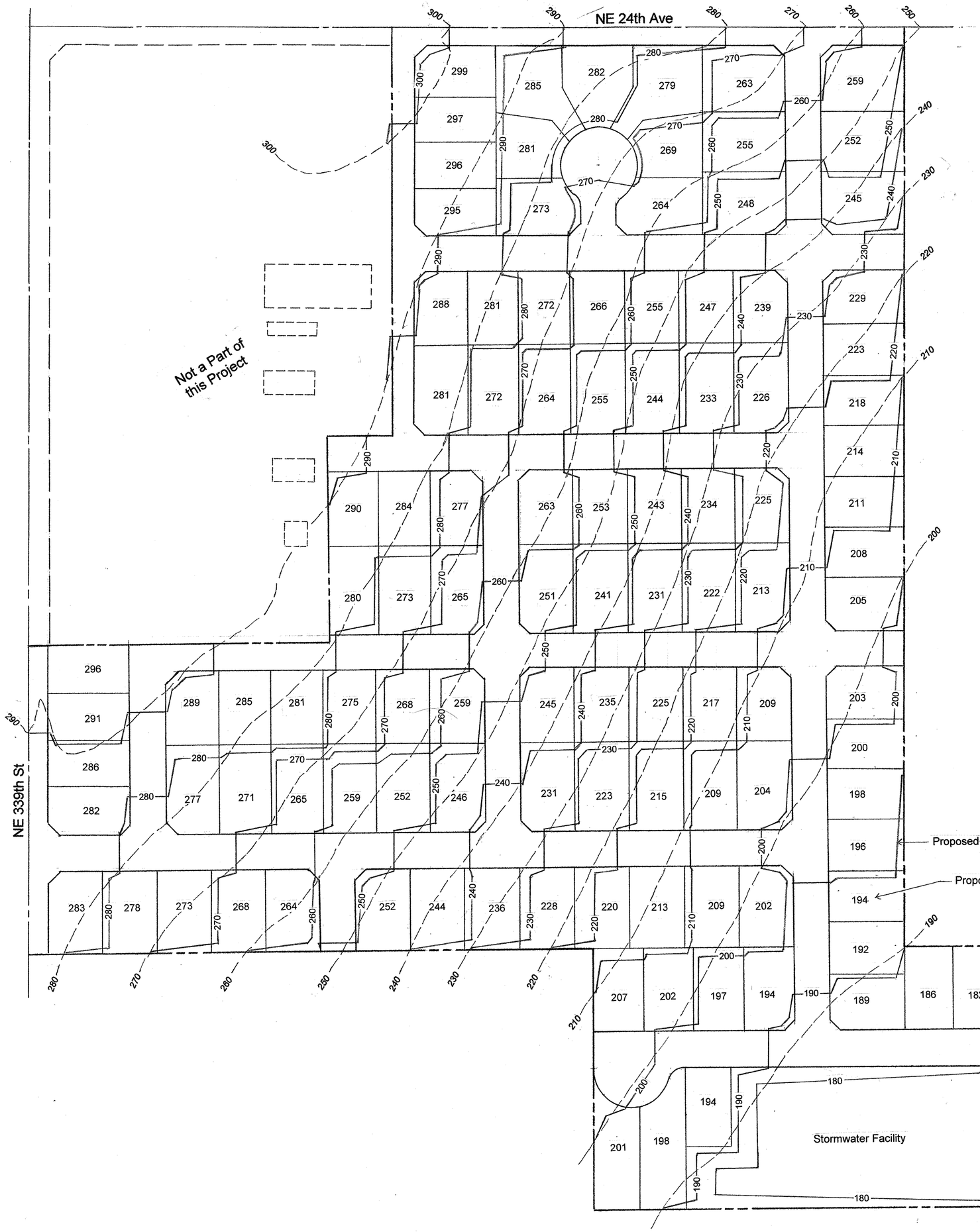
ED GREER Land Use Planning & Designs
8002 NE Hwy 99 #546 Vancouver WA 98665
360.904.4964 ed@ed-greer.net

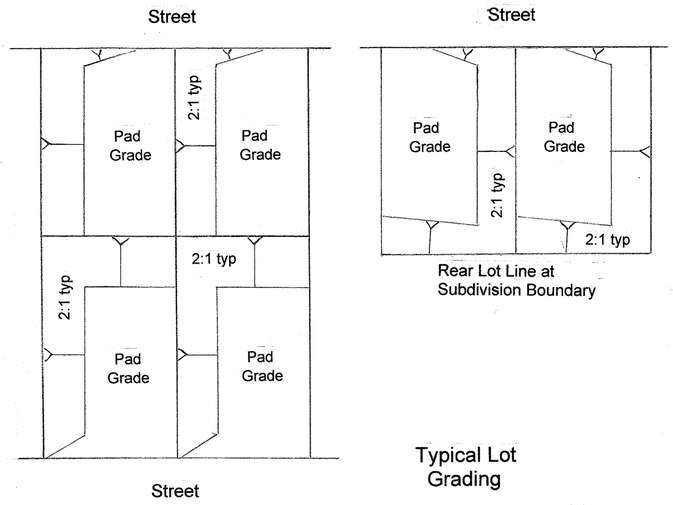
Applicant: RK Land Development, LLC
1520 SW Eaton Blvd Battle Ground WA 98604
360.608.3991 huntergrinia06@gmail.com

Sunrise Terrace

a Residential Subdivision
City of La Center WA

Preliminary Plat





Typical Lot Grading

Notes

1. This Preliminary Grading Plan indicates existing contours at 10' intervals due to the existing grades of approximately 10%, proposed contours at 10' intervals, and proposed pad grades.
2. Preliminary plans for drainage and erosion control are shown on a separate plan, consistent with applicable provisions of LCMC Chapter 18.320.
3. At preliminary stage, it appears that no retaining walls will be necessary. Preliminary earth quantities:
   Excavation: 67,500 cy Embankment: 61,200 cy
4. All Erosion Control methods shall be indicated on the final Civil Engineering Plans per City of La Center Erosion Control Guidelines.

Scale: 1" = 100'

0 100' 200'

Graphic Scale

ED GREER Land Use Planning & Designs
8002 NE Hwy 99 #546 Vancouver WA 98665
360.904.4964 ed@ed-greer.net

Applicant: RK Land Development, LLC
1520 SW Eaton Blvd Battle Ground WA 98604
360.608.3991 huntergina06@gmail.com

Sunrise Terrace

a Residential Subdivision
City of La Center WA

Preliminary Grading Plan

305 NW Pacific Highway
La Center, Washington 98629
T/360.263.7661 F/360.263.7666

PRE-APPLICATION CONFERENCE
Sunrise Terrace Subdivision (2014-003-PAC)
Meeting to be conducted on Thursday January 8, 2015 – 10:00 AM

PROJECT INFORMATION

Proposal: The applicant proposes to lift the urban holding zoning overlay and subdivide 34.4 acres into one hundred twenty one (121) detached single-family residential lots. The site lies within a Low Density Residential (LDR-7.5) zoning district.

Location: The site address is 1908 NE Lockwood Creek Road, La Center, WA and is southwest of the intersection of NE Lockwood Creek Road and NE 339th Street. Assessor parcel numbers are 209047-000, 209062-000, 986027-188 and 986027-189; NE ¼ of Section 2, T4N, R1E, WM.

Applicant: RK Land Development 1520 SW Eaton Blvd., Battle Ground, WA 98604, 360.608.3991, huntergina06@gmail.com

Representative: Ed Greer, Land Use Planning, 8002 NE Highway 99, #546, Vancouver, WA 98665, 360.904.4964, ed@ed-greer.net; Jeff Whitten, Wolfe Group, LLC, 2401 W. Main St., Suite 210, Battle Ground, WA 98604, jeff@wolfe_group.com

Owners/Addresses: John and Sandy Perrott, P.O. Box 128 La Center, WA 98629 and Lee Norden, 727 3rd St. Woodland, WA 98674

REVIEW

Development Standards

Subsequent application(s) shall address the following development standards. Failure of the City to cite specific requirements of the La Center Municipal Code (LCMC) in this report does not relieve the applicant of the responsibility to meet all applicable criteria.

Public Works and Engineering

Chapter 12.10 -- Public and Private Road Standards

City of La Center Engineering Standards for Construction shall apply to all public road improvements unless modified by the director. LCMC 12.10.040.

A performance bond in the amount not less than 110% of the construction estimate shall be provided prior to issuance of building permits. LCMC 12.10.110.

General roadway and right-of-way standards shall apply and provide for the continuation or appropriate projection of existing principal streets in the surrounding area and on adjacent parcels; LCMC 12.10.090.

The applicant shall provide full street improvements on interior streets according to the City of La Center Local Access standard ST-15.

In addition to the interior street improvements, street lights, street trees and stormwater improvements. LCMC 12.10.190.

For driveways to each lot the applicant will need to comply with maximum driveway width as shown on standard detail attached.

A bond for all public improvements shall be posted by the developer in the amount of 110% of the construction for final plat or when improvements are complete and accepted by the City

Comments

Streets and Circulation

The preliminary plat shows circulation to NE 339th Street per the City Engineering Standards if Avenue "D" is extended to 339th Street as shown in the future developed area shown in the northeast corner of the plat. To provide adequate circulation to 339th the applicant will be conditioned to extend Avenue "D" to 339th Street as part of the development application. Circulation through the development to NE 24 Avenue does not appear to meet the 500-foot maximum street spacing for this first phase of development. There is no access from the development south of 339th Street shown on the plat; only Cul-de-sacs dead-ending (Circle "E, "D" and future "F") just west of NE 24th Avenue. To meet the City circulation requirements at minimum Cul-de-Sac Circle "E" will need to be extended to NE 24th Avenue.

The minimum Cul-de-Sac radius is 108-feet to Right of Way line and 45-feet to gutter flowline with a 6-foot wide sidewalk including 0.5-foot curb. See attached Cul-de-sac detail

The City Local Access standard for all interior subdivision streets requires a 32-foot wide to gutter flowline dimension and 30-foot pavement width for a 0.5-foot wide curb. See the attached Local Access Standard ST-15.

A hammerhead turnaround is proposed for the west end of "D" Street for three lots. Section 2.12 (B) of the city engineering standards allows for the use of a temporary hammerhead that is under 200-feet in length. A temporary hammerhead must have sidewalk on both sides of the street, and one side of the half street, and have dimensions as shown on the attached standard. Once the street is extended the temporary hammerhead shall be removed and sidewalk extended through the hammerhead.

NE 339th Street is classified as a Rural Minor Collector and Lockwood Creek Road is classified as a Rural Major Collector. NE 24th Street is not classified but will be a collector street and will be designated as a Rural Minor Collector. See attached city standard details for Rural Minor and Rural Major Collectors. The Capital Facilities Plan requires bicycle lanes for collector roads and therefor the details show bike lane striping instead of parking lanes.

Streets naming (and addressing) will be conducted by the City.

Grading

A grading and erosion control permit is required as part of the subdivision plans. As part of the grading plans finished floor elevations need to be shown for the lots in addition to grading quantities, the plan shall show retaining walls necessary to grade the lots.

The City Erosion Control Standards require that any activity disturbance over 500 SF must comply with the City standards. As part of these standards a construction stormwater permit is required from the Department of Ecology and an SWPPP will be necessary as part of the plan submittal to the City.

Chapter 13.10 -- Sewer System Rules and Regulations

Connection to public sewer is required. LCMC 13.10. All work is to be performed by a duly licensed contractor in the City of La Center. LCMC 13.10.230. Work will be performed using an open trench method unless otherwise approved. LCMC 13.10.200. All costs associated with installing the side sewer shall be borne by the applicant. LCMC 13.10.110. The Applicant's Engineer proposes to add 50 homes to the existing pump station #3 in Lockwood Creek Development and existing pump station #2 adjacent to Stonecreek Development.

The City Engineer reviewed the Sunrise Terrace Sanitary Sewer Capacity Analysis for Pump Station #2 and #3. Although the General Sewer Plan shows that existing pump stations #2 and #3 have an existing peak capacity of 0.29 MGD each, this is not the capacity of the pumping stations, according to the Department of Ecology Sewage Design Manual (Orange Manual). As indicated in the attached "Orange Manual" it says "the number of pumps shall allow the station to provide the peak design flow with the largest pump out of order". This means that if there are currently two pumps, only one pump can be used for the peak capacity of each of the separate pumping systems. If one pump has a capacity of 100 gpm, then if it is running continually during the peak day flow, it will pump 0.144 MGD (100gpm x 60 min/hour x 24 hr/day).

According to the calculations for the Sunrise Terrace, there are 124 ERU's tributary to PS#3 (Parkside Estates 46 lots, Lockwood Creek 76 lots, Post Office 1 ERU, Library 1 ERU). This appears to be correct. The remaining tributary ERU's to pump station #2 is 78 (Stonecreek Estates, Elementary School, Middle School, High School, and Community Center & other uses i.e. splash pad, concession stand). This is for basin D1 and is shown on Table A2 from the GSP.

This gives a total 202 ERU's tributary to pump station #2 for a daily flow of 0.0599 MGD (202 x 2.7 persons per ERU x 110 gpd). Using a peaking factor calculated at 3.95 (per GSP) this gives a peak flow of **0.24 MGD tributary to PS#2**. This appears to verify the existing peak flow in the Sunrise Terrace calculations (see attached excerpts). The GSP appears to calculate the peak flow to the pump station at 0.179 MGD and the peak capacity at 0.29 MGD.

The Sunrise calculations add another 50 ERU's to pump station #2 which would make a peak flow of 0.29 MGD. Since the peak flow per D.O.E. is one pump (100 gpm = 0.144 MGD), **the development would far exceed the peak flow of pump station #2**. In addition the existing peak flow tributary to pump station number #3 is also 100 gpm or 0.144 MGD. The existing peak flow tributary to pump station #3 is 0.15 MGD (124 ERU), which currently exceeds the pump capacity at pump station #3.

At a minimum additional pumping capacity will be needed at pump stations #2 and #3 or enlarging the existing pumps to be able to pump the peak flow with development with one pump.

Our Sewer Department is planning to verify the actual pumping rate of the existing pumps to determine if they each are pumping 100 gpm. In addition we need to verify that the existing wet well has capacity to operate for the existing peak flow (diameter, depth, elevations of inlet pipe, pump height, etc.). Once we know this information **the applicant will need to calculate if the basins have capacity with additional pumps or larger pumps.** We will review these calculations.

The force main size tributary to pump station #3 and pump station #2 will also need to be verified by the applicant for the additional flow to the system from the development.

Once the city has collected data of the existing pumps and wet well it will be given to the applicant to verify the system requirements for the proposed development.

Connections shall be made at a manhole at the intersection of East 18th Place and Lockwood Creek Road. Connection to the manhole, sewer main open-trench installation in Lockwood Creek Road shall be constructed per City Engineering Standards. LCMC 13.10.180. A minimum 8 inch diameter public main pipe will be installed between the proposed Sunrise development to the point of connection at the City manhole. LCMC 13.10.190. A back water valve is required, if the lots are lower than the street, on each sewer connection from the lots and will be located at the property line within the applicants property. A cleanout is required at the property line. LCMC 13.10.110. *La Center Engineering Standards for Construction* are also applicable.

Calculations shall be submitted to determine design compliance of the sewer system within the development, the future upstream incoming influent and the adequacy of the downstream facilities shall be submitted for approval.

Existing septic system must be abandoned or removed as necessary per Clark County Environmental Health permitting.

Chapter 18.10 Development Code General Provisions

Geotechnical Study. A complete application will include a geotechnical study and report, prepared by a geotechnical engineer or geologist, licensed in the state of Washington. The report shall include at a minimum, testing to support the structural section of the roadway, site building construction, grading, retaining wall design, as applicable, and subsurface drainage. LCMC 18.212.050.

Traffic Impact Analysis. A compete application will require a traffic impact analysis and circulation plan which considers adjacent land parcels, topography, natural features, sensitive lands, existing improvements, and existing streets together with their potential alignments in relation to this site. The impact analysis should be conducted at intersections along Lockwood Creek Road, NE 339th Street, NE 24th Avenue, Highland Road, East 4th Street and Pacific Highway, and Aspen Avenue. The report shall include average daily traffic and peak hour traffic for intersections and streets as noted above. LCMC 18.212.050(n).

Chapter 18.320 (Stormwater and Erosion Control)

Section 18.320.120 (1) LCMC states that ground-disturbing activities of more than 500 square feet are subject to the requirements of *City of La Center Erosion Control Guidelines*. Section 18.320.120 (2)(a) LCMC states that the creation of more than 2,000 square feet of impervious surface is subject to stormwater regulation.

The applicant proposes to create new impervious interior streets in the subdivision. Per LCMC 18.320.210, treatment BMPs shall be sized to the treat the water quality design storm, defined as the six-month, 24-hour storm runoff volume.

The applicant proposes to treat stormwater from pollution generating surfaces (impervious) with rain gardens or bioswales, or other approved BMP's. The treatment will need to meet the City of La Center and 1992 Puget Sound Manual which requires compliance with the Water Pollution Control Act and the Water Resources Act.

Per LCMC 18.320.220, if infiltration is used for disposal of stormwater, the project must infiltrate the 100-year storm where local soil types and ground water conditions are suitable. Per the Puget Sound Manual, an emergency overflow above the 100-year storm event needs to be shown.

If infiltration of stormwater is not feasible for quality treatment and quantity disposal, stormwater runoff must be detained meeting the requirements of Chapter 18.320 LCMC and then discharged into the existing low point on the site. Clark County Soil Groups or USDA may be used to determine the hydrology of the site. Isopluvials shall be used to determine the design storm frequency (attached). Per the City Ordinance, a forested condition must be used for the pre-developed surface condition. The HEC-1 flood hydrograph package or HEC HMS may be used for hydrologic computation of site quantity control.

The collection system shall designed by the rational method using HEC-12 1984 edition standards for gutter and storm pipe capacity. As an alternate, WSDOT Hydraulics Manual can be used for inlet capacity design. The 100-year rainfall intensity must be used for pipe capacity design using the rational method. Attached is the City rainfall intensity chart.

Per LCMC 14.10.140, a preliminary stormwater plan and preliminary stormwater report shall be submitted for review as part of the land use application. The stormwater report must also address stormwater how energy dissipation will be accomplished so that the downstream property is not impacted by stormwater.

Downspouts connections from the houses must connect directly into the site stormwater system. Laterals from the storm main in the street must be shown to serve each lot. A Technical Information Report (TIR) is required along with the development plans for approval of the stormwater system.

Maintenance of Stormwater Facility

If the stormwater treatment and disposal facility is within public Right of Way, the applicant shall maintain the facility for two years after development. An operations manual must be submitted for City review approval for the maintenance of the facility in all cases. The City is disinclined to own or maintain the stormwater facility. Adequate bonding is required to guarantee maintenance of the facility for a period of two years following final plat. Stormwater facilities must be located in a separate tract.

Potable Water

Water system connections are regulated by Clark Public Utility (CPU) and a permit and plan approval will be required for City plan approval. You were provided with a copy of the CPU Water Availability report at the meeting. Provide proof that the on-site well was properly abandoned.

Street Lighting

Street light design and installation is reviewed and approved by CPU. LID for street lighting is preferred.

Chapter 15.10 (Fire Code):

The builder shall plan for access road widths to accommodate the fire district's engines and aerial ladder truck. The ladder truck is 39 feet long and requires a clear area 20 feet wide to deploy its ladder outriggers.

Any *cul-de-sac* must have a 45-foot radius with no on-street parking allowed.

Hydrants. Fire hydrants during this development would normally be spaced every 500' feet (IFC 508.5.1). A looped water main system is preferred. The fire district urges the developer to install these hydrants before road paving and sidewalk construction begins. No obstruction will be allowed that would keep fire apparatus further than 10 feet from any hydrant in the project. A three foot clear radius shall be maintained around all hydrants. The location of all hydrants should be approved by the Fire District.

The project engineering staff should work closely with the fire district in regard to hydrant placement in the development.

Sprinklers. The fire district urges every developer and builder to consider installation of residential sprinklers in all homes in all projects. There are many advantages to residential sprinkler systems for the buildings occupants and firefighter safety.

Fire flow. The applicant shall provide a documented fire flow of 1,000 GPM to the subdivision. The Clark County Fire Marshal and Fire District 12 would lower this requirement to 500 GPM if every structure had an approved residential sprinkler system and a long term plan in place to eventually improve fire flow.

Building Comments

The building Official provided the following comments during the meeting:

1. Identify the proposed setbacks for each lot.
2. Submit a geotechnical report analyzing the development design and for lot infill. The report should propose plat development conditions for the builders, by lot if required.
3. The plat notes should stipulate amount of impervious/saturation development allowed (Maximum building lot coverage is 35 % and maximum impervious surface area is 50%).
4. Plat conditions for individual lot build out should include provision of adequate foundation drainage, in particular on the high side of the each lot.
5. If retaining walls are to be constructed there needs to be design details in the plat conditions for the builder(s). Any required walls shall be installed and approved before final occupancy approval. Other walls built shall be built to a plat standard detail.
6. Fencing should be uniform. Provide a fence detail.
7. An adequate absorption/dissipater design should be included in the plat conditions for storm water that can't flow by gravity to the storm lateral.
8. No lot's development shall create hazards or conditions for any adjacent lot.
9. Stormwater collected from newly created impervious sources or surfaces (roof, slabs, flatworks, etc) shall be terminated in an approved manner.
10. Provide a plat note and detail for a concrete truck washout area which builders and contractors shall be required to use and maintain until final build out.
11. Coordinate with Tim Dawdy, CCF&R regarding hydrant spacing and related fire flow and fire protections issues he might have.

Land Use

Legal Lot Determination:

Please submit an application for legal lot determination.

Chapter 18.130 (Low Density Residential)

The site is zoned LDR-7.5, low density residential with a minimum lot size of 7,500 feet. Single-family detached residential dwelling units are a permitted use within the zoning district.

The minimum average lot size in the district is 7,500 S.F. and the development must meet a minimum of 4 units per gross acre, minus right-of-way. The applicant proposes 4.6 units per net acre.

Ninety percent (90%) of all new parcels in this district must average within 10 percent of 7,500 square feet as a total development and any phase within the development. The remaining 10 percent of lots may

be reduced to 6,000 square feet as a result of density transfer per LCMC 18.300.130. Individual parcels may not be smaller than 6,000 square feet or larger than 11,000 square feet. LCMC 18.130.020(1)(a). All proposed lots exceed 7,500 S.F. except for two lots approximately 6,500 S.F. abutting proposed D St. No proposed lots exceed 11,000 S.F.

Clark County GIS indicates a mapped National Wetland on tax lot 986027-189. Washington Department Natural Resources FPARS web site indicates a class N seasonal stream that traverses the southeast corner of tax lot 98027-189. If Critical Areas are present density transfer is available. A maximum of 10% of the lots may be reduced if the applicant proposes to use the density transfer provisions of LCMC 18.300.

Each lot shall comply with the dimensional standards within Table 18.130.090.

Minimum Lot Width (feet)	Minimum Lot Depth (feet)	Minimum Front Yard Setback (feet)[1, 2]	Minimum Side Yard Setback (feet)[2]	Minimum Street Side Yard Setback (feet)[2]	Minimum Rear Yard (feet)[2, 3]
60	90	20	7.5	10	20

[2] The city may permit a minimum lot area of 6,000 square feet when critical areas are present and a transfer of density is proposed per LCMC 18.300.130. Under no circumstances may lots of less than 6,000 square feet be permitted.

[3] The maximum lot area of a lot abutting the urban growth area boundary may exceed 11,000 square feet pursuant to this section. A border lot also is subject to different setbacks. The maximum lot area also can be exceeded for multifamily development.

Maximum building lot coverage shall not exceed 35 percent. Maximum impervious surface area shall not exceed 50 percent. Your proposed plat should calculate building lot coverage per lot and total amount of impervious surface area to be created.

Chapter 18.190 Urban Holding District

The property currently has an Urban Holding 10 (UH-10) overlay. If the Public Works Director or City engineer certifies that the capital facility deficiencies associated with the property have been resolved, the City may remove the UH-10 overlay. The overlay can be removed concurrently with the approval of the Final Plat for development or as a separate Type II application and land use review not associated with subdivision approval. LCMC 18.190.060.

18.210 Subdivisions

Submittal Requirements (§§18.210.030): A completed application form and the following materials will be required, if applicable, prior to a determination of technical completeness (ten copies and an electronic version of all materials), please):

1. The information listed in LCMC §§18.210.010(2), provided an environmental checklist or EIS is required for a technically complete application unless categorically exempt.
2. Written authorization to file the application signed by the owner of the property that is the subject of the application, if the applicant is not the same as the owner as listed by the Clark County assessor.
3. Proof of ownership document, such as copies of deeds and/or a policy or satisfactory commitment for title insurance.
4. A legal description of the property proposed to be divided.
5. If a subdivision contains large lots or tracts which at some future time are likely to be re-subdivided, the application shall include a master plan of all land under common ownership in order to provide for extension and opening of streets at intervals which will permit a subsequent division of each divisible parcel into lots of smaller size.

6. A copy of the pre-application conference summary, if the application was subject to pre-application review, and all information required to address issues, comments and concerns in the summary.
7. A written description of how the proposed preliminary plat does or can comply with each applicable approval criterion for the preliminary plat, and basic facts and other substantial evidence that support the description.
8. The names and addresses of owners of land within a radius of 300 feet of the site. Owner names and addresses shall be printed on mailing labels.
   a. The applicant shall submit a statement by the assessor's office or a title company certifying that the list is complete and accurate, based on the records of the Clark County assessor within 30 days of when the list is submitted.
   b. If the applicant owns property adjoining or across a right-of-way or easement from the property that is the subject of the application, then notice shall be mailed to owners of property within a 300-foot radius, as provided above, of the edge of the property owned by the applicant adjoining or across a right-of-way or easement from the property that is the subject of the application.
9. Applications necessarily associated with the preliminary plat, such as applications for exceptions, adjustments or variances to dimensional requirements of the base or overlay zones or for modifications to the road standards in Chapter 12.10 LCMC that are required to approve the preliminary plat application as proposed.
10. A critical area delineation and assessment if required by Chapter 18.300 LCMC and an application for a critical area permit.
12. Preliminary grading, erosion control and drainage plans, which may be a single plan, consistent with applicable provisions of Chapter 18.320 LCMC.
13. Evidence that potable water will be provided to each lot from a public water system, and that each lot will be connected to public sewer.
14. A phasing plan, if proposed.
15. An archaeological predetermination
16. Additional information:
    a.
    b. A signed *Agreement to Pay Outside Professional Review Expenses Related to Land Use Application.* (Provided during the meeting.)

Vesting: Applications are vested on the date the city deems the application to be technically complete.

Subdivision Review Process: All correspondence must be submitted to the La Center City Clerk. Subdivision applications are processed as a Type III land use review requiring a public hearing before the La Center Hearing Examiner. Within 14 days after the Clerk finds the application technically complete, the Clerk shall mail a Notice of Application to you and adjacent property owners. The comment period shall remain open for a minimum of 14 days. The City will schedule a hearing within 78 days after the City finds the application to be technically complete. The City shall issue a staff report a minimum of seven calendar days prior to the hearing date. An appeal of the Hearing Examiner's decision must be made to the City Council within 14 days after the date of issuance of the decision.

Subdivision Approval criteria (LCMC 18.210.040): The applicant carries the burden of proof to demonstrate that the proposal complies with the following city regulations and standards:

- Chapter 12.05 LCMC, Sidewalks;
- Chapter 12.10 LCMC, Public and Private Road Standards;
- Chapter 15.05 LCMC, Building Code and Specialty Codes;
- Chapter 15.35 LCMC, School Impact Fees;

- Chapter 18.245 LCMC, Supplemental Development Standards;
- Chapter 18.300 LCMC, Critical Areas;
- Chapter 18.310 LCMC, Environmental Policy;
- Chapter 18.320 LCMC, Stormwater and Erosion Control;
- Title 18, Development Code;
- The subdivision must make appropriate provision for parks, trails, potable water supplies and disposal of sanitary wastes; and
- The subdivision complies with Chapter 58.17 RCW.

Subdivision General Issues:

1. To approve the preliminary plat, the Hearing Examiner must make an affirmative finding that "appropriate provision for potable water supplies and for the disposal of sanitary wastes".
2. All existing wells and septic systems must be properly decommissioned prior to final plat.
3. The City may refuse bonds in lieu of improvements at the time of final platting if such bonding has not been previously discussed and documented.
4. Flag lots are discouraged.
5. The preliminary plat shall expire five years from the date of the Final Order. RCW 17.58.140(3)(a).
6. Phasing is permitted. All phases must be identified on the preliminary plat.

Chapter 18.245 Supplementary Development Standards

The applicant did not include specific information regarding the fencing, hedging, solid waste, lighting, noise, and landscaping requirements regulated by Chapter 18.245. The subsequent application must address these specific issues.

Chapter 18.260 Variances

No variances have been requested.

Chapter 18.275 Sign Requirements

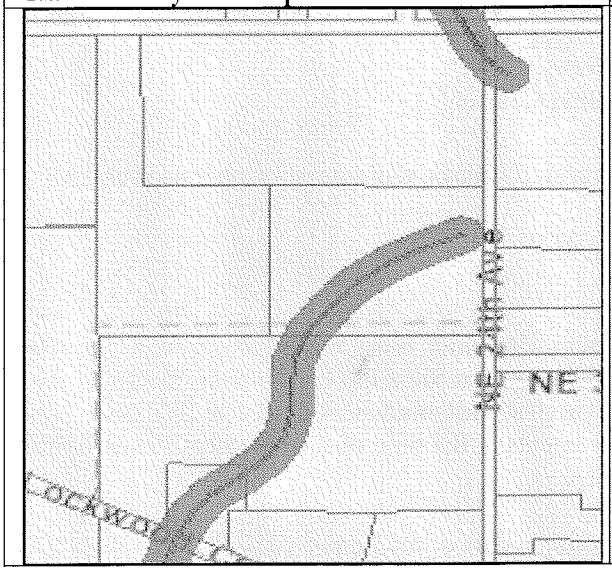
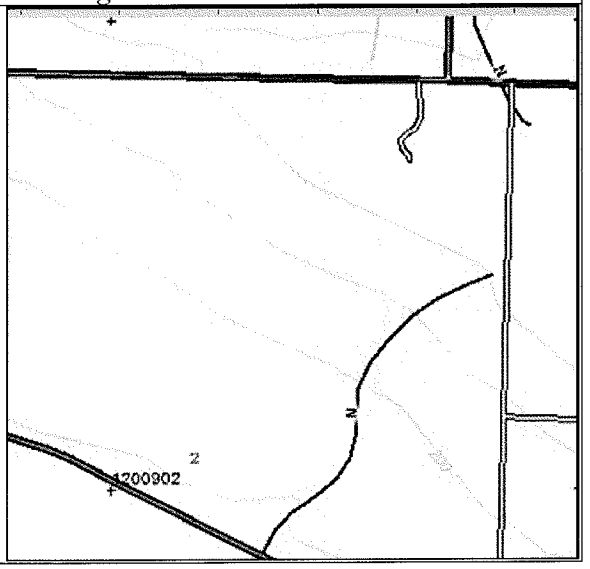
If proposed, monument signs must comply with this chapter.

Chapter 18.280 Off-Street Parking and Loading Requirements

Each dwelling unit shall be provided with two off-street parking spaces per Table 18.280.010. This may be accommodated with a note on the plat requiring each lot to provide two off-street parking spaces. Parking spaces within garages, carports and driveways serve to meet this requirement.

Chapter 18.300 Critical Areas

Department Natural Resources FPARS web site indicates a class N seasonal stream that traverses the southeast corner and northeast corner of tax lot 98027-189

Clark County GIS: Riparian Habitat	Washington DNR: FPARS – Class N Streams
	

Clark County GIS indicates a mapped National Wetland Inventory (NWI) and the presence of hydric soils (Odne) on tax lot 986027-189.

The applicant provided a "Preliminary Wetland Assessment" prepared by Cascadia Ecological Services, Inc. (Cascadia) dated October 14, 2014. Cascadia conducted wetland assessments and soil sampling in the mapped NWI wetlands and Odne soils. Cascadia concluded that based on field sampling and observations of "upland soils, lack of hydrophytic vegetation, and hydrology indicators, the property does not contain any City of La Center regulated wetlands …".

Cascadia reports the "presence of a "large drainage ditch" along the south boundary of Tax lot 986027-179. In places "the ditch is in excess of six feet deep". Cascadia concluded the ditch does not contain indicators of wetland hydrology and that it "likely conveys seasonal stormwater from the east rather quickly through the study area given the relatively consistent slope from east to west."

Cascadia's assessment of the "ditch" is consistent with that of a seasonal stream Cascadia did not address the possible Class N stream at the northeast corner of tax lot 98027-179. Type Np streams with low mass wasting potential and less than 3 feet in width on average require a 150-foot buffer. Type Ns streams with high mass wasting potential within a defined channel require a 75-foot buffer. LCMC Table 18.300.090(2)(f) – Riparian Areas. A complete applicant must include an assessment of the quality and function of both Class N streams.

Private improvements in critical areas are not permitted. Pervious trails and public facilities and services may be placed in critical areas and buffers. LCMC 18.300.050. **Platting lots in critical areas, such as riparian buffers is strongly discouraged.**

Chapter 18.310 (Environmental Policy)

The project review application must include a SEPA checklist and appropriate processing fees. The City will review the SEPA checklist and application materials and will make a threshold determination. The City will run the SEPA comment and land use comment period concurrently and will not make a

decision on the land use application until after the close of the SEPA comment period. An archeological predetermination is required.

Application Fees

An estimated fee schedule was provided during the meeting. Based upon the information provided to date, we estimate that the land use application fees will include: Critical Area review ($340); Legal Lot Determination ($425 + $75/lot); Preliminary subdivision plat ($3,400 +$135/lot); SEPA ($170 x 3); Variances (ranges from $425-$2,125/variance request). The applicant is responsible for payment of fees related to development/engineering review costs as contained in La Center Resolution No. 13-372 (copy provided at pre-application conference).

The City requires an applicant pay actual costs of outside professional services including engineering, legal, and planning. Impact fees shall be assessed against each lot at time of building permit.

January 8, 2015 - Conference Attendees

Name	Address	Phone	Email
Jeff Sarvis, Public Works Director	419 E Cedar Ave., Suite 201 La Center, WA 98629	360-263-7661	j.sarvis@ci.lacenter.wa.us
Tony Cooper, P.E., City Engineer	419 E Cedar Ave., Suite 201 La Center, WA 98629	360-263-2889	acooper@ci.lacenter.wa.us
Dave Johnson, Building Inspector	419 E Cedar Ave., Suite 201 La Center, WA 98629	360-262-7665	djohnson@ci.lacenter.wa.us
Eric Eisemann, Planning Consultant	215 W 4th St., #201 Vancouver, WA 98662	360-750-0038	e.eisemann@e2landuse.com

City of La Center

Rational Method Rainfall Intensity Design Values

Tc	Intensity (in./hr)			
minutes	2-year	10-year	25-year	100-year
5	**1.88**	**2.84**	**3.33**	**4.13**
10	1.32	2.00	2.32	2.86
15	1.08	1.63	1.87	2.31
20	0.93	1.40	1.61	1.98
25	0.83	1.25	1.43	1.76
30	0.76	1.14	1.30	1.60
35	0.70	1.06	1.20	1.47
40	0.65	0.99	1.12	1.37
45	0.62	0.93	1.05	1.29
50	0.58	0.88	1.00	1.22
55	0.56	0.84	0.95	1.16
60	0.53	0.80	0.91	1.11
120	0.38	0.56	0.63	0.77
180	0.31	0.46	0.51	0.62
240	0.26	0.40	0.44	0.53
300	0.24	0.35	0.39	0.47
360	0.21	0.32	0.35	0.43
420	0.20	0.30	0.33	0.40
480	0.19	0.28	0.30	0.37
540	0.18	0.26	0.29	0.35
600	0.17	0.25	0.27	0.33
660	0.16	0.24	0.26	0.31
720	0.15	0.23	0.25	0.30
780	0.15	0.22	0.24	0.29
840	0.14	0.21	0.23	0.27
900	0.14	0.20	0.22	0.26
960	0.13	0.20	0.21	0.26
1020	0.13	0.19	0.21	0.25
1080	0.12	0.18	0.20	0.24
1140	0.12	0.18	0.19	0.23
1200	0.12	0.17	0.19	0.23
1260	0.11	0.17	0.18	0.22
1320	0.11	0.17	0.18	0.22
1380	0.11	0.16	0.18	0.21
1440	0.11	0.16	0.17	0.21

Exhibit C
Isopluvial Maps for Design Storms in Clark County

2-Year, 24-Hour Isopluvials

Use no less than 2" for design storms

LA CENTER 2.25"

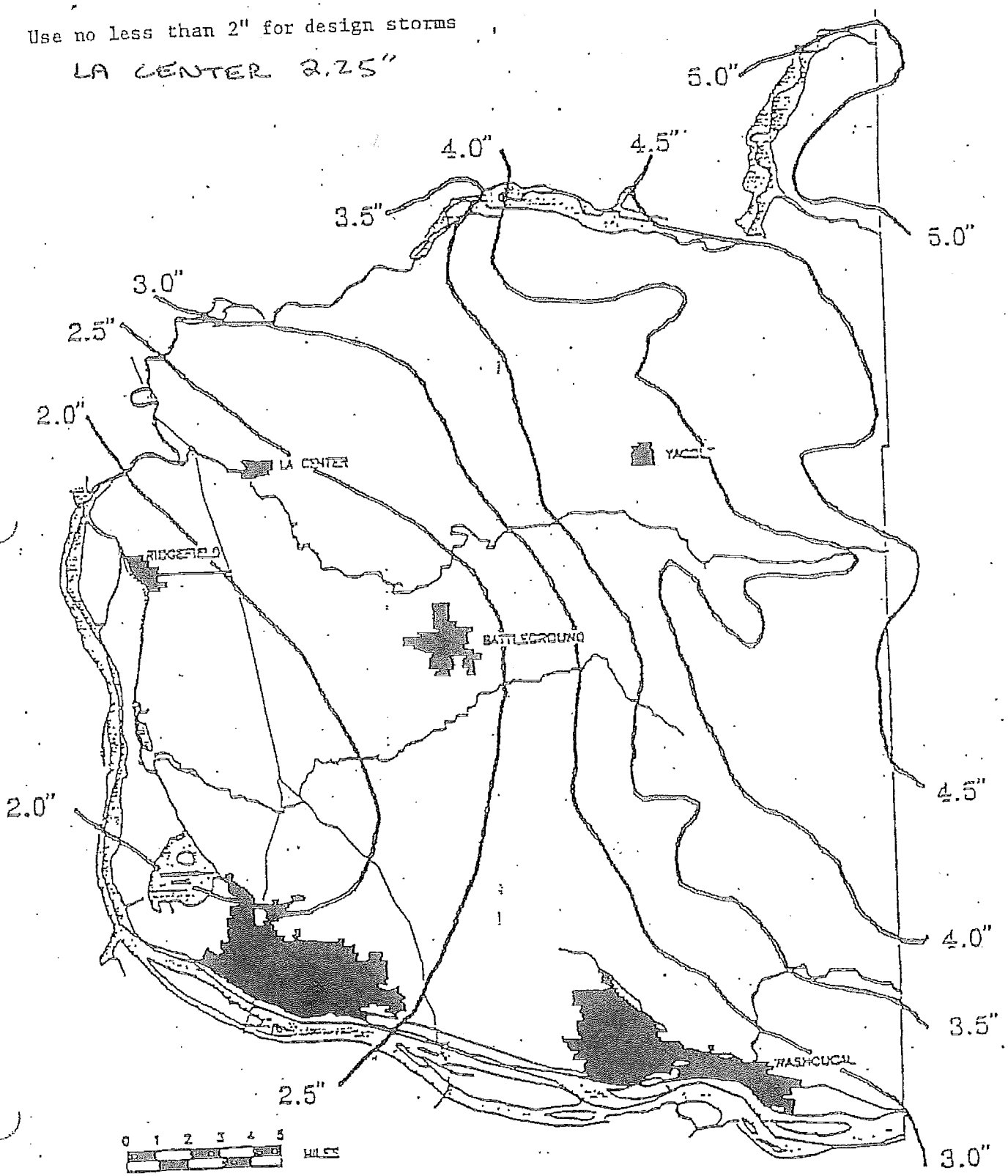
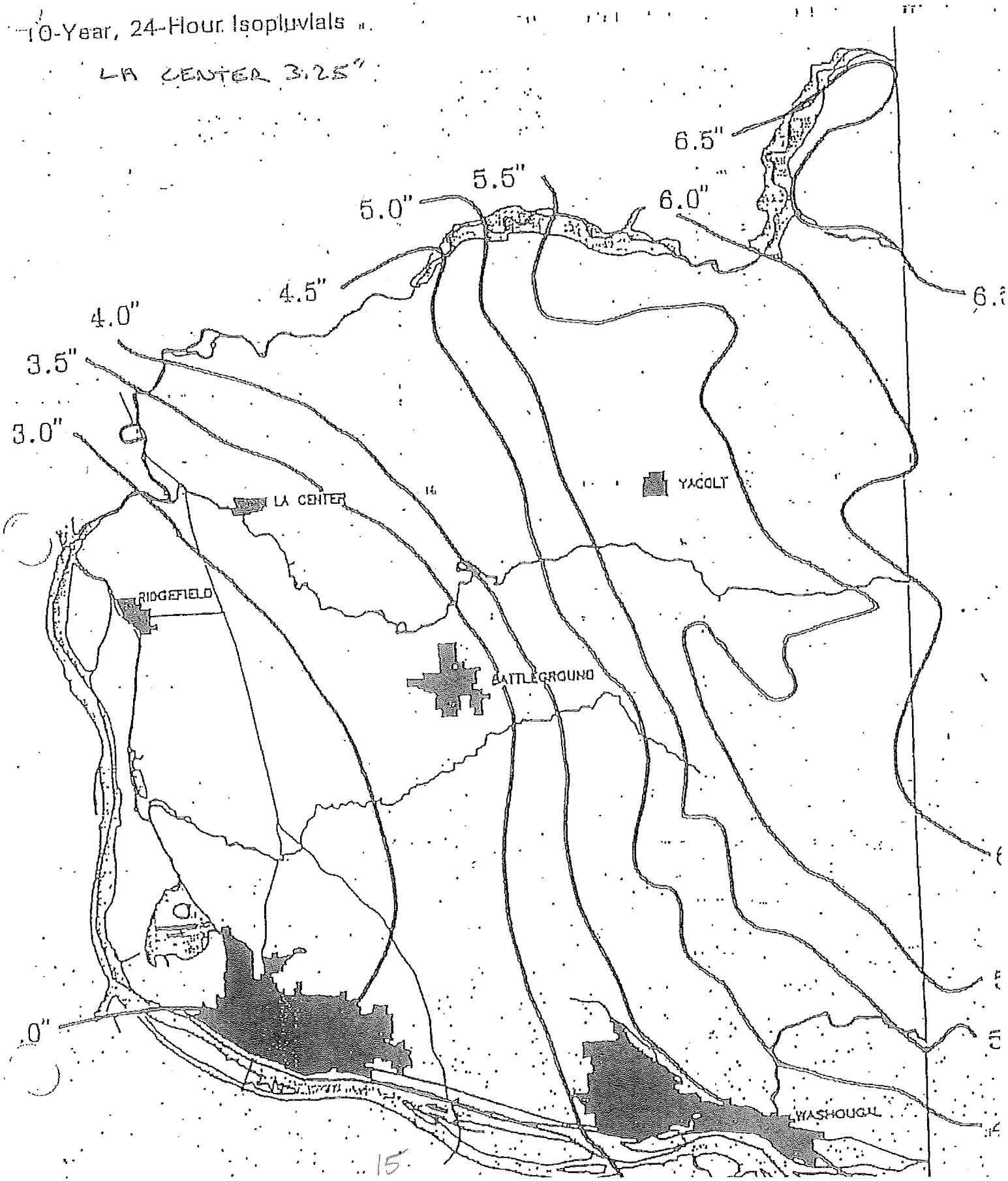


Exhibit C

Isopluvial Maps for Design Storms in Clark County



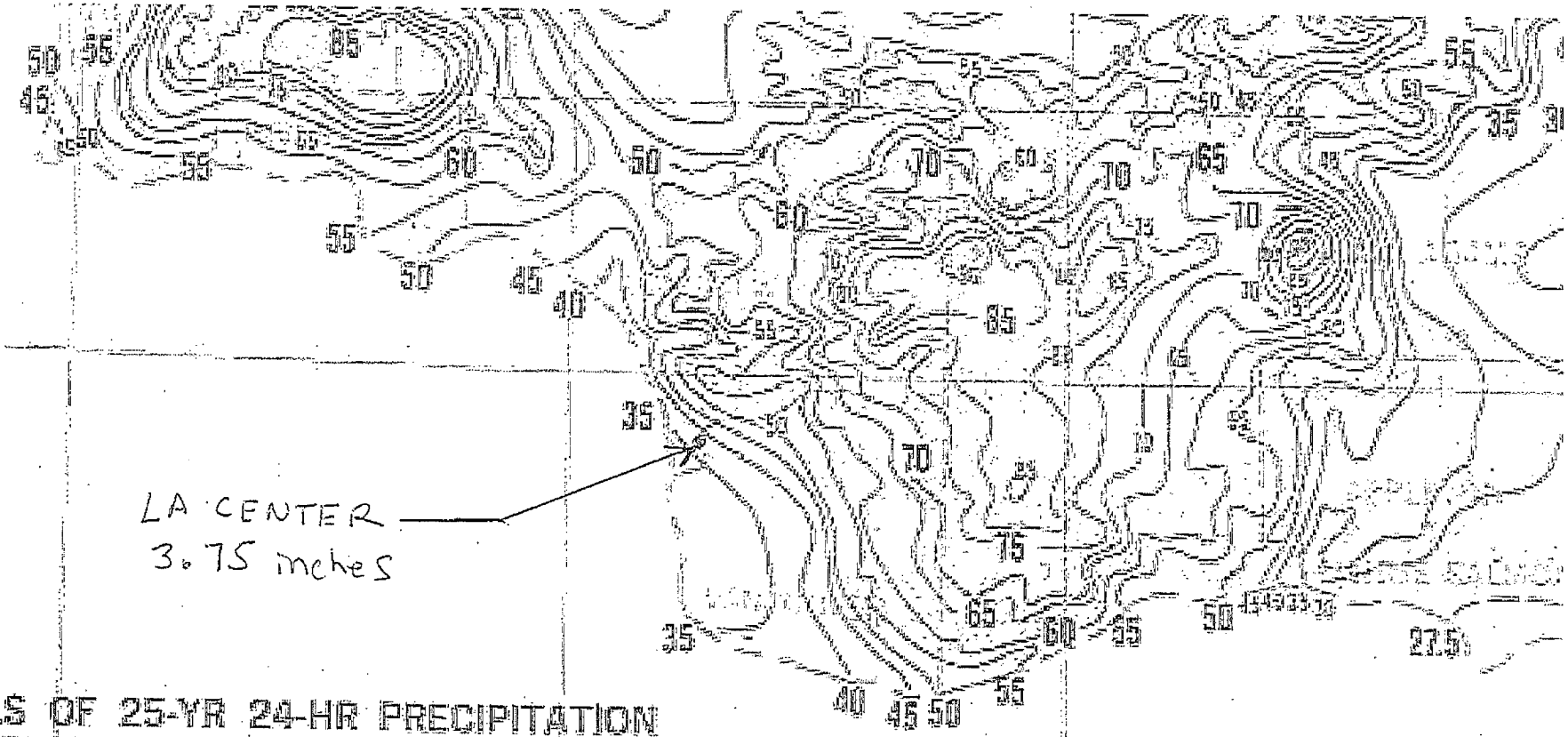


Figure 28

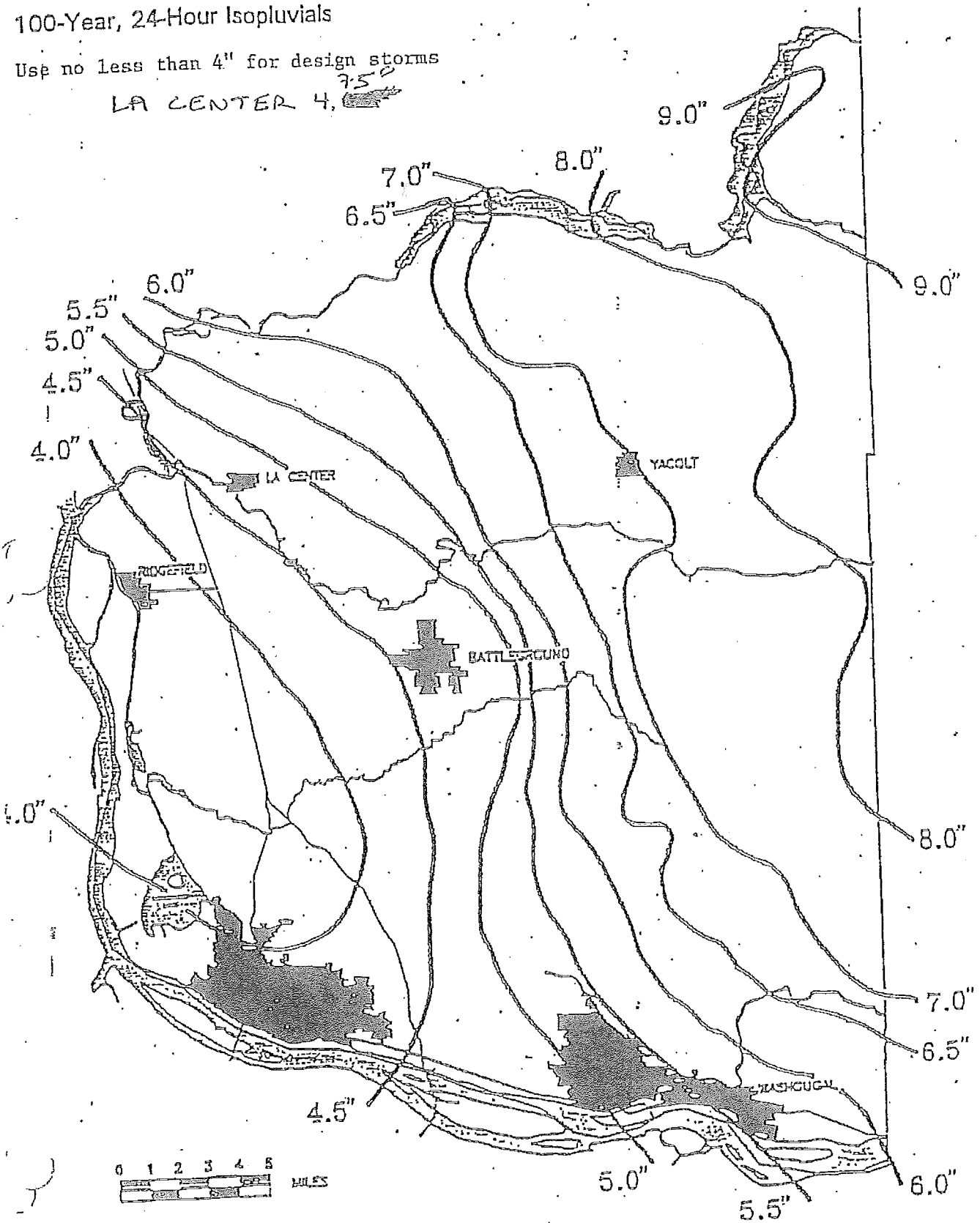
ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION
IN TENTHS OF AN INCH

Exhibit C
Isopluvial Maps for Design Storms in Clark County

100-Year, 24-Hour Isopluvials

Use no less than 4" for design storms

LA CENTER 4, 7.5



C2-1.2.2 System Hydraulics

System hydraulics should provide an optimum balance for the project's force main characteristics, pump selection, and minimum and maximum flows. The force main should be small enough in diameter to minimize solids deposition yet large enough that the total head permits a good pump selection and minimizes the requirements for surge protection facilities. Recommended sizing considerations for force mains are covered under the force main section (see C2-3). A cost-benefit analysis is often useful in selecting the best alternative.

Pump stations shall be designed to operate under the full range of projected system hydraulic conditions. Both new and old pipe conditions should be evaluated, along with the various combinations of operating pumps and minimum and maximum flows, to determine the highest head and lowest head pumping conditions. The system should be designed to prevent a pump from operating for long periods of time beyond the pump manufacturer's recommended normal operating range.

Selection of head loss coefficients for pipes and valves should be conservative to allow for installation and equipment variations and normal aging of the pumping system.

C2-1.2.3 Number of Pumps

The number of pumps selected shall allow the station to provide the peak design flow with the largest pump out of order. Also, the number of pumps should correlate to the wetwell size and prevent excessively short periods between pump starts. On constant speed pump stations, the number of pumps is often based on the pumping capacity required to provide a minimum scour velocity in the force main.

C2-1.2.4 Pump Selection

Pumps should be designed for pumping sewage and capable of passing solids at least 3 inches in diameter. Pump suction and discharge should be 4 inches or greater. Exceptions to these criteria are discussed in the sections on grinder pumps and septic tank effluent pumps (see C1-10).

C2-1.2.5 Wetwells

Sewage pump station wetwells should be designed to provide acceptable pump intake conditions, adequate volume to prevent excessive pump cycling, and sufficient depth for pump control, while minimizing solids deposition.

For constant speed pumps, the minimum volume between pump on and off levels can be calculated using the following general formula:

$V = tQ/4$, where

V = minimum volume (gallons)

t = minimum time between pump starts

Q = pump capacity (gallons/minute)

Recommendations for various pump intake designs can be found in the references included at the end of this chapter. At normal operating levels, the designer should consider the following recommendations:

ANALYSIS OF PUMP STATION 2

Existing Capacity: 0.29 MGD

Existing Gravity Flow Entering PS 2:

"Stonecreek Estates"
Elementary School
Middle School
High School
Community Center/Park

545 pers = 202 ERU
2.71

Total existing ERU's = 78 = 210 persons = 0.023 MGD (gravity feed)

Flow from PS 3 = 0.037 MGD (not peaked)

Peaking Factor = 3.96 (based on population from Basins D1 & D2 (545 persons))

=> Existing Peaked Flow = (0.023 MGD + 0.037 MGD)(3.96) = 0.24 MGD ✓

Proposed Flow Entering PS 2 (with additional 121 lots):

Total proposed ERU's = 202+121 = 323 = 872 persons = 0.096 MGD ✓

Peaking Factor = 3.84 ✓

=> Proposed Peaked Flow = (0.096 MGD)(3.84) = 0.37 MGD

The addition of 121 residential lots will exceed the current operating capacity of Pump Station 2 by approximately 28%.

ANALYSIS OF FORCE MAIN 2

Existing Capacity: 0.45 MGD

Proposed Flow Entering FM 2 (with additional 121 lots) = 0.37 MGD (from above)

The addition of 121 residential lots will not exceed the current operating capacity of Force Main 2.

As can be seen from the analysis on the previous sheets, the capacity of Pump Station 2 is the "choke point" of the downstream system with regards to the proposed "Sunrise Terrace" development project. As shown, Pump Station 3, Force Main 3, and Force Main 2 each have existing capacity to serve the proposed 121 lots in "Sunrise Terrace". Pump Station 2 actually has existing capacity to accommodate an additional 50 lots. Therefore, if the "Sunrise Terrace" project were phased, it would be reasonable to allow the development of up to 50 lots prior to requiring upgrades to Pump Station 2. The calculation below documents this finding.

ANALYSIS OF PUMP STATION 2 (with addition of only 50 lots)

Existing Capacity: 0.29 MGD ← 2 pumps simultaneously (N.O.) use 1 pump per P.I.C.

Proposed Flow Entering PS 2 (with additional 50 lots):

Peak = 0.144 MGD

Total proposed ERU's = 202+50 = 252 = 680 persons = 0.075 MGD

Peaking Factor = 3.90

=> Peaked Flow = (0.075 MGD)(3.90) = 0.29 MGD

The addition of 50 residential lots will not exceed but will bring Pump Station 2 to It's current operating capacity.

↳ Not Correct - Capacity one Pump @ 0.144 MGD capacity

In this study we have focused on the larger concerns that were emphasized within the General Sewer Plan for this portion of the city. Obviously, there are other areas of the existing sanitary sewer infrastructure that must be analyzed for capacity such as the sewer mains leading to Pump Station 3. Another item to consider is that any upgrades to either Pump Station 2 or 3 will likely require upgrades to the respective force mains to handle the higher flows that will be generated by the Pump Station upgrades.

The intent of this analysis has been to demonstrate that there is remaining capacity within the existing sanitary sewer system presently and to identify at what point upgrades to the system are needed in order to maintain a properly functioning system.

Proposed Flow with additional 50 ERU's

ANALYSIS OF PUMP STATION 3

Existing Capacity: 0.29 MGD

Existing Gravity Flow Entering PS 3:

"Parkside Estates" 46 lots
"Lockwood Creek" 76 lots
Post office (assume 1 ERU)
Library (assume 1 ERU)

Total existing ERU's = 124 = 335 persons = 0.037 MGD

Peaking Factor = 4.06

=> Existing Peaked Flow = (0.037 MGD)(4.06) = 0.15 MGD

0.144 pump capacity, peak pump station flow for one pump is 0.144/mg. Existing peak capacity of pump station #3 is currently exceeded.

Proposed Flow Entering PS 3 (with additional 121 lots):

Total proposed ERU's = 124+121 = 245 = 661 persons = 0.073 MGD

Peaking Factor = 3.91

=> Proposed Peaked Flow = (0.073 MGD)(3.91) = 0.29 MGD

The addition of 121 residential lots will not exceed but will bring Pump Station 3 to It's current operating capacity.

ANALYSIS OF FORCE MAIN 3

Existing Capacity: 0.45 MGD

Proposed Flow Entering FM 3 (with additional 121 lots) = 0.29 MGD (from above)

The addition of 121 residential lots will not exceed the current operating capacity of Force Main 3.

SANITARY SEWER NARRATIVE

The proposed "Sunrise Terrace" residential subdivision project comprises approximately 34.4 acres and is planned for a total of 121 lots. The project contains tax parcels 209047-000, 986027-188, 986027-189, and a portion of 209062-000. All of these properties lie within sewer drainage basin D2 as specified in the City of La Center's General Sewer Plan. The proposed point of connection to the existing city sewer system is near the intersection of Lockwood Creek Road and East 18th Place. A large amount of helpful information exists within the current General Sewer Plan prepared by Wallis Engineering in 2006. In it, all assumptions used in the analysis of existing and future flows is described and documented.

The purpose of this study is to analyze the effects that the proposed project will have on the existing sanitary sewer infrastructure. The study specifically examines existing Pump Stations 2 & 3 as well as their respective force mains. The primary concern is that when the additional sanitary sewer flows from the proposed development are added to the existing flow, the capacities of either of these pump stations and/or their force mains may be exceeded. We have used the same assumptions and design methodology as has been presented in the General Sewer Plan for our analysis of the impacts from the proposed "Sunrise Terrace" project. The primary assumptions dealing with the way flows are computed are listed below.

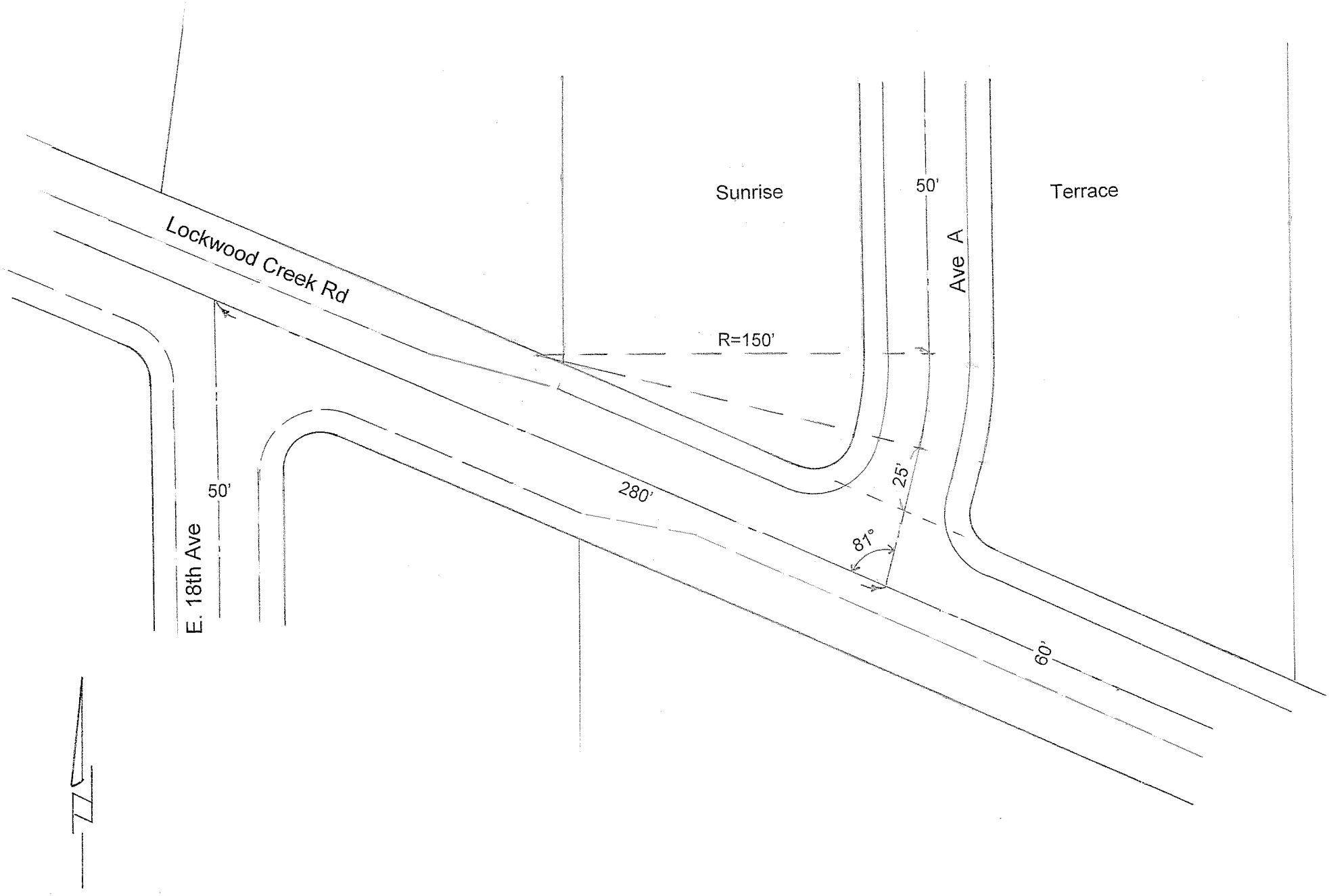
1 lot = 1 Equivalent Residential Unit (ERU)

1 ERU = 2.7 persons

Daily Use = 110 gal/day/person (includes Infiltration & Inflow (I & I))

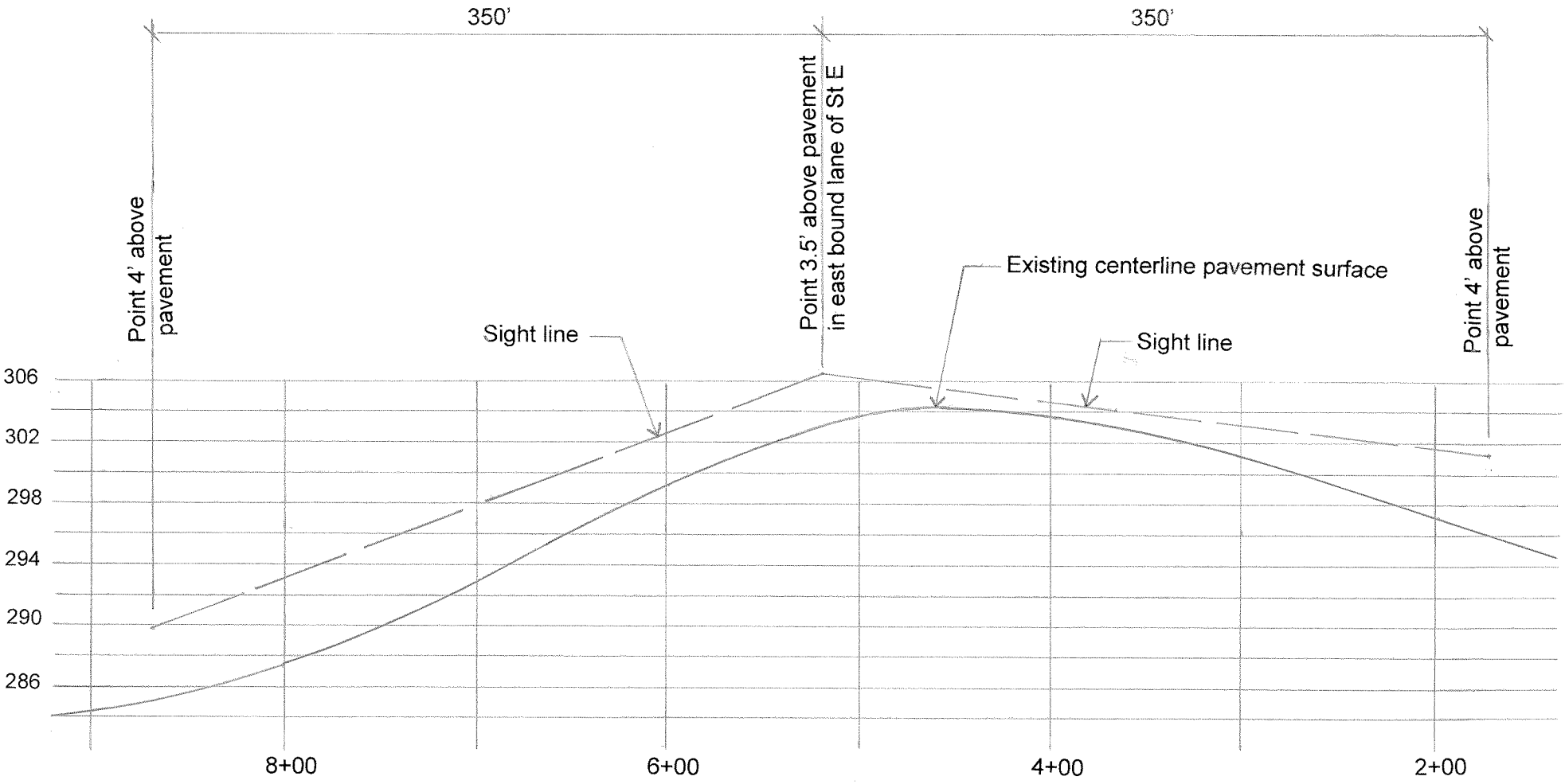
Peaking Factor = 1+ 14/(4+P^.5) where P = population in thousands

Circulation Plan



Scale: 1" = 50'

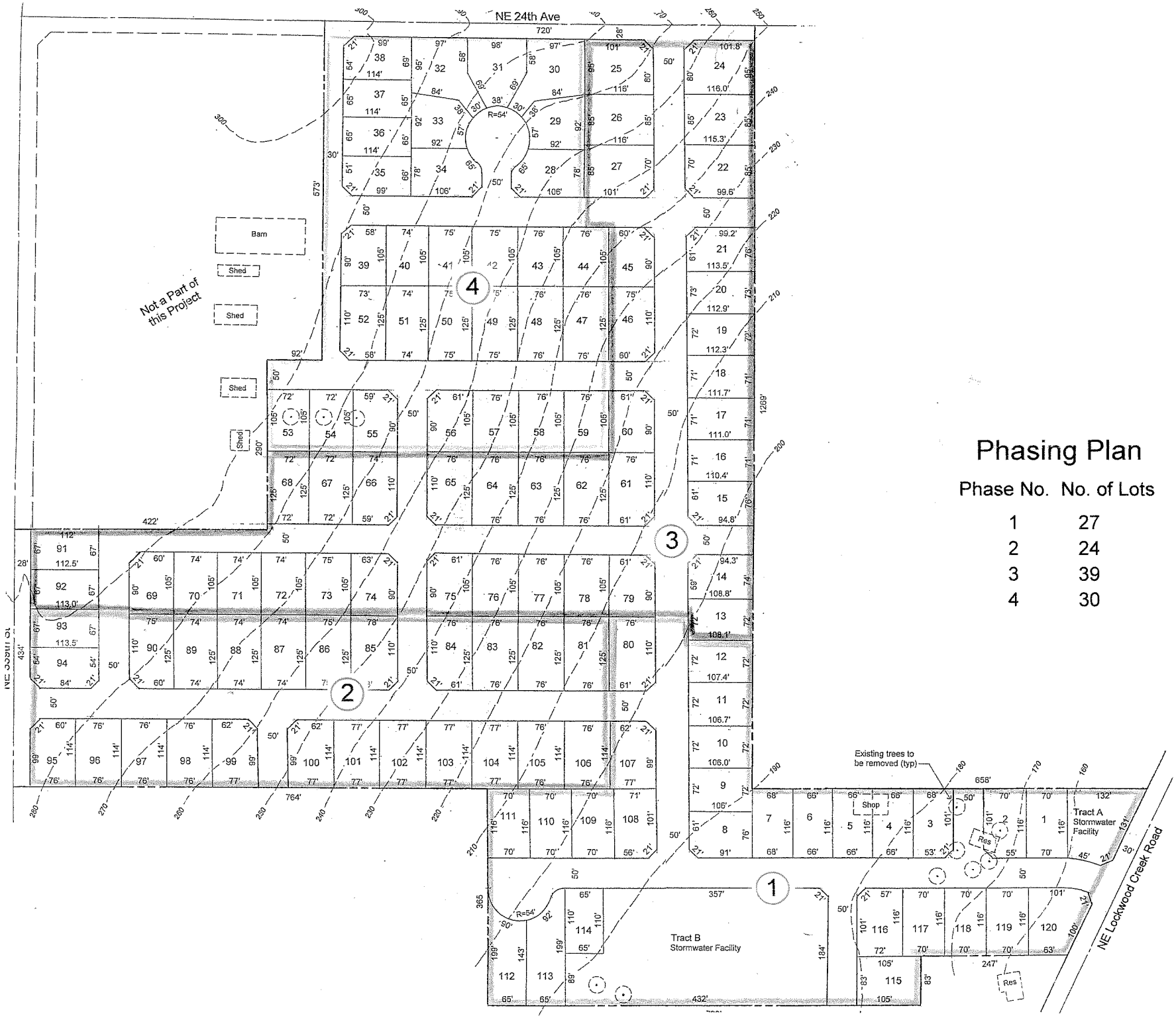
Intersection Spacing Analysis



Centerline Profile of NE 24th Ave
Stationing: 0+00 at centerline intersection of NE 339th St

Horiz: 1" = 80'
Vert: 1" = 10'

Sight Distance Analysis
at NE 24th Ave & Proposed St E



Phasing Plan

Phase No.	No. of Lots
1	27
2	24
3	39
4	30

ANSTINE RICHARD & ANSTINE SARA
PO BOX 10
LA CENTER WA, 98629

BARSNESS TODD & BARSNESS
2420 NE 340TH CIR
LACENTER WA, 98629

BLACKWELL LAURA
33509 NE 24TH AVE
LA CENTER WA, 98629

BLANCAS DALE & PONA-PARTIDA
230 E 18TH PL
LACENTER WA, 98629

BREWER JOSEPHINE L
2216 NE 339TH ST
LA CENTER WA, 98629

BURSON NORMAN D
219 E 18TH PL
LA CENTER WA, 98629

BYERS JANSON & BYERS KARA
17622 85TH AVE NE
ARLINGTON WA, 98223

CHISHOLM SCOTT S
312 E 18TH PLACE
LA CENTER WA, 98629

ELLERTSON PROPERTIES II LLC
PO BOX 1864
BATTLE GROUND WA, 98604

EXCELSIOR MORTGAGE EQUITY FUND
5800 SW MEADOWS RD STE 230
LAKE OSWEGO OR, 97035

FOWLER JANICE
PO BOX 22
WOODLAND WA, 98674

GODWIN CRAIG A & GODWIN TRACEY
33119 NE 24TH AVE
LA CENTER WA, 98629

HANTHO FRED M
1376 SW CHARLES ST
DUNDEE OR, 97115

JENSEN BRYON L
1613 E 4TH WAY
LACENTER WA, 98629

JOHNSON GERALD
PO BOX 621
RIDGEFIELD WA, 98642

JOHNSON GERALD L
PO BOX 621
RIDGEFIELD WA, 98642

LEWIS WILLIAM R & LEWIS CHRISTINE
311 E 18TH PL
LACENTER WA, 98629

MANNING KENNETH & MANNING
1819 NE 339TH ST
LACENTER WA, 98629

MANNING KENNETH L & MANNING
1819 NE 339TH ST
LACENTER WA, 98629

MCCARTHY JOHNNY B & STEINMETZ
310 E 18TH PL
LA CENTER WA, 98629

MORRICE-ROBY JANET M
33509 A NE 24TH AVE
LACENTER WA, 98629

NORDEN LEE E
727 3RD ST
WOODLAND WA, 98674

PENSCO TRUST COMPANY CUSTODIAN
PENSCO TRUST COMPANY
DENVER CO, 80217

PERROTT JOHN S & PERROTT SANDY
PO BOX 128
LACENTER WA, 98629

REED PATRICIA KAY
2000 NE LOCKWOOD CREEK RD
LACENTER WA, 98629

RIVERS FRED B & RIVERS ANNA M
33911 NE 24TH AVE
LACENTER WA, 98629

RUKLISS ANDREW K & RUKLISS CAROL
33404 NE 24TH AVE
LA CENTER WA, 98629

RUNNELS JOSHUA JAMES & RUNNELS
227 E 18TH PL
LA CENTER WA, 98629

SCHMALTZ STEVEN L
226 E 18TH PL
LACENTER WA, 98629

SMITH MARK S & SMITH CHRISTY M
307 E 17TH PL
LACENTER WA, 98629

VAN NESS DONALD R ETAL
34215 NE 23RD AVE
LA CENTER WA, 98629

WEIL RICK & WEIL ROBIN L
PO BOX 1808
LACENTER WA, 98629

WINCHELL KRISTINE
PO BOX 776
LACENTER WA, 98629

Transamerica Title Insurance Co

A Service of Transamerica Corporation

THIS SPACE RESERVED FOR RECORDER'S USE:

G 628270 862071

Filed for Record at Request of Mail –
Name First Ind. Bank
Address 1313 Main Street
City and State Vancouver, Washington

FILED FOR RECORD
CLARK CO. WASH.
Pioneer National Title Ins. Co.
MAR 13 4 39 PM '73
AUDITOR DON BONKER

Statutory Warranty Deed

FORM NO. W-964 (PREV. 467-1)

THE GRANTOR ROBERT L. GRANGER AND LARIENE GRANGER, husband and wife

for and in consideration of TEN AND NO/100 ($10.00) DOLLARS AND OTHER CONSIDERATIONS

in hand paid, conveys and warrants to LEE E. NORDEN AND JANET L. NORDEN, husband and wife

the following described real estate, situated in the County of Washington: CLARK , State of

Beginning at a point 12 chains South and 0.15 chains West of the Northeast corner of the Northwest quarter of Section 2, Township 4 North, Range 1 East of the Willamette Meridian, in Clark County, Washington; thence West 5.40 chains; thence South 10.90 chains; thence East 1.25 chains; thence South 4.06 chains to the center of the County Road; thence South 64° East along the center of said Road, 4.63 chains; thence north 17.03 chains to the point of beginning.

Subject to: Restrictions, Easements, and Reservations of record.

19.00

Real Estate Excise Tax
Sh. 11 Rev. Laws 1951
$190.00 has been paid
Rcpt. #108885 Date 3/13/73
Sec. 61, Sec. Mid. No.
June S. Sparks
Clark County Treasurer
By
Deputy

TAX ON CONVEYANCES — STATE OF WASHINGTON DEPARTMENT OF REVENUE — CH. 180 LAWS OF 1935 — TWO DOLLARS

TAX ON CONVEYANCES — STATE OF WASHINGTON DEPARTMENT OF REVENUE — CH. 180 LAWS OF 1935 — TWO DOLLARS

TAX ON CONVEYANCES — STATE OF WASHINGTON DEPARTMENT OF REVENUE — CH. 180 LAWS OF 1935 — FIVE DOLLARS

Dated this 9th day of March ,19 73

Robert L. Granger (SEAL)
Robert L. Granger

Larlene Granger (SEAL)
Larlene Granger

STATE OF WASHINGTON, }
County of Clark } ss.

On this day personally appeared before me Robert L. Granger and Lariene Granger

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 mentioned.

GIVEN under my hand and official seal this 9th day of March ,19 73

NOTARY PUBLIC

Janet L. Norden
Notary Public in and for the State of Washington, residing at Vancouver

84652

3684242
Page: 1 of 2
07/28/2003 04:25P
FIDELITY NATIONAL TITLE D 20.00 Clark County, WA

Name: Mr. and Mrs. Perrott
Address: 2219 NE 339th Street
City, State: La Center, WA 98629

Real Estate Excise Tax
Ch. 11 Rev. Laws 1951
EXEMPT
Affd. # 523747 Date 7-28-03
For Details of tax paid see
Affd. #
Doug Lasher
Clark County Treasurer
By
Deputy

Fidelity National Title Company of Washington, Inc.

S2T4N R1E, WM

QUIT CLAIM DEED

V31704 LC

THE GRANTOR John Scott Perrott and Sandra Decker-Perrott, husband and wife

for and in consideration of mere change in identity

conveys and quit claims to John S. Perrott and Sandra D. Perrott, husband and wife the following described real estate, situated in the County of Clark, State of Washington, including any after acquired title:

SEE EXHIBIT 'A' ATTACHED HERETO AND BY REFERENCE MADE A PART HEREOF

Tax Account No.: 209062-000

Dated: July 18, 2003

John Scott Perrott

Sandra Decker-Perrott

STATE OF WASHINGTON
COUNTY OF CLARK

I certify that I know or have satisfactory evidence that John Scott Perrott and Sandra Decker-Perrott the person(s) who appeared before me, and said person(s) acknowledged that they signed this instrument and acknowledged it to be their free and voluntary act for the uses and purposes therein mentioned in this instrument.

Dated: 7-22-03

LINDA C. COMLEY NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 5-30-07

Notary Public in and for the State of Washington

Residing at ~~Vancouver~~ Battle Ground, WA

My appointment expires: 5-30-07

Linda C. Comley

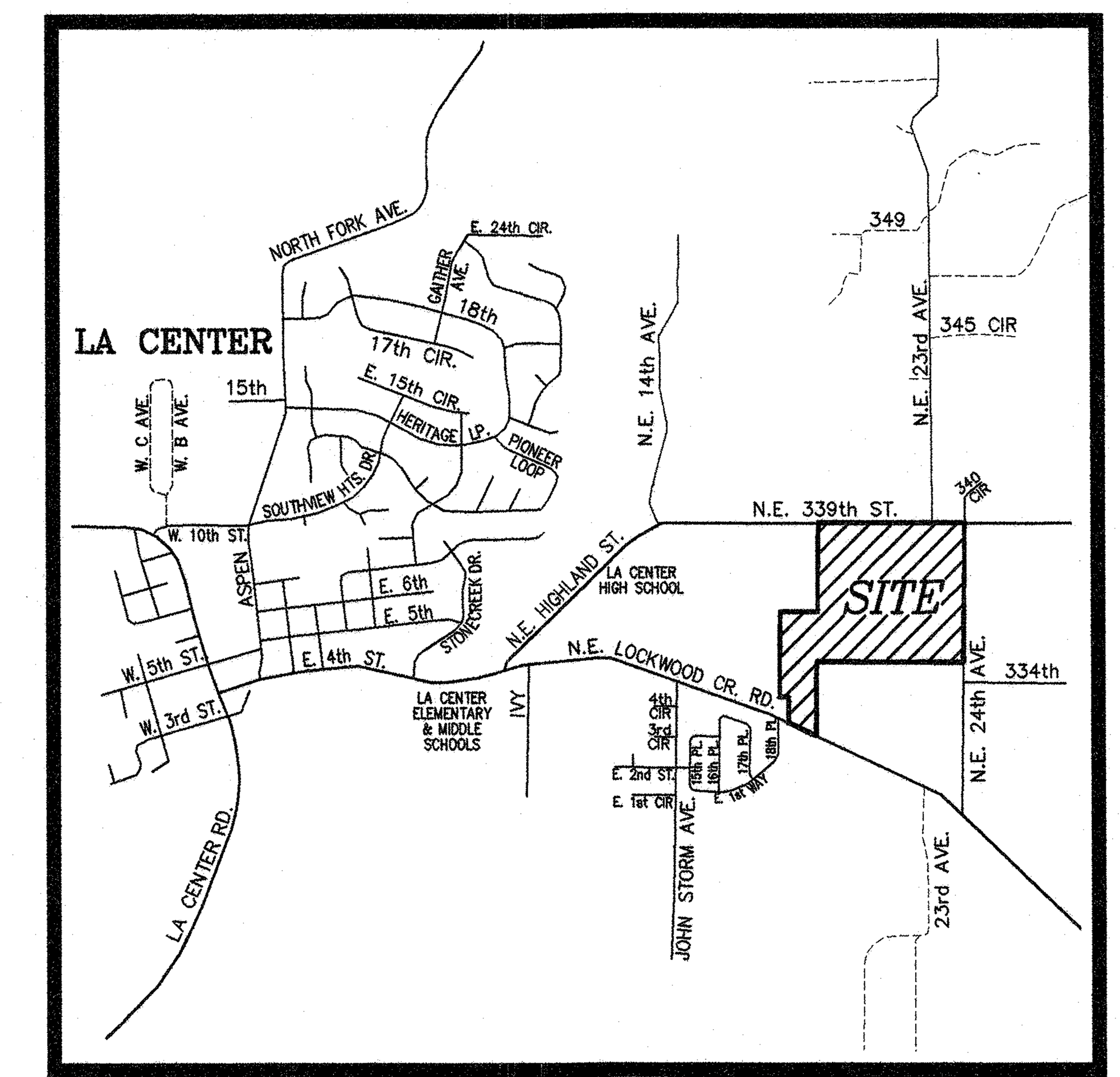
EXHIBIT 'A'

DESCRIPTION:

ORDER NO: V31704 LC

A parcel of property in the West half of the Northeast quarter of Section 2, Township 4 North, Range 1 East of the Willamette Meridian in Clark County, Washington, described as follows:

BEGINNING at the Northeast corner of said West half of the Northeast quarter of Section 2; thence South 1°48'40" West along the East line of said West half, 1229.66 feet; thence North 88°11'22" West 1297.17 feet to the West line monumented by Olson Engineering, Inc. as shown in that survey recorded in Book 28 at Page 24, records of Clark County, Washington; thence North 0°58'08" East along said line, 363.84 feet; thence North 0°28'57" East along said line, 147.65 feet; thence North 1°35'10" East along said line, 398.98 feet; thence North 1°12'58" East 299.21 feet to the West line of said Northeast quarter of Section 2; thence North 1°49'22" East along said West line 20.00 feet to the North line of said Section 2; thence South 88°31'46" East along said North line 427.34 feet to the South quarter corner of Section 35, Township 5 North, Range 1 East of the Willamette Meridian; thence South 88°01'48" East along the North line of said Section 2, a distance of 883.28 feet to the point of beginning.



VICINITY MAP

APPLICANT:

RK LAND DEVELOPMENT
1520 S.W. EATON BLVD.
BATTLE GROUND, WA 98604
PHONE: (360) 608-3991

NOTES:

ALL STORMWATER RUNOFF GENERATED FROM THE PROJECT SITE WILL BE TREATED AND DETAINED ON THE SITE.

STORMWATER RUNOFF FROM THE PROPOSED DEVELOPMENT WILL BE TREATED WITH THE USE OF WETPONDS PRIOR TO RELEASE FROM THE SITE.

STORMWATER RUNOFF FROM THE PROPOSED DEVELOPMENT WILL BE DETAINED WITH THE USE OF A SURFACE DETENTION POND TO LIMIT THE PEAK DISCHARGE RATES LEAVING THE SITE.

ALL ROOF DRAINAGE WILL BE DIRECTED TO THE STREET OR DIRECTLY TO THE STORM PIPE SYSTEM.

THE WOLFE GROUP, L.L.C.
Land Planning, Consulting & Civil Engineering
2401 W. Main Street, Suite 210
Battle Ground, WA 98604
(360) 687-2699

SUNRISE TERRACE

A Residential Subdivision in the N.E. 1/4 of Section 2 T.4N., R.1E., W.M. in the City of La Center, Clark County, WA

PRELIMINARY STORMWATER PLAN

JOB #: 15-05
DESIGNED: JEW
DRAWN: JEW
APPROVED: JEW
DATE: JULY 2015
SCALE: HORIZ.:1"=100' VERT.:N/A
SHEET 1 / 1

Harper
Houf Peterson
Righellis Inc.

Sunrise Terrace

GRR-01

Sewer Basin Capacity Analysis

June 22, 2015 (REV)

Prepared For:

Ed Greer
8002 NE Hwy 99 #546
Vancouver WA 98665
ed@ed-greer.net

Prepared By:

Harper Houf Peterson Righellis Inc.
1104 Main Street, Suite 100
Vancouver, WA 98660
P: 360-750-1131 F: 360-750-1141

Rob VanderZanden, P.E.

HHPR

ENGINEERS ◆ PLANNERS
LANDSCAPE ARCHITECTS ◆ SURVEYORS

SUNRISE TERRACE May 26, 2015
SEWER BASIN CAPACITY ANALYSIS

BACKGROUND

Ed Greer, Consultant, has submitted an application entitled Sunrise Terrace to the City of La Center on behalf of RK Land Development. The proposal is to subdivide approximately 35 acres in the LDR-7.5 zone into 121 residential lots. The city has requested that a sewer basin analysis be prepared to evaluate the impact of this proposal on the existing collection system and to establish what the future capacity requirements will be for the sewer collection system serving the project area. In particular the city has requested the analysis to address system capacity required to accommodate build out in sewer sub-basins D2 and D3 as identified in the La Center General Sewer Plan dated July 2006, hereinafter "GSP".

APPROACH

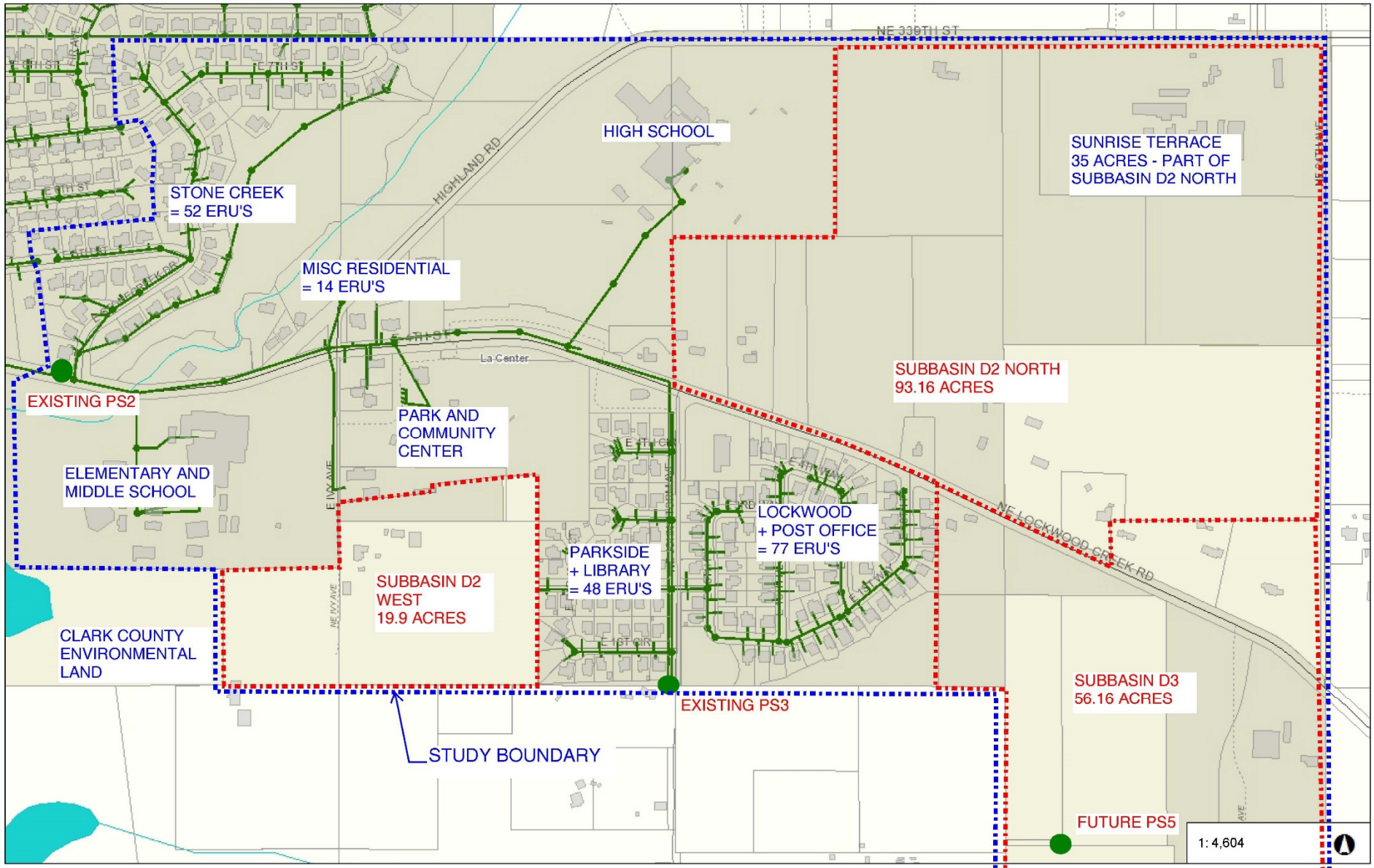
The analysis uses measure basin flows rather than the flows estimated by the GSP. To establish future flows, the current average flow rates were determined using pump station records. City of La Center provided data that was used to evaluate average pump run times and pump capacity. The current "equivalent residential unit" (ERU) flow rate was calculated for residential properties and per capita flows were established for the schools. The future condition is based on estimated residential densities for developable properties and uses the calculated ERU. For the schools, a future condition of 10 percent growth is used with the assumption that growth in excess of 10 percent will require constructing new schools at alternate locations. Required capacities of the various system elements have been determined in accordance with criteria established in the Washington Department of Ecology "Criteria for Sewage Works Design", hereinafter "DOE Design Manual".

BASIN INFORMATION

The study area is shown on Figure 1 and primarily consists of Basin D2 and D3 as defined in the La Center GSP. A portion of Basin C contributes to Pump Station 2 and has been included in the study area in order to evaluated future pumping needs at PS2. As shown on Figure 1, the study area has been divided into 10 sub-basins as follows:

Sub-basin	Approximate Area	Description
D3	56.16 ac	Future LDR 7.5 Residential areas
D2 North	93.16 ac	Future LDR 7.5 includes Sunrise Terrace
Lockwood	24 ac	Existing Residential 77 ERU's
Parkside	13 ac	Existing Residential 48 ERU's
D2 West	19.9 ac	Future LDR 7.5
High School	29.4 ac	High School – Population 602
City of La Center	11.5 ac	Park/Comm Center and Shop
Elem/Mid School	26 ac	Elem/Mid School Population 1150
Misc Residential	+/- 30 ac	14 residences generally on E 4th Street
Stone Creek	+/- 20 ac	52 units in subdivision contribute to PS2

FIGURE 1 LA CENTER SEWER BASIN STUDY AREA



The collection system components are shown on Figure 2. The elements of the system to be evaluated include:

- Lift Station #2 on the downstream end of the basin and the associated force main;
- an existing 8 inch gravity sewer in E 4th Street;
- the 4 inch force main from Lift Station #3 which discharges to the upstream end of the 8 inch gravity sewer;
- Lift Station #3
- A future Lift Station #5 (as designated in the current La Center Sewer Plan) and associated force main.

PUMP STATION DATA

City of La Center provided pump station SCADA records for several one week periods over the past year. Each of the data sets provides minute by minute pump run data (i.e. 1440 lines of data per day). Beginning with the records from February 2015, wetwell liquid level is also include in the data files. The records were used to determine the average annual pumping rate for pump stations #2 and #3. To balance the data, four seasonal averages were calculated and from the seasonal numbers, the annual average pump run time was calculated. A spreadsheet that demonstrates the summary of these calculation is included in Appendix 1. The one-year average run time for the two pump stations from these calculations are:

Pump Station	Average Run Time Minutes/Day
No. 2	374.6
No. 3	353.2

The city conducted drawdown tests at the two pump station to determine the pumping rates for the stations. This information was compared to calculations made from the SCADA records using the wetwell liquid levels. By processing the data for change in liquid level, a weekly in-flow volume was calculated. When divided by pump run time, a pumping rate was calculated: (i.e. gal per week / minutes per week = pumping rate, gpm). The SCADA data generally supported the city's findings from draw down testing and as a result, the following current pumping rates are used:

Pump Station	Average Pump Rate - gpm
No. 2	130
No. 3	58

On the basis of the above data, the one-year average amount pumped each day for each of the pump station is as follows:

Pump Station	Average Daily Pumped Gallons
No. 2	48,697
No. 3	20,484

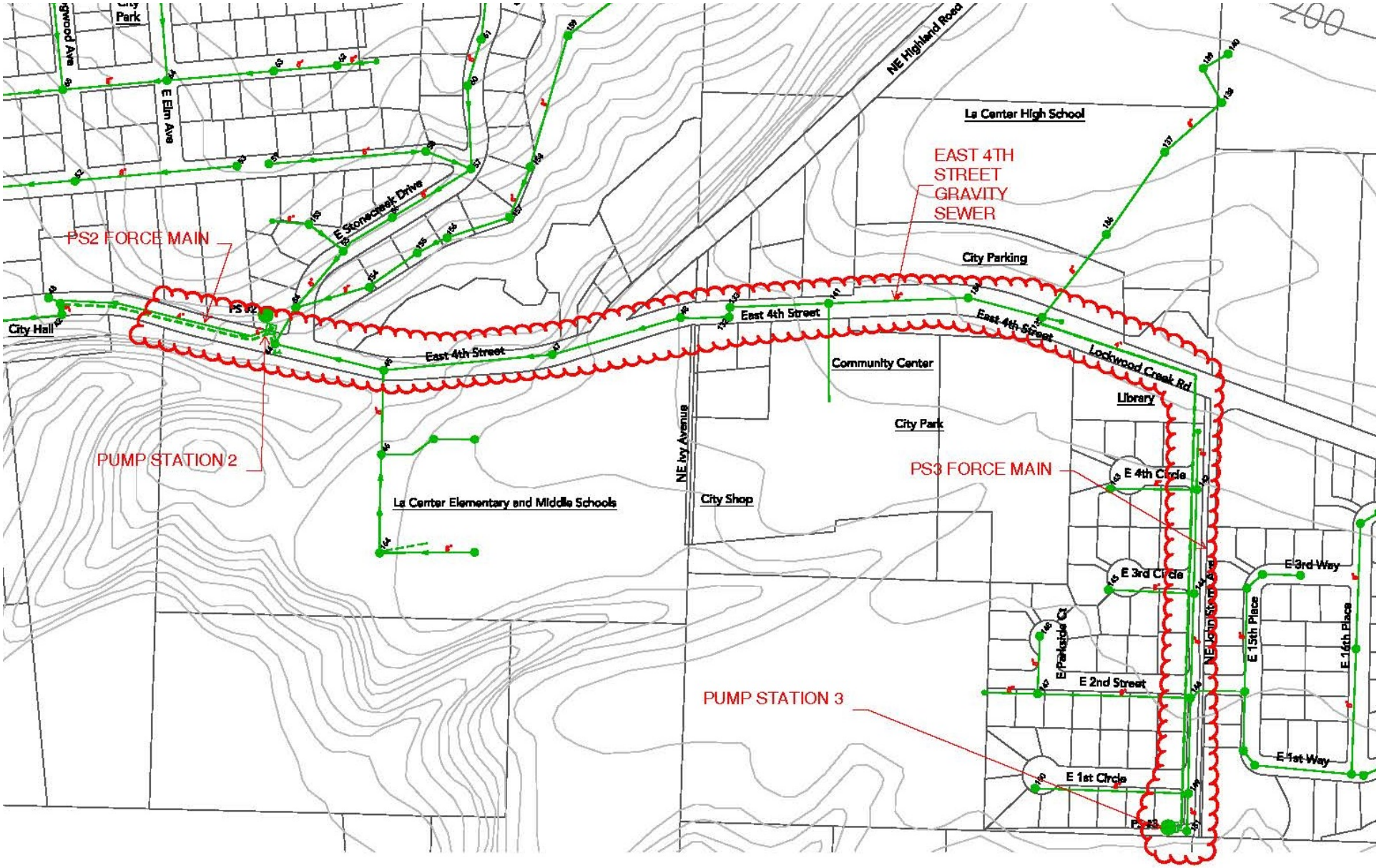


FIGURE 2 – SEWER COLLECTION SYSTEM ELEMENTS

ERU CALCULATION FOR BASIN D

The majority of the development in Basin D consists of newer homes or homes recently connected to sewer. Recently constructed sewer collection systems within the basin are primarily PVC with rubber gasket joints. Because of this, the collection system is tighter and less subject to infiltration and inflow than the city-wide system average. The system-wide ERU flow rate from the GSP is not applicable to this basin.

To establish a specific ERU for Basin D, the average flow rate from pump station No. 3 is divided by the number of contributing units (Parkside and Lockwood) as follows:

ERU = 20,484 gallons per day / 125 units = 164 gpd

At 2.7 person per ERU the per capita flow rate for the basin is: 164 gpd/2.7 = 61 gpcd

SCHOOL DISTRICT FLOWS

Populations for the school facilities were received from the La Center School District office and are included in the sub-basin information shown above. To estimate flows, a per capita flow rate was first estimated from guidelines in the DOE Design Manual (Table G2.1 Design Basis for New Sewage Works). The per capita flow rate was then refined using pump station records in order to arrive at a representative per capita flow from the schools. The High School meets the condition for schools with showers and cafeteria as shown in the DOE Manual. The Elementary/Middle School meets the condition for schools without showers and with cafeteria. The rates from the DOE Manual and the calculated flow rates are as follows:

Campus	DOE Manual gpd/cap	Calculated gpd/cap
High School	16	13
Elem/Mid	10	8

The calculated flow rates were used to estimate future design flows for the basin.

SPLASH PAD

A recreational feature contributes substantial flows to the sewer system from the public park. Information provided by Tony Cooper at City of La Center indicates that the splash pad discharges 9,000 gallons per day over 8 hours or 18.8 gallons per minute. Since the splash pad generally operates when school is not in session, it is appropriate to compare splash pad flows with school district flows including application of the peaking factor. The average day flow from the combined elementary/middle/high school facilities is 17,026 gpd. Using a peaking factor of 3.8, the dedicated share of pump station capacity for the school system is 64,700 gpd or 45 gpm.

For this analysis, the contribution from the splash pad is not included because the total flow rate, and therefore the dedicated pump station capacity required, will be substantially lower during times when school is out.

FUTURE DEVELOPMENT DENSITIES

To determine the required system capacity for the fully developed Basin D, development density was estimated for the currently undeveloped areas within Sub-basins D3, D2 North and D2 West. The zoning

in these areas is LDR 7.5 with a required Minimum Net Density of 4 units per acre (LCMC 18.130.080). Net density by definition is calculated after deducting right-of-way areas. For this analysis, estimated units per gross acre is needed. The existing Parkside Subdivision within the study area has a lot layout that is very close to the maximum possible density. Parkside has an overall density of (47 units / 11.9 acres) 3.95 units per gross acre. Lockwood Creek Subdivision which contains common property and environmental buffers has an overall density of (76 units / 24 acres) 3.17 units per gross acre. In consideration of the impacts to future development due to environmental constraints and shapes of properties, a density for future development of 3.5 units per gross acre has been assumed.

FLOW PROJECTIONS AND CAPACITIES

A spreadsheet file within Appendix 1 contains calculated current and future flows for each sub-basin and for each pump station. Future flows include two sets of calculations: one for capacities required by the addition of Sunrise Terrace to the existing condition and one for future or ultimate full build out capacity. Existing and required pump station capacities are summarized below:

Pump Station Number	Existing Capacity	Current Req'd Capacity	With Sunrise Terrace	Future Req'd Capacity
PS2	130 gpm	129 gpm	177 gpm	370 gpm
PS3	58 gpm	57 gpm	110 gpm	304 gpm
PS5	N/A	0 gpm	0 gpm	88 gpm

The calculations indicate that both PS2 and PS3 are presently very near capacity and there is not significant available pumping capacity to address additional flows. Any new flows will require upgrades to the current pumping capacity.

FORCE MAINS

The DOE Design Manual recommends force mains be sized so that velocities in the force main fall between a minimum of 2 feet per second (fps) which is the fluid velocity required for flushing to an optimum high velocity of 5 fps. The range of velocities results in pipe capacities as follows:

FM Pipe Size	Low (2 fps) Rate	High (5 fps) Rate
4 inch	75 gpm	200 gpm
6 inch	175 gpm	450 gpm
8 inch	310 gpm	790 gpm

Based on the pumping rates indicated above, the existing 4 inch force main from PS3 will be adequate for the build out of the Sunrise Terrace Subdivision but will require upgrading to a 6 inch in the future to accommodate full build out of basin D. The 4 inch force main from PS2 is adequate now but will be very close to capacity with the added flows from Sunrise Terrace. This will impact the ability of PS2 to operate with 2 pumps running. Upgrading the force main to 6 inch should be considered at such time as improvements to the pump station are being implemented. A 4 inch main for the future PS5 will be adequate for full build out of the subbasin.

PUMP STATION WET WELLS

Both PS2 and PS3 are 6 foot diameter wetwells. To determine if the existing pump station wetwells will have adequate capacity for future flows, the available wetwell volume between pump on and pump off levels is compared to the recommended volume in accordance with the DOE Design Manual. For constant speed pumps the manual recommends use of the following formula:

$$V = tQ/4 \qquad \text{(Section C2-1.2.5)}$$

Where V = minimum volume (gallons)
t = minimum time between starts
Q = pump capacity in gpm

Submersible pumps are generally recommended to be limited to not more than 10 starts per hour or one start every 6 minutes. With two pumps alternating the minimum time between starts is 3 minutes. The available wetwell volume for pumping is the capacity from the top limit at 6 inches below the invert elevation of the influent pipe to the bottom limit maintaining 18 inches of liquid above the floor. The available wetwell volume was determined from pump station as-built information provided by the city. The high end of the pump station capacity "Q" for each pump station was calculated with the above formula as follows:

Pump Station	Wetwell Height	Wetwell Volume	Calculated Max Pumping Rate
PS2	3.9 feet	930 gal	1100 gpm
PS3	3.0 feet	635 gal	847 gpm

Based on the above calculations, the existing 6 foot diameter pump station wetwells will be adequate for the future build out of the contributing basins.

CAPACITY OF GRAVITY SEWER

The gravity sewer in East 4th Avenue was evaluated for present and future capacity beginning from manhole 135 on the upstream to manhole 44 on the downstream. Pipe capacities based on existing diameter and slope were used from the GSP where they are shown on Table A-3. The calculations for existing and future conditions are included in Appendix 1. All pipes have adequate capacity for current flows and for flow that includes the additional 121 ERU's from Sunrise Terrace. The downstream gravity pipe segment from manhole 45 to manhole 44 will need to be upgraded for the full build out condition.

SUMMARY AND CONCLUSIONS

- Pump Station No. 5 will be require for the future condition. To meet the full build out of Basin D3 the pump station will require a capacity of 88 gpm and a 4 inch force main.
- Pump Station No. 3 is presently near its pumping capacity. The pump station will need to be upgraded to a capacity of 110 gpm to address the additional flow from Sunrise Terrace. The capacity for the full build out condition is 304 gpm. The wetwell will not need to be upgraded.
- The 4 inch force main from PS3 will be adequate through completion of Sunrise Terrace and will need to be upgraded to a 6 inch to accommodate build out.

- The gravity sewer in East 4th Street has adequate capacity for the completion of Sunrise Terrace. The downstream portion of the gravity sewer will need to be upgraded as the basin approaches build out.
- Pump Station No. 2 is presently near capacity. The pump station will need to be upgraded to a capacity of 177 gpm to address the additional flow from Sunrise Terrace. The capacity for the full build out condition is 370 gpm. The wetwell will not need to be upgraded.
- The 4 inch force main from PS2 will require velocities on the order of 4.5 feet per second to carry the 177 gpm flows after completion of Sunrise Terrace. The ability of the pump station to operate with two pumps running during high flow periods will be greatly restricted with a 4 inch force main. It is recommended that the force main be upgraded to a 6 inch to accommodate the Sunrise Terrace flows.

APPENDIX 1

CALCULATION OF AVERAGE FLOW RATE FROM LA CENTER PUMP STATION RECORDS

WEEK ENDING	RUN TIME MINUTES PER DAY				CALC AVE	CALC	CALC PUMP
DATE	PUMP 2A	PUMP 2B	PUMP 3A	PUMP 3B	DAILY FLOW	INFLOW GPM	RATE GPM
7/12/2014	260.3	229.3					
7/12/2014			65.9	148.3			
10/8/2014	143.1	150.1					
10/8/2014			140.4	208.4			
11/8/2014	196.6	200.9					
11/8/2014			245.7	276.3			
12/8/2014	194.1	210.1					
12/8/2014			253.9	230.6			
1/28/2015	161.0	163.1					
1/28/2015			209.0	114.3			
2/8/2015	200.4	205.1			50223.2	34.9	123.8
2/8/2015			251.6	114.6	31891.6	22.2	87.1
2/12/2015	235.6	240.7			54952.1	38.2	115.4
2/12/2015			283.0	123.1	34984.4	24.3	86.1
5/2/2015	141.4	150.6			40459.7	28.1	138.6
5/2/2015			171.7	240.0	22498.1	15.6	54.6
5/6/2015*	109.7	120.0			46669.8	32.4	139.1
5/6/2015*			142.4	182.1	27274.8	18.9	56.6

FOUR SEASONS FOR ANNUAL AVERAGE MINUTES/DAY		
	PS2	PS3
PS2 SUMMER	489.6	
PS3 SUMMER		214.1
PS2 FALL	345.4	
PS3 FALL		435.4
PS2 WINTER	402.6	
PS3 WINTER		395.0
PS2 SPRING	260.9	
PS3 SPRING		368.1

	PS2	PS3
AVE PS MINUTES/DAY	374.6	353.2
PUMPING RATE (GPM)	130	58
AVERAGE DAILY FLOW (GPD)	48697	20484

* 4 DAY PERIOD

BASIN CALCULATIONS - CURRENT AND FUTURE FLOWS

PUMP STATION CAPACITY REQUIRED

SYSTEM ELEMENT	AREA ACRES	ERU'S PER ACRE	TOTAL ERU'S	TOTAL PERSONS	GPD PER CAP	AVE DAY FLOW PRESENT	EXIST'G WITH SUNRISE TERR.	AVE DAY FLOW FUTURE	PEAKING FACTOR	DESIGN FLOW MGD	PS ERU'S SERVED	AVE DAY GAL	PEAKING FACTOR	DESIGN FLOW GPM
SUBBASIN D3	56.16	3.5	197	532	61	0	0	32452	3.9	0.000				
PS5 CURRENT											N/A	N/A	N/A	N/A
PS5 FUTURE											197	32452	3.9	88
SUBBASIN D2 NORTH	93.16	3.5	326	880	61	0	0	53680	3.8	0.000				
ADD SUNRISE TERRACE			121	327	61	0	19947							
SUBBASIN D2 WEST	19.9	3.5	70	189	61	0	0	11529	4.1	0.000				
PARKSIDE SUB			48	130	61	7930	7930	7930	4.2	0.033				
LOCKWOOD CR SUB			77	208	61	12688	12688	12688	4.1	0.052				
PS3 CURRENT											125	20618	4	57
PS3 WITH SUNRISE TERR.											246	40565	3.9	110
PS3 FUTURE											718	118279	3.7	304
HIGH SCHOOL			48	602	13	7826		8609						
PARK + COMM CENTER			2	5	61	305		305	4.3	0.001				
14 ERU'S ADJACENT			14	38	61	2318		2318	4.3	0.010				
ELEM + MIDDLE SCHOOL			56	1150	8	9200		10120						
STONE CREEK			52	140	61	8540		8540	4.2	0.036				
PS2 CURRENT											297	48807	3.8	129
PS2 WITH SUNRISE TERR.											418	68754	3.7	177
PS2 FUTURE											890	148171	3.6	370

INPUT DATA	
ERU (UNITS) PER ACRE	3.5
RESIDENTIAL ERU GPD/C	61
PERSONS/ERU	2.7
ELEM/MIDDLE SCHOOL GPD/C	8
HIGH SCHOOL GPD/C	13

EAST 4TH STREET GRAVITY SEWER CAPACITY ASSESSMENT

MH/MH	CAPACITY FROM GSP	PRESENT FLOW gpm	PRESENT % OF CAP	FLOW W/ SUNRISE	W/ SUNRISE % OF CAP	FUTURE FLOW gpm	FUTURE % OF CAP	CONTRIBUTING FLOWS
135/134	0.55	0.113	21%	0.189	34%	0.472	86%	PS3 AND HIGH SCHOOL
134/141	1.08	0.113	10%	0.189	18%	0.472	44%	
141/133	1.53	0.124	8%	0.2	13%	0.483	32%	ADDED ERU'S
133/132	2.21	0.124	6%	0.2	9%	0.483	22%	
132/48	1.11	0.124	11%	0.2	18%	0.483	44%	
48/47	1.64	0.124	8%	0.2	12%	0.483	29%	
47/45	1.95	0.124	6%	0.2	10%	0.483	25%	
45/44	0.49	0.161	33%	0.237	48%	0.523	107%	ADD ELEM/MID
44/PS2								
contributions								
PS3		0.082		0.158		0.438		
HIGH SCHOOL		0.031		0.031		0.034		
RES AND PARK ERU'S		0.011		0.011		0.011		
ELEM/MID SCHOOL		0.037		0.037		0.04		

APPENDIX 2

APPENDIX 2: City of La Center comments and **Responses.**

Pump station data and flow calculations

1. *The report uses a per capita flow rate of 61 gpcd, which is less than the 110 gpcd required in City standards. The 61 gpcd rate was developed using actual pumping data from pump station #2 and #3 and applied a peaking factor to determine projected peak flows with the Sunrise Terrace Development. This methodology of flow rate calculation is acceptable to the city since it is based on actual data on not theoretical data.*
   a. *Wallis Engineering comments that the comparison of the two per capita flow rates should be discussed and the appropriateness of the selected rate.*
   b. *Wallis Engineering suggests that the calculated flow rate may be subject to D.O.E. review. The City will ask D.O.E. if review is needed for upgrading pumps and force main.*

   RESPONSE:

   Department of Ecology makes specific recommendations for wastewater design flow rates in Table G2-1 in the Orange Book. The recommended flow rate for "Dwellings" is 100 gpd per person. La Center has adopted 110 gpd per person for the system-wide flow rate based on flow measurements specific to the city on a city-wide basis. Paragraph G2-1.2.4 of the Orange Book states with regard to use of Table G2-1 "Any deviation should be based on sound engineering judgement substantiated in the engineering report". Use of 61 gpd per person as well as the calibrated specific rates for the schools has been substantiated in the report and is representative of a basin with much less impact due to infiltration. The flow rates were calculated based on the best available data from existing pumped flow rates.

2. *Wallis Engineering comments that the precipitation used for the past three years has been lower than the average and that the analysis should take this into account. The precipitation given to HHPR was part of the data collected near the pump station by the City and is reflective of actual rainfall amount. The peaking factor should provide enough factor of safety for peak flow analysis with I&I but HHPR should check if higher averages of rainfall might affect the per capita flow.*

   RESPONSE:

   USGS rainfall records from Portland airport for the one year period that matches the pump station data used show a rainfall total of 35.2 inches. In comparison to the annual rainfall for the previous 20 years at the same source, the rainfall data set was less than the annual rainfall for eleven of the previous 20 years and more than the rainfall for nine of the years. The conclusion is that an adjustment for the water year is not warranted.

3. *Wallis Engineering comments that the population density increase per the General Sewer Plan be used for the future projected flows. Future UGA expansion is shown in the north and west portion of La Center and the eastern boundary will likely not occur. The applicant will not need*

to include the 50-year UGA for the purpose of the analysis for the Sunrise Development. For future development that occurs, the city will require developers analyze the upstream and downstream sewer system.

Pump station and gravity capacity

1. *Wallis Engineering notes that it is not clear that calculated capacities include pump station 5 discharging into pump station 3 and then to pump station 2. Submit a diagram or figure showing the anticipated build out flow to help resolve the flow path.*

   RESPONSE:

   See Figure 3 – Sub Basin Schematic, attached.

2. *The report did not analyze the gravity flow system downstream of the proposed connection of the Sunrise Terrace sanitary sewer system to the main in Lockwood Creek Road. Please include analysis of the downstream gravity system to pump station 3.*

   RESPONSE:

   An 8 inch gravity sewer at minimum slope (.004 ft/ft) has a capacity of 0.491 mgd. The combined contributing area of the gravity system that discharges to PS3 at ultimate buildout will include 451 ERU's. The maximum flow (with peaking factor) for this population is 0.28 mgd. The 8 inch gravity sewer at any slope will have adequate capacity.

3. *Wallis Engineering comments that the City has identified that pump stations #2 and #3 currently operate at capacity. The possibility of the City increasing capacity and efficiency of the existing pump stations was discussed in meeting. Since the meeting, operation adjustments were discussed and reviewed by the City. We believe that pump station #3 cannot be modified to provide additional capacity of the system.*

   The pumps in station #3 will need to be replaced to accommodate the Sunrise Terrace Development, as well as existing flows, and the control panel will need to be modified to support the use of the new pumps. The City may make modifications to the existing pump station panel at the time of upgrade for the development. The City will be pay for any additional maintenance upgrade beyond the modifications required for the development.

   Pump station #2 has had some modifications including a new impeller and it will likely work efficiently in the near future. The City has conducted some preliminary hydraulic analysis of pump station #2 with the existing 4-inch force main and found that by increasing the existing force main from a 4-inch diameter to a 6-inch diameter pipe, this will likely give enough capacity to operate up to 200 gallons per minute. The engineer will need to submit supporting calculations to support this change in pipe size.

In addition, there is currently no generator at this East 4th Street at Stonecreek Drive station and at a minimum; the developer will need to install a portable generator for pump station #2 operation for Sunrise Terrace Development. The control panel will need to be modified to allow for easy access with the generator and ability to "plug in" the portable generator during emergency conditions.

a. *Wallis Engineering comments that discussing these elements in the report is beneficial to identifying potential capacity upgrades. These modifications should be discussed in the report.*

RESPONSE:

Design of pump station improvements will require a detailed assessment of current operations and conditions and is beyond the scope of this analysis. Available information on the current pump curves provides some insight.

Pump station No. 2 shows a design point of 200 gpm at 45 ft of head. The actual pumping rate was calculated at 130 gpm. This rate would indicate a design point on the curve of 48 ft of pumping head. At 130 gpm, the head loss in 600 feet of 4 inch force main is about 8 feet with fittings and therefore the pumps are seeing 40 feet of elevation head. Replacement with a 6 inch force main would result in about 4 feet of friction loss and potentially would result in a design point for the existing pumps of 210 gpm at 44 feet of head. Since the force main will ultimately need to be upgraded to a 6 inch. Upgrading the force main could create additional capacity without changing out the pumps and panel. The Flygt NP3102 pump curve is attached with the indicated points.

Pump station No. 3 shows a design point of 144 gpm at 55 ft of head. Current performance would indicate an operating condition of 58 gpm at 62 ft. of head based on the calculated rate. Information from the General Sewer Plan sets the discharge manhole invert at elevation 145. The as built for station 3 shows a pumping elevation of about 83. If the elevation information is on the same datum, this would represent a pumping head of 62 feet before friction is considered. It would appear that the pumps in station 3 may be performing to specifications. All information and assumptions will need to be field verified. The solution to the capacity of Pump station No. 3 will be to reassess the elevation and friction and select pumps for the required condition. This may require upsizing of pumps and panel. The PACO curve RC-5834 with the design and estimated actual performance points is attached.

4. *Wallis Engineering suggests that pump station design and selection should consider future wear and tear on the pumps, per the D.O.E requirements considering the future growth within the 20-year design life. This should be included in the report.*

RESPONSE:

In the basin analysis and report, future pump station requirements were developed based on "ultimate" buildout of the basin. It is not known at this time what the expected

rate of development is for the balance of the basin. Given that both pump stations have already been constructed, it is anticipated that interim upgrades to stations No. 2 and 3 will be implemented prior to the ultimate buildout. For the interim pumping condition as well as for the ultimate condition, the specific pump design point should include consideration of additional capacity to address wear. At the time of pump selection, the designer should allow for a factor on the order of 5 percent of flow to address capacity for pump wear.

Pump station and gravity capacity

Wallis Engineering notes that revision of the report may be necessary to include the following:

1. *The analysis and capacity calculations should also include a minimum of 1-hour of storage of peak flows per D.O.E manual.*

   RESPONSE:

   Paragraph C2-1.8.5 of the Orange Book addresses additional wetwell capacity for "remote sewage pump stations". The La Center stations are not remote and response times will generally be short. Appropriate measures to address reliability include: high level alarm and monitoring capability; fixed or portable generators and pump panel transfer switch; by-pass pumping connection point; a portable gas engine pump should be considered for use in the event of damage to electric pumps.

2. *The report should discuss the potential for upgrade of the wet wells based on the potential of future build-out conditions.*

   RESPONSE:

   Six foot diameter wetwells are generally large enough for 10 HP submersible pumps and will be adequate for most 15 HP pumps. The pump conditions for station No. 2 and 3 assuming ultimate flow rates and installation of replacement 6 inch force mains is approximated in the table below. Flow rates include a 5 percent allowance for pump wear. Pump sizing calculations assume 50 percent pump efficiency.

Lift Station No.	Future Flow Required	Approx. Pumping Head	Estimated HP
2	389 gpm	49	9.6
3	320 gpm	72	11.6

Based on the estimates above, future pumps will not exceed 15 HP and it will be possible to select pumps for the six foot diameter wetwells at each of the pump stations. The above estimates are preliminary and should be confirmed with additional field investigation of the specific pumping conditions.

Attachments include Figure 3 and pump curves for station 2 and 3

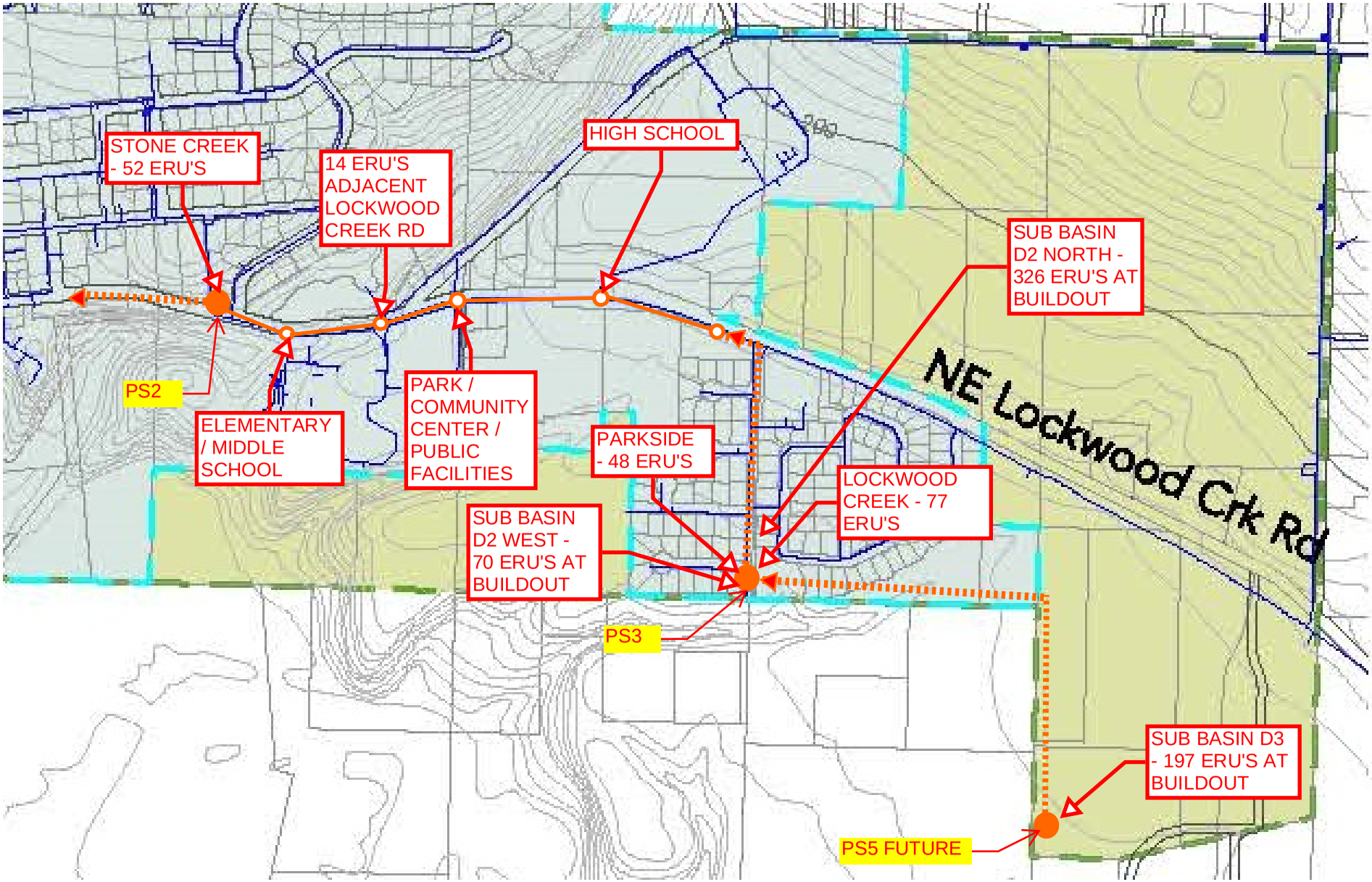


Figure 3 - Sub-Basin Schematic

Pump Station 2

090

PERFORMANCE CURVE

PRODUCT: NP3102.181	TYPE: MT		
DATE: 2013-07-11	PROJECT:	CURVE NO: 63-462-00-3703	ISSUE: 9

IMPELLER DIAMETER: 182 mm

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.81	0.75	0.64
EFFICIENCY	85.0 %	85.5 %	84.0 %
MOTOR DATA	---	---	---

COMMENTS

INLET/OUTLET: -/ 4 Inch

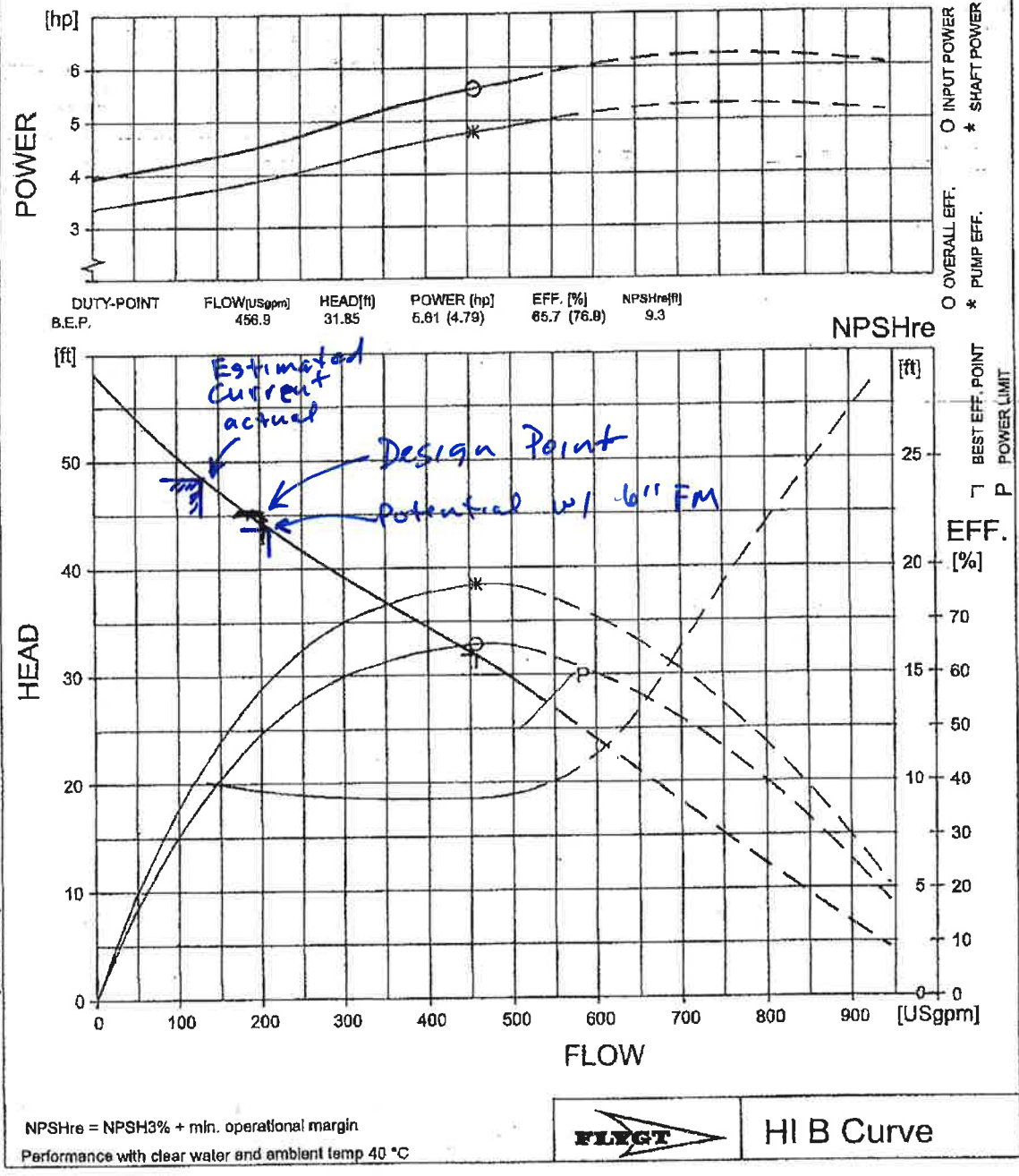
IMP. THROUGHLET: ---

RATED POWER	5	hp
STARTING CURRENT ...	41	A
RATED CURRENT ...	6.7	A
RATED SPEED	1745	rpm
TOT.MOM.OF INERTIA ...	0.028	kgm2
NO. OF BLADES	2	

MOTOR #	STATOR	REV
18-11-4AL	61D	10

FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	460 V	4

GEARTYPE: --- RATIO: ---



FLYPS3.1.6.6 (20090313)

NPSHre = NPSH3% + min. operational margin

Performance with clear water and ambient temp 40 °C

HI B Curve

PUMP STATION 3

Project: SOUTHVIEW HEIGHTS IV
by: JOANNE NYLANDER

File: (untitled)
Date: 12/02/96

CURVE: RC-5834 PUMP DATA SHEET Catalog: PACO-WW v. 1

TYPE - SPEED: QDC/TP - 1800

PUMP Size: 495-21
Speed: 1740 rpm
Imp dia: 8.2 in

Maximum tmp: 150 °F
pres: 87 psi
Minimum flow: - % of BEP
Suction size: 4 in
Discharge size: 4 in

FLUID Water tmp: 60 °F
SG: 1
vsc: 1.1 cpois
vapor: 0.26 psi
atm: 14.7 psi

AVAILABLE HEAD NPSHa: - ft

PIPING Pressure: - psi
Suction elev: - ft
size: - in
Discharge size: - in

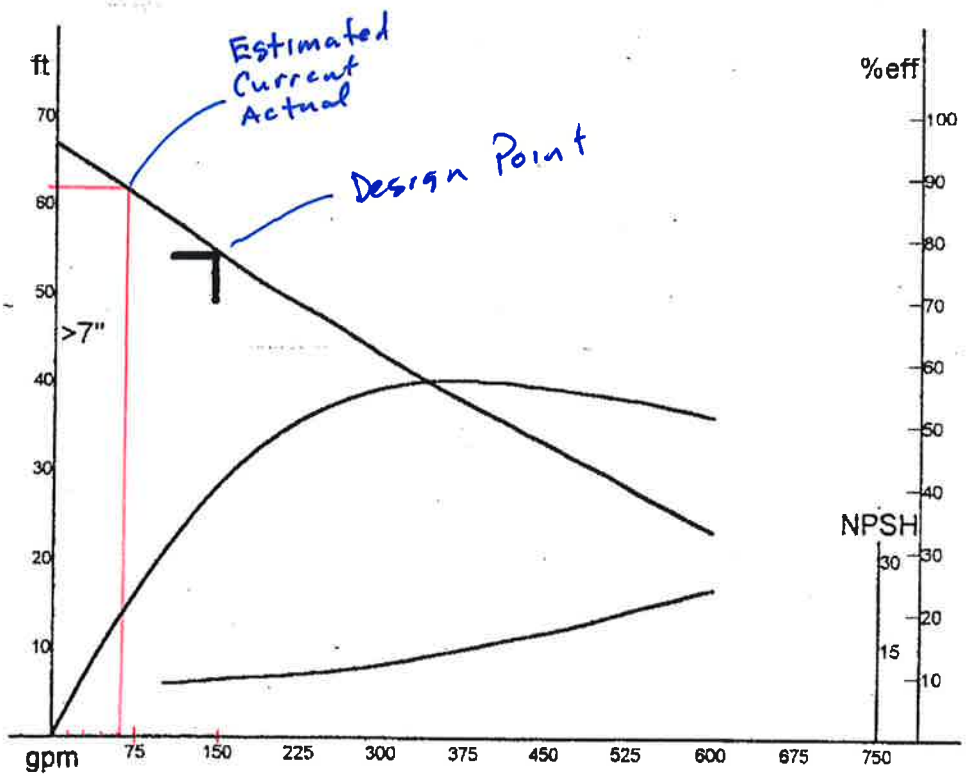
>9.3"

DESIGN CONDITIONS

FLOW: 144 gpm
TDH: 54.77 ft
EFF: 39 %
POWER: 5.106 bhp
NPSHr: 9.63 ft ***

DESIGN NOTES

BEP: 57%eff @ 400
MAX: 6.91 bhp @ 550
SHUTOFF: 67.01 ft
MIN FLOW: - gpm
SPECIFIC Speed: 2370
Suction: 4350



PERFORMANCE EVALUATION

	FLOW gpm	SPEED rpm	TDH ft	PUMP %eff	POWER bhp	NPSHr ft	MOTOR %eff	POWER kWh	HRS/YR	COST
120%	172.8	1740	52.29	44	5.186	10				
100%	144	1740	54.77	39	5.106	9.63				
80%	115.2	1740	57.29	33	5.05	9.22				
60%	86.4	1740	59.76	26	5.015	9				
40%	57.6	1740	62.18	17	5.32	9				

CHANGED CONDITIONS

CASCADIA
ECOLOGICAL SERVICES, INC.

TECHNICAL MEMORANDUM

TO:	FROM:
Ed Greer	Jim Barnes
COMPANY:	DATE: 6/16/2015
RE: Tax Parcel 209047-000, 209062-000, 86027188, & 986027-189	CC:

☐ URGENT ☑ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

This purpose of this technical memorandum is to provide clarification to comments in the City of La Center pre-application conference report provided to Ed Greer dated January 8, 2015. The report raised questions regarding a ditch identified by Cascadia Ecological Services, Inc. (CES) in a October 2014 preliminary wetland assessment report and a possible stream in the northeast portion of the project area.

In the pre-application conference report, it was stated that more information was needed to make the case that the “ditch” along the south portion of Tax Parcel 986027189 does not meet the criteria of a seasonal stream according to the definitions given in the City of La Center Municipal Code. In addition, a Washington DNR FPARS Map was provided in the report which shows a possible Class N stream in the north east corner of Tax Parcel 98027-179.

CES came to the conclusion in the October preliminary wetland assessment report that, based on observations of the upland soils, lack of hydrophytic vegetation, and hydrology indicators, the property does not contain any City of La Center regulated wetlands or other critical areas. An additional site visit was completed on June 16, 2015 to revisit the two potential stream areas identified by the city in the pre-application conference report.

The City of La Center Municipal Code section addressing critical areas is based on the definitions given in the Washington Administrative Code. According to WAC 220-660-030, a "Watercourse," "river" or "stream" means any portion of a stream or river channel, bed, bank, or bottom waterward of the ordinary high water line of waters of the state. Watercourse also means areas in which fish may spawn, reside, or pass, and tributary waters with defined bed or banks that influence the quality of habitat downstream. Watercourse also means waters that flow intermittently or that fluctuate in level during

the year, and the term applies to the entire bed of such waters whether or not the water is at peak level. A watercourse includes all surface-water-connected wetlands that provide or maintain habitat that supports fish life. This definition does not include irrigation ditches, canals, storm water treatment and conveyance systems, or other entirely artificial watercourses, except where they exist in a natural watercourse that has been altered by humans.

As mentioned in the October preliminary wetland assessment report, an east-west oriented man-made conveyance ditch is located along the south boundary of Tax Parcel 986027189. The ditch is at its widest and deepest point near the southeast corner of the parcel adjacent to NE 24th Avenue and gradually becomes narrower and less deep as it approaches the southwest corner. At that location the ditch merges into an open field north of a Christmas tree farm. The ditch is dominated by black cottonwood (*Populus balsamifera*) trees and Himalayan blackberry (*Rubus armeniacus*) thickets along its edges. Although the ditch is in excess of six feet deep in places, the ground surface was dry and there were no indicators of wetland hydrology present. No scour marks or defined channel within the flat ditch bottom was observed. Most of the ground surface at the bottom of the ditch is either bare soil or mosses. According to historical aerial imagery, this ditch did not exist prior to 2005. It appears to have been constructed in 2005 as shown in Figure 1.

The City of La Center Municipal Code defines riparian habitat areas as areas adjacent to aquatic systems with flowing water (e.g., rivers, perennial or intermittent streams, seeps, springs) that contain elements of both aquatic and terrestrial ecosystems which mutually influence each other.

Because the ditch meets the definition of an artificial watercourse and does not provide any aquatic habitat, it would not be regulated by the Washington Department of Fish and Wildlife (Steve West, personal communication, June 16, 2015) nor would it be regulated as a riparian habitat area by the City of La Center.

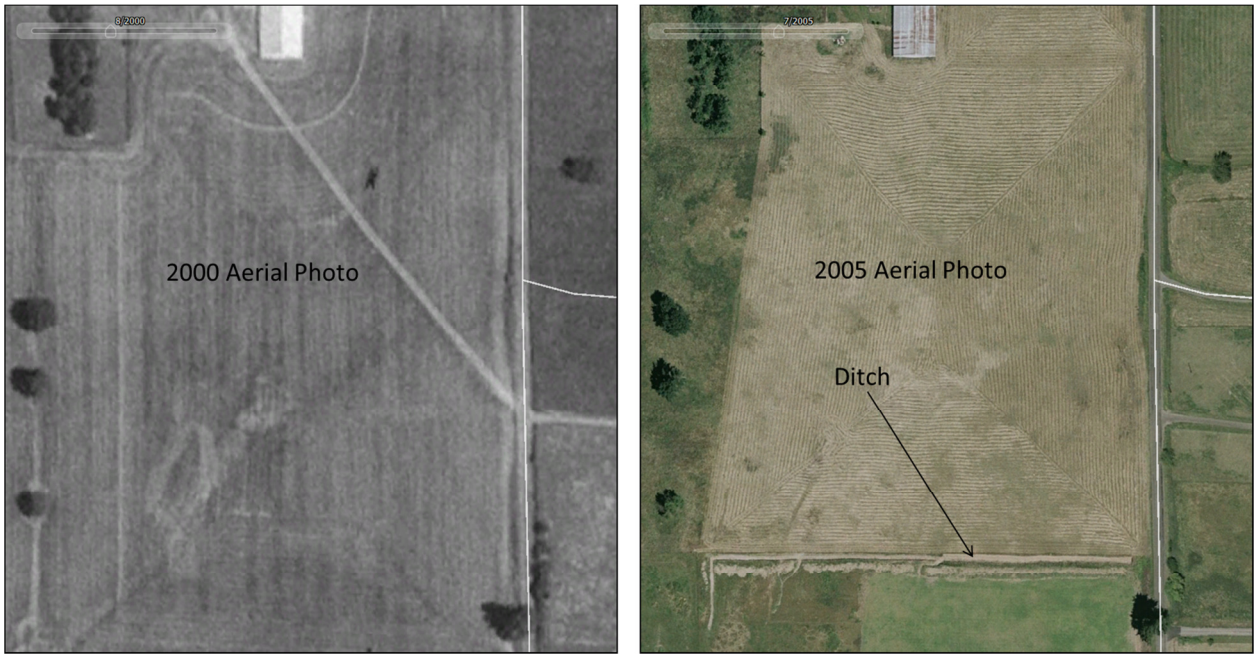


Figure 1. Aerial photography of south boundary of Tax Parcel 986027189 (Source: Google Earth)

The northeast portion of the Tax Parcel 98027-179 in the location of the possible Class N stream consists of upland pasture. No wetlands or stream exists in this location (Figure 2). Directly north of the property and south of NE 339th Street is a road ditch and a culvert was located at the intersection of NE 339th Street and NE 24th Avenue. The culvert crosses underneath NE 339th Street and outlets into a forested swale that continues to the northwest. This is likely the drainage that is mapped by the WDNR FPARS website as the Class N stream. Because it is located off-site and is functionally isolated by NE 339th Street, any buffers to protect riparian habitat functions would not extend onto the project area.

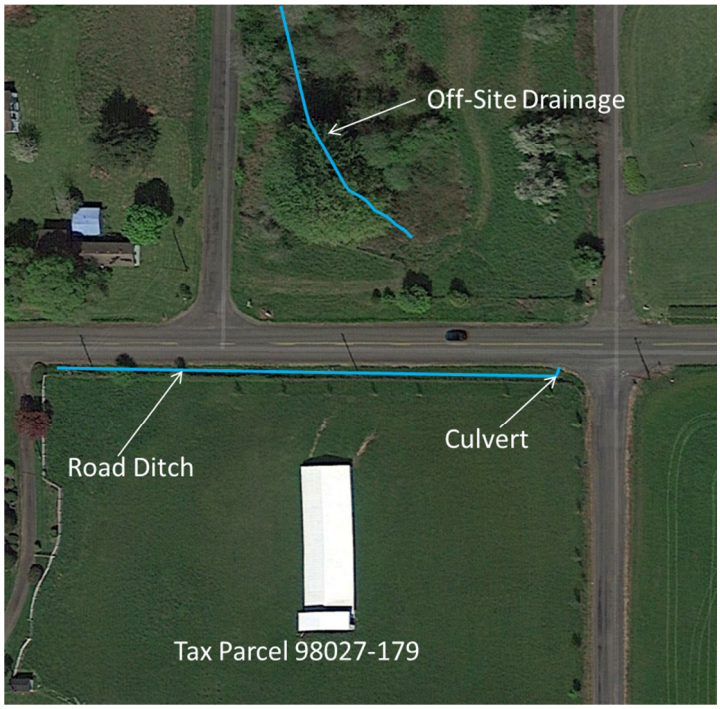


Figure 2. NE portion of Tax Parcel 98027-179

This report documents the investigation, best professional judgment and conclusions of Cascadia Ecological Services, Inc. It should be used at your own risk unless it has been reviewed and approved in writing by the City of La Center under their jurisdictional standards.

References

La Center Municipal Code Chapter 18.300. 2012. Critical Areas. La Center, Washington.

West, Steve. (6/15/15). Interview by J.S. Barnes [Phone]. Vancouver, WA.

Washington Administrative Code 220-660-030.

Geotechnical Site Investigation

Sunrise Terrace

La Center, Washington

June 26, 2015

Geotechnical ■ Environmental ■ Special Inspections

Columbia West
Engineering, Inc

11917 NE 95th Street
Vancouver, Washington
98682
Phone: 360-823-2900
Fax: 360-823-2901




www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

GEOTECHNICAL SITE INVESTIGATION
SUNRISE TERRACE
LA CENTER, WASHINGTON

Prepared For:

RK Land Development, LLC
c/o Mr. Ed Greer
1520 SW Eaton Blvd.
Battle Ground, Washington 98604

Site Location:

1908 NE Lockwood Creek Road
Parcel Nos. 209062000, 986027189, 986027188, 209047000
La Center, Washington

Prepared By:

Columbia West Engineering, Inc.
11917 NE 95th Street
Vancouver, Washington 98682
Phone: 360-823-2900
Fax: 360-823-2901

Date Prepared:

June 26, 2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

GEOTECHNICAL SITE INVESTIGATION
SUNRISE TERRACE
LA CENTER, WASHINGTON

1.0 INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) was retained by RK Land Development, LLC to conduct a geotechnical site investigation for the proposed Sunrise Terrace residential development located in La Center, Washington. The purpose of the investigation was to observe and assess subsurface soil conditions at specific locations and provide geotechnical engineering analyses, planning, and design recommendations for proposed development. The specific scope of services was outlined in a proposal contract dated April 29, 2015. This report summarizes the investigation and provides field assessment documentation and laboratory analytical test reports. This report is subject to the limitations expressed in Section 6.0, *Conclusion and Limitations*, and Appendix E.

1.1 General Site Information

As indicated on Figures 1 and 2, the subject site is located at 1908 NE Lockwood Creek Road in La Center, Washington. The site consists of tax parcels 209047000, 986027188, 986027189, and a portion of parcel 209062000 contributing to a proposed development area of approximately 33.7 acres. The regulatory jurisdictional agency is the City of La Center, Washington. The approximate latitude and longitude are N 45° 51' 50" and W 122° 38' 58", and the legal description is a portion of the NW ¼ of Section 02, T4N, R1E, Willamette Meridian.

1.2 Proposed Development

Review of preliminary site plans indicates that proposed development will consist of a single-family residential subdivision that will include approximately 120 building lots, asphalt concrete roadways, underground utilities, and stormwater management facilities. Columbia West understands that cut and fill will likely be proposed at the property. This report is based upon proposed development as described above and may not be applicable if modified.

2.0 REGIONAL GEOLOGY AND SOIL CONDITIONS

The subject site lies within the Willamette Valley/Puget Sound Lowland, a wide physiographic depression flanked by the mountainous Coast Range on the west and the Cascade Range on the east. Inclined or uplifted structural zones within the Willamette Valley/Puget Sound Lowland constitute highland areas and depressed structural zones form sediment-filled basins. The site is located in the norther portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

According to the *Geologic Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington (*Russell C. Evarts, USGS Geological Survey, 2004*)*, near-surface soils are

expected to consist of Pleistocene aged, unconsolidated, rhythmically bedded periglacial deposits of sand, silt, and clay derived from catastrophic outburst floods of Glacial Lake Missoula (Qfs) transitioning to Pleistocene to Pliocene, semi-consolidated, pebble to cobble sedimentary conglomerate (QTc) in the northwest portion of the site. Previously published geologic mapping has identified the conglomerate as the Troutdale Formation.

The *Web Soil Survey (*United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2013 Website*)* identifies surface soils primarily as Gee silt loam with smaller areas mapped as Hillsboro silt loam and Odne silt loam. Although soil conditions may vary from the broad USDA descriptions, these soils generally consist of fine-textured sand, silt, and clay with very low to low permeability, moderate to high water capacity, and low shear strength. They are generally moisture sensitive, somewhat compressible, and described as having low to moderate shrink-swell potential. They exhibit a slight erosion hazard based primarily upon slope grade. According to Clark County GIS, Odne soils mapped at the site are classified as hydric.

3.0 REGIONAL SEISMOLOGY

Recent research and subsurface mapping investigations within the Pacific Northwest appear to suggest the historic potential risk for a large earthquake event with strong localized ground movement may be underestimated. Past earthquakes in the Pacific Northwest appear to have caused landslides and ground subsidence, in addition to severe flooding near coastal areas. Earthquakes may also induce soil liquefaction, which occurs when elevated horizontal ground acceleration and velocity cause soil particles to interact as a fluid as opposed to a solid. Liquefaction of soil can result in lateral spreading and temporary loss of bearing capacity and shear strength.

There are at least four major known fault zones in the vicinity of the site that may be capable of generating potentially destructive horizontal accelerations. These fault zones are described briefly in the following text.

Portland Hills Fault Zone

The Portland Hills Fault Zone consists of several northwest-trending faults located along the northeastern margin of the Tualatin Mountains, also known as the Portland Hills, and the southwest margin of the Portland Basin. The fault zone is approximately 25 to 30 miles in length and is located approximately 17 miles southwest of the site. According to *Seismic Design Mapping, State of Oregon (Geomatrix Consultants, 1995),* there is no definitive consensus among geologists as to the zone fault type. Several alternate interpretations have been suggested.

According to the *USGS Earthquake Hazards Program*, the fault was originally mapped as a down-to-the-northeast normal fault, but has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults, and as a steep escarpment caused by asymmetrical folding above a south-west dipping, blind thrust fault. The Portland Hills fault offsets Miocene Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been

described along the fault trace, and the fault is mapped as buried by the Pleistocene aged Missoula flood deposits.

However, evidence suggests that fault movement has impacted shallow Holocene deposits and deeper Pleistocene sediments. Seismologists recorded a M3.2 earthquake thought to be associated with the fault zone near Kelly Point Park in November 2012, a M3.9 earthquake thought to be associated with the fault zone near Kelly Point Park in April 2003, and a M3.5 earthquake possibly associated with the fault zone occurred approximately 1.3 miles east of the fault in 1991. Therefore, the Portland Hills Fault Zone is generally thought to be potentially active and capable of producing possible damaging earthquakes.

Gales Creek-Newberg-Mt. Angel Fault Zone

Located approximately 40 miles southwest of the site, the northwest-striking, approximately 50-mile long Gales Creek-Newberg-Mt. Angel Structural Zone forms the northwestern boundary between the Oregon Coast Range and the Willamette Valley, and consists of a series of discontinuous northwest-trending faults. The southern end the fault zone forms the southwest margin of the Tualatin basin. Possible late-Quaternary geomorphic surface deformation may exist along the structural zone *(Geomatrix Consultants, 1995)*.

According to the *USGS Earthquake Hazards Program*, the Mount Angel fault is mapped as a high-angle, reverse-oblique fault, which offsets Miocene rocks of the Columbia River Basalts, and Miocene and Pliocene sedimentary rocks. The fault appears to have controlled emplacement of the Frenchman Spring Member of the Wanapum Basalts, and thus must have a history that predates the Miocene age of these rocks. No unequivocal evidence of deformation of Quaternary deposits has been described, but a thick sequence of sediments deposited by the Missoula floods covers much of the southern part of the fault trace.

Although no definitive evidence of impacts to Holocene sediments have clearly been identified, the Mount Angel fault appears to have been the location of minor earthquake swarms in 1990 near Woodburn, Oregon, and a M5.6 earthquake in March 1993 near Scotts Mills, approximately four miles south of the mapped extent of the Mt. Angel fault. It is unclear if the earthquake occurred along the fault zone or a parallel structure. Therefore, the Gales Creek-Newberg-Mt. Angel Structural Zone is considered potentially active.

Lacamas Lake-Sandy River Fault Zone

The northwest-trending Lacamas Lake Fault and northeast-trending Sandy River Fault intersect north of Camas, Washington approximately 21 miles southeast of the site, and form part of the northeastern margin of the Portland basin. According to *Geology and Groundwater Conditions of Clark County Washington (USGS Water Supply Paper 1600, Mundorff, 1964)* and the *Geologic Map of the Lake Oswego Quadrangle (Oregon DOGAMI Series GMS-59, 1989)*, the Lacamas Lake fault zone consists of shear contact between the Troutdale Formation and underlying Oligocene andesite-basalt bedrock. Secondary

shear contact associated with the fault zone may have produced a series of prominent northwest-southeast geomorphic lineaments in proximity to the site.

According to the *USGS Earthquake Hazards Program* the fault has been mapped as a normal fault with down-to-the-southwest displacement, and has also been described as a steeply northeast or southwest-dipping, oblique, right-lateral, slip-fault. The trace of the Lacamas Lake fault is marked by the very linear lower reach of Lacamas Creek. No fault scarps on Quaternary surficial deposits have been described. The Lacamas Lake fault offsets Pliocene-aged sedimentary conglomerates generally identified as the Troutdale formation, and Pliocene to Pleistocene aged basalts generally identified as the Boring Lava formation.

Recent seismic reflection data across the probable trace of the fault under the Columbia River yielded no unequivocal evidence of displacement underlying the Missoula flood deposits, however, recorded mild seismic activity during the recent past indicates this area may be potentially seismogenic.

Cascadia Subduction Zone

The Cascadia Subduction Zone has recently been recognized as a potential source of strong earthquake activity in the Portland/Vancouver Basin. This phenomenon is the result of the earth's large tectonic plate movement. Geologic evidence indicates that volcanic ocean floor activity along the Juan de Fuca ridge in the Pacific Ocean causes the Juan de Fuca Plate to perpetually move east and subduct under the North American Continental Plate. The subduction zone results in historic volcanic and potential earthquake activity in proximity to the plate interface, believed to lie approximately 20 to 50 miles west of the general location of the Oregon and Washington coast *(Geomatrix Consultants, 1995)*.

4.0 GEOTECHNICAL AND GEOLOGIC FIELD INVESTIGATION

A geotechnical field investigation consisting of visual reconnaissance, twelve test pits (TP-1 through TP-12), and one infiltration test (IT-1) was conducted at the site on June 10, 2015. Test pits were excavated with a track-mounted excavator. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) specifications. Disturbed soil samples were collected from relevant soil horizons and submitted for laboratory analysis. Analytical laboratory test results are presented in Appendix A. Exploration locations are indicated on Figure 2. Subsurface exploration logs are presented in Appendix B. Soil descriptions and classification information are provided in Appendix C. A photo log is presented in Appendix D.

4.1 Surface Investigation and Site Description

The approximate 33.7-acre subject site consists of four tax parcels located at 1908 NE Lockwood Creek Road in La Center, Washington. The subject site is generally surrounded by rural farmland and may be accessed through frontage along NE 339th Street to the north, NE 24th Avenue to the east, and NE Lockwood Creek Road to the south. Site reconnaissance and review of topographic mapping indicates gently rolling to moderately southwest sloping terrain with site elevations ranging from 294 feet above mean sea level

(amsl) adjacent to 339th Street to 152 ft amsl at Lockwood Creek Road. Slopes of 5 to 10 percent characterize most of the site with localized steeper grades observed in the east-central area. The site appears to be currently utilized for agricultural purposes as evidenced by perimeter fencing, grassy pastures, and recently tilled farmland. Towards the southern end of the site, an existing residential structure with two outbuildings joins Lockwood Creek Road via a gravel driveway. With the exception of recently tilled areas, open areas of the site were primarily covered with grass. Vegetation also included occasional trees, shrubs, and vines observed along fence lines and near the existing residence.

4.2 Subsurface Exploration and Investigation

Test pit explorations TP-1 through TP-12 were advanced to a maximum depth of 15 feet below ground surface (bgs). Exploration locations were selected to observe subsurface soil characteristics in proximity to proposed development areas and are indicated on Figure 2.

4.2.1 Soil Type Description

The field investigation indicated the southernmost parcel is generally covered with approximately 12 inches of sod and topsoil in the observed locations. In areas of the site where recent tilling had occurred, exploration indicated that disturbed, organic-rich topsoil extended to depths of 14 to 16 inches. Underlying the topsoil layer, subsurface soils resembling native USDA Gee soil series descriptions were encountered. Subsurface lithology was reasonably consistent at all explored locations and may generally be described by soil types identified in the following text.

Soil Type 1 – Lean CLAY with Sand / SILT with Sand

Soil Type 1 was observed to primarily consist of light brown to mottled brown and gray, moist to wet, medium stiff to stiff, low plasticity lean CLAY with sand and SILT with sand. Soil Type 1 was observed underlying the topsoil layer in all test pits and extended to depths of 6 to 13.5 feet below ground surface. In several test pits, Soil Type 1 was observed to the maximum depth of exploration.

Analytical laboratory testing conducted upon representative soil samples obtained from test pits TP-1 and TP-12 indicated approximately 77 to 84 percent by weight passing the No. 200 sieve and in situ moisture contents ranging from 29 to 36 percent. Atterberg Limits analysis indicated a liquid limit ranging from 33 to 38 percent and a plasticity index ranging from 8 to 14 percent. Soil Type 1 is classified CL and ML according to USCS specifications and A-6(12), A-6(11), and A-4(6) according to AASHTO specifications.

Soil Type 2 – Sandy Lean CLAY

Soil Type 2 was observed to primarily consist of blueish gray, wet, medium stiff, low plasticity sandy lean CLAY. Soil Type 2 was observed below Soil Type 1 in test pits TP-1 and TP-3 and extended to the maximum depth of exploration.

Analytical laboratory testing conducted upon a representative soil sample obtained from test pit TP-1 indicated approximately 66 percent by weight passing the No. 200 sieve and

an in situ moisture content of approximately 32 percent. Atterberg Limits analysis indicated a liquid limit of 32 percent and a plasticity index of 14 percent. Soil Type 2 is classified CL according to USCS specifications and A-6(7) according to AASHTO specifications.

Soil Type 3 – Gravelly Lean CLAY with Sand (Apparent Sedimentary Conglomerate)

Soil Type 3 was observed to primarily consist of weathered orange to black, moist, stiff to very stiff, cemented, medium plasticity gravelly lean CLAY with sand. The degree of weathering and cementation varied throughout the soil unit and the presence of pebbles, gravels, and cobbles ranged trace to abundant. Soil Type 3 may represent Pleistocene to Pliocene, semi-consolidated, deeply weathered pebble to boulder sedimentary conglomerate (QTc) mapped by Evarts (2004). Soil Type 3 was observed below Soil Type 1 in test pits TP-8, TP-9, and TP-12 and extended to the maximum depth of exploration.

Analytical laboratory testing conducted upon a representative soil sample obtained from test pit TP-9 indicated approximately 57 percent by weight passing the No. 200 sieve and an in situ moisture content of approximately 19 percent. Atterberg Limits analysis indicated a liquid limit of 44 percent and a plasticity index of 25 percent. Soil Type 3 is classified CL according to USCS specifications and A-7-6(11) according to AASHTO specifications.

4.2.2 Groundwater

Groundwater was encountered within several test pits at depths ranging from 6 to 12 feet below ground surface. Review of nearby well logs obtained from the State of Washington Department of Ecology indicates that static groundwater levels in the area may vary significantly. Variations in ground water elevations likely reflect the screened interval depth of these wells, changes in ground surface elevation, and the presence of multiple aquifers and confining units. Groundwater levels are often subject to seasonal variance and may rise during extended periods of increased precipitation. Perched groundwater may also be present in localized areas. Seeps and springs may become evident during site grading, primarily along slopes or in areas cut below existing grade. Structures, roads, and drainage design should be planned accordingly.

5.0 DESIGN RECOMMENDATIONS

The geotechnical site investigation suggests the proposed development is generally compatible with surface and subsurface soils, provided the recommendations presented in this report are utilized and incorporated into the design and construction processes. The primary geotechnical concerns associated with the site are fine-textured soils, shallow groundwater, and drainage. Design recommendations are presented in the following text sections.

5.1 Site Preparation and Grading

Vegetation, organic material, unsuitable fill, and deleterious material that may be encountered should be cleared from areas identified for structures and site grading. Vegetation, other organic material, and debris should be removed from the site. Stripped topsoil should also be removed, or used only as landscape fill in nonstructural areas with slopes less than 25 percent. The anticipated stripping depth for sod and highly organic

topsoil is anticipated to vary between 12 and 16 inches. The required stripping depth may increase in areas of existing fill, heavy organics, deep till zones, or previously existing structures. Actual stripping depths should be determined based upon visual observations made during construction when soil conditions are exposed. The post-construction maximum depth of landscape fill placed or spread at any location onsite should not exceed one foot.

Previously disturbed soil, debris, or unconsolidated fill encountered during grading or construction activities should be removed completely and thoroughly from structural areas. This includes gravel driveways, old foundations, basement walls, utilities, associated soft soils, and debris. Excavation areas should be backfilled with engineered structural fill.

Test pits excavated during site exploration activities were backfilled loosely with onsite soils. Test pits located within structural areas should be properly backfilled with engineered fill during site improvements construction.

Site grading activities should be performed in accordance with requirements specified in the 2012 *International Building Code* (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, and grading activities should be observed and documented by Columbia West.

5.2 Engineered Structural Fill

Areas proposed for fill placement should be appropriately prepared as described in the preceding text. Surface soils should then be scarified and compacted prior to additional fill placement. Engineered structural fill should be placed in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within two percentage points of optimum conditions. A field density at least equal to 95 percent of the maximum dry density, obtained from the standard Proctor moisture-density relationship test (ASTM D698), is recommended for structural fill placement. For engineered structural fill placed on sloped grades, the area should be benched to provide a horizontal surface for compaction.

Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. Field compaction testing should be performed for each vertical foot of engineered fill placed. Engineered fill placement should be observed by Columbia West.

Engineered structural fill placement activities should be performed during dry summer months if possible. Most clean native soils may be suitable for use as structural fill if adequately moisture-conditioned to achieve recommended compaction specifications. Native clay soils with a plasticity index greater than 20 (Soil Type 3) should be evaluated and approved by Columbia West prior to re-use as structural fill. Because they are moisture-sensitive, fine-textured soils are often difficult to excavate and compact during wet weather conditions. If adequate compaction is not achievable with clean native soils, import structural fill consisting of well-graded granular material with a maximum particle size of three inches and no more than five percent passing the No. 200 sieve is recommended.

Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by Columbia West prior to placement. Laboratory analyses should include particle-size gradation and standard Proctor moisture-density analysis.

5.3 Cut and Fill Slopes

Fill placed on existing grades steeper than 5H:1V should be horizontally benched at least 10 feet into the slope. Fill slopes greater than six feet in height should be vertically keyed into existing subsurface soil. A typical fill slope cross-section is shown in Figure 3. Drainage implementations, including subdrains or perforated drain pipe trenches, may also be necessary in proximity to cut and fill slopes if seeps or springs are encountered. Drainage design may be performed on a case-by-case basis. Extent, depth, and location of drainage may be determined in the field by Columbia West during construction when soil conditions are exposed. Failure to provide adequate drainage may result in soil sloughing, settlement, or erosion.

Final cut or fill slopes at the site should not exceed 2H:1V without individual slope stability analysis. The values above assume a minimum horizontal setback for loads of 10 feet from top of cut or fill slope face or overall slope height divided by three (H/3), whichever is greater. A minimum slope setback detail for structures is presented in Figure 4.

Concentrated drainage or water flow over the face of slopes should be prohibited, and adequate protection against erosion is required. Fill slopes should be constructed by placing fill material in maximum 12-inch level lifts, compacting as described in Section 5.2, *Engineered Structural Fill* and horizontally benching where appropriate. Fill slopes should be overbuilt, compacted, and trimmed at least two feet horizontally to provide adequate compaction of the outer slope face. Proper cut and fill slope construction is critical to overall project stability and should be observed and documented by Columbia West.

5.4 Foundations

Based upon correspondence with the client, residential foundations are anticipated to consist of shallow continuous perimeter or column spread footings. Footings should be designed by a licensed structural engineer and conform to the recommendations below. Typical building loads are not expected to exceed approximately 2 to 3 kips per foot for perimeter footings or 10 kips per column. If actual loading exceeds anticipated loading, additional analysis should be conducted for the specific load conditions and proposed footing dimensions.

The existing ground surface should be prepared as described in Section 5.1, *Site Preparation and Grading*, and Section 5.2, *Engineered Structural Fill*. Foundations should bear upon firm native soil or engineered structural fill.

To evaluate bearing capacity for proposed structures, serviceability and reliability of shear resistance for subsurface soils was considered. Allowable bearing capacity is typically a function of footing dimension and subsurface soil properties, including settlement and shear resistance. Based upon in situ field testing and laboratory analysis, the estimated allowable bearing capacity for well-drained foundations prepared as described above is

1,500 psf. Bearing capacity may be increased by one-third for transient lateral forces such as seismic or wind. The modulus of subgrade reaction is estimated to be 250 psi/inch. The estimated coefficient of friction between in situ compacted native soil or engineered structural fill and in-place poured concrete is 0.45. Lateral forces may also be resisted by an assumed passive soil equivalent fluid pressure of 250 psf/f against embedded footings. The upper six inches of soil should be neglected in passive pressure calculations.

Footings should extend to a depth at least 18 inches below lowest adjacent grade to provide adequate bearing capacity and protection against frost heave. Foundations constructed during wet weather conditions may require over-excavation of saturated subgrade soils and granular structural backfill prior to concrete placement. Over-excavation recommendations should be provided by Columbia West during foundation excavation and construction. Excavations adjacent to foundations should not extend within a 1.5H:1V angle projected down from the outside bottom footing edge without additional geotechnical analysis.

Foundations should not be permitted to bear upon existing fill or disturbed soil. Because soil is often heterogeneous and anisotropic, Columbia West should observe foundation excavations prior to placing forms or reinforcing bar to verify subgrade support conditions are as anticipated in this report.

5.5 Settlement

Total long-term static footing displacement for shallow foundations constructed as described in this report is not anticipated to exceed approximately 1 inch. Differential settlement between comparably loaded footing elements is not expected to exceed approximately ½ inch over a span of 50 feet. The resulting vertical displacement after loading may be due to elastic distortion, dissipation of excess pore pressure, or soil creep.

5.6 Excavation

Soils at the site were explored to a maximum depth of 15 feet using a track-mounted excavator. Blasting or specialized rock-excavation techniques are not anticipated.

Groundwater was encountered within several test pits at depths ranging from 6 to 12 feet, however, perched groundwater layers may exist at shallow depths depending on seasonal fluctuations of the water table. Recommendations as described in Section 5.7 *Dewatering* should be considered in locations where subsurface construction activities intersect the water table.

Based upon laboratory analysis and field testing, near-surface soils may be Washington State Industrial Safety and Health Administration (WISHA) Type C. For temporary open-cut excavations deeper than four feet, but less than 20 feet in soils of these types, the maximum allowable slope is 1.5H:1V. WISHA soil type should be confirmed during field construction activities by the contractor. Soil is often anisotropic and heterogeneous, and it is possible that WISHA soil types determined in the field may differ from those described above.

The contractor should be held responsible for site safety, sloping, and shoring. Columbia West is not responsible for contractor activities and in no case should excavation be conducted in excess of all applicable local, state, and federal laws.

5.7 Dewatering

Groundwater elevation and hydrostatic pressure should be carefully considered during design of utilities, retaining walls, or other structures that require below-grade excavation. As described previously, shallow groundwater may be encountered in some areas proposed for development. Utility trenches in shallow groundwater areas or excavations and cuts that remain open for even short periods of time may undermine or collapse due to groundwater effects. Placement of layers of riprap or quarry spalls in localized areas on shallow excavation side slopes may be required to limit instability. Over-excavation and stabilization of pipe trenches or other excavations with imported crushed aggregate or gabion rock may also be necessary to provide adequate subgrade support.

Significant pumping and dewatering may be required to temporarily reduce the groundwater elevation to allow construction of proposed below-grade structures, installation of utilities, or placement of structural fills. Dewatering via a sump within excavation zones may be insufficient to control groundwater and provide excavation side slope stability. Dewatering may be more feasibly conducted by installing a system of temporary well points and pumps around proposed excavation areas or utility trenches. Depending on proposed utility depths, a site-specific dewatering plan may be necessary. Well pumps should remain functioning at all times during the excavation and construction period. Suitable back-up pumps and power supplies should be available to prevent unanticipated shut-down of dewatering equipment. Failure to operate pumps full-time may result in flooding of the excavation zones, resulting in damage to forms, slopes, or equipment.

5.8 Lateral Earth Pressure

If retaining walls are proposed, lateral earth pressures should be carefully considered in the design process. Hydrostatic pressure and additional surcharge loading should also be considered. Retained material may include engineered structural backfill or undisturbed native soil. Structural wall backfill should consist of imported granular material meeting *Section 9-03.12(2)* of WSDOT Standard Specifications. Backfill should be prepared and compacted to at least 95 percent of maximum dry density as determined by the modified Proctor test (ASTM D1557). Recommended parameters for lateral earth pressures for in situ soils and engineered structural backfill consisting of imported granular fill meeting WSDOT specifications for *Gravel Backfill for Walls 9-03.12(2)* are presented in Table 1.

The design parameters presented in Table 1 are valid for static loading cases only and are based upon in situ existing soils or compacted granular backfill. The recommended earth pressures do not include surcharge loads, dynamic loading, hydrostatic pressure, or seismic design.

Table 1. Lateral Earth Pressure Parameters for Level Backfill

Retained Soil	Equivalent Fluid Pressure for Level Backfill			Wet Density	Drained Internal Angle of Friction
	At-rest	Active	Passive		
Undisturbed native SILT and CLAY (Soil Types 1 and 2)	60 pcf	41 pcf	293 pcf	110 pcf	27°
Undisturbed native Gravelly Lean CLAY with Sand (Soil Type 3)	62 pcf	42 pcf	346 pcf	120 pcf	29°
Approved Structural Backfill Material	52 pcf	32 pcf	568 pcf	135 pcf	38°
WSDOT 9-03.12(2) compacted aggregate backfill					

** The upper 6 inches of soil should be neglected in passive pressure calculations. If exterior grade from top or toe of retaining wall is sloped, Columbia West should be contacted to provide location-specific lateral earth pressures.*

If seismic design is required for unrestrained walls, seismic forces may be calculated by superimposing a uniform lateral force of $10H^2$ pounds per lineal foot of wall, where H is the total wall height in feet. The resultant force should be applied at 0.6H from the base of the wall.

A continuous one-foot-thick zone of free-draining, washed, open-graded 1-inch by 2-inch drain rock and a 4-inch perforated gravity drain pipe is assumed behind retaining walls. Geotextile filter fabric should be placed between the drain rock and backfill soil. Specifications for drainpipe design are presented in Section 5.10, *Drainage*. If walls cannot be gravity drained, saturated base conditions and/or applicable hydrostatic pressures should be assumed.

Final retaining wall design should be reviewed and approved by Columbia West. Retaining wall subgrade and backfill activities should also be observed and tested for compliance with recommended specifications by Columbia West during construction.

5.9 Seismic Design Considerations

According to the *United States Geologic Survey (USGS) 2012 Seismic Design Maps Summary Report,* the anticipated peak ground and maximum considered earthquake spectral response accelerations resulting from seismic activity for the subject site are summarized in Table 2.

Table 2. Approximate Probabilistic Ground Motion Values for 'firm rock' sites based on subject property longitude and latitude

	2% Probability of Exceedance in 50 yrs
Peak Ground Acceleration	0.39 g
0.2 sec Spectral Acceleration	0.89 g
1.0 sec Spectral Acceleration	0.40 g

The listed probabilistic ground motion values are based upon "firm rock" sites with an assumed shear wave velocity of 2,500 ft/s in the upper 100 feet of soil profile. These values should be adjusted for site class effects by applying site coefficients Fa and Fv as defined in 2012 IBC Tables 1613.3.3(1) and (2). The site coefficients are intended to more accurately characterize estimated peak ground and respective earthquake spectral response accelerations by considering site-specific soil characteristics and index properties.

The *Site Class Map of Clark County, Washington* (Washington State Department of Natural Resources, 2004), indicates the northeast and southwest portions of the site may be represented by Site Class D and C respectively in *2012 IBC Section 1613.3.2*. Based upon site-specific testing and review of well logs and local geologic maps, site soils may be considered to be Site Class C. This site class designation indicates that some amplification of seismic energy may occur during a seismic event because of subsurface conditions.

Localized peak ground accelerations exceeding the adjusted values may occur in some areas in direct proximity to an earthquake's origin. This may be a result of amplification of seismic energy due to depth to competent bedrock, compression and shear wave velocity of bedrock, presence and thickness of loose, unconsolidated alluvial deposits, soil plasticity, grain size, and other factors.

Identification of specific seismic response spectra is beyond the scope of this investigation. If site structures are designed in accordance with recommendations specified in the 2012 IBC, the potential for peak ground accelerations in excess of the adjusted and amplified values should be understood.

5.10 Drainage

At a minimum, site drainage should include surface water collection and conveyance to properly designed stormwater management structures and facilities. Drainage design in general should conform to City of La Center regulations. Finished site grading should be conducted with positive drainage away from structures. Depressions or shallow areas that may retain ponding water should be avoided. Roof drains, low-point drains, and perimeter foundation drains are recommended for structures. Drains should consist of separate systems and gravity flow with a minimum two-percent slope away from foundations into the stormwater system or approved discharge location.

Perimeter foundation drains should consist of 3-inch perforated PVC pipe surrounded by a minimum of 1 ft^3 of clean, washed drain rock per linear foot of pipe and wrapped with geotextile filter fabric. Open-graded drain rock with a maximum particle size of 3 inches and less than 2 percent passing the No. 200 sieve is recommended. Geotextile filter fabric should consist of Mirafi 140N or approved equivalent, with AOS between No. 70 and No. 100 sieve. The water permittivity should be greater than 1.5/sec. Figure 5 presents a typical foundation drain. Perimeter drains may limit increased hydrostatic pressure beneath footings and assist in reducing potential perched moisture areas.

Subdrains should also be considered if portions of the site are cut below surrounding grades. Shallow groundwater, springs, or seeps should be conveyed via drainage channel or perforated pipe into the stormwater management system or an approved discharge. Recommendations for design and installation of perforated drainage pipe may be performed on a case-by-case basis by the geotechnical engineer during construction. Failure to provide adequate surface and sub-surface drainage may result in soil slumping or unanticipated settlement of structures exceeding tolerable limits. A typical perforated drain pipe trench detail is presented in Figure 6.

Foundation drains and subdrains should be closely monitored after construction to assess their effectiveness. If additional surface or shallow subsurface seeps become evident, the drainage provisions may require modification or additional drains. Columbia West should be consulted to provide appropriate recommendations.

5.11 Infiltration Testing Results

To investigate the feasibility of subsurface disposal of stormwater, Columbia West conducted in situ infiltration testing at one location within the project area on June 10, 2015. Results of in situ infiltration testing are presented in Table 3. The soil classification presented in Table 3 is based upon laboratory analysis. The measured infiltration rate is presented as a coefficient of permeability (k) and has been reported without application of a factor of safety.

As indicated in Table 3, the test was conducted within test pit TP-1 at the indicated depth. Soils in the tested location were observed and sampled where appropriate to adequately characterize the subsurface profile. Tested native soils are classified as SILT with sand. Soil laboratory analytical test reports are provided in Appendix A.

Single-ring, falling head infiltration testing was performed by inserting a three-inch diameter pipe into the soil at the noted depth. The test was conducted by filling the pipe with water and recording time and water level drop measurements. Using Darcy's Law for saturated flow in homogeneous media, the coefficient of permeability (k) was then calculated.

Table 3. Infiltration Test Data

Infiltration Test No.	Depth to Groundwater (feet bgs)	Location	Soil Type	Measured Infiltration Rate*	Approximate Test Depth	Passing No. 200 Sieve (%)
IT-1	12.0	TP-1, See Figure 2	ML, SILT with Sand	< 0.1 in/hr	7.0 feet	77.3

*Infiltration rate as defined by soil's approximate vertical coefficient of permeability (k).

As indicated in Table 3, soils in the tested location exhibited a very low coefficient of permeability. Due to the presence of shallow groundwater and fine-textured soils, the site has limited potential for infiltration. If infiltration is considered, a gravity overflow should be provided to an appropriate discharge location.

5.12 Bituminous Asphalt and Portland Cement Concrete

Based upon review of preliminary site plans, proposed development will include new asphalt concrete roadways. Columbia West recommends adherence to City of La Center paving guidelines unless a site-specific pavement design is conducted.

For dry weather construction, pavement surface sections should bear upon competent subgrade consisting of scarified and compacted native soil or engineered structural fill. Wet weather pavement construction is discussed later in Section 5.13, *Wet Weather Construction Methods and Techniques*. Subgrade conditions should be evaluated and tested by Columbia West prior to placement of crushed aggregate base. Subgrade evaluation should include nuclear gauge density testing and wheel proof-roll observations conducted with a 12-cubic yard, double-axle dump truck or equivalent. Nuclear gauge density testing should be conducted at 150-foot intervals or as determined by the onsite geotechnical engineer. Subgrade soil should be compacted to at least 95 percent of the modified Proctor dry density, as determined by ASTM D1557. Areas of observed deflection or rutting during proof-roll evaluation should be excavated to a firm surface and replaced with compacted crushed aggregate.

Crushed aggregate base should be compacted and tested in accordance with the specifications outlined above. Asphalt concrete pavement should be compacted to at least 91 percent of maximum Rice density. Nuclear gauge density testing should be conducted to verify adherence to recommended specifications. Testing frequency should be in accordance with Washington Department of Transportation and City of La Center specifications.

Portland cement concrete curbs and sidewalks should be installed in accordance with City of La Center specifications. Curb and sidewalk aggregate base should be observed and proof-rolled by Columbia West. Soft areas that deflect or rut should be stabilized prior to pouring concrete. Concrete should be tested during installation in accordance with ASTM C171, C138, C231, C143, C1064, and C31. This includes casting of cylinder specimen at a frequency of four cylinders per 100 cubic yards of poured concrete. Recommended field and analytical laboratory concrete testing includes slump, air entrainment, temperature, and unit weight.

5.13 Wet Weather Construction Methods and Techniques

Wet weather construction often results in significant shear strength reduction and soft areas that may rut or deflect. Installation of granular working layers may be necessary to provide a firm support base and sustain construction equipment. Granular layers should consist of all-weather gravel, 2x4-inch gabion, or other similar material (six-inch maximum size with less than five percent passing the No. 200 sieve).

Construction equipment traffic across exposed soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for wet soils. Wet weather construction may also result in generation of significant excess quantities of soft wet soil. This material should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Over-excavation may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric is also recommended. Crushed aggregate base should be installed in a single lift with trucks end-dumping from an advancing pad of granular fill. During extended wet periods, stripping activities may also need to be conducted from an advancing pad of granular fill. Once installed, the crushed aggregate base should be compacted with several passes from a static drum roller. A vibratory compactor is not recommended because it may further disturb the subgrade. Subdrains may also be necessary to provide subgrade drainage and maintain structural integrity.

Crushed aggregate base should be compacted to at least 95 percent of maximum dry density according to the modified Proctor density test (ASTM D1557). Compaction should be verified by nuclear gauge density testing. Observation of a proof-roll with a loaded dump truck is also recommended as an indication of future pavement performance.

It should be understood that wet weather construction is risky and costly. It is recommended that Columbia West observe and document wet weather construction activities. Proper construction methods and techniques are critical to overall project integrity.

5.14 Erosion Control Measures

Based upon field observations and laboratory testing, the erosion hazard for site soils in flat to shallow-gradient portions of the property is likely to be low. The potential for erosion generally increases in sloped areas. Therefore, disturbance to vegetation in sloped areas should be minimized during construction activities. Soil is also prone to erosion if unprotected and unvegetated during periods of increased precipitation. Erosion can be minimized by performing construction activities during dry summer months.

Site-specific erosion control measures should be implemented to address the maintenance of exposed areas. This may include silt fence, biofilter bags, straw wattles, or other suitable methods. During construction activities, exposed areas should be well-compacted and protected from erosion with visqueen, surface tactifier, or other means, as appropriate. Temporary slopes or exposed areas may be covered with straw, crushed aggregate, or riprap in localized areas to minimize erosion. Erosion and water runoff during wet weather conditions may be controlled by application of strategically placed channels and small detention depressions with overflow pipes.

After grading, exposed surfaces should be vegetated as soon as possible with erosion-resistant native vegetation. Jute mesh or straw may be applied to enhance vegetation. Once established, vegetation should be properly maintained. Disturbance to existing native vegetation and surrounding organic soil should also be minimized during construction activities.

5.15 Soil Shrink/Swell Potential

Based upon laboratory analysis, near-surface soils contain as much as 85 percent by weight passing the No. 200 sieve and exhibit a plasticity index ranging from 8 to 25 percent. This indicates potential for soil shrinking or swelling and underscores the

importance of proper moisture-conditioning during fill placement. Medium plasticity soils should be placed and compacted at a moisture content at least two percent above optimum as determine by laboratory analysis.

5.16 Utility Installation

Utility installation may require subsurface excavation and trenching. Excavation, trenching and shoring should conform to federal (Occupational Safety and Health Administration) (OSHA) (29 CFR, Part 1926) and *WISHA* (WAC, Chapter 296-155) regulations. Site soils may slough when cut vertically and sudden precipitation events or perched groundwater may result in accumulation of water within excavation zones and trenches.

Utilities should be installed in general accordance with manufacturer's recommendations. Utility trench backfill should consist of crushed aggregate or other coarse-textured, free-draining material acceptable to the client, City of La Center, and Columbia West. Trench backfill material within 18 inches of the top of utility pipes should be hand compacted (i.e., no heavy compaction equipment). The remaining backfill should be compacted to at least 95 percent of maximum dry density as determined by the standard Proctor moisture-density test (ASTM D698). Clean, free-draining, fine bedding sand is recommended for use in the pipe zone. With exception of the pipe zone, backfill should be placed in loose lifts not exceeding 12 inches in thickness.

Compaction of utility trench backfill material should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. It is recommended that field compaction testing be performed at 200-foot intervals along the utility trench centerline at the surface and midpoint depth of the trench. Compaction frequency and specifications may be modified for non-structural areas in accordance with recommendations of the site geotechnical engineer.

6.0 CONCLUSION AND LIMITATIONS

This geotechnical site investigation report was prepared in accordance with accepted standard conventional principles and practices of geotechnical engineering. This investigation pertains only to material tested and observed as of the date of this report, and is based upon proposed site development as described in the text herein. This report is a professional opinion containing recommendations established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. Soil conditions may differ between tested locations or over time. Slight variations may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions are as anticipated in this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Columbia West cannot accept responsibility for deviations from recommendations described in this report. Future performance of structural facilities is often related to the degree of construction observation by qualified personnel. These services should be performed to the full extent recommended.

This report is not an environmental assessment and should not be construed as a representative warranty of site subsurface conditions. The discovery of adverse environmental conditions, or subsurface soils that deviate significantly from those described in this report, should immediately prompt further investigation. The above statements are in lieu of all other statements expressed or implied.

This report was prepared solely for the client and is not to be reproduced without prior authorization from Columbia West. Final engineering plans and specifications for the project should be reviewed and approved by Columbia West as they relate to geotechnical and grading issues prior to final design approval. Columbia West is not responsible for independent conclusions or recommendations made by other parties based upon information presented in this report. Unless a particular service was expressly included in the scope, it was not performed and there should be no assumptions based upon services not provided. Additional report limitations and important information about this document are presented in Appendix E. This information should be carefully read and understood by the client and other parties reviewing this document.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

Lance V. Lehto, PE, GE
President

REFERENCES

Annual Book of ASTM Standards, Soil and Rock (I), v04.08, American Society for Testing and Materials, 1999.

Beeson, M.H., Tolan, T.L., Madin, I.P., *Geologic Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon*; Oregon Department of Geology and Mineral Industries; Geological Map Series GMS-59, 1989.

Clark County Maps Online (http://gis.clark.wa.gov/ccgis/mol/property.htm)

Evarts, Russell C., *Geological Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington, Scientific Investigations Map 2844*, US Geological Survey, 2004.

Geomatrix Consultants, *Seismic Design Mapping, State of Oregon*, January 1995.

International Building Code: *2012 International Building Code, 2012 edition*, International Code Council, 2012.

Mundorff, M.J., *Geology and Groundwater Conditions of Clark County*, USGS Water Supply Paper 1600, 1964.

Phillips, William M., *Geological Map of the Vancouver Quadrangle, Washington and Oregon,* Open File Report 87-10, Washington State Department of Natural Resources, Division of Geology and Earth Resources, 1987.

Safety and Health Regulations for Construction, 29 CFR Part 1926, Occupational Safety and Health Administration (OSHA), revised July 1, 2001.

Safety Standards for Construction Work, Part N, Excavation, Trenching and Shoring, Washington Administrative Code, Chapter 296-155, Division of Industrial Safety and Health, Washington Department of Labor and Industries, February, 1993.

State of Washington Department of Ecology, *Washington State Well Log Viewer (apps.exy.wa.gov/wellog/).*

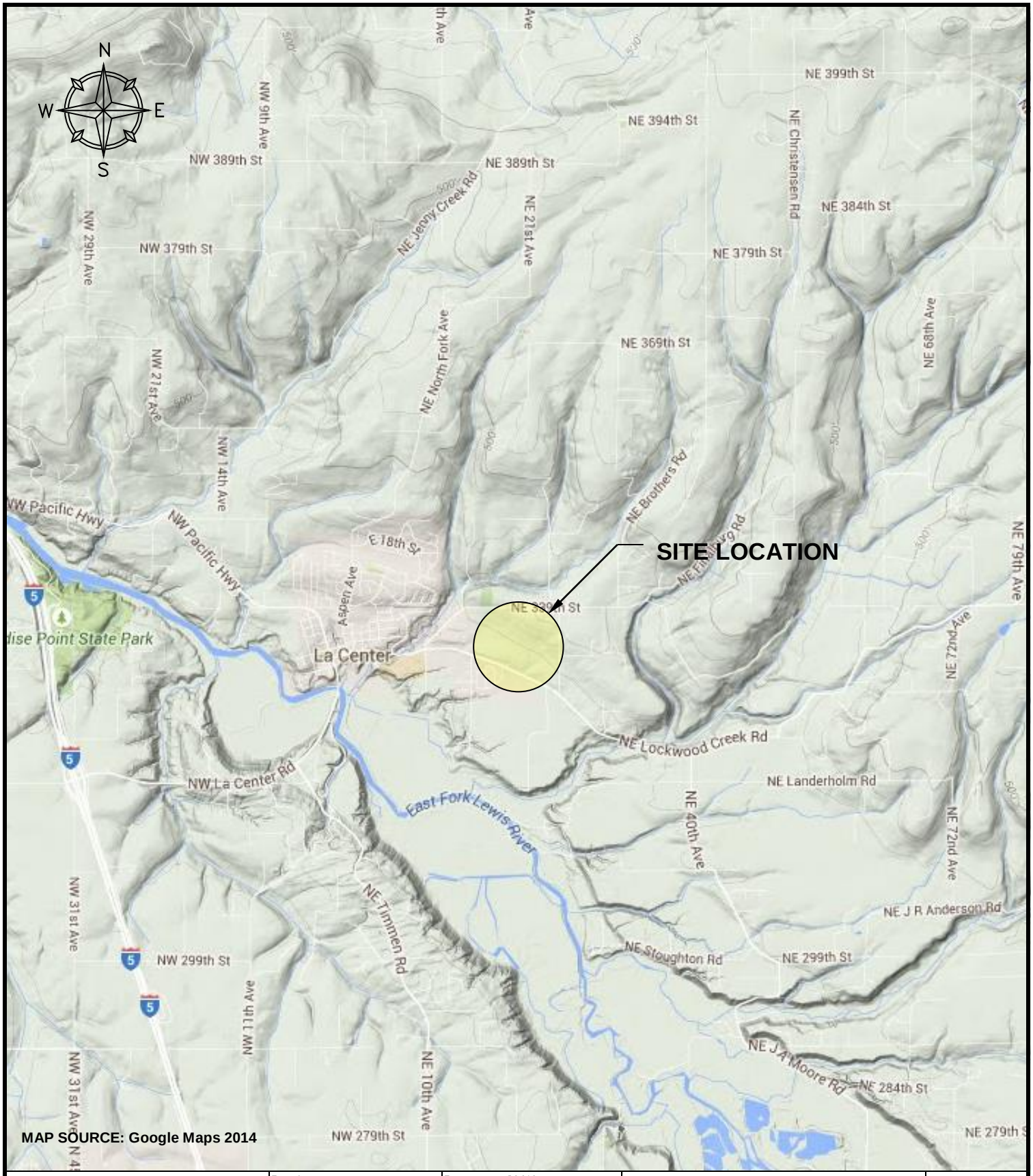
United States Geologic Survey (USGS), *2012 Seismic Design Maps, Web Application, Accessed June 2014*

Wong, Ivan, et al, *Earthquake Scenario and Probabilistic Earthquake Ground Shaking Maps for the Portland, Oregon, Metropolitan Area*, IMS-16, Oregon Department of Geology and Mineral Industries, 2000.

Palmer, Stephen P., Magsino, Sammantha L., Poelstra, James L., and Niggemann, Rebecca A., *Site Class Map of Clark County, Washington; Liquefaction Susceptibility Map of Clark County Washington;* Washington State Department of Natural Resources, September 2004.

Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture *2013 website* (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.).

FIGURES



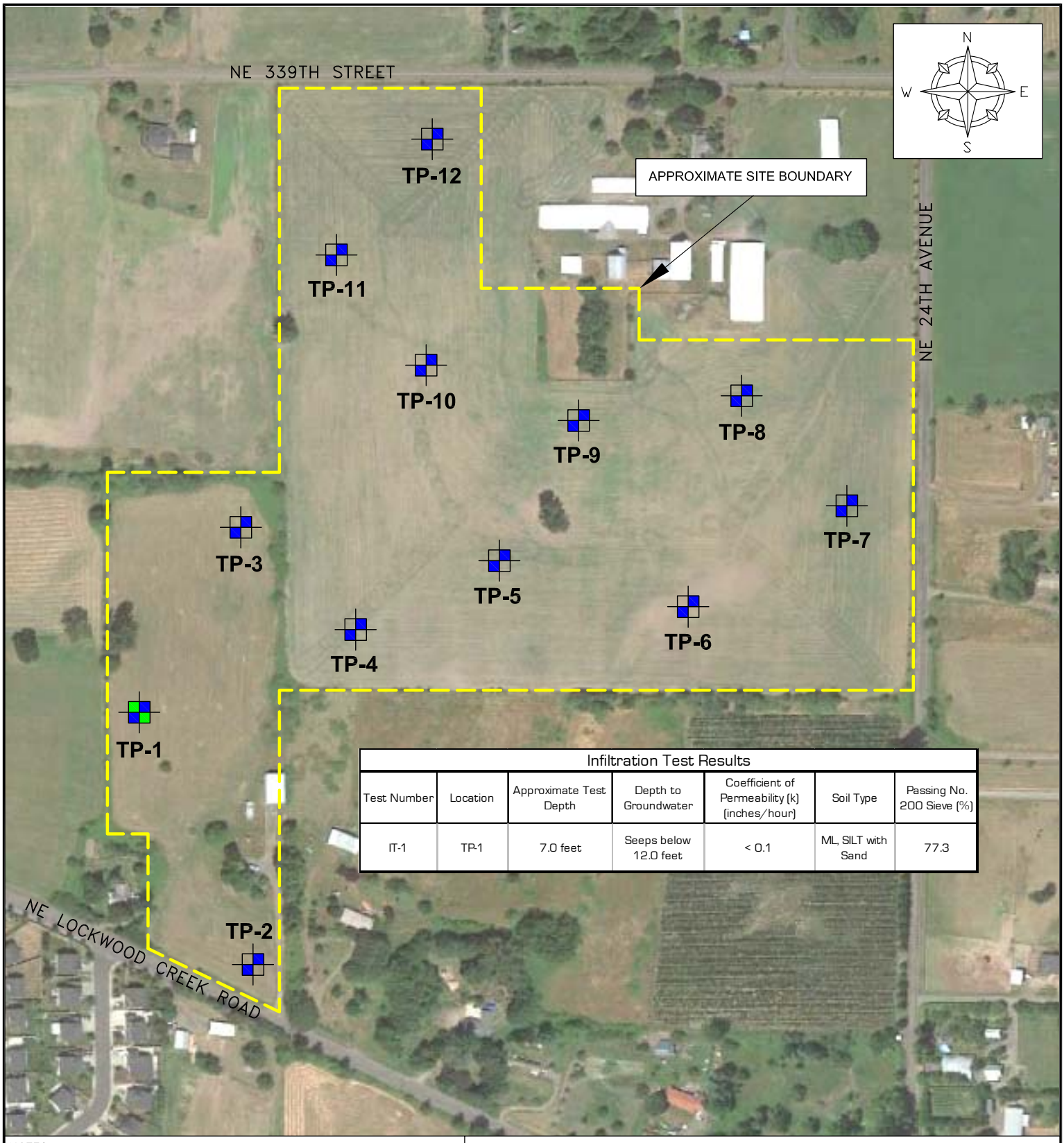
Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc
11917 NE 95th Street
Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Design	Drawn: GLW		
Checked: LVL	Date: 06/22/2015		
Client: RK LD, LLC	Rev	By	Date
Job No.: 15159			
CAD File: FIGURE 1			
Scale: ~1:50,000			

SITE LOCATION MAP

SUNRISE TERRACE
LA CENTER, WASHINGTON

FIGURE
1



Infiltration Test Results

Test Number	Location	Approximate Test Depth	Depth to Groundwater	Coefficient of Permeability (k) (inches/hour)	Soil Type	Passing No. 200 Sieve (%)
IT-1	TP-1	7.0 feet	Seeps below 12.0 feet	< 0.1	ML, SILT with Sand	77.3

NOTES:
1. SITE LOCATION: 1908 NE LOCKWOOD CREEK ROAD, LA CENTER, WASHINGTON, PARCEL NOS. 209062000, 986027189, 986027188, 209047000
2. SITE IS APPROXIMATELY 33.7 ACRES IN SIZE.
3. DRAWING IS NOT TO SCALE.
4. BASE MAP OBTAINED FROM GOOGLE EARTH.
5. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
6. TEST PITS BACKFILLED LOOSELY WITH ONSITE SOIL ON 6/9/2015.

APPROXIMATE LOCATION OF TEST PIT EXPLORATION

APPROXIMATE LOCATION OF INFILTRATION TEST

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc
11917 NE 95th STREET
VANCOUVER, WASHINGTON 98682
PHONE: 360-823-2900 FAX: 360-823-2901
www.columbiawestengineering.com

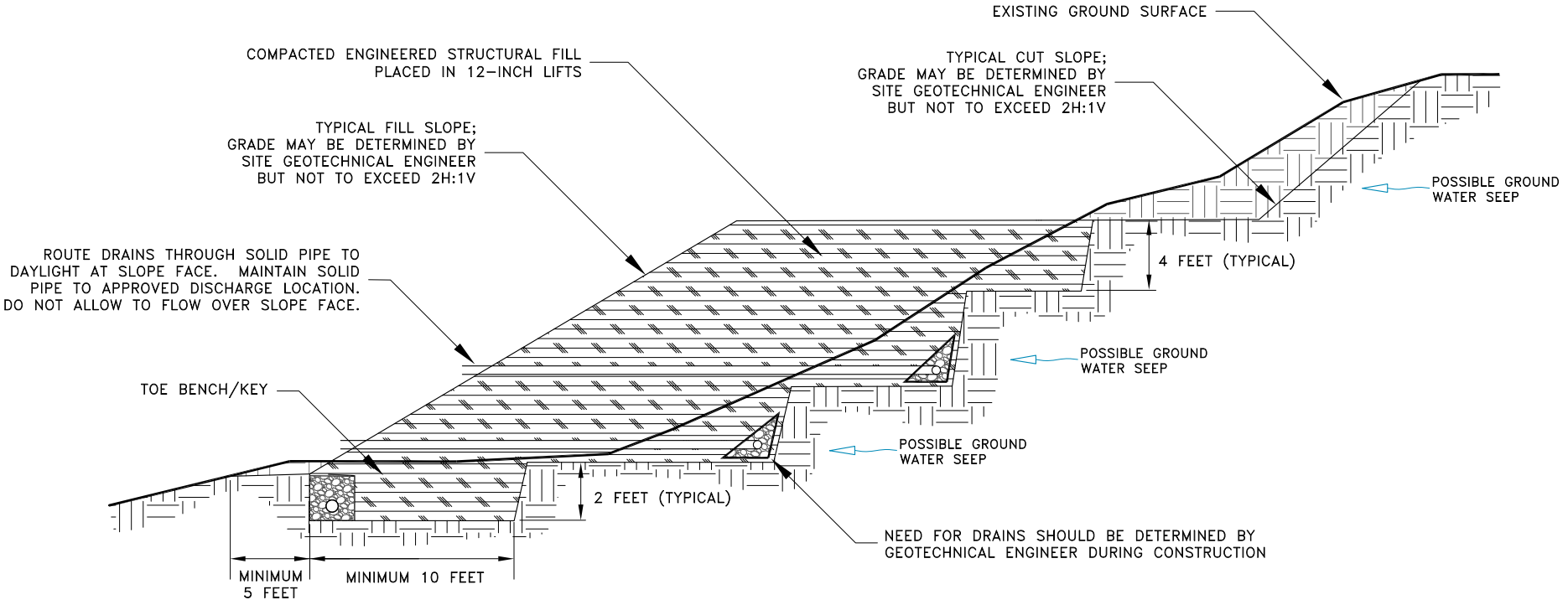
Design:	Drawn: GLW			
Checked: LVL	Date: 6/15/15			
Client: RK LD, LLC	Rev	By	Date	
Job No: 15159				
CAD File: FIGURE 2				
Scale: NONE				

EXPLORATION LOCATION MAP

SUNRISE TERRACE
LA CENTER, WASHINGTON

FIGURE 2

TYPICAL CUT AND FILL SLOPE CROSS-SECTION

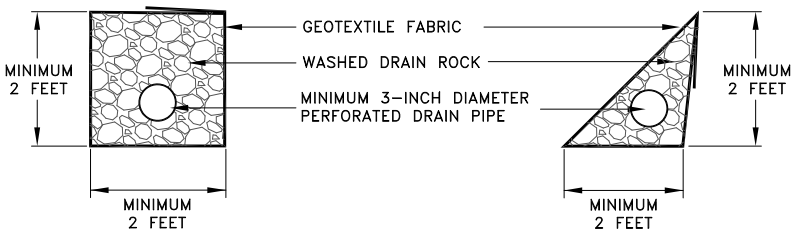


DRAIN SPECIFICATIONS

GEOTEXTILE FABRIC SHALL CONSIST OF MIRAFI 140N OR APPROVED EQUIVALENT WITH AOS BETWEEN No. 70 AND No. 100 SIEVE.

WASHED DRAIN ROCK SHALL BE OPEN–GRADED ANGULAR DRAIN ROCK WITH LESS THAN 2 PERCENT PASSING THE No. 200 SIEVE AND A MAXIMUM PARTICLE SIZE OF 3 INCHES.

TYPICAL DRAIN SECTION DETAIL

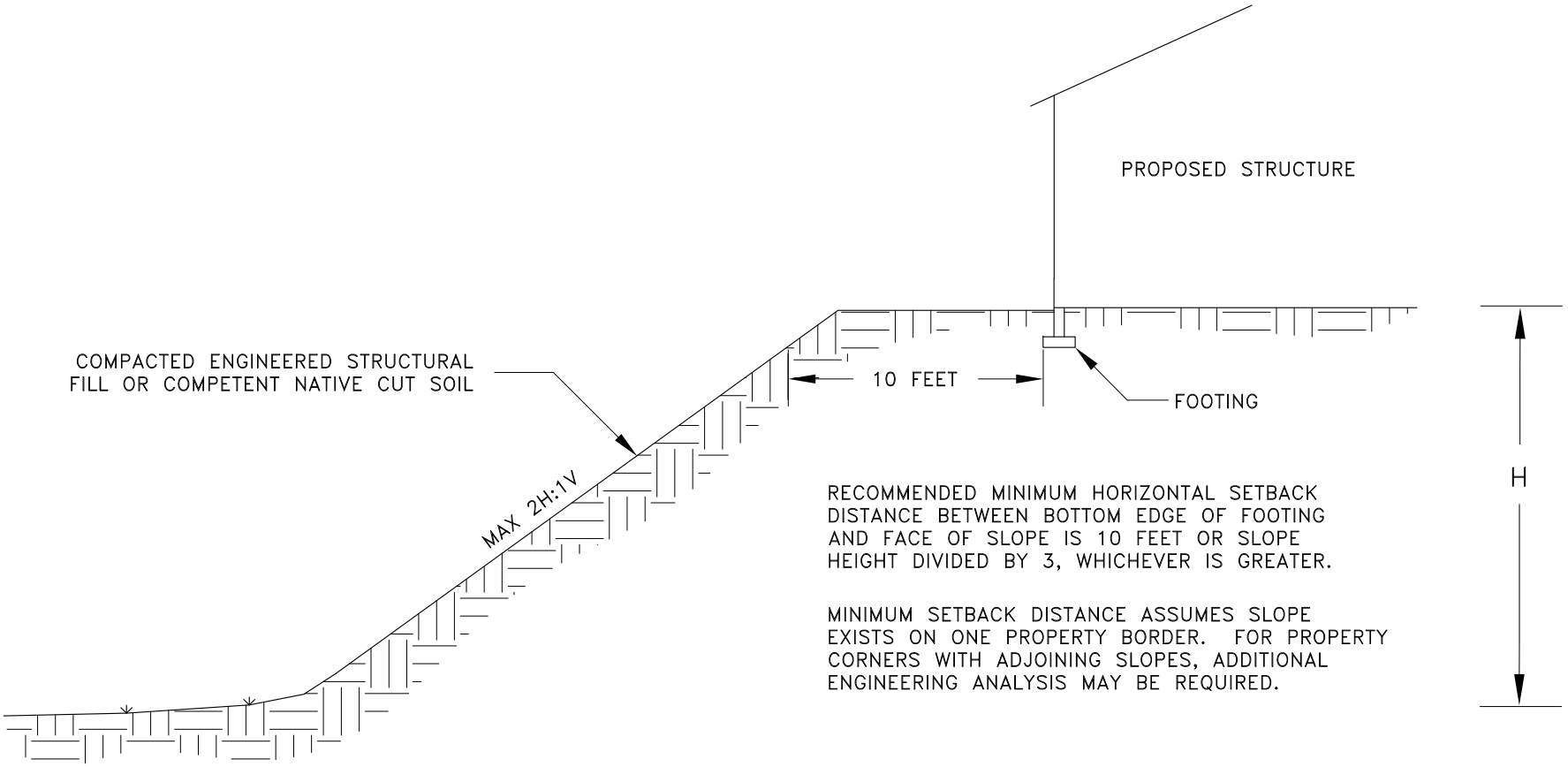


NOTES:
1. DRAWING IS NOT TO SCALE.
2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
3. DRAWING REPRESENTS TYPICAL FILL AND CUT SLOPE SECTION, AND MAY NOT BE SITE–SPECIFIC.

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc
11917 NE 95th STREET
VANCOUVER, WASHINGTON 98682
PHONE: 360-823-2900 FAX: 360-823-2901
www.columbiawestengineering.com

Design:	Drawn: GLW	TYPICAL CUT AND FILL SLOPE CROSS–SECTION	FIGURE 3
Checked: LVL	Date: 6/22/15		
Client: RK LD, LCC	Rev / By / Date	SUNRISE TERRACE LA CENTER, WASHINGTON	
Job No: 15159			
CAD File: FIGURE 3			
Scale: NONE			

MINIMUM FOUNDATION SLOPE SETBACK DETAIL



RECOMMENDED MINIMUM HORIZONTAL SETBACK DISTANCE BETWEEN BOTTOM EDGE OF FOOTING AND FACE OF SLOPE IS 10 FEET OR SLOPE HEIGHT DIVIDED BY 3, WHICHEVER IS GREATER.

MINIMUM SETBACK DISTANCE ASSUMES SLOPE EXISTS ON ONE PROPERTY BORDER. FOR PROPERTY CORNERS WITH ADJOINING SLOPES, ADDITIONAL ENGINEERING ANALYSIS MAY BE REQUIRED.

NOTES:
1. DRAWING IS NOT TO SCALE.
2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
3. DRAWING REPRESENTS TYPICAL FOUNDATION SETBACK DETAIL, AND MAY NOT BE SITE-SPECIFIC.

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc
11917 NE 95th STREET
VANCOUVER, WASHINGTON 98682
PHONE: 360-823-2900 FAX: 360-823-2901
www.columbiawestengineering.com

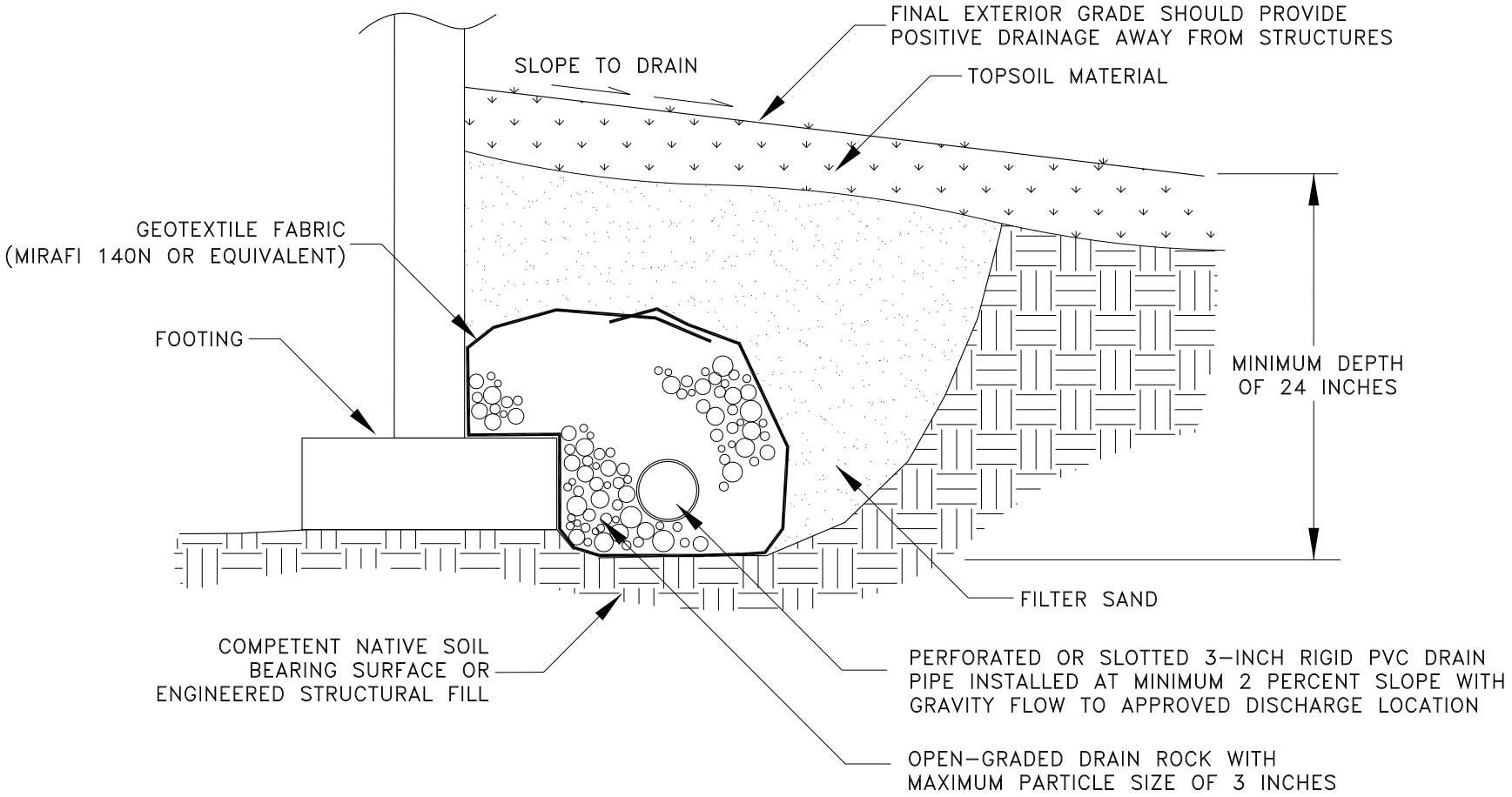
Design:	Drawn: GLW			
Checked: LVL	Date: 6/22/15			
Client: RK LD, LCC	Rev	By	Date	
Job No: 15159				
CAD File: FIGURE 4				
Scale: NONE				

MINIMUM FOUNDATION SLOPE SETBACK DETAIL

SUNRISE TERRACE
LA CENTER, WASHINGTON

FIGURE 4

TYPICAL PERMITER FOOTING DRAIN DETAIL



NOTES:
1. DRAWING IS NOT TO SCALE.
2. DRAWING REPRESENTS TYPICAL FOOTING DRAIN DETAIL AND MAY NOT BE SITE-SPECIFIC

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc
11917 NE 95th STREET
VANCOUVER, WASHINGTON 98682
PHONE: 360-823-2900 FAX: 360-823-2901
www.columbiawestengineering.com

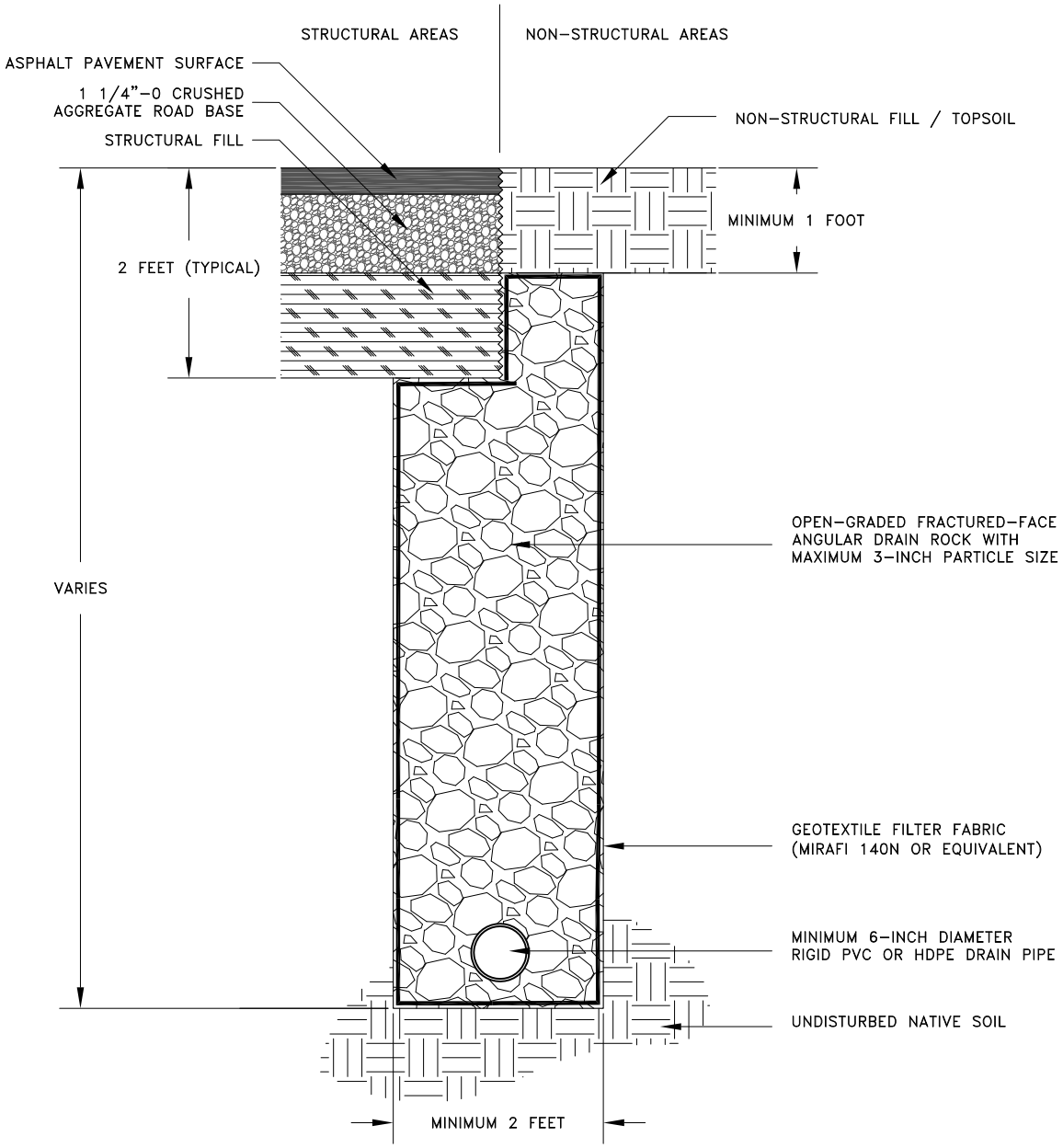
Design:	Drawn: GLW		
Checked: LVL	Date: 6/22/15		
Client: RK LD, LCC	Rev	By	Date
Job No: 15159			
CAD File: FIGURE 5			
Scale: NONE			

TYPICAL PERIMETER FOOTING DRAIN DETAIL

SUNRISE TERRACE
LA CENTER, WASHINGTON

FIGURE 5

TYPICAL PERFORATED DRAIN PIPE TRENCH DETAIL



NOTE: LOCATION, INVERT ELEVATION, DEPTH OF TRENCH, AND EXTENT OF PERFORATED PIPE REQUIRED MAY BE MODIFIED BY THE GEOTECHNICAL ENGINEER DURING CONSTRUCTION BASED UPON FIELD OBSERVATION AND SITE–SPECIFIC SOIL CONDITIONS.

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc
11917 NE 95th STREET
VANCOUVER, WASHINGTON 98682
PHONE: 360-823-2900 FAX: 360-823-2901
www.columbiawestengineering.com

Design:	Drawn: GLW	TYPICAL PERFORATED DRAIN PIPE TRENCH DETAIL	FIGURE 6
Checked: LVL	Date: 6/22/15		
Client: RK LD, LCC	Rev / By / Date		
Job No: 15159		SUNRISE TERRACE	
CAD File: FIGURE 6		LA CENTER, WASHINGTON	
Scale: NONE			

APPENDIX A
LABORATORY TEST RESULTS

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-384
		REPORT DATE 06/18/15	FIELD ID TP1.1
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY with Sand	Test Pit TP-01 depth = 2.5 feet	CL, Lean Clay with Sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-6(12)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

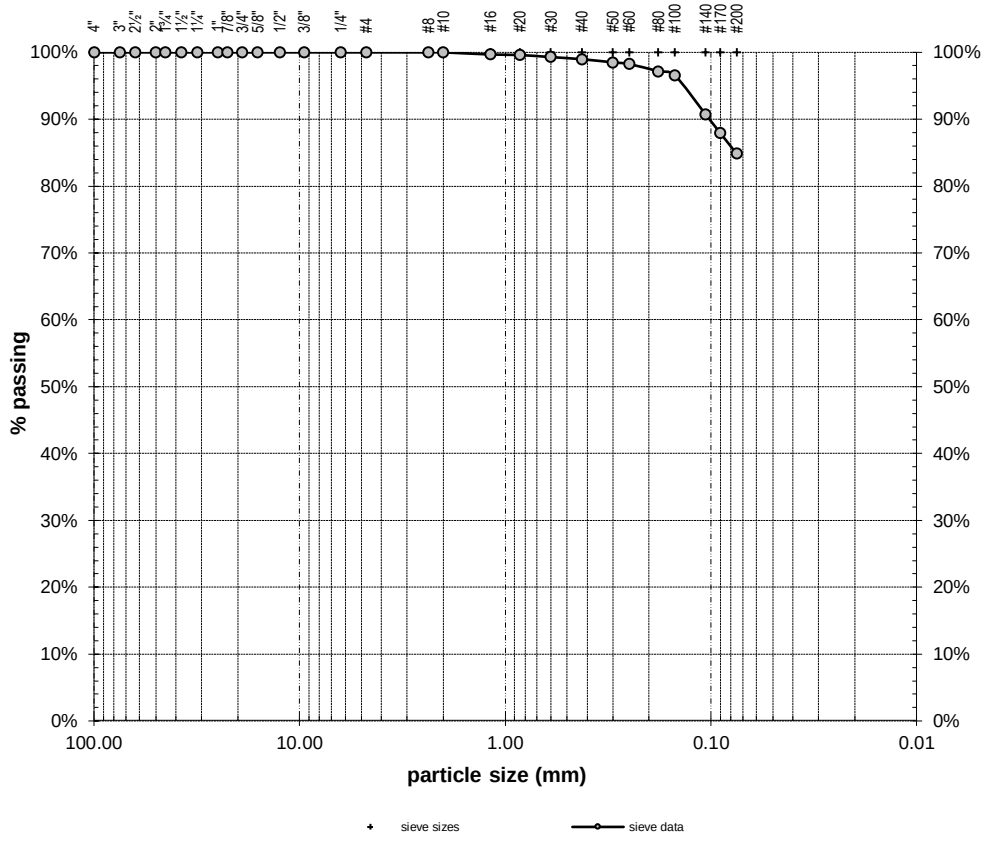
ADDITIONAL DATA

initial dry mass (g) =	192.0		
as-received moisture content =	32.6%	coefficient of curvature, C_C =	n/a
liquid limit =	38	coefficient of uniformity, C_U =	n/a
plastic limit =	24	effective size, $D_{(10)}$ =	n/a
plasticity index =	14	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel =	0.0%
% sand =	15.2%
% silt and clay =	84.8%

GRAIN SIZE DISTRIBUTION



			PERCENT PASSING			
	SIEVE SIZE		SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30		100.0%		
	#4	4.75	100.0%			
SAND	#8	2.36		100.0%		
	#10	2.00	100.0%			
	#16	1.18		99.7%		
	#20	0.850	99.6%			
	#30	0.600		99.3%		
	#40	0.425	99.0%			
	#50	0.300		98.5%		
	#60	0.250	98.3%			
	#80	0.180		97.2%		
	#100	0.150	96.6%			
	#140	0.106		90.7%		
	#170	0.090		87.9%		
	#200	0.075	84.8%			

DATE TESTED	TESTED BY
06/16/15	JMR/JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-384
		REPORT DATE: 06/18/15	FIELD ID: TP1.1
		DATE SAMPLED: 06/10/15	SAMPLED BY: GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY with Sand	Test Pit TP-01 depth = 2.5 feet	CL, Lean Clay with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	38
plastic limit =	24
plasticity index =	14

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	31.47	35.60	34.74	
dry soil + pan weight, g =	28.63	31.51	30.83	
pan weight, g =	20.77	20.73	20.76	
N (blows) =	35	26	20	
moisture, % =	36.1 %	37.9 %	38.8 %	

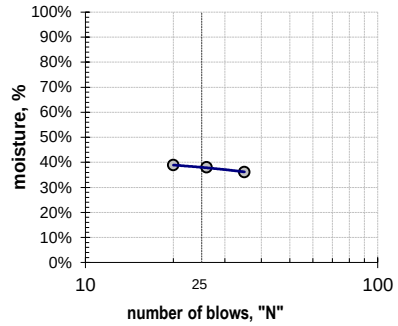
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

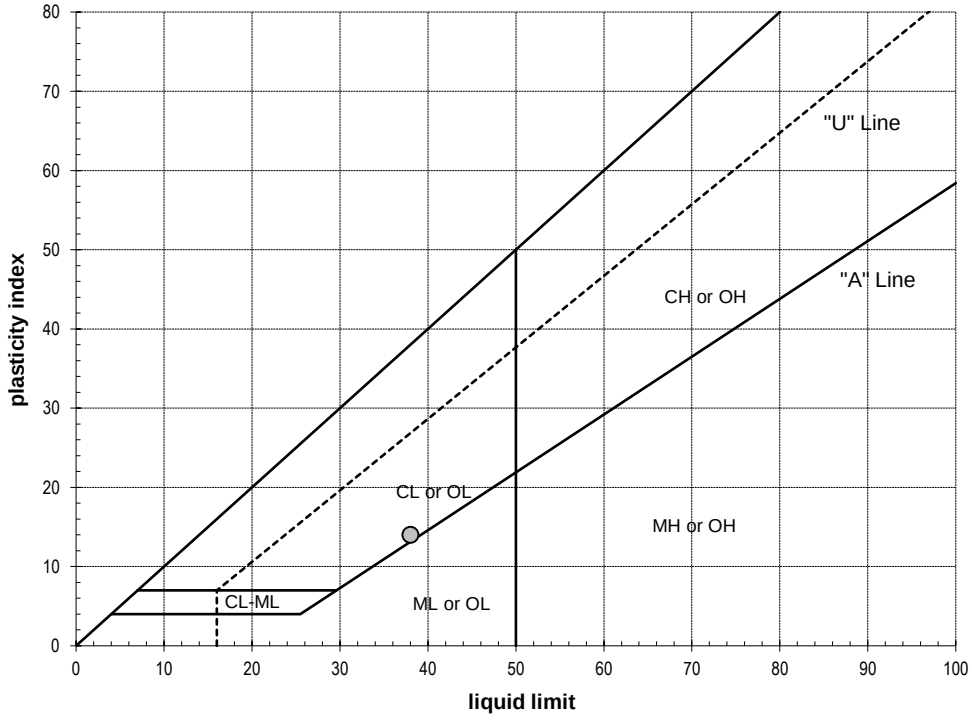
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	28.38	29.26		
dry soil + pan weight, g =	26.91	27.58		
pan weight, g =	20.57	20.57		
moisture, % =	23.2 %	24.0 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	15.2%
% silt and clay =	84.8%
% silt =	n/a
% clay =	n/a
moisture content =	32.6%

DATE TESTED	TESTED BY
06/16/15	JJC/JMR

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-385
		REPORT DATE 06/18/15	FIELD ID TP1.2
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Sand	Test Pit TP-01 depth = 7 feet	ML, Silt with Sand
SPECIFICATIONS none		**AASHTO SOIL TYPE** A-4(6)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

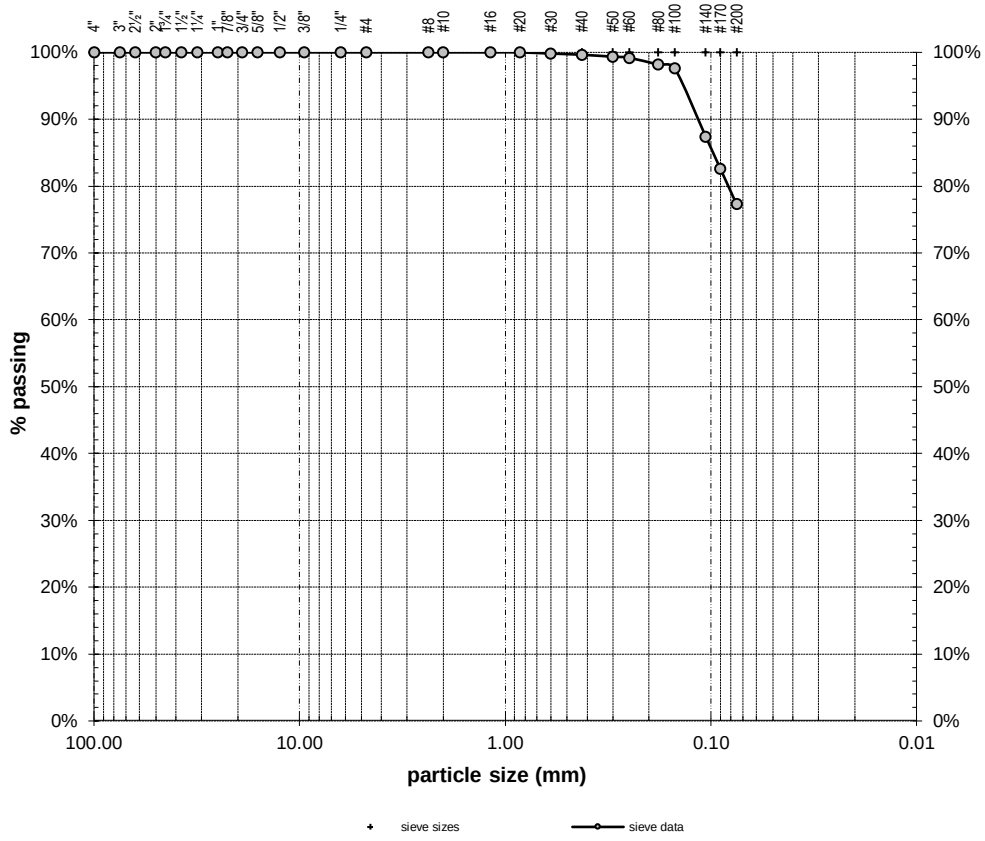
ADDITIONAL DATA

initial dry mass (g) =	124.1		
as-received moisture content =	36.0%	coefficient of curvature, C_C =	n/a
liquid limit =	33	coefficient of uniformity, C_U =	n/a
plastic limit =	25	effective size, $D_{(10)}$ =	n/a
plasticity index =	8	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 22.7%
% silt and clay = 77.3%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30		100.0%		
	#4	4.75	100.0%			
SAND	#8	2.36		100.0%		
	#10	2.00	100.0%			
	#16	1.18		100.0%		
	#20	0.850	100.0%			
	#30	0.600		99.8%		
	#40	0.425	99.6%			
	#50	0.300		99.3%		
	#60	0.250	99.2%			
	#80	0.180		98.2%		
	#100	0.150	97.6%			
	#140	0.106		87.4%		
	#170	0.090		82.6%		
	#200	0.075	77.3%			

DATE TESTED	TESTED BY
06/16/15	JMR/JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-385
		REPORT DATE 06/18/15	FIELD ID TP1.2
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Sand	Test Pit TP-01 depth = 7 feet	ML, Silt with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	33
plastic limit =	25
plasticity index =	8

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	35.87	38.50	38.27	35.74
dry soil + pan weight, g =	32.20	34.17	33.92	31.97
pan weight, g =	20.76	20.72	20.63	20.69
N (blows) =	33	31	21	18
moisture, % =	32.1 %	32.2 %	32.7 %	33.4 %

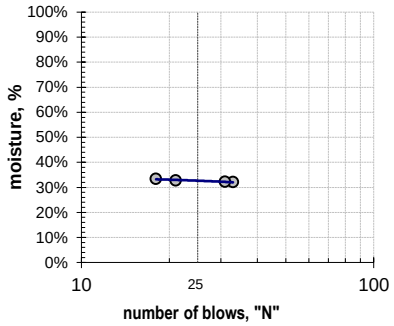
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

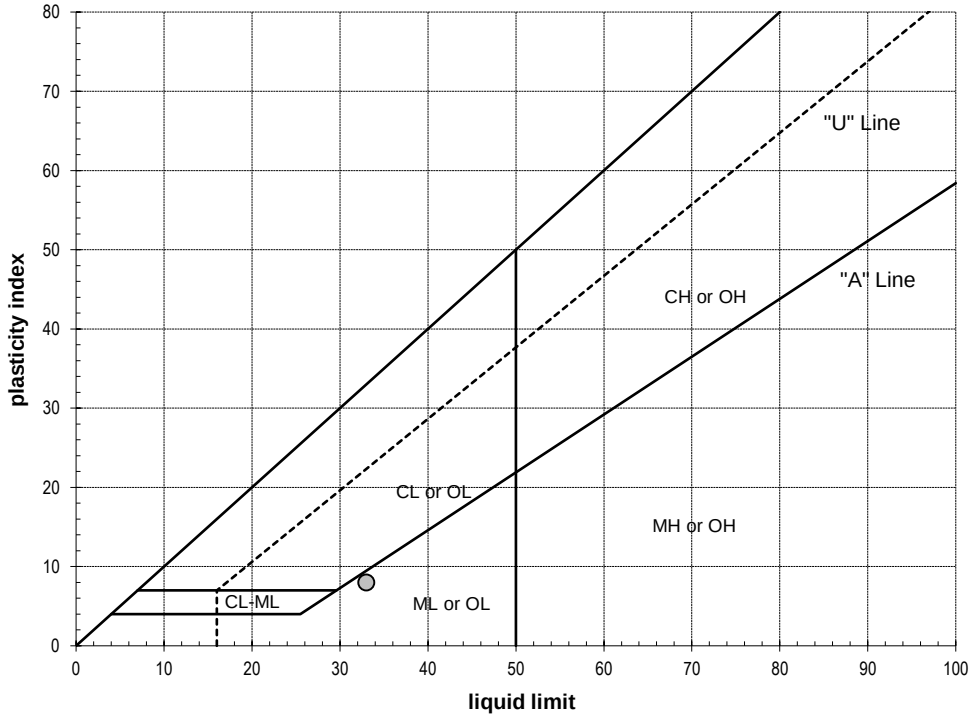
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	29.12	28.78		
dry soil + pan weight, g =	27.46	27.15		
pan weight, g =	20.77	20.65		
moisture, % =	24.8 %	25.1 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	22.7%
% silt and clay =	77.3%
% silt =	n/a
% clay =	n/a
moisture content =	36.0%

DATE TESTED	TESTED BY
06/17/15	JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-386
		REPORT DATE 06/18/15	FIELD ID TP1.3
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Lean CLAY	Test Pit TP-01 depth = 14 feet	CL, Sandy Lean Clay
SPECIFICATIONS none		AASHTO SOIL TYPE A-6(7)

LABORATORY TEST DATA

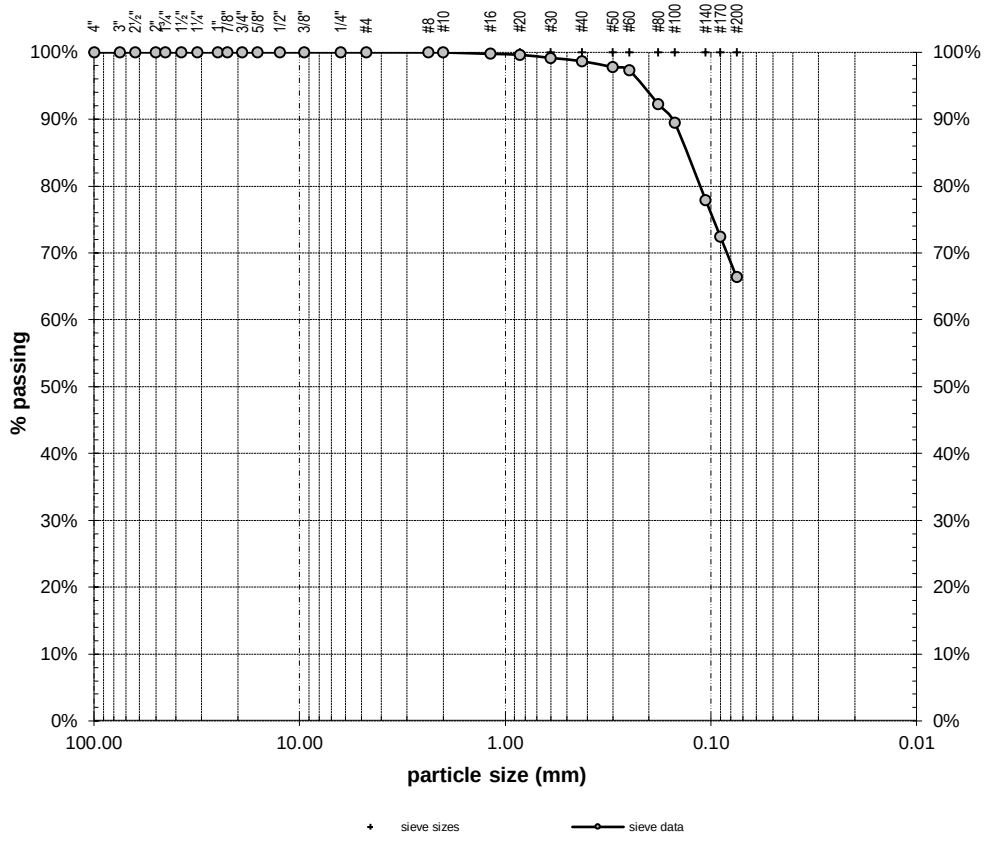
LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

ADDITIONAL DATA

initial dry mass (g) =	151.8		
as-received moisture content =	31.9%	coefficient of curvature, C_C =	n/a
liquid limit =	32	coefficient of uniformity, C_U =	n/a
plastic limit =	18	effective size, $D_{(10)}$ =	n/a
plasticity index =	14	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 33.6%
% silt and clay = 66.4%



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30		100.0%		
	#4	4.75	100.0%			
SAND	#8	2.36		100.0%		
	#10	2.00	100.0%			
	#16	1.18		99.8%		
	#20	0.850	99.6%			
	#30	0.600		99.2%		
	#40	0.425	98.7%			
	#50	0.300		97.8%		
	#60	0.250	97.3%			
	#80	0.180		92.3%		
	#100	0.150	89.5%			
	#140	0.106		77.9%		
	#170	0.090		72.5%		
	#200	0.075	66.4%			

DATE TESTED	TESTED BY
06/16/15	JMR/JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-386
		REPORT DATE 06/18/15	FIELD ID TP1.3
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Lean CLAY	Test Pit TP-01 depth = 14 feet	CL, Sandy Lean Clay

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	32
plastic limit =	18
plasticity index =	14

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	39.19	41.37	38.65	34.68
dry soil + pan weight, g =	35.01	36.66	34.32	31.15
pan weight, g =	20.89	20.86	20.86	20.52
N (blows) =	35	32	24	16
moisture, % =	29.6 %	29.8 %	32.2 %	33.2 %

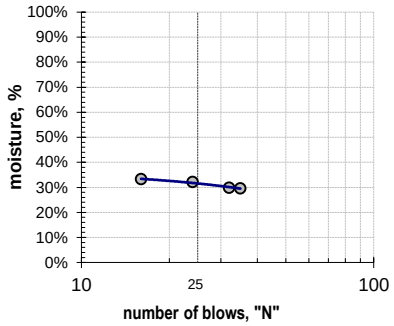
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

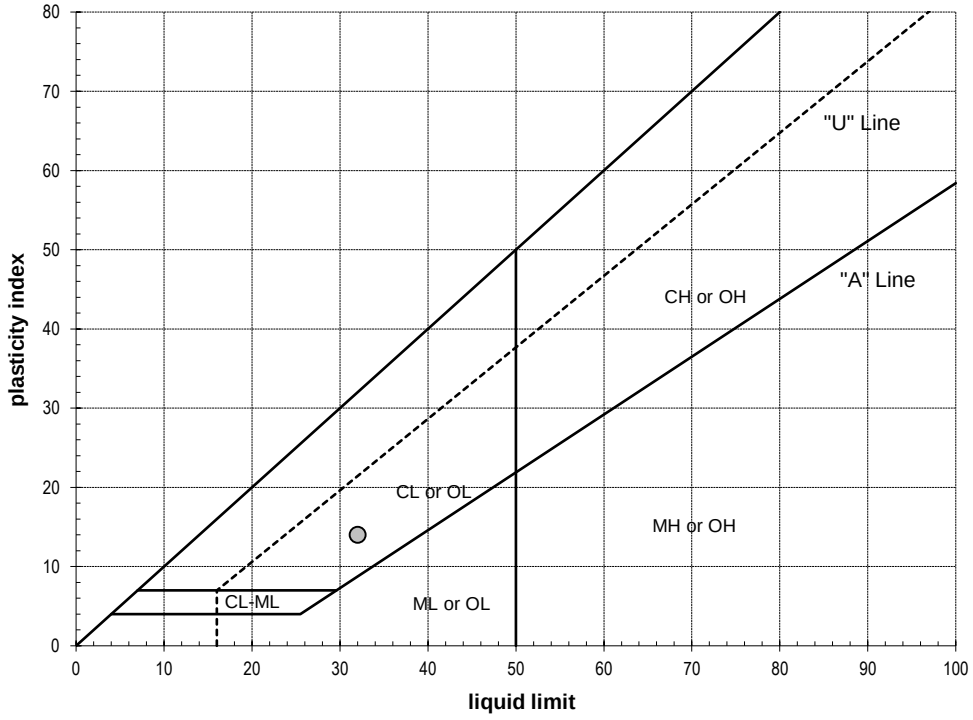
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.50	27.65		
dry soil + pan weight, g =	26.48	26.58		
pan weight, g =	20.78	20.73		
moisture, % =	17.9 %	18.3 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	33.6%
% silt and clay =	66.4%
% silt =	n/a
% clay =	n/a
moisture content =	31.9%

DATE TESTED	TESTED BY
06/17/15	MJR/JMR

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-387
		REPORT DATE 06/18/15	FIELD ID TP9.1
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Gravelly Lean CLAY with Sand	Test Pit TP-09 depth = 11 feet	CL, Gravelly Lean Clay with Sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-7-6(11)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

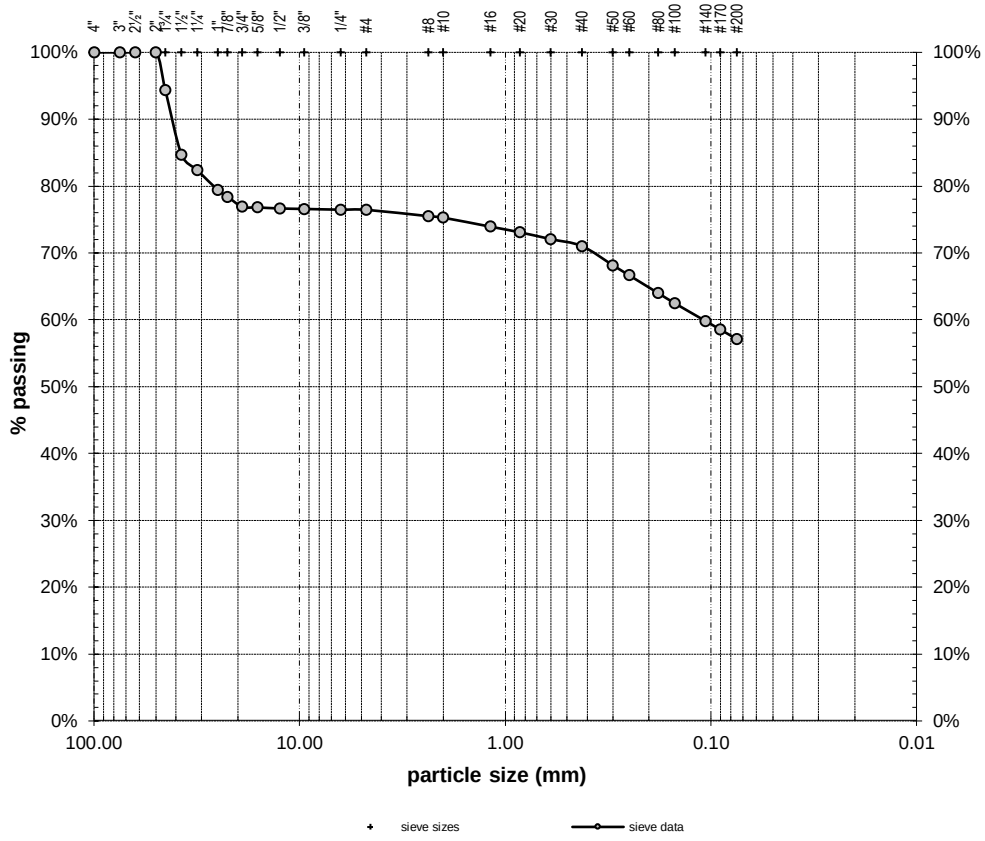
ADDITIONAL DATA

initial dry mass (g) =	1517.2		
as-received moisture content =	19.4%	coefficient of curvature, C_C =	n/a
liquid limit =	44	coefficient of uniformity, C_U =	n/a
plastic limit =	19	effective size, $D_{(10)}$ =	n/a
plasticity index =	25	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	0.109 mm

SIEVE DATA

% gravel = 23.5%
% sand = 19.3%
% silt and clay = 57.1%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0	100.0%			
	1.75"	45.0		94.4%		
	1.50"	37.5	84.7%			
	1.25"	31.5		82.4%		
	1.00"	25.0	79.4%			
	7/8"	22.4		78.4%		
	3/4"	19.0	76.9%			
	5/8"	16.0		76.8%		
	1/2"	12.5	76.7%			
	3/8"	9.50		76.6%		
	1/4"	6.30	76.5%			
	#4	4.75	76.5%			
SAND	#8	2.36		75.5%		
	#10	2.00	75.3%			
	#16	1.18		73.9%		
	#20	0.850	73.1%			
	#30	0.600		72.1%		
	#40	0.425	71.0%			
	#50	0.300		68.2%		
	#60	0.250	66.7%			
	#80	0.180		64.0%		
	#100	0.150	62.5%			
	#140	0.106		59.8%		
	#170	0.090		58.5%		
	#200	0.075	57.1%			

DATE TESTED	TESTED BY
06/16/15	BTT/JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-387
		REPORT DATE 06/18/15	FIELD ID TP9.1
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Gravelly Lean CLAY with Sand	Test Pit TP-09 depth = 11 feet	CL, Gravelly Lean Clay with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	44
plastic limit =	19
plasticity index =	25

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	33.26	33.18	34.26	34.05
dry soil + pan weight, g =	29.61	29.45	30.16	29.89
pan weight, g =	20.83	20.68	20.75	20.66
N (blows) =	35	31	27	21
moisture, % =	41.6 %	42.5 %	43.6 %	45.1 %

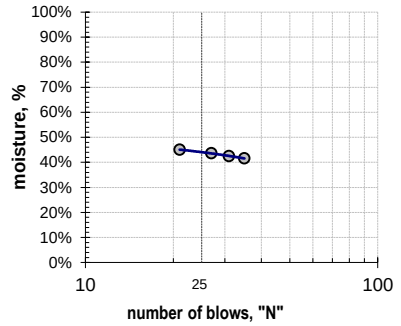
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

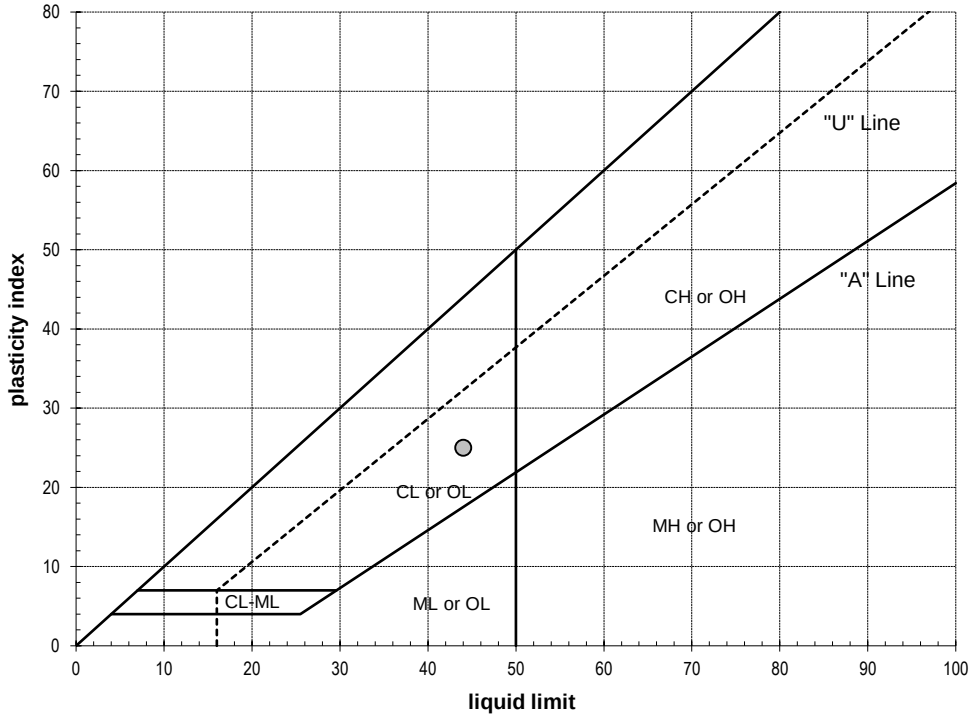
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	28.93	28.58		
dry soil + pan weight, g =	27.62	27.35		
pan weight, g =	20.57	20.82		
moisture, % =	18.6 %	18.8 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	23.5%
% sand =	19.3%
% silt and clay =	57.1%
% silt =	n/a
% clay =	n/a
moisture content =	19.4%

DATE TESTED	TESTED BY
06/17/15	JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-388
		REPORT DATE 06/18/15	FIELD ID TP12.1
		DATE SAMPLED 06/10/15	SAMPLED BY GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY with Sand	Test Pit TP-12 depth = 3.5 feet	CL, Lean Clay with Sand
SPECIFICATIONS none		AASHTO SOIL TYPE A-6(11)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913, D422

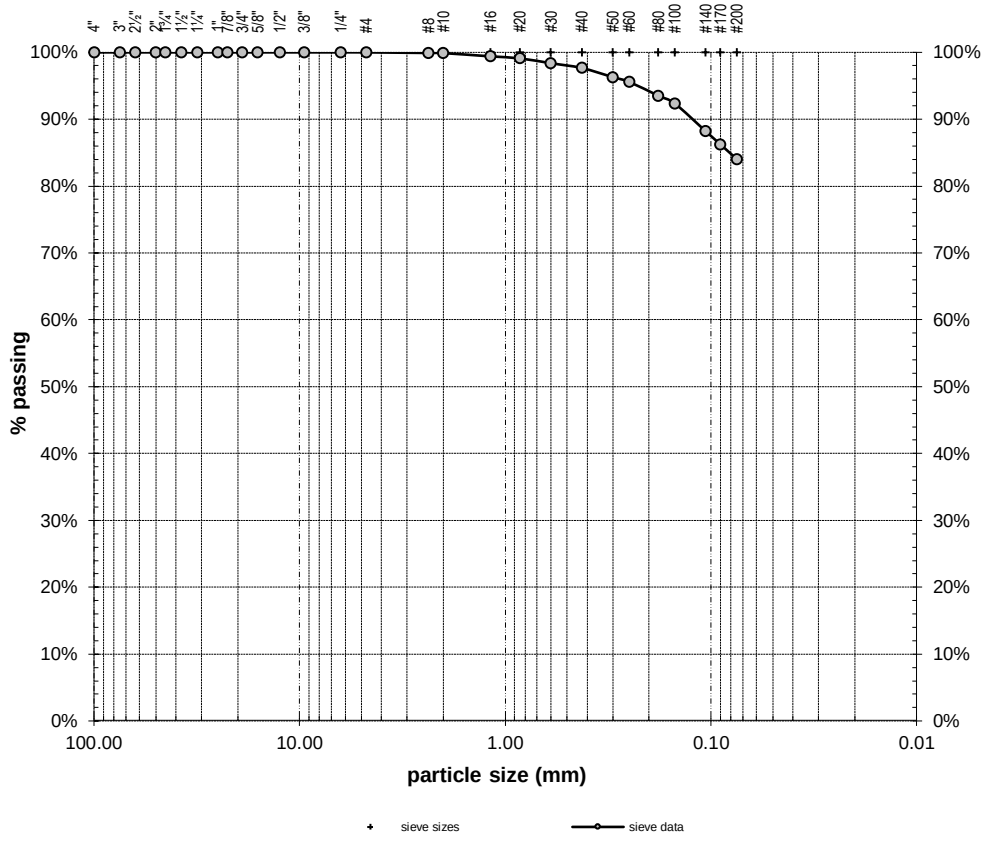
ADDITIONAL DATA

initial dry mass (g) =	155.4		
as-received moisture content =	29.1%	coefficient of curvature, C_C =	n/a
liquid limit =	36	coefficient of uniformity, C_U =	n/a
plastic limit =	23	effective size, $D_{(10)}$ =	n/a
plasticity index =	13	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel =	0.0%
% sand =	15.9%
% silt and clay =	84.1%

GRAIN SIZE DISTRIBUTION



	SIEVE SIZE		PERCENT PASSING			
			SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100.0%		
	4.00"	100.0		100.0%		
	3.00"	75.0		100.0%		
	2.50"	63.0		100.0%		
	2.00"	50.0		100.0%		
	1.75"	45.0		100.0%		
	1.50"	37.5		100.0%		
	1.25"	31.5		100.0%		
	1.00"	25.0		100.0%		
	7/8"	22.4		100.0%		
	3/4"	19.0		100.0%		
	5/8"	16.0		100.0%		
	1/2"	12.5		100.0%		
	3/8"	9.50		100.0%		
	1/4"	6.30		100.0%		
	#4	4.75	100.0%			
SAND	#8	2.36		99.9%		
	#10	2.00	99.9%			
	#16	1.18		99.4%		
	#20	0.850	99.1%			
	#30	0.600		98.4%		
	#40	0.425	97.7%			
	#50	0.300		96.3%		
	#60	0.250	95.6%			
	#80	0.180		93.5%		
	#100	0.150	92.4%			
	#140	0.106		88.2%		
	#170	0.090		86.2%		
	#200	0.075	84.1%			

DATE TESTED	TESTED BY
06/16/15	JMR/JJC

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

11917 NE 95th Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
Sunrise Terrace Residential Subdivision La Center, Washington	RK Land Development, LLC c/o Mr. Ed Greer 1520 SW Eaton Blvd Battle Ground, WA 98604	15159	S15-388
		REPORT DATE: 06/18/15	FIELD ID: TP12.1
		DATE SAMPLED: 06/10/15	SAMPLED BY: GLW

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY with Sand	Test Pit TP-12 depth = 3.5 feet	CL, Lean Clay with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT: Liquid Limit Machine, Hand Rolled

TEST PROCEDURE: ASTM D4318

ATTERBERG LIMITS

liquid limit =	36
plastic limit =	23
plasticity index =	13

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	37.85	36.51	37.40	
dry soil + pan weight, g =	33.43	32.34	32.77	
pan weight, g =	20.75	20.82	20.69	
N (blows) =	32	23	15	
moisture, % =	34.9 %	36.2 %	38.3 %	

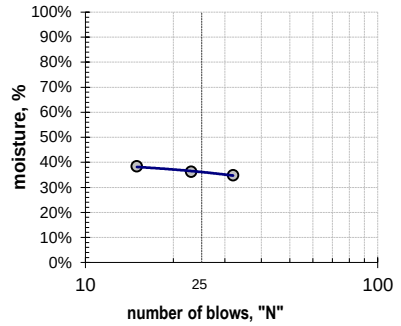
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

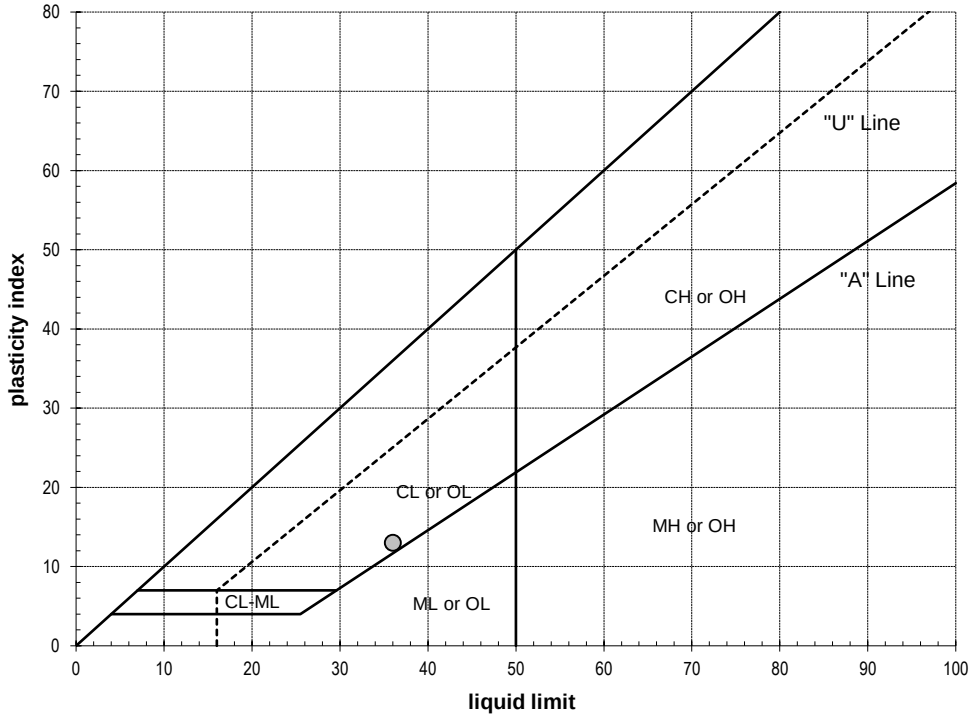
PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.09	27.04		
dry soil + pan weight, g =	25.85	25.87		
pan weight, g =	20.57	20.78		
moisture, % =	23.5 %	23.0 %		

LIQUID LIMIT



PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	15.9%
% silt and clay =	84.1%
% silt =	n/a
% clay =	n/a
moisture content =	29.1%

DATE TESTED	TESTED BY
06/17/15	MJR/JMR

This report may not be reproduced except in full without prior written authorization by Columbia West Engineering, Inc.

COLUMBIA WEST ENGINEERING, INC. authorized signature

APPENDIX B
SUBSURFACE EXPLORATION LOGS

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-1
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	186 ft amsl	Seeps below 12.0 ft	0810	0910

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 12 inches of grass and topsoil till zone.					
		Gee silt loam		CL		Light brown to gray lean CLAY with sand, mottled, moist, stiff, lightly cemented, low plasticity. [Soil Type 1]					
	TP-1.1		A-6(12)				32.6	84.8	38	14	
5											
				ML		Light brown to orange SILT with sand, mottled, moist to wet, medium stiff, low plasticity. [Soil Type 1]					
	TP-1.2		A-4(6)				36.0	77.3	33	8	IT-1 D = 7.0 feet k < 0.1 in/hr
10						Occasional sandy interbeds.					
						Groundwater seeps observed.					
						Increased excavation effort on weathered, orange to black, strongly cemented layer of sand, silt, and clay.					
				CL		Blue-gray sandy lean CLAY, wet, medium stiff, low plasticity. [Soil Type 2]					
	TP-1.3		A-6(7)				31.9	66.4	32	14	
15						Bottom of test pit at 15.0 feet. Groundwater encountered at 12.0 feet bgs.					

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-2
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	158 ft amsl	not encountered	0917	0945

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 12 to 14 inches of grass and topsoil till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, low plasticity. [Soil Type 1]					
5						Occasional sandy interbeds throughout profile.					
			A-4	ML		Light brown to orange SILT with sand, mottled, very moist, medium stiff, low plasticity. [Soil Type 1]					
10						Bottom of test pit at 13.0 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-3
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	204 ft amsl	Seeps below 8.5 ft	0954	1020

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 12 inches of grass and topsoil till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, stiff, lightly cemented, low plasticity. [Soil Type 1]					
5						Fine roots observed to 4 feet.					
			A-4	ML ▼		Light brown SILT with sand, wet, medium stiff, low plasticity. [Soil Type 1]					
10						Groundwater seeps observed below 8.5 feet.					
						Bottom of test pit at 13.5 feet. Groundwater encountered at 8.5 feet bgs.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-4
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	196 ft amsl	Seeps below 6.0 ft	1027	1055

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 15 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist to wet, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5						Groundwater seeps observed below 6 feet.					
			A-4	ML		Light brown SILT with sand, wet, medium stiff, low plasticity. [Soil Type 1]					
10						Occasional sandy interbeds throughout profile.					
						Increased excavation effort on weathered, orange to black, strongly cemented layer of sand, silt, and clay.					
			A-6	CL		Blue-gray sandy lean CLAY, wet, medium stiff, low plasticity. [Soil Type 2]					
15						Bottom of test pit at 14.0 feet. Groundwater encountered at 6.0 feet bgs.					

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-5
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	226 ft amsl	not encountered	1107	1135

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 14 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5						Occasional sandy interbeds throughout profile.					
10			A-4	ML		Light brown SILT with sand, very moist, medium stiff to stiff, low plasticity. [Soil Type 1]					
						Bottom of test pit at 11.5 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-6
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	234 ft amsl	Seeps below 10.0 ft	1146	1210

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 15 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Orange-brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5											
			A-4	ML		Light brown SILT with sand, very moist, medium stiff to stiff, low plasticity. [Soil Type 1]					
10						Groundwater seeps below 10 feet. Becomes wet.					
						Bottom of test pit at 11.0 feet. Groundwater encountered at 10.0 feet bgs.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-7
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	274 ft amsl	not encountered	1217	1250

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 14 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5											
			A-4	ML		Light brown SILT with sand, very moist, medium stiff to stiff, low plasticity. [Soil Type 1]					
10						Plasticity increases.					
						Bottom of test pit at 13.0 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-8
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	286 ft amsl	not encountered	1303	1350

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 16 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5											
			A-7	CL		Orange to black lean CLAY with sand, moist, stiff to very stiff, lightly to moderately cemented, medium plasticity. [Soil Type 3]					
10						Soils may represent CONGLOMERATE (QTc) of Evarts, 2004; described as rounded to sub angular pebbles and cobbles of igneous and sedimentary composition in semi-consolidated matrix of sand, silt, and clay.					
						Bottom of test pit at 13.0 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-9
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	266 ft amsl	not encountered	1405	1435

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Recently sown farmland. Approximately 14 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5											
10	TP-9.1		A-7-6(11)	CL		Orange to black gravelly lean CLAY with sand, moist, very stiff, lightly to moderately cemented, medium plasticity. [Soil Type 3]	19.4	57.1	44	25	
						Soils may represent CONGLOMERATE (QTc) of Evarts, 2004; described as rounded to sub angular pebbles and cobbles of igneous and sedimentary composition in semi-consolidated matrix of sand, silt, and clay.					
						Bottom of test pit at 12.0 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-10
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	272 ft amsl	not encountered	1441	1500

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 12 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5											
						Plasticity increases.					
10											
						Bottom of test pit at 11.0 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-11
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	274 ft amsl	not encountered	1508	1520

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 14 inches of disturbed, organic rich till zone.					
		Gee silt loam	A-6	CL		Orange-brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]					
5											
10						Bottom of test pit at 9.5 feet. Groundwater not encountered.					
15											

11917 NE 95TH Street, Vancouver, Washington 98682
Phone: 360-823-2900, Fax: 360-823-2901
www.columbiawestengineering.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
Sunrise Terrace	RK Land Development, LLC		15159	TP-12
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	Excavator	GLW	6/10/15
TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	292 ft amsl	not encountered	1527	1600

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Tilled farmland. Approximately 14 inches of disturbed, organic rich till zone.					
	TP-12.1	Gee silt loam	A-6(11)	CL		Brown to gray lean CLAY with sand, mottled, moist, medium stiff to stiff, lightly cemented, low plasticity. [Soil Type 1]	29.1	84.1	36	13	
5			A-7	CL		Orange to black gravelly lean CLAY with sand, moist, stiff to very stiff, lightly to moderately cemented, medium plasticity. [Soil Type 3] Soils may represent CONGLOMERATE (QTc) of Evarts, 2004; described as rounded to sub angular pebbles and cobbles of igneous and sedimentary composition in semi-consolidated matrix of sand, silt, and clay.					
10						Bottom of test pit at 11.0 feet. Groundwater not encountered.					
15											

APPENDIX C
SOIL CLASSIFICATION INFORMATION

SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

COMPONENT	ASTM/USCS		AASHTO	
	size range	sieve size range	size range	sieve size range
Cobbles	> 75 mm	greater than 3 inches	> 75 mm	greater than 3 inches
Gravel	75 mm – 4.75 mm	3 inches to No. 4 sieve	75 mm – 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm – 19.0 mm	3 inches to 3/4-inch sieve	-	-
Fine	19.0 mm – 4.75 mm	3/4-inch to No. 4 sieve	-	-
Sand	4.75 mm – 0.075 mm	No. 4 to No. 200 sieve	2.00 mm – 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm – 2.00 mm	No. 4 to No. 10 sieve	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve	-	-
Fine	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	< 0.075 mm	Passing No. 200 sieve	< 0.075 mm	Passing No. 200 sieve

Consistency for Cohesive Soil

CONSISTENCY	SPT N-VALUE (BLOWS PER FOOT)	POCKET PENETROMETER (UNCONFINED COMPRESSIVE STRENGTH, tsf)
Very Soft	2	less than 0.25
Soft	2 to 4	0.25 to 0.50
Medium Stiff	4 to 8	0.50 to 1.0
Stiff	8 to 15	1.0 to 2.0
Very Stiff	15 to 30	2.0 to 4.0
Hard	30 to 60	greater than 4.0
Very Hard	greater than 60	-

Relative Density for Granular Soil

RELATIVE DENSITY	SPT N-VALUE (BLOWS PER FOOT)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	more than 50

Moisture Designations

TERM	FIELD IDENTIFICATION
Dry	No moisture. Dusty or dry.
Damp	Some moisture. Cohesive soils are usually below plastic limit and are moldable.
Moist	Grains appear darkened, but no visible water is present. Cohesive soils will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grains. Sand and silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is much wetter than optimum moisture content and is above plastic limit.

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 Percent or Less Passing .075 mm)				Silt-Clay Materials (More than 35 Percent Passing 0.075)		
Group Classification	A-1	A-3	A-2	A-4	A-5	A-6	A-7
Sieve analysis, percent passing:							
2.00 mm (No. 10)	-	-	-				
0.425 mm (No. 40)	50 max	51 min	-	-	-	-	-
0.075 mm (No. 200)	25 max	10 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)							
Liquid limit				40 max	41 min	40 max	41 min
Plasticity index	6 max	N.P.		10 max	10 max	11 min	11 min
General rating as subgrade	Excellent to good			Fair to poor			

Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

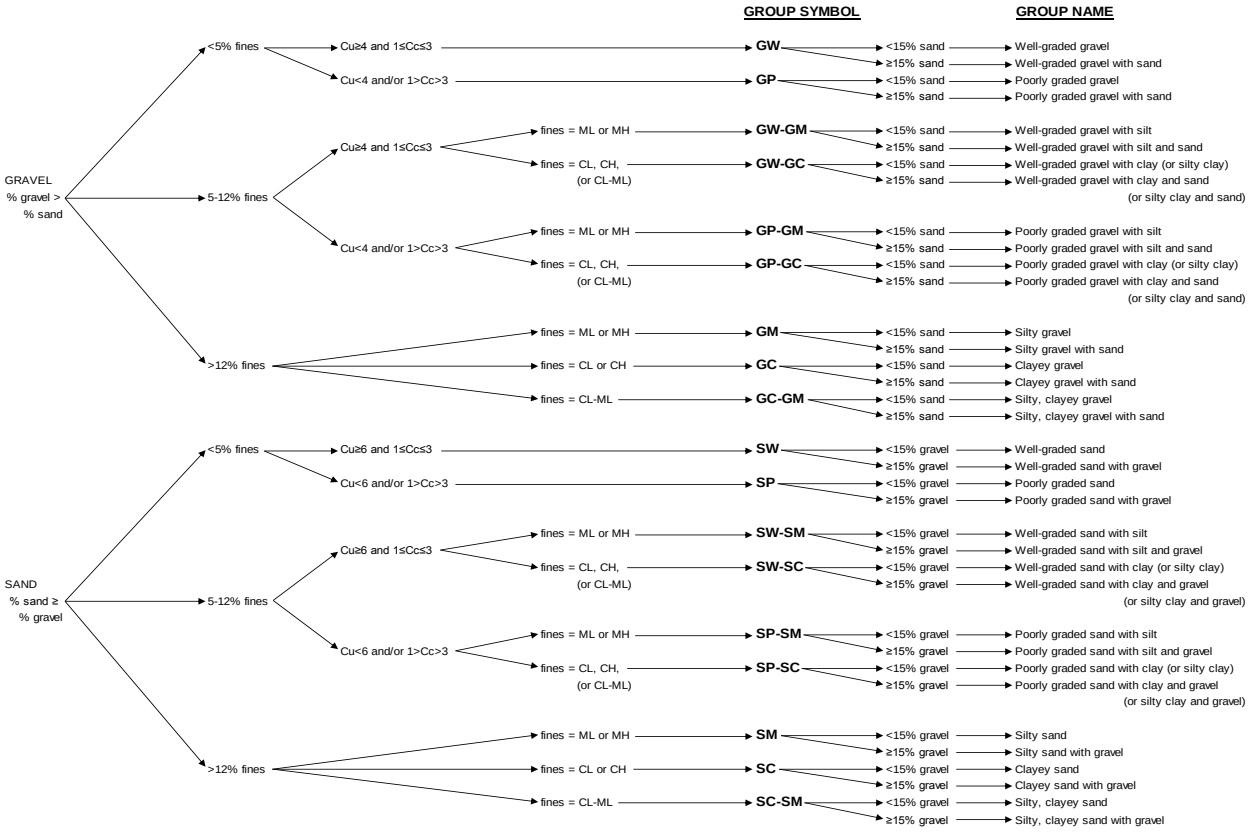
TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 Percent or Less Passing 0.075 mm)							Silt-Clay Materials (More than 35 Percent Passing 0.075 mm)			
	A-1			A-2							A-7
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5, A-7-6
Sieve analysis, percent passing:											
2.00 mm (No. 10)	50 max	-	-	-	-	-	-	-	-	-	-
0.425 mm (No. 40)	30 max	50 max	51 min	-	-	-	-	-	-	-	-
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11min
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General ratings as subgrade	Excellent to Good							Fair to poor			

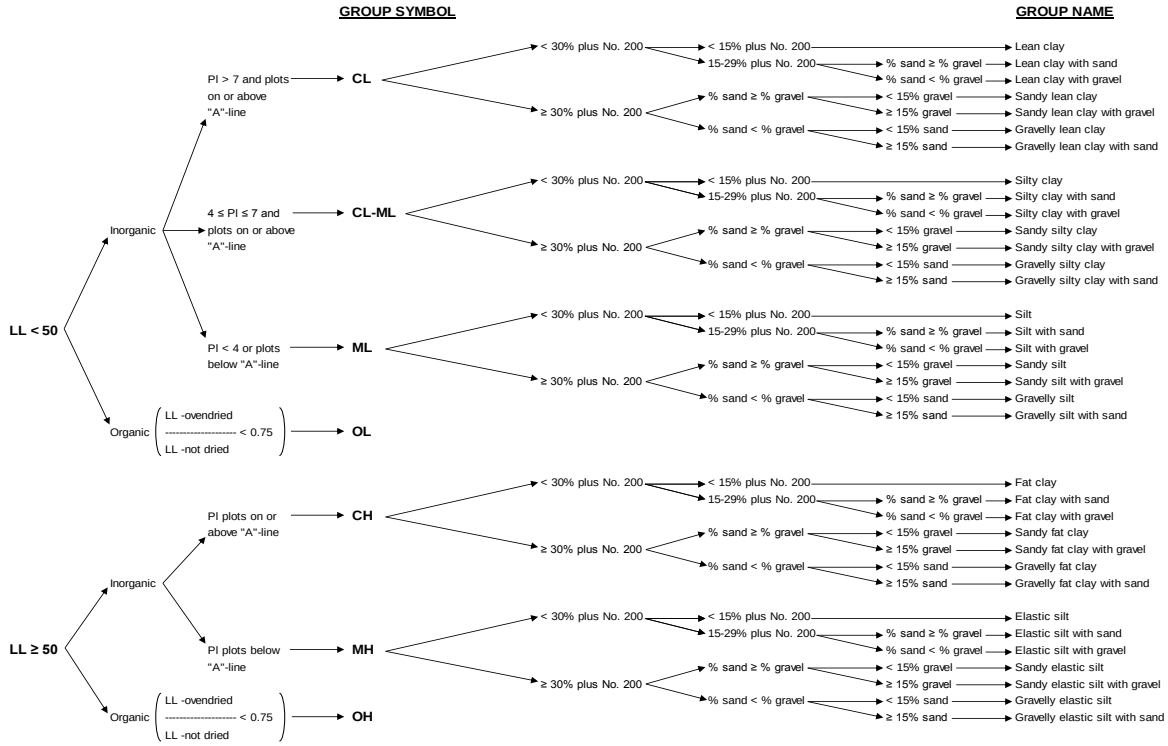
Note: Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30 (see Figure 2).

AASHTO = American Association of State Highway and Transportation Officials

USCS SOIL CLASSIFICATION SYSTEM



Flow Chart for Classifying Coarse-Grained Soils (More Than 50% Retained on No. 200 Sieve)



Flow Chart for Classifying Fine-Grained Soil (50% or More Passes No. 200 Sieve)

APPENDIX D
PHOTO LOG

SUNRISE TERRACE
LA CENTER, WASHINGTON
PHOTO LOG

Conducting Test Pit Exploration in Southernmost Parcel

Central Area of the Site, Facing Northwest

SUNRISE TERRACE
LA CENTER, WASHINGTON
PHOTO LOG

Fine-Textured Soil Profile Typical of the Site

Shallow Groundwater Observed in Several Test Pits

APPENDIX E
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

Date: June 26, 2015
Project: Sunrise Terrace
La Center, Washington

Geotechnical and Environmental Report Limitations and Important Information

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction QA/QC

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future

performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled *Report Ownership*. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors

Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

Report Ownership

Columbia West retains the ownership and copyright property rights to this entire report and its contents, which may include, but may not be limited to, figures, text, logs, electronic media, drawings, laboratory reports, and appendices. This report was prepared solely for the client, and other relevant approved users or parties, and its distribution must be contingent upon prior express written consent by Columbia West. Furthermore, client or approved users may not use, lend, sell, copy, or distribute this document without express written consent by Columbia West. Client does not own nor have rights to electronic media files that constitute this report, and under no circumstances should said electronic files be distributed or copied. Electronic media is susceptible to unauthorized manipulation or modification, and may not be reliable.

Consultant Responsibility

Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.

CULTURAL RESOURCES REPORT COVER SHEET

Author: Robert Freed

Title of Report: Clark County Archaeological Predetermination Report for the Sunrise Terrace Subdivision in La Center, Clark County, Washington

Date of Report: July 6, 2015

County: Clark Section: 2 Township: 4N Range: 1E

Quad: Ridgefield Acres: 16.6

PDF of report submitted (REQUIRED) X Yes

Historic Property Inventory Forms to be Approved Online? ☐ Yes X No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes X No

TCP(s) found? ☐ Yes X No

Replace a draft? ☐ Yes X No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # X No

Were Human Remains Found? ☐ Yes DAHP Case # X No

DAHP Archaeological Site #:

_____
_____
_____
_____
_____
_____
_____
_____
_____

- Submission of PDFs is required.
- Please be sure that any PDF submitted to DAHP has its cover sheet, figures, graphics, appendices, attachments, correspondence, etc., compiled into one single PDF file.
- Please check that the PDF displays correctly when opened.

CITY OF LA CENTER

ARCHAEOLOGICAL PREDETERMINATION REPORT

Property Owner: **Rob Smith, RK Land Development LLC** Telephone: **(360) 608-3991**
(Print Name)

Mailing Address: **1520 SW Eaton Blvd., Battle Ground, WA 98604**
(No., City, State, ZIP)

Applicant: **Ed Greer (for RK Land Development)** Telephone: **(360) 904-4964**
(Print Name)

Mailing Address: **8002 NE Highway 99, No. 546, Vancouver, WA 98665**
(No., City, State, ZIP)

Relationship to Owner: **Project Planning Consultant**

Property Address: **2219 NE 339th Street & 1908 NE Lockwood Creek Road, La Center, WA 98629**

Legal description: **Parcel Nos. 209062-000 & 209047-000**

The project is located in the N ½, Section 2, T4N, R1E, Willamette Meridian, on the Ridgefield, WA, USGS Quadrangle Map (Figure 1).

(If a Metes and Bounds description, check here ☐, and attach narrative to this application.)

Parcel Acreage: **23.2 acres** Disturbance Area Acreage: **16.6 acres**

Attach an 8½ x 11 site plan map drawn to scale and indicating the proposed disturbance area if significantly smaller than the parcel. Also indicate the locations of any artifacts found and the locations of subsurface probes.

General Physical Description of Site, including current uses:

Parcel No. 209062-000 on NE 339th Street is owned by the Perrott family and is 15.7 acres. Parcel No. 209047-000 on NE Lockwood Creek Road is owned by the Norden family and is 7.5 acres. Only 9.1 acres of the Perrott parcel are included in the proposed project; the other 6.6 acres consisting of a residence (circa 1903) and agricultural-related structures will remain intact and are not part of the project (Figure 2). Two other parcels (Nos. 986027-188 and 986027-189) located between these two parcels will be included in the proposed subdivision. The Perrott family also owns these two parcels which were proposed for a short plat in 2007. Hudson (2007) prepared an Archaeological Predetermination Report for the 20 acres, and no archaeological material was identified. The report was reviewed and accepted by Clark County on 10/29/07 (DAHP Log No, 1351126). The three current Perrott parcels were originally one parcel.

The Perrott property is still being used for agricultural purposes, as a new crop of alfalfa has recently been planted. This crop also covers the two parcels examined by Hudson. Otherwise, a one-half-acre corral is enclosed by a wooden fence which will be removed and incorporated into the subdivision. A crop of hay is currently being harvested on the Norden parcel. Also present is a residence (circa 1925), two sheds, and a garage/workshop structure (1976), all of which will be removed. Mr. Norden indicated the Anderson family owned much of the agricultural land in the vicinity for many years and previously raised chickens on the Perrot property (Lee Norden, personal communication). The structures in which the chickens were raised are among those buildings remaining intact on the Perrott parcel.

Description of proposed activity:

The proposed project consists of constructing the Sunrise Terrace Subdivision consisting of 120 single-family residential lots, streets, and two stormwater collection facilities (Figure 3; Site Plan). All structures currently on Parcel No. 209047-000 (the Norden property) will be removed.

Predetermination Trigger:

- X Located in an area considered to have a low-moderate to moderate-high probability (80-100%) for the presence of archaeological resources.
- ☐ Disturbance area within ¼ mile of known archaeological site.
- ☐ Director option.
- ☐ Discovery principle.

Predetermination not necessary because:

- ☐ Disturbance area previously adequately investigated or exempt.
- ☐ Disturbance area separated by geographic barrier from known archaeological site.
- ☐ Disturbance area has been substantially disturbed previously.
- ☐ Applicant chooses to submit full survey instead of predetermination.

BACKGROUND RESEARCH

Detail all background research, including review of records, documentation, maps, and other pertinent literature:

The Washington State Department of Archaeology and Historic Preservation's electronic data base was accessed via WISAARD to conduct background research for the project. Additional information was accessed at the Fort Vancouver Regional Library, the Clark County Historical Museum library, and Archaeological Consulting Services' library.

As previously mentioned, Hudson (2007) examined 20 acres on the two adjacent parcels that will be incorporated into the currently proposed subdivision. No archaeological material was identified. Eight archaeological investigations have been conducted within a one-mile radius of the project area and include: Oliver and Schmidt (2010) investigated a road reroute project 0.25 mile to the east; DeLyria (2001) examined a 700-foot-long water pipeline one mile to the east; Lloyd-Jones, Held, and Reese (2008) examined a one-acre area for an intersection realignment one mile to the southwest; Gall and Smith (2011) investigated a 3.75-acre project area 0.5 mile to the west for the reconstruction of a failing section of Pacific Highway 99; Mills (2002) examined a three-acre area for a proposed park one mile to the west; Wilson and Mills (2005) examined a four-acre project area for a residential subdivision one mile to the northwest; Freed (2007) investigated the City of La Center's Wastewater Treatment Plant for proposed upgrades one mile to the west; and Mastrangelo and Holschuh (2014) examined a proposed street roundabout project one mile to the west. In these investigations, DeLyria (2001) identified 60-70 year-old historic archaeological deposits that were recommended to be avoided during construction; Lloyd-Jones et al. (2008) identified two historic structures that were recommended as not eligible for Register listing; and Mills 92002) recorded historic archaeological site 45CL532. Otherwise, the investigations yielded negative findings.

The closest recorded prehistoric archaeological site (45CL1122) is located 1.25 miles to the southwest within the floodplain of the East Fork Lewis River (Solimano et al. 2015). Recorded artifacts included debitage, a projectile point, pestle, knife, net sinker, and canoe anchor. The site has not yet been evaluated.

The 1854 and 1863 Government Land Office maps for T4N/R1E were examined. Neither map showed any features, land claims, or structures in the vicinity. The La Center, WA, USGS quadrangle maps (1940 and 1954)

were examined and showed the present-day roads in the area and the structures currently in the project area. R. A. Habersham's *Map of Clarke County, Washington Territory, 1888,* indicates M. Anderson owned the property. The Metsker's Real Estate Atlas maps were examined. The 1943 map indicates Curtis Anderson owned the property, while Kent E. Anderson was the owner on the 1961, 1974, and 1993 maps. These maps also indicate Lockwood Creek Road was formerly known as County Rd. No. 42 and NE 24th Avenue on the east side of the project area was previously known as Bartlett Road. A 1960 aerial photograph in the Clark County Soil Survey indicates the project area, as well as most of the surrounding land, was being used for agricultural purposes (McGee 1972). Nearby historic sites include the La Center Cemetery, also known as the Mt. Zion Cemetery (45CL870), which is located immediately due north of the project area on the north side of NE 339th Street. The two-acre cemetery was originally founded in 1881 by the IOOF with the earliest burial being interred in 1874. The Clark County Historic Survey and Inventory recorded the Perrott residence as the Anderson homestead and a Historic Property Inventory Form was completed (Freed, Chamberlain, & Kubik, 2000). Otherwise, early historic maps and records do not indicate any evidence of farmsteads, roads, or other historic structures or features in the project area or information regarding previous land use of the property.

References Cited

DeLyria, David
2001 *Clark County Archaeological Predetermination Report for the Adams Way LUD #6 CPU Watermain Installation.* Archaeological Services of Clark County.

Freed, Robert A.
2007 *Archaeological Investigation for City of La Center Wastewater Treatment Plant Upgrade Project, Clark County, Washington.* Archaeological Consulting Services Letter Report No. 108.

Freed, Robert A., Holly K. Chamberlain, and Barbara J. Kubik
2000 *Clark County Historic Resource and Inventory Report.* Prepared for the Clark County Board of Commissioners by Heritage Research Associates, Inc.

Gall, Alexander, and Michael Smith
2011 *Cultural Resources Survey of the Proposed Moorehaven Slide Repair Project Areas, La Center, Clark County, Washington.* Archaeological Services of Clark County Report No. 11719.

Hudson, Andrew
2007 *Clark County Archaeological Predetermination Report for the Perrott Short Plat.* Archaeological Services of Clark County.

Lloyd-Jones, Jeff, Jonathon Held, and Jo Reese
2008 *Cultural Resource Survey for the Proposed Intersection Realignment at Highland & East 4th Street, La Center, Clark County, Washington.* Archaeological Investigations Northwest, Inc., Report No. 2096.

Mastrangelo, Liz, and Dana L. Holschuh
2014 *Cultural resources Survey for the City of La Center Pacific Highway at 4th Street Roundabout Project Area, Federal Aid #STPR-D063(003) 100214-11-FHWA, Clark County, Washington.* Archaeological Services Survey Report No. 14113.

McGee, Dale A.
1972 *Soil Survey of Clark County, Washington.* U.S. Department of Agriculture, Washington, D.C.

Mills, Bonnie
2002 *Clark County Archaeological Predetermination Report for the Lewis River Wetland Stewardship.* Archaeological Investigations Northwest, Inc., letter Report No. 696.

Oliver, Liz, and Sunshine Schmidt
2010 *A Cultural* Resource *Survey of the Ross-Lexington Road Spur Addition.* Bonneville Power Administration Project # WA2010 010.

Solimano, Paul, Kanani Paraso, Breanne Taylor, Matt Goodwin, and Donald Shannon
2015 *Cultural Resources Survey Report for the Proposed East Fork Lewis River La Center Wetlands Restoration Project, Clark County, Washington.* Willamette CRA Technical Report No. 15-13.

Wilson, Meredith A., and Bonnie J. Mills
2005 *Clark County Archaeological Predetermination Report for the Cedar Avenue Subdivision.* Archaeological Investigations Northwest, Inc., Report No. 1521.

SURFACE INSPECTION

Date of inspection: **June 22-24, 2015** Time of day: **morning**

Weather conditions at time of inspection: **Partly cloudy to sunny with temperature in mid-70s**

Describe soil visibility: X Over 50% visible **(Perrott Parcel)** X Less than 50% visible **(Norden Parcel)**

Describe the proposed project's locational characteristics including, but not limited to, topography, hydrology, wetlands, vegetation, and any prominent features located on or near the proposed project:

The project area is located one mile east of La Center's downtown. The project area is surrounded by agricultural fields with widely dispersed residences. Most of the original Douglas fir/cedar/spruce forests were removed by early settlers to establish agricultural properties, which in recent years are being replaced by residential subdivisions. The confluence of Lockwood and Riley creeks is located one mile to the southeast, and the former creek flows into the East Fork Lewis River one mile south of the project area. NE 339th Street borders the Perrott property on the north and NE 24th Avenue on the east. NE Lockwood Creek Road borders the Norden parcel on the south.

The Perrott property gradually slopes from the north to the southwest from elevation contour 290 feet above mean sea level (amsl) to 280 feet amsl. A recently planted crop of alfalfa covers the entire ground surface, except for the corral area. The sprouts are only three inches high. Tall grass, thistle, and maple trees now cover the one-half-acre corral area.

The Norden parcel also slopes from the northeast to the southwest losing 50 feet in elevation from contour 210 to 160 feet amsl. Blackberries and a variety of trees are growing along the wire fence on the property boundary. Hay that was cut two weeks earlier and was currently drying covers half of the ground surface. A short grassy lawn surrounded the area immediately around the structures with some ornamental landscaping and trees (i.e., rhododendron, ferns, lilies, maple, sweet gum, oak, etc.). A few piles of yard debris and building materials were present. A 400-foot-long compacted gravel driveway leads from NE Lockwood Road to the buildings.

Describe surface investigation procedures:

The entire project area was examined by walking parallel transects 30 feet apart (Figures 4- 8). The Perrott parcel was examined by walking transects in an east-west direction. Surface visibility was excellent (about 80%) since the field had recently been plowed and the newly planted alfalfa plants were only three inches high. Ground exposure was excellent because of the widely dispersed plants. Surface visibility was further enhanced by the presence of backdirt piles from rodent activity and the tracks created two weeks earlier by

the backhoe used to conduct the geotechnical investigation. The backfilled holes were clearly visible, creating additional soil exposures. Virtually no rock was present on the ground surface, and the soil appeared to be a silty loam. The corral portion was examined separately because it was fenced off from the open field. Because of the vegetation in this location, visibility was only about five percent. Surface exposures were a result of rodent backdirt piles and one backfilled geotechnical trench.

The Norden parcel was examined by walking transects 30 feet apart in a north-south direction in the northern two-thirds of the parcel, while walking transects in an east-west direction around and south of the residence. This strategy was used in order to walk between the rows of cut hay lying on the ground surface. Meander transects were walked around the buildings. Surface visibility was about ten percent. Most of the exposures were due to rodent backdirt piles and backfilled geotechnical trenches. The road cut along the southern property boundary was also examined, but blackberries and vegetation limited the exposures.

Describe any artifacts found. Show artifact locations on map (see page 2).

No cultural material was identified.

SUBSURFACE INSPECTION

Describe and quantify amount of subsurface probing and manual surface exposing activities that were carried out, if any.

Justify the locations of the subsurface probes. Describe the soils and stratigraphy. Describe the soil screening method. Describe any artifacts found. Show artifact locations on map (see page 2).

Sixteen shovel probes were excavated, seven on the Perrott property and nine on the Norden property. Fewer were excavated on the former property because of the better surface visibility. The cylindrical-shaped probes measured 50 cms deep and 50 cms wide. Soil was screened through one-eighth-inch mesh. Findings were identical in all of the probes. A medium-brown silt loam with virtually no rock was encountered in every probe, and the findings were consistent McGee's (1972) description of the silt loam series mapped (Map No. 16) in the project area. McGee (1972) identified three different silt loam series in the area: Hillsboro, Odne, and Gee. The deposits were composed of fine to medium-grained soils related to the Columbia River Pleistocene floods. Greg Williamson (Columbia West Engineering) confirmed similar findings during the geotechnical investigation (personal communication). The only difference was encountering a conglomerate with gravel deposits at a depth of 6-7 feet in the very northern portion of the project area.

FINDINGS AND CONCLUSIONS

State findings and conclusions.

No archaeological material was identified during the investigation, and no further archaeological work is recommended.

In the unlikely event that intact archaeological deposits are encountered during construction, work should be halted immediately and Clark County officials in the Long-Range Planning Department and the Washington State Department of Archaeology and Historic Preservation be notified in order for the findings to be investigated and assessed by a professional archaeologist. If human remains are encountered, the area is to be secured and the Clark County coroner contacted to determine the remains' origin.

RECOMMENDATION

Recommendation:

An archaeological resource survey is necessary.

X An archaeological resource survey is not necessary.

CERTIFICATION AND SIGNATURE

I certify that I am a

X professional archaeologist, as defined by RCW 27.53.030(8).

Signature of Archaeologist: Robert A. Freed Date: **July 6, 2015**

Please Print or Type:

Name: **Robert A. Freed, M.A.**

Firm: **Archaeological Consulting Services**

Address: **1515 NW 136th Street, Vancouver, WA 98685**

Phone: **(360) 607-4407**

Fax:

E-mail: **rfreed3313@outlook.com**

REVIEWER'S RECOMMENDATION

Recommendation:

☐ An archaeological resource survey is not necessary.

☐ An archaeological resource survey is necessary.

☐ Report is not complete and adequate (20.99.110A, .230B). Request additional information or new report.

Additional Comments:

Signature of Reviewing Archaeologist:

Date:

FINAL DETERMINATION

Final Determination:

- ☐ An archaeological resource survey is not necessary.
- ☐ An archaeological resource survey is necessary.
- ☐ Report is not complete and adequate (20.99.110A, .230B). Requesting additional information or new report.

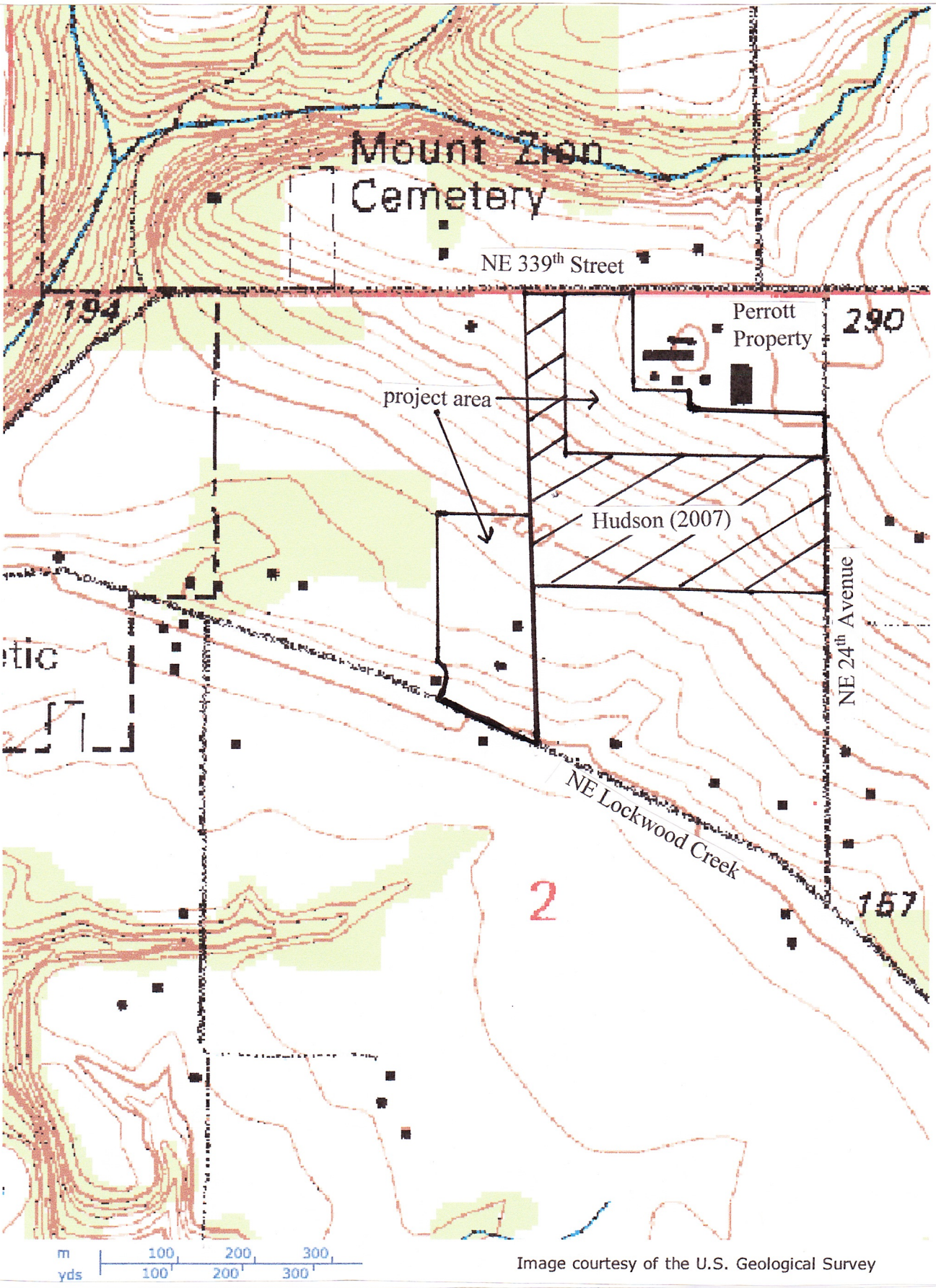
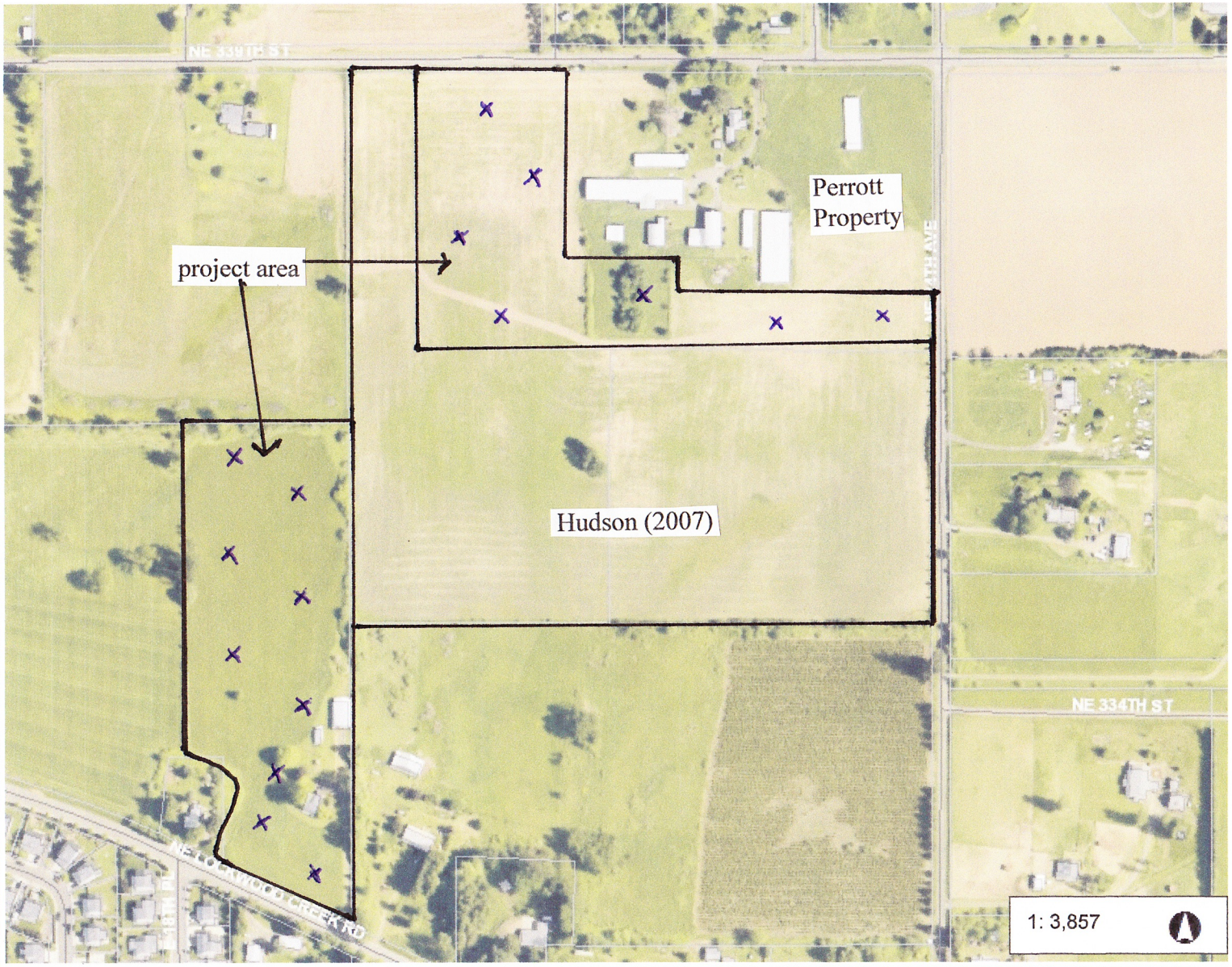
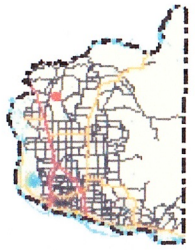


FIGURE 1. Project Location on Ridgefield, WA, USGS Quadrangle Map

FIGURE 2. PROJECT AREA





Legend

- Building Footprints
- Taxlots
- Roads
- ImageOrtho
  - Red: Band_1
  - Green: Band_2
  - Blue: Band_3
- Cities Boundaries
- Urban Growth Boundaries

Notes:

SHOVEL PROBE LOCATIONS

642.8 0 321.41 642.8 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

This map was generated by Clark County's "MapsOnline" website. Clark County does not warrant the accuracy, reliability or timeliness of any information on this map, and shall not be held liable for losses caused by using this infromation.

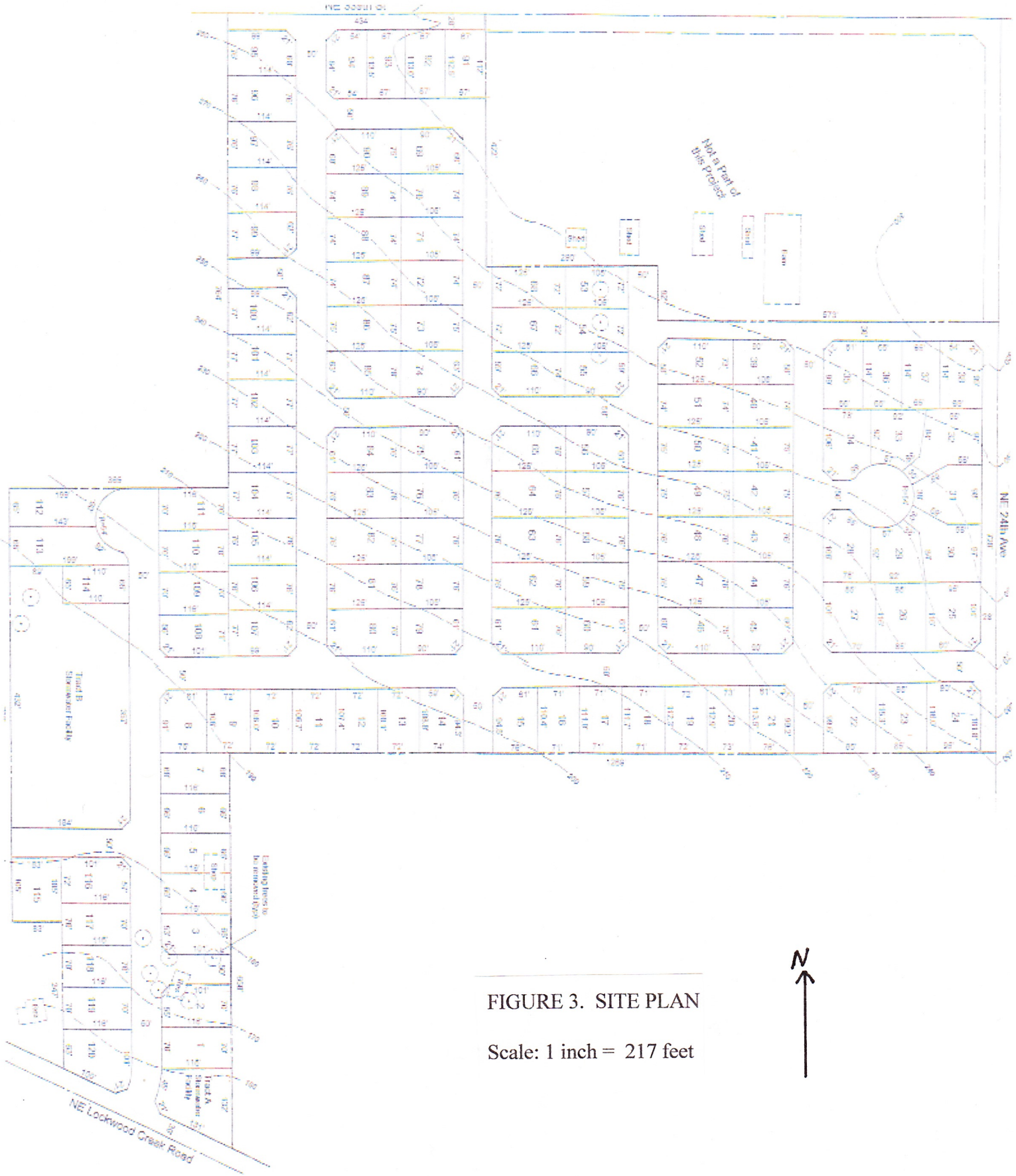


FIGURE 3. SITE PLAN

Scale: 1 inch = 217 feet

FIGURE 4. View of Perrott property from the northwest corner of the project area. Chicken coops and farm structures remaining on the Perrott property visible in the background

FIGURE 5. View of the Perrott property from NE 24th Avenue to the west. Trees to the left of the structure are located in the corral

FIGURE 6. View of the Norden property to the north. Perrott property and farm structures are located in the background

FIGURE 7. View of the Norden property from the northwest corner to the southeast with structures in the background

FIGURE 8. View to the southwest of the circa 1925 residence to be removed from the Norden property

CASCADIA
ECOLOGICAL SERVICES, INC.

PRELIMINARY WETLAND ASSESSMENT

TO:	FROM:
Ken Ingalls	Jim Barnes
COMPANY:	DATE:
	10/14/2014
RE:	CC:
Tax Parcels 209047-000, 209062-000, 986027-188, & 986027-189	Ed Greer

☐ URGENT ☑ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

On October 7, 2014, I completed a site visit to tax parcels 209047-000, 209062-000, 986027-188, & 986027-189 which are located in the City of La Center, Washington (Plan Sheet 1 of 3). Tax Parcel 209047000 is located at 1908 NE Lockwood Creek Road. The other three parcels are best accessed by parking at Tax Parcel 209062000 which is located along the north portion of the study area at 2219 NE 339th Street.

The purpose of the site visit was to determine whether the site contains any City of La Center regulated wetlands or other critical areas. Prior to conducting the site investigation, a review was completed of existing resource information to assist with the determination of wetlands within the confines of the study area. This review included the Clark County Soil Survey, National and Clark County wetland Inventory maps, USGS Topographic Quadrangle maps and aerial photographs.

According to the Clark County GIS, the southeast portion of Tax Parcel 209062000 is mapped as containing a National Wetland Inventory wetland (Plan Sheet 2 of 3). In addition, the south portion of this tax parcel and 986027-188 to the west, and the north part of 209047000 are mapped with hydric soils. The Natural Resources Conservation Service defines hydric soils as soils that form under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

The study area soils are mapped as Gee silt loam, 0 to 8 percent slopes (GeB), Gee silt loam, 8 to 20 percent slopes (GeD), Hillsboro silt loam, 8 to 15 percent slopes (HoC), and Odne silt loam, 0 to 5 percent slopes (OdB).

The Gee series consists of deep, moderately well drained soils formed in old alluvium on dissected high terraces and terrace escarpments. Slopes are 0 to 60 percent. The average annual precipitation is about 45 inches. The mean annual temperature is about 51 degrees F. These soils are at elevations of 150 to 300 feet on rolling and hilly terraces. They formed in mixed alluvium with some volcanic ash in the upper part. Gee soils occur in a humid marine climate with relatively cool, dry summers and mild, moist winters.

The Hillsboro series consists of deep, well-drained soils on terraces. These are medium-textured soils that developed in deposits of old Columbia River alluvium. Most areas are nearly level to gently sloping, but strongly sloping to very steep areas are along drainageways and streams. Most areas are in the southwestern, central, and south-central parts of the county.

The Odne series consists of deep, poorly drained soils formed in alluvium in basins and drainageways on terraces. Slopes are 0 to 1 percent. The average annual precipitation is about 50 inches. The mean annual temperature is about 50 degrees F. Odne soils occur in terrace drainageways and basins at elevations of 100 to 500 feet. Odne soils occur in a mild marine climate having an annual precipitation of 40 to 60 inches with relatively cool, dry summers and mild, wet winters. Odne soils are classified as hydric soils.

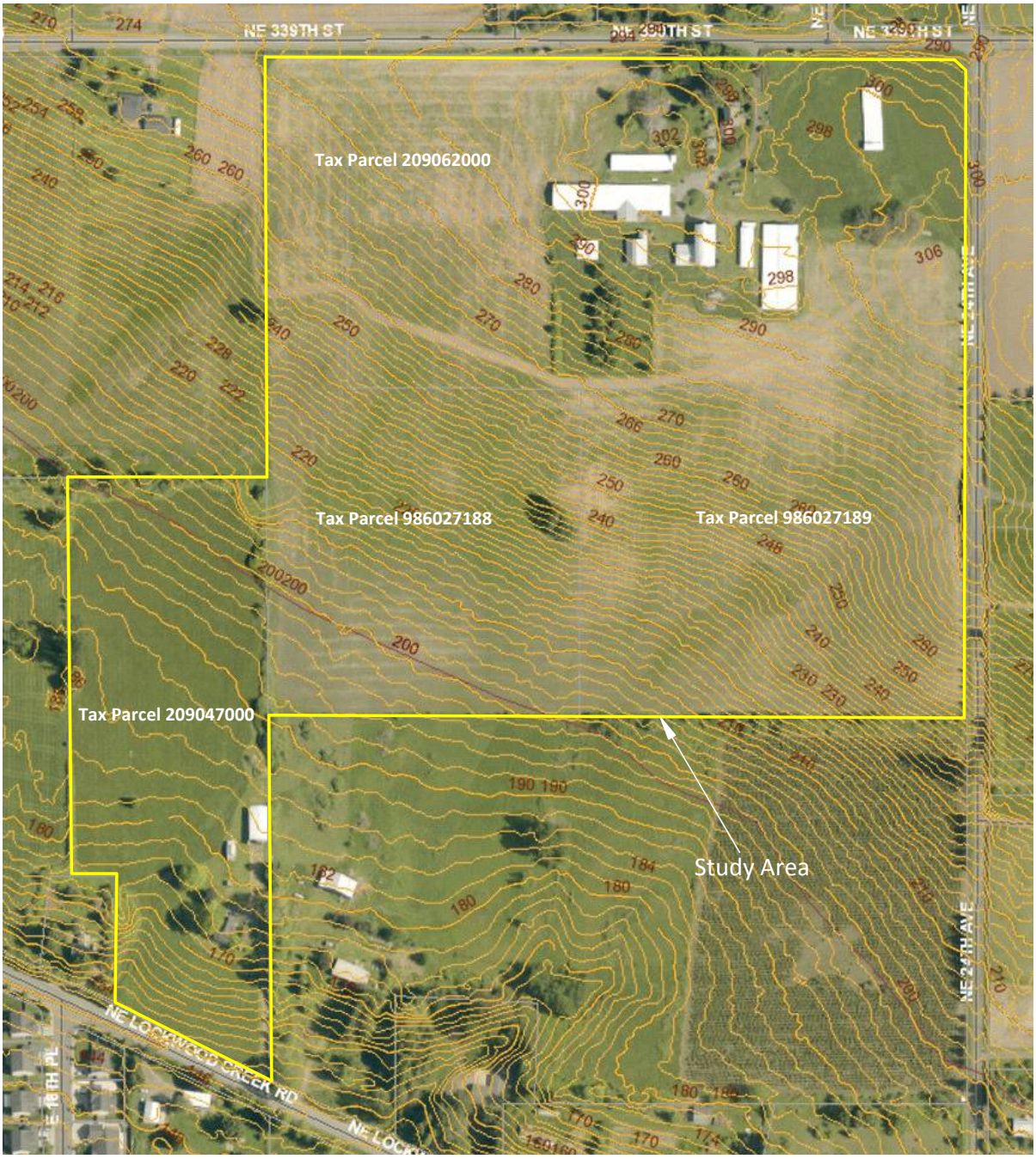
In order to conduct the wetland assessment, soil data sampling points were taken within the portion of the study area mapped as containing NWI wetlands and Odne soils. Sampling point locations are shown on Plan Sheet 2 of 3. All of tax parcels 209062-000, 986027-188, & 986027-189 consist of agricultural fields except for the north portion of 209062000 which contains a residence and numerous farm buildings. The remainder of the property is currently planted with a wheat crop which had not been harvested prior to the site visit. The topography is sloping north to south from NE 339th Street and is likely in the range of 10 percent or greater from north to south. There are no depressional areas within these three tax parcels and no wetlands were found in the area of the mapped NWI wetland shown on Plan Sheet 2 of 3. All of the soil sampling points generally matched the soil description given for the Gee soil series with a soil chroma and matrix of 10YR 3/2 to 3/3 to a depth of 18 inches.

A large drainage ditch was located along the south boundary of Tax Parcel 986027189. The ditch is at its widest and deepest point near the southeast corner of the parcel adjacent to NE 24th Avenue and gradually becomes narrower and less deep as it approaches the southwest corner. At that location the ditch veers to the south and drainage from it presumably flows onto the property to the south which is located outside of the study area. The ditch is dominated by black cottonwood (*Populus balsamifera*) trees and Himalayan blackberry (*Rubus armeniacus*) thickets along its edges. Although the ditch is in excess of six feet deep in places, the ground surface was dry and there were no indicators of wetland hydrology present. The ditch likely conveys seasonal stormwater from the east rather quickly through the study area given the relatively consistent slope from east to west.

Tax Parcel 209047000 comprises the south part of the study area. This parcel contains a residence and outbuildings in its south portion accessed from NE Lockwood Creek Road. The north part of the site consists of mowed upland pasture fringed by shrubs and trees along the perimeter. Soil sampling points taken in the north part of the parcel also generally matched the soil description given for the Gee soil series with a soil chroma and matrix of 10YR 3/2 to a depth of 18 inches. The majority of the mowed field is dominated by a plant community consisting tall fescue (*Festuca arundinacea*), sweet vernalgrass (*Anthoxanthum odoratum*), ox-eye daisy (*Leucanthemum vulgare*), Canada thistle (*Cirsium arvense*), colonial bentgrass (*Agrostis capillaris*), lanceleaf plantain (*Plantago lanceolata*), and Queen Anne's lace

(*Daucus carota*). The shrub and tree hedge areas are dominated by Himalayan blackberry thickets, Douglas fir (*Pseudotsuga menziesii*), beaked hazelnut (*Corylus cornuta*), and big-leaf maple (*Acer macrophyllum*).

Based on my observations of the upland soils, and lack of hydrophytic vegetation and hydrology indicators, the property does not contain any City of La Center regulated wetlands or other critical areas. This report documents the investigation, best professional judgment and conclusions of Cascadia Ecological Services, Inc. It should be used at your own risk unless it has been reviewed and approved in writing by the City of La Center under their jurisdictional standards.



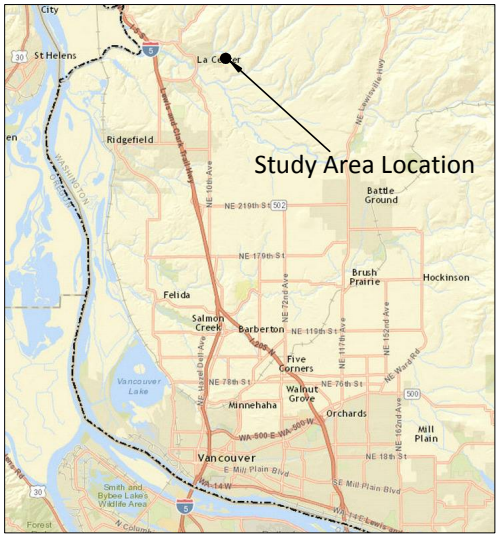
Map Legend

- Slopes and Geologic Hazards
  - Contour Lines
    - Contour Lines - 2 ft
    - Contour Lines - 10 ft
    - Contour Lines - 200 ft
- **Land Records**
  - Building Footprints
  - Taxlots

0 150 300
Feet

N

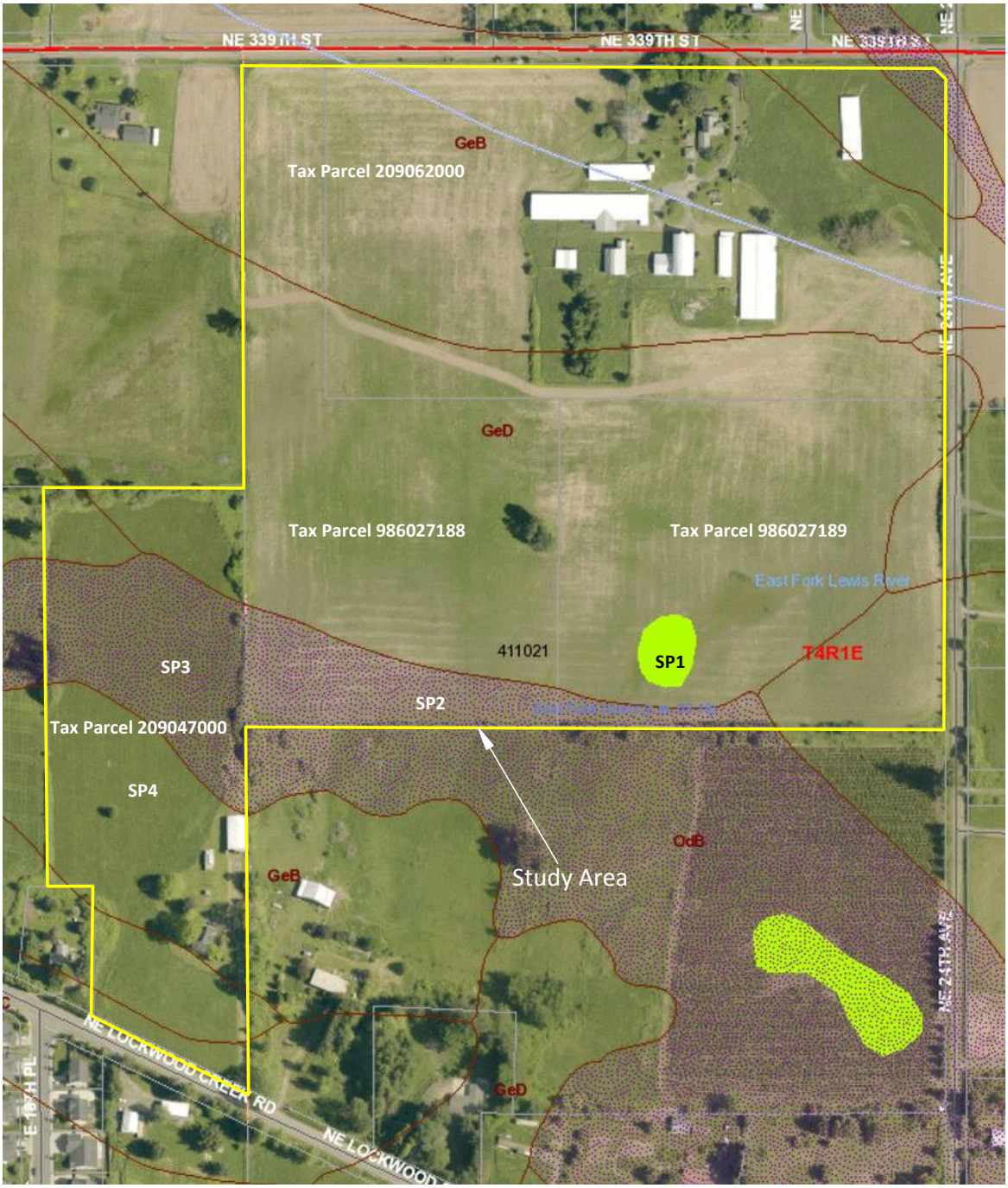
Map Source: Clark County GIS (2014)



Clark County Map

CASCADIA
ECOLOGICAL SERVICES, INC.

Plan Sheet 1 of 3
Preliminary Wetland Assessment
GIS Overlay - Slopes & Geologic Hazards
Applicant: Ken Ingalls
Location: La Center, WA
County: Clark
Date: 10/14/14



Map Legend

Soils and Wetlands Inventory
- Soil Type
- Hydric Soils
- Wetlands Presence
- NWI Wetland
- Modeled Wetland

Water Features and Watersheds
- Watershed
- Sub-Watershed

Land Records
- Building Footprints
- Taxlots

Public Land Survey System
- Township
- Sections
- 1/4 Section

0 150 300
Feet

SP1 - Soil Sampling Point

N

Map Source: Clark County GIS (2014)

CASCADIA
ECOLOGICAL SERVICES, INC.

Plan Sheet 2 of 3
Preliminary Wetland Assessment
Environmental GIS Overlay
Applicant: Ken Ingalls
Location: La Center, WA
County: Clark
Date: 10/14/14

Photo 1 – Taken from southeast corner of Tax Parcel 986027189 facing northwest

Photo 2 – Taken from southeast corner of Tax Parcel 986027189 facing west

Photo 3 – Taken from northwest corner of Tax Parcel 209047000 facing east

Photo 4 – Taken from northwest corner of Tax Parcel 209047000 facing southeast

SUNRISE TERRACE

LA CENTER, WASHINGTON

DATE:
July 7, 2015

PREPARED FOR:
RK Land Development LLC

PREPARED BY:
Max Scheideman
Daniel Stumpf, EI
Todd Mobley, PE, PTOE

7/7/15

LANCASTER
ENGINEERING

321 SW 4th Ave., Suite 400 | Portland, OR 97204 | 503.248.0313 | lancasterengineering.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. A proposed 120-lot residential subdivision is located west of NE 24th Avenue, south of NE 339th Street, and north of NE Lockwood Creek Road in La Center, Washington. The project site is comprised of three tax lots and part of a fourth, which total approximately 34 acres. Two of the tax lots are vacant while the other two are occupied by one single-family detached home and additional structures used for agricultural purposes.

2. The trip generation calculations show that the proposed development, minus the existing single-family home, will generate an estimated 89 trips during the morning peak hour with 23 trips entering and 66 trips exiting the site. During the evening peak hour, the property is projected to generate an estimated 119 trips with 75 entering and 44 exiting the site.

3. Left-turn lane warrants were not projected to be met for any of the site access study area intersections under any of the analysis scenarios.

4. Traffic signal warrants were examined for each of the applicable study intersections and were not found to be met for any of the analysis scenarios. No new traffic signals are recommended.

5. Based on the detailed analysis, adequate sight distance is available for the proposed new intersection access approaches to NE Lockwood Creek Road, NE 24th Avenue, and NE 339th Street. No sight distance mitigations are necessary or recommended.

6. A detailed examination of the crash history at the study intersections shows no significant safety hazards and no trends that are indicative of design deficiencies. No safety mitigations are recommended.

7. Each of the study intersections is projected to operate within the performance standards established by the City of La Center through the year 2017, either with or without the addition of site trips from the proposed development. No operational mitigations are recommended.

PROJECT DESCRIPTION

INTRODUCTION

This Transportation Impact Study (TIS) addresses the development of a proposed 120-lot residential subdivision located west of NE 24th Avenue, south of NE 339th Street, and north of NE Lockwood Creek Road in La Center, Washington. The project site is comprised of three tax lots and part of a fourth which total approximately 34 acres. Two of the tax lots are vacant while the other two are occupied by a single-family detached home and additional structures used for agricultural purposes.

This report addresses the traffic impacts of the proposed development on the transportation system in the vicinity of the site. Based on the scope of work provided by the City of La Center, the report includes safety and capacity/level-of-service analyses at the following intersections:

- NE 24th Avenue at NE 339th Street
- NE 24th Avenue at NE Lockwood Creek Road
- NE Lockwood Creek Road at NE Highland Avenue
- W 4th Street at Aspen Avenue
- NE Pacific Highway at W 4th Street

Upon development of the project site, the following site access intersections were analyzed:

- NE 24th Avenue at North Local Access Drive
- NE 24th Avenue at South Local Access Drive
- NE 339th Street at Local Access Drive
- NE Lockwood Creek Road at Local Access Drive

The purpose of the study is to determine whether the transportation system in the vicinity of the site is capable of safely and efficiently supporting the existing and proposed uses, and to determine any mitigation that might be necessary to do so.

All supporting data and calculations are included in the technical appendix to this report.

LOCATION DESCRIPTION

The project site is located west of and adjacent to NE 24th Avenue, south and adjacent to NE 339th Street, and north and adjacent to NE Lockwood Creek Road in La Center, Washington.

The subject site is located in a predominately agricultural area, with single-family detached homes and farmland to the north, south and east. A single-family detached housing subdivision is located southwest of the site and a La Center High School is located to the west.

VICINITY STREETS

NW Pacific Highway is classified as a Major Collector by the City of La Center. The roadway generally has one travel lane in each direction with a posted speed of 25 mph north of the East Fork Lewis River and a posted speed of 50 mph south of the river. Curbs and sidewalks are provided on both sides of the roadway north of the river.

W 4th Street, E 4th Street and NE Lockwood Creek Road are classified as Major Collectors by the City of La Center. W 4th Street has a three-lane cross-section and is located between NW Pacific Highway and Aspen Avenue. E 4th Street has a two-lane cross-section and is located between Aspen Avenue and E Ivy Avenue/NE Highland Avenue, where it then becomes NE Lockwood Creek Road. NE Lockwood Creek Road also has a two-lane cross-section with one travel lane in each direction. The posted speeds along this route, west and east of the proposed site access onto NE Lockwood Creek Road, are 25 mph and 35 mph, respectively. A school speed zone with a posted speed of 20 mph is in effect during school hours between E Cedar Avenue and NE John Storm Avenue. Bicycle lanes are provided for a short distance to the right of each directional outer travel lane of the roadway at the intersection of NE Lockwood Creek Road at NE Highland Avenue. On-street parking is partially allowed along W 4th Street and E 4th Street within the downtown area. Curbs and sidewalks are provided along both sides of the W 4th Street and generally on both sides of E 4th Street. NE Lockwood Creek Road has curbs and sidewalks along the roadway west of the proposed site access along NE Lockwood Creek Road.

Aspen Avenue is classified as a Minor Collector by the City of La Center. It has a two-lane cross-section with a posted speed limit of 25 mph. On-street parking is generally allowed on both sides of the roadway. Curbs and sidewalks are provided along both sides of the roadway.

NE Highland Avenue and NE 339th Street are classified as Minor Collectors by the City of La Center. NE Highland Avenue becomes NE 339th Street to the east of the intersection with NE 14th Avenue. Both roadways generally have a two-lane cross-section with one travel lane in each direction. NE Highland Avenue has a posted speed of 25 mph while NE 339th Street generally has a posted speed of 35 mph. A school speed zone with a posted speed of 20 mph is in effect during school hours between E 4th Street and the eastern edge of the school property line. Limited bicycle lanes are provided to the right of each directional outer travel lane along the route for a short distance north from the intersection of NE Lockwood Creek Road at NE Highland Avenue. Curbs and sidewalks partially provided along NE Highland Avenue.

NE 24th Avenue is classified as a Minor Collector by the City of La Center. The roadway has a two-lane cross-section without centerline striping. There is no posted speed limit; therefore a statutory speed of 25 mph is applied to the roadway. Curbs, sidewalks, and bicycle lanes are not provided and the roadway does not have enough width to allow for on-street parking.

STUDY INTERSECTIONS

The intersection of NE 24th Avenue at NE 339th Street is a four-legged intersection that is two-way stop controlled for the northbound approach of NE 24th Avenue and the southbound approach of NE 340th Circle. All four approaches have a single shared left-turn/through/right-turn lane.

The intersection of NE 24th Avenue at NE Lockwood Creek Road is a four-legged intersection, where the northbound approach is a local access driveway. The intersection is stop controlled along the southbound approach of NE 24th Avenue and while un-controlled traffic along the access driveway is expected to stop and yield to traffic along NE Lockwood Creek Road. All intersection approaches have a single full-movement turn lane.

The intersection of NE Lockwood Creek Road at NE Highland Avenue is a four-legged intersection and is two-way stop controlled for the northbound approach of E Ivy Avenue and the southbound approach of NE Highland Avenue. The all intersection approaches have one left-turn lane and one shared through/right-turn lane with a bicycle lane to the right of the outer travel lane. Intersection crosswalks are marked on all intersection legs.

The intersection of W 4th Street at Aspen Avenue is a three-legged intersection that is stop controlled for the southbound approach of Aspen Avenue. The southbound approach has one left-turn lane and one right-turn lane. The eastbound approach of W 4th Street has one left-turn lane and one through lane. The westbound approach of E 4th Street has a single shared through/right-turn lane. Intersection crosswalks are striped on the northern and western intersection legs.

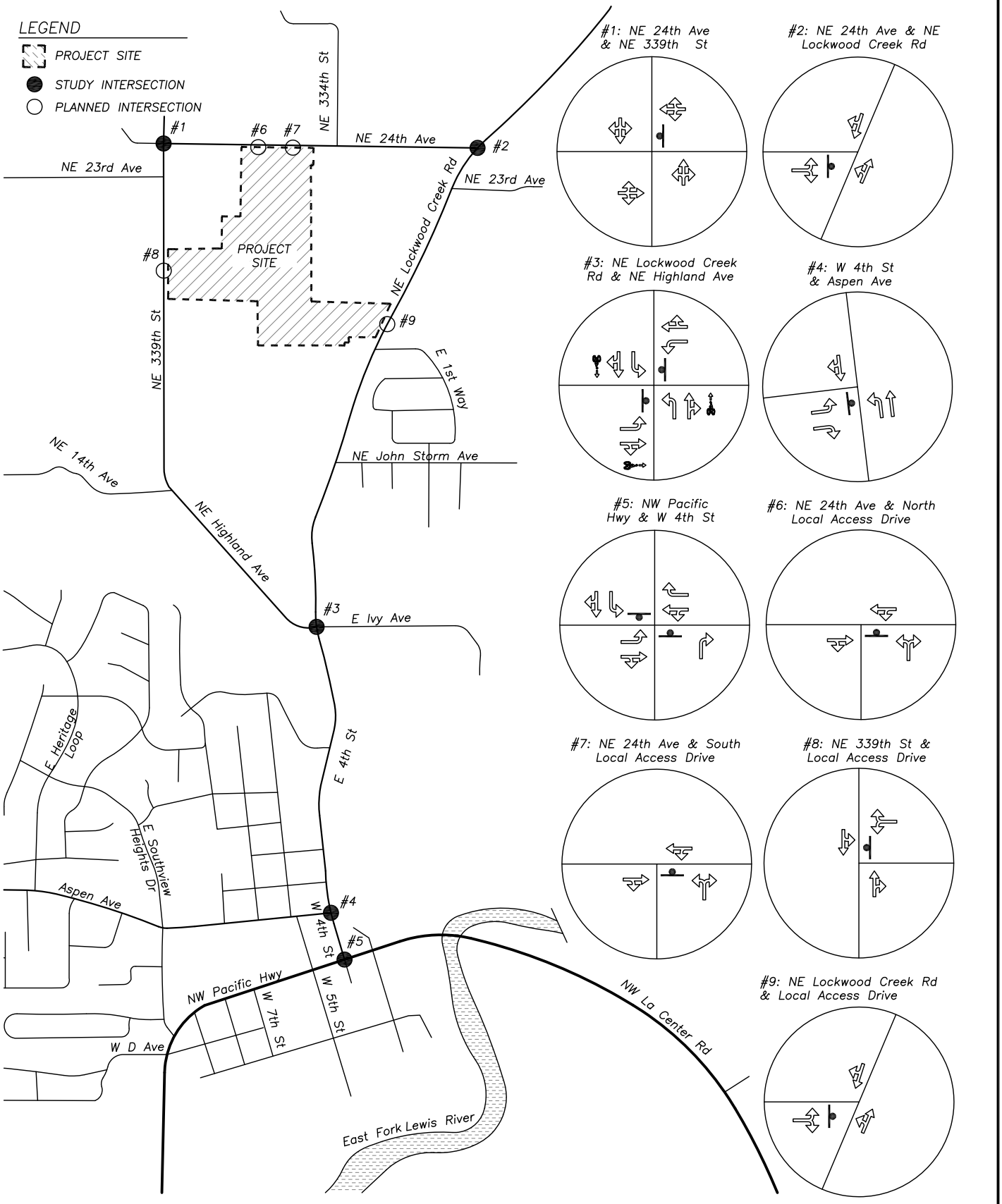
The intersection of NE Pacific Highway at W 4th Street is a four-legged intersection and is two-way stop controlled for the eastbound approach of the Chips Casino driveway access and the westbound approach of W 4th Street. The northbound approach has one right-turn lane and one shared left-turn/through lane. The southbound approach has one left-turn lane and one shared through/right-turn lane. The westbound approach has one left-turn and one right-turn lane. The eastbound approach is striped as having one right-turn lane, however this striping is not always observed and vehicles occasionally make through movements. Intersection crosswalks are marked on the northern, eastern, and western intersection legs. The southern leg of the intersection does not provide a marked crosswalk.

A vicinity map displaying the project site, vicinity streets, and the study area intersections with their associated lane configurations is shown in Figure 1 on page 7.

TRAFFIC COUNTS

Traffic counts were conducted at the study area intersections on Thursday, June 4th, 2015 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. Data corresponding to each intersection's peak hour was used for analysis.

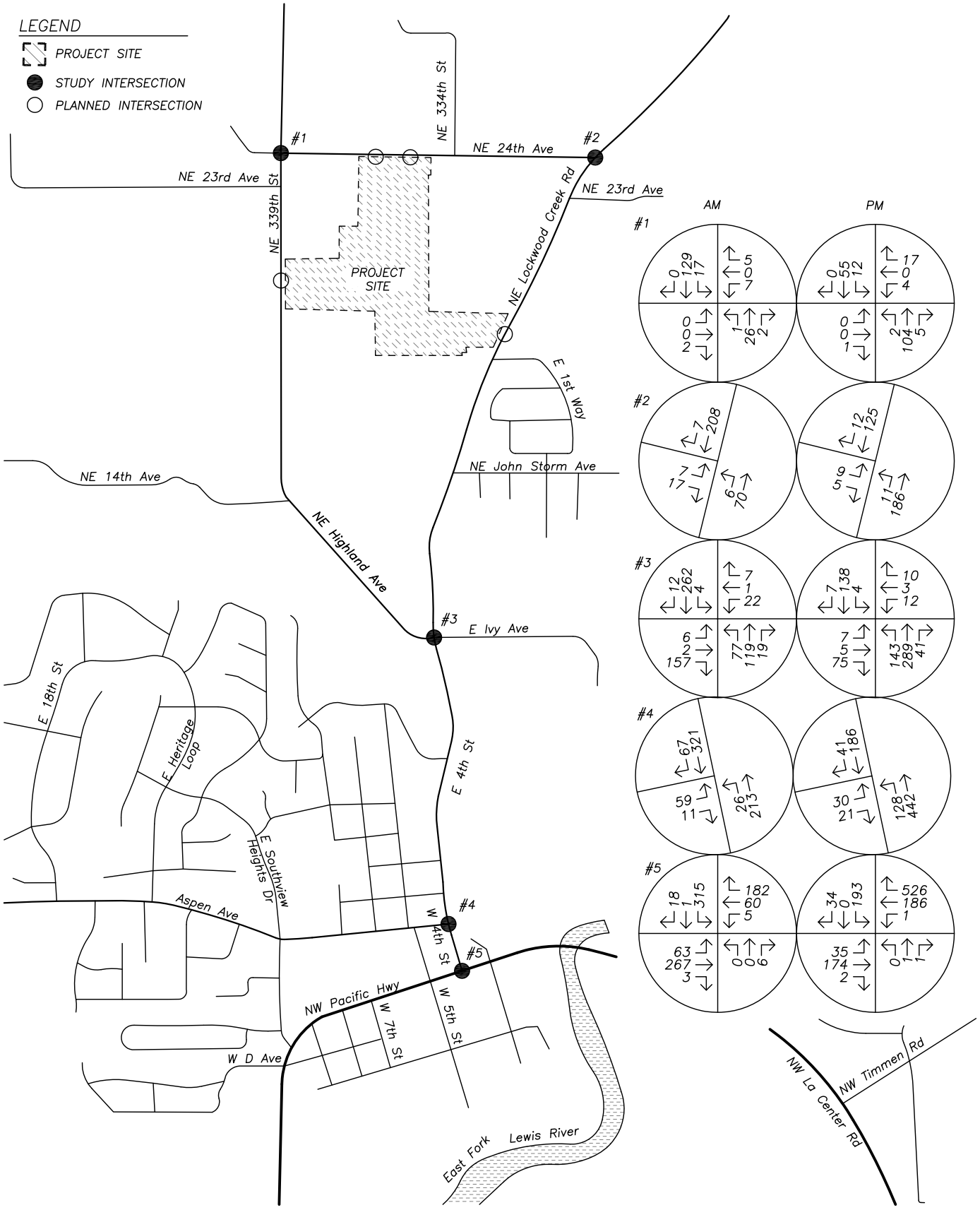
Figure 2 on page 8 shows the existing AM and PM peak hour traffic volumes for the study area intersections.



VICINITY MAP

no scale

FIGURE 1



TRAFFIC VOLUMES
Existing Conditions
AM & PM Peak Hours

no scale

FIGURE 2

TRIP GENERATION & DISTRIBUTION

TRIP GENERATION

The proposed development will construct 120 single-family detached houses and the remove one existing single-family detached home and existing farmland. To estimate the number of trips that will be generated by the proposed development, trip rates from the *TRIP GENERATION MANUAL*, Ninth Edition, published by the Institute of Transportation Engineers (ITE), were used. Data from land-use code 210, *Single-Family Detached Housing*, was used to estimate the proposed development's trip generation based on the number of dwelling units.

The trip generation calculations show that the proposed development, minus the existing single-family home, is projected to generate a total of 89 trips during the morning peak hour, with 23 trips entering and 66 trips exiting the site. During the evening peak hour, the property is projected to generate a total of 119 trips with 75 entering and 44 exiting the site. During a typical weekday, the site is projected to generate total of 1,132 daily trips, with half entering and half exiting the site.

The trip generation estimates are summarized in Table 1. Detailed trip generation calculations are included in the technical appendix to this report.

Table 1: Trip Generation Summary

	ITE Code	Size	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total	Weekday Total
Proposed									
Single-Family Detached Housing	210	120 units	23	67	90	76	44	120	1,142
Existing									
Single-Family Detached Housing	*210*	*(1 unit)*	*0*	*(1)*	*(1)*	*(1)*	*0*	*(1)*	*(10)*
Total New Trips		**119 units**	**23**	**66**	**89**	**75**	**44**	**119**	**1,132**

TRIP DISTRIBUTION

The directional distribution of site trips to and from the proposed development was estimated based on locations of likely trip destinations, locations of major transportation facilities in the site vicinity, and existing travel patterns at study area intersections.

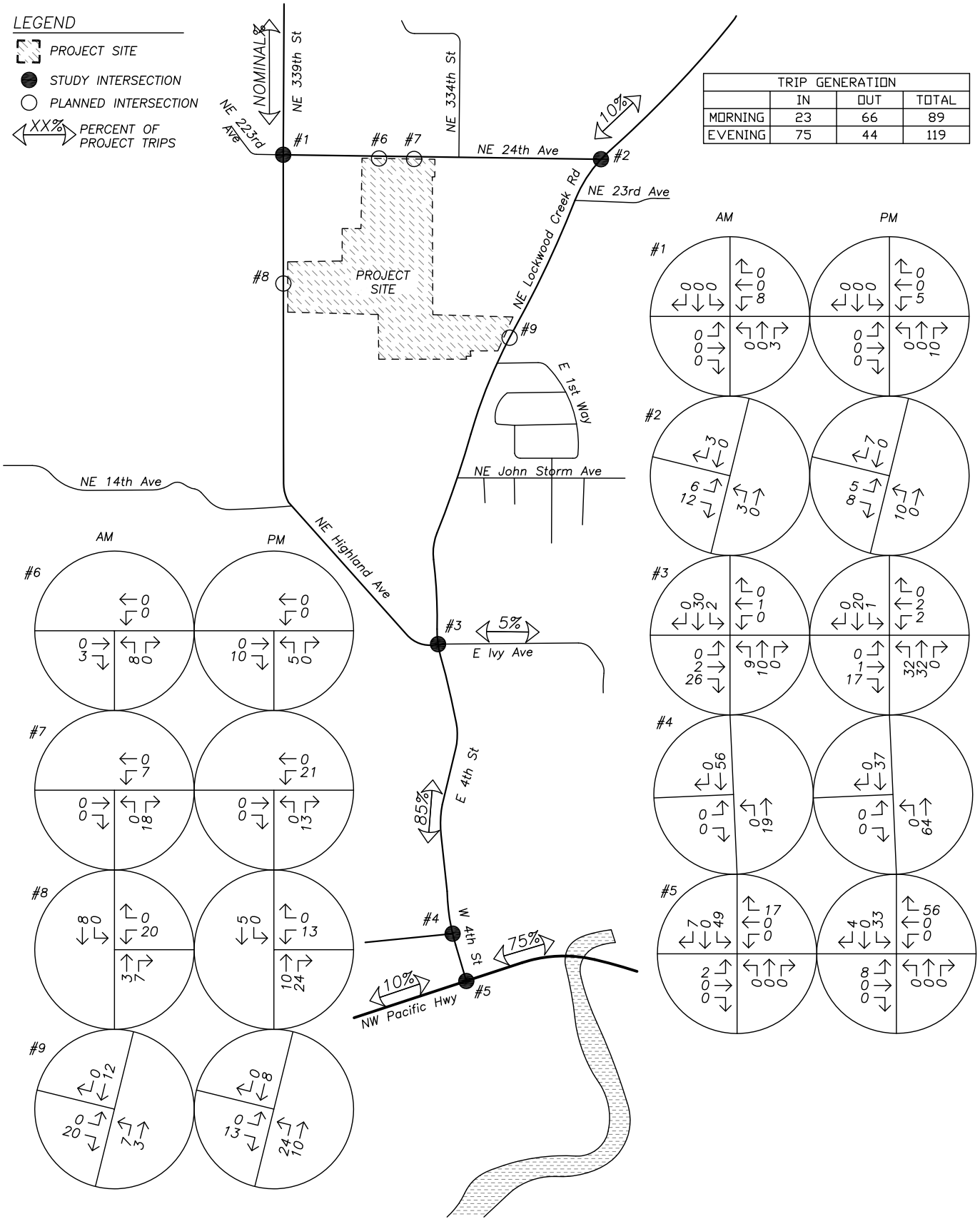
The following trip distribution was estimated and used for analysis:

- 75 percent to and from the south along NW Pacific Highway.
- 10 percent to and from the north along NW Pacific Highway.
- 10 percent to and from the east along NE Lockwood Creek Road.
- 5 percent to and from the south along E Ivy Avenue (primarily to schools).

The proposed development is planned to have four accesses connecting the project site to adjacent roadways; two accesses intersecting NE 24th Avenue, one access intersecting NE Lockwood Creek Road, and one access intersecting NE 339th Street. Based on the site layout and trip distribution, projected trips generated by the project site are anticipated to utilize site accesses accordingly:

- 37 percent of trips generated will utilize the access along NE Lockwood Creek Road.
- 30 percent of trips generated will utilize the access along NE 339th Street.
- 20 percent of trips generated will utilize the south access along NE 24th Avenue.
- 13 percent of trips generated will utilize the north access along NE 24th Avenue.

The trip distribution and assignment of site trips generated by the proposed development during the morning and evening peak hours is shown in Figure 3 on page 11.



TRIP GENERATION			
	IN	OUT	TOTAL
MORNING	23	66	89
EVENING	75	44	119

SITE TRIP DISTRIBUTION & ASSIGNMENT
AM & PM Peak Hours

no scale

FIGURE 3

OPERATIONAL ANALYSIS

BACKGROUND TRAFFIC

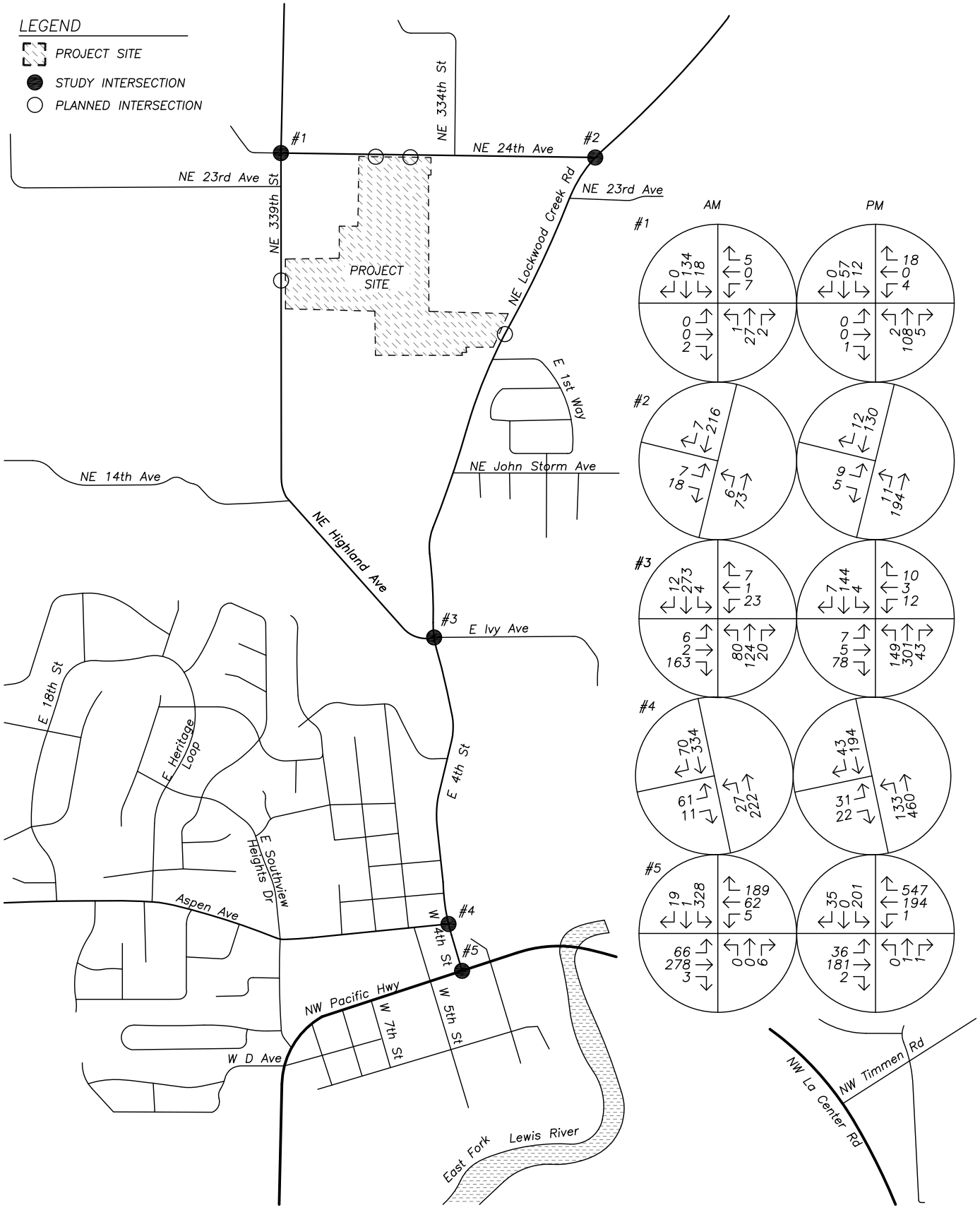
To provide analysis of the impact of the proposed development on the nearby transportation facilities, an estimate of future traffic volumes is required. In order to calculate the future traffic volumes, a compounded growth rate of two percent per year for an assumed build-out condition of two years was applied to the measured existing traffic volumes to approximate year 2017 background conditions.

Figure 4 on page 13 shows the projected year 2017 background volumes for the morning and evening peak hour traffic volumes of the study area intersections.

BACKGROUND PLUS SITE TRIPS

Peak hour trips calculated to be generated form the proposed development, as described earlier within the Trip Generation section, were added to the project year 2017 background traffic volumes to obtain the projected 2017 background plus site trips.

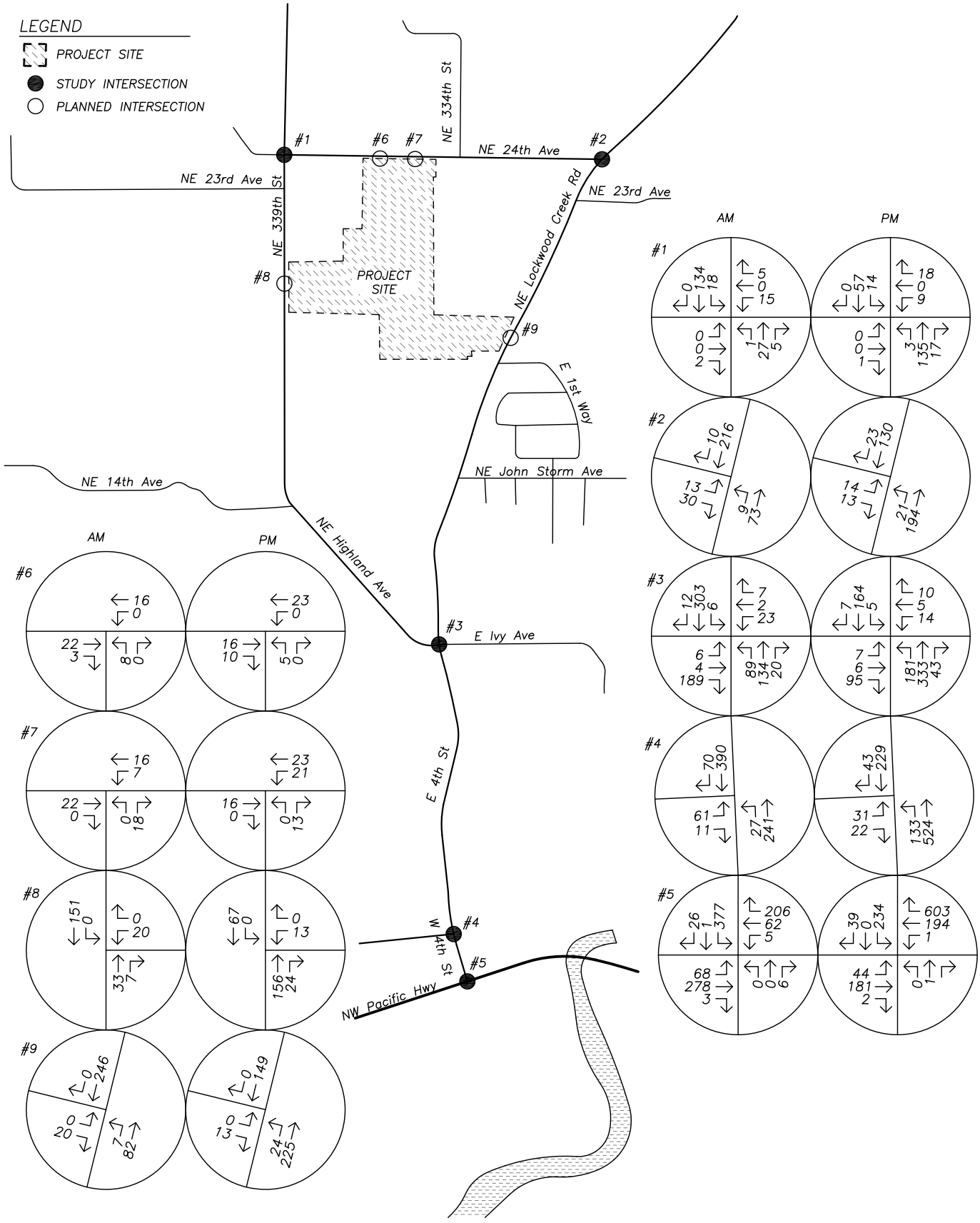
Figure 5 on page 14 shows the projected year 2017 peak hour background traffic volumes with the addition of site trips from the proposed development.



TRAFFIC VOLUMES
Year 2017 Background Conditions
AM & PM Peak Hours

no scale

FIGURE 4



TRAFFIC VOLUMES
2017 Background Conditions + Site Trips
AM & PM Peak Hours

no scale

FIGURE 5

INTERSECTION CAPACITY AND LEVEL OF SERVICE ANALYSIS

To determine the performance of the study intersections, a capacity analysis was conducted for the morning and evening peak hours for existing conditions, year 2017 background conditions, and year 2017 background plus site trips from the proposed development. The analysis was conducted according to the unsignalized intersection analysis methodology given in the *HIGHWAY CAPACITY MANUAL* (HCM) published by the Transportation Research Board.

Levels of service (LOS) can range from LOS A, which indicates very little or no delay experience by vehicles, to LOS F, which indicates a high degree of congestion and delay. The City of La Center's operating standards, outlined in the *La Center Urban Area Capital Facilities Plan (2008)*, require LOS D or better for signalized intersections and LOS E or better for unsignalized intersections. Intersections comprised of local streets do not have an LOS standard.

The intersection of NE 24th Avenue at NE 339th Street currently operates at LOS A during the morning and evening peak hours and is expected to remain LOS A for the morning and evening peak hours through year 2017. With added project trips, the intersection is expected to increase to LOS B during the morning peak hour and remain LOS A during the evening peak hour.

The intersection of NE 24th Avenue at NE Lockwood Creek Road currently operates at LOS B for morning and evening peak hours. The intersection is expected to remain LOS B during the morning and evening peak hours through year 2017, with or without added project trips.

The intersection of NE Lockwood Creek Road and NE Highland Avenue currently operates at LOS C during morning and evening peak hours. Under year 2017 background conditions, the intersection is projected to increase to LOS D during the morning peak hour and remain LOS C during the evening peak hour. Upon competition of the proposed development, the intersection is expected to increase to LOS E during the morning peak hour and remain at LOS C during the evening peak hour.

The intersection of W 4th Street at Aspen Avenue currently operates at LOS C for morning and evening peak hours. The intersection is expected to remain LOS C during the morning and evening peak hours through year 2017, with or without added project trips.

The intersection of NE Pacific Highway and W 4th Street currently operates at LOS B during the morning peak hour and LOS C during the evening peak hour. Under year 2017 background conditions, the intersection is projected to increase to LOS C during the morning peak hour and remain LOS C during the evening peak hour. With added project trips in year 2017, the intersection is expected to remain at LOS C during the morning and evening peak hours.

Upon competition of the proposed development, four new site access intersections were analyzed. The intersection of NE 24th Avenue at the North Local Access Drive is projected to operate at LOS A during morning and evening peak hours. Likewise, the intersection of NE 24th Avenue at the South Local Access Drive is projected to operate at LOS A during morning and evening peak hours. The intersection of NE 339th Street at the Local Access Drive is projected to operate at LOS B during the morning and evening peak hours. The intersection of NE Lockwood Drive and Local Access Drive is expected to operate at LOS B during the morning peak hour and LOS A during the evening peak hour.

Based on the detailed analysis, all studied intersections are projected to operate within the performance standards established by the City of La Center through the year 2017, with or without the trips from the proposed development. Accordingly, no operational mitigations are required or recommended.

The results of the capacity analysis, along with the levels of service, delay, and v/c ratios are shown in Table 2 on the following page. Detailed calculations, as well as tables showing the relationships between delay and level of service are included in the technical appendix to this report.

Table 2: Capacity Analysis Summary

	AM			PM		
	LOS	Delay (s)	v / c	LOS	Delay (s)	v / c
NE 24th Ave at NE 339th St						
2015 Existing	A	10	0.02	A	9	0.03
2017 Background	A	10	0.02	A	9	0.03
2017 Background + Site	B	10	0.04	A	10	0.04
NE 24th Ave at NE Lockwood Creek Rd						
2015 Existing	B	11	0.19	B	10	0.09
2017 Background	B	11	0.19	B	10	0.09
2017 Background + Site	B	11	0.20	B	11	0.10
NE Lockwood Creek Rd at NE Highland Ave						
2015 Existing	C	23	0.39	C	18	0.22
2017 Background	D	26	0.42	C	19	0.22
2017 Background + Site	E	39	0.53	C	24	0.25
W 4th St at Aspen Ave						
2015 Existing	C	17	0.29	C	16	0.27
2017 Background	C	18	0.30	C	17	0.28
2017 Background + Site	C	20	0.34	C	19	0.32
NE Pacific Hwy at W 4th St						
2015 Existing	B	15	0.49	C	16	0.32
2017 Background	C	16	0.53	C	17	0.43
2017 Background + Site	C	18	0.61	C	19	0.51
NE 24th Ave at North Local Access Drive						
2017 Background + Site	A	9	0.02	A	9	0.02
NE 24th Ave at South Local Access Drive						
2017 Background + Site	A	9	0.02	A	9	0.02
NE 339th St at Local Access Drive						
2017 Background + Site	B	10	0.08	B	14	0.38
NE Lockwood Creek Rd at Local Access Drive						
2017 Background + Site	B	11	0.22	A	10	0.13

SAFETY ANALYSIS

WARRANT ANALYSIS

Left-turn lane and traffic signal warrants were examined for each of study intersections where such treatments would be applicable.

A left-turn refuge is primarily a safety consideration for the major street, removing left-turning vehicles from the through traffic stream. The left-turn lane warrants used were developed from the National Cooperative Highway Research Project's (NCHRP) *Report 457*. The turn lane warrants were evaluated based on the number of advancing and opposing vehicles as well as the number of left-turning vehicles, the travel speed, and the number of through travel lanes.

Left-turn lane warrants were not projected to be met for any of the site access study area intersections under any of the analysis scenarios.

Traffic signal warrants were examined at study area intersection to determine whether the installation of a new traffic signal will be warranted at the intersection upon build-out of the proposed development. Due to insufficient main and side-street traffic volumes, traffic signal warrants are not met for any unsignalized study area intersections under any of the analysis scenarios. No new installations of traffic signals are recommended.

SIGHT DISTANCE

Intersection sight distance was evaluated at each of the proposed accesses for the proposed development. The minimum required intersection sight distance was determined in accordance with *A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS*, published in 2011 by the American Association of State Highway and Transportation Officials (AASHTO). Intersection sight distance measurements are based on an approaching driver's eye height of 3.5 feet above the road and an eye height of 3.5 feet with the opposing driver's eye 15 feet behind the edge of the near-side travel lane.

NE Lockwood Creek Road

The access on NE Lockwood Creek Road will be located approximately 100 feet east of the western edge of the project site that intersects NE Lockwood Creek Road. Based on the posted speed limit of 35 mph, a minimum of 390 feet of intersection sight distance is required in both directions of the access to ensure uninterrupted flow of through traffic. Intersection sight distance for vehicles turning right and left from the proposed site access are 890 feet to the east, limited by foliage along the roadway, and 1,490 feet to the west, limited by the crest of a hill, respectively. Left-turning vehicles from NE Lockwood Creek Road to the site access have a sight distance of 1,546 feet to the east, limited by a combination of roadside vegetation and a power pole.

NE 24th Avenue – South Access

The south access on NE 24th Avenue will be located approximately 125 feet north of the southern edge of the project site that intersects with NE 24th Avenue. The proposed access is situated on a

roadway sloping uphill to the north at a 6.25 percent grade. Based on the statutory residential speed limit of 25 mph, a minimum of 280 feet of intersection sight distance is required in both directions. Intersection sight distance for northbound vehicles is measured at 637 feet, limited by a tree along the western edge of NE 24th Avenue. For southbound vehicles intersection sight distance was measured to be 253 feet, where sight distance is obstructed by the crest of the vertical curve of a hill. Since 253 feet is less than the 280 feet required for intersection sight distance, stopping sight distance was investigated.

As explained in the AASHTO manual, stopping sight distance is considered the minimum requirement to ensure safe operation of the driveway. This is the distance that allows an oncoming driver to see a hazard n the roadway, react, and come to a complete stop if necessary to avoid a collision. Conversely, intersection sight distance is an operational measure, intended to provide sufficient line of sight along the major street so that a driver could turn from the driveway without impeding traffic flow.

In this case, stopping sight distance is the appropriate standard since NE 24th Avenue is a local rural street with features that already require the attention of drivers traveling the road, such as narrow driveways that are lined with natural vegetation.

Based on the posted speed limit of 25 mph and an upward grade of 6.25 percent to the north, a minimum of 165 feet of stopping sight distance is required for southbound vehicles and 143 feet for northbound vehicles. Since sight distance for northbound vehicles is measured at 637 feet and 253 feet for southbound vehicles, adequate stopping sight distance is available looking both to the north and the south from the subject access location.

NE 24th Avenue – North Access

The north access on NE 24th Avenue will be located approximately 500 feet south of NE 339th Street. Based on the posted speed limit of 25 mph, a minimum of 280 feet of intersection sight distance is required in both directions of the access. Intersection sight distance for vehicles turning right and left from the proposed site access are 533 feet to the north and 637 feet to the south, respectively. Left-turning vehicles from the NE 24th Avenue to the north site access have a sight distance of 1,369 feet to the north. Obstructions to sight distance in both the north and south directions are caused the crest of hills along NE 24th Avenue.

NE 339th Street

The access on NE 339th Street will be located approximately 145 feet east of the western property line of the project site. Based on the posted speed limit of 35 mph, a minimum of 390 feet of intersection sight distance is required in both directions of the access. Intersection sight distance for vehicles turning right and left from the proposed site access are 665 feet to the west and 671 feet to the east, respectively. Left-turning vehicles from the NE 339th Street to the site access have a sight distance of 665 feet to the west. Obstructions to sight distance in both directions are caused the crest of hills along NE 339th Street.

Based on the detailed analysis, adequate sight distance is available for the proposed new intersection access approaches to NE Lockwood Creek Road, NE 24th Avenue, and NE 339th Street. No sight distance mitigations are necessary or recommended.

CRASH DATA ANALYSIS

Using data obtained from WSDOT's Crash Data and Reporting Branch, a review was performed for the most recent five years of available crash data (January of 2010 through December of 2014) at each of the study area intersections. A crash rate was calculated under the common assumption that traffic counted during the evening peak period represents 10 percent of the average daily traffic (ADT) at the intersection. Crash rates greater than 1.0 crashes per million entering vehicles (CMEV) are generally indicative of a need for further investigation and possible mitigation.

The intersection of NE 24th Avenue at NE 339th Street had no reported crashes during the five year analysis period.

The intersection of NE 24th Avenue at NE Lockwood Creek Road had a total of two crashes during the analysis period. One of the crashes was a rear-end collision while the other was a fixed object collision, where the motorist drove off the road. One crash reported "property damage only" while the other crash reported "possible injury". The crash rate for the intersection was calculated to be 0.31 CMEV.

The intersection of NE Lockwood Creek Road at NE Highland Avenue reported four crashes during the analysis period. Two of the crashes were turning-type collisions, one was a rear-end collision, and one was a fixed object collision caused by speeding. All crashes reported "property damage only". The crash rate for the intersection was calculated to be 0.30 CMEV.

The intersection of W 4th Street at Aspen Avenue had a total of three crashes during the analysis period. There were two rear-end collisions and a fixed object collision, where an alcohol intoxicated driver crashed into a building. The two rear-end collisions resulted in "property damage only" while the fixed object collision resulted in "serious injuries". The crash rate for the intersection was calculated to be 0.19 CMEV.

The intersection of NE Pacific Highway at W 4th Street had a total of five crashes during the analysis period. Three of these crashes were turning-type collisions, one was a rear-end collision, and one was a collision with a pedestrian. Two of the crashes were resulted in "property damage only", two resulted in "possible injury", and one resulted in "serious injury". The crash resulting in "serious injury" involved a pedestrian crossing NE Pacific Highway whereby a northbound motorist failed to yield right-of-way to the pedestrian. The crash rate for the intersection was calculated to be 0.24 CMEV.

Based on detailed review of all crash data, no significant patterns are evident and the crash data does not appear to be indicative of a significant safety hazard. Accordingly, no safety mitigations are recommended.

CONCLUSIONS

Each of the study intersections is projected to operate within the performance standards established by the City of La Center through the year 2017, either with or without the addition of site trips from the proposed development. No operational mitigations are recommended.

A detailed examination of the crash history at the study intersections shows no significant patterns are evident and the crash data does not appear to be indicative of a significant safety hazard. No safety mitigations are recommended.

Sight distance was examined at the site access locations. All site access locations were determined to have acceptable intersection sight distance, with the exception of NE 24th Avenue at the South Local Access Drive, which was observed to have acceptable stopping sight distance.

Signal warrants were examined for all studied intersections and were not met under any of the analysis scenarios. Traffic volumes on the major and minor-street approaches at the remaining study intersections were too low to meet traffic signal warrants. No new traffic signals are recommended.

Left-turn lane warrants were examined at the site access locations and were not met under any of the analysis scenarios. No left-turn lane mitigation is recommended.

Based on the analysis, the transportation system in the site vicinity is capable of safely supporting the proposed development.

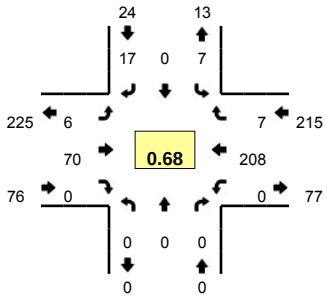
APPENDIX

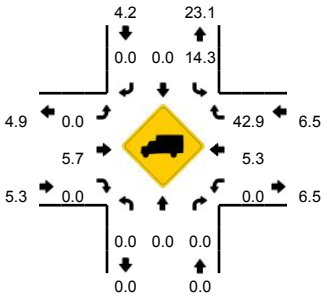
Preliminary Plat	*Sunrise Terrace* a Residential Subdivision City of La Center WA	Applicant: RK Land Development, LLC 1520 [illegible] 360.[illegible]	ED GREER Land Use Planning & Designs 8002 NE Hwy 99 #546 Vancouver WA 98665 360.904.4984 ed@ed-greer.net

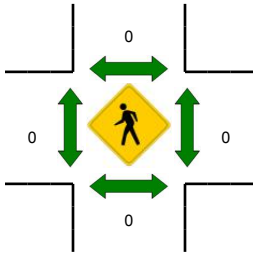
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

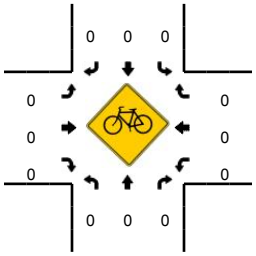
LOCATION: NE 24th Ave -- NE Lockwood Creek Rd | **QC JOB #:** 13416201
CITY/STATE: La Center, WA | **DATE:** Thu, Jun 04 2015

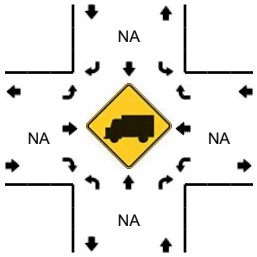
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 7:55 AM -- 8:10 AM

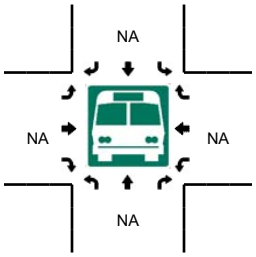












5-Min Count Period Beginning At	NE 24th Ave (Northbound)				NE 24th Ave (Southbound)				NE Lockwood Creek Rd (Eastbound)				NE Lockwood Creek Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	1	0	0	0	0	3	0	0	0	10	0	0	14	
7:05 AM	0	0	0	0	0	0	0	0	0	9	0	0	0	12	0	0	21	
7:10 AM	0	0	0	0	0	0	1	0	1	9	0	0	0	11	0	0	22	
7:15 AM	0	0	0	0	1	0	0	0	1	5	0	0	0	19	0	0	26	
7:20 AM	0	0	0	0	1	0	0	0	0	4	0	0	0	12	0	0	17	
7:25 AM	0	0	0	0	0	0	0	0	0	2	0	0	0	10	2	0	14	
7:30 AM	0	0	0	0	0	0	0	0	0	3	0	0	0	16	0	0	19	
7:35 AM	0	0	0	0	1	0	1	0	0	4	0	0	0	16	1	0	23	
7:40 AM	0	0	0	0	2	0	0	0	0	4	0	0	0	15	1	0	22	
7:45 AM	0	0	0	0	1	0	5	0	0	2	0	0	0	17	0	0	25	
7:50 AM	0	0	0	0	0	0	2	0	0	2	0	0	0	14	2	0	20	
7:55 AM	0	0	0	0	2	0	0	0	1	5	0	0	0	23	1	0	32	255
8:00 AM	0	0	0	0	0	0	4	0	1	7	0	0	0	34	2	0	48	289
8:05 AM	0	0	0	0	0	0	1	0	0	9	0	0	0	25	0	0	35	303
8:10 AM	0	0	0	0	1	0	0	0	2	6	0	0	0	15	0	0	24	305
8:15 AM	0	0	0	0	0	0	1	0	1	7	0	0	0	13	0	0	22	301
8:20 AM	0	0	0	0	0	0	1	0	1	11	0	0	0	13	0	0	26	310
8:25 AM	0	0	0	0	0	0	2	0	0	10	0	0	0	7	0	0	19	315
8:30 AM	0	0	0	0	1	0	1	0	0	4	0	0	0	10	1	0	17	313
8:35 AM	0	0	0	0	1	0	1	0	0	9	0	0	0	4	0	0	15	305
8:40 AM	0	0	0	0	1	0	0	0	0	6	0	0	0	4	1	0	12	295
8:45 AM	0	0	0	0	1	0	0	0	2	5	0	0	0	9	1	0	18	288
8:50 AM	0	0	0	0	1	0	1	0	0	5	0	0	0	8	0	0	15	283
8:55 AM	0	0	0	0	0	0	0	0	0	5	0	0	0	3	1	0	9	260

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	8	0	20	0	8	84	0	0	0	328	12	0	460
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	8	4		12
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

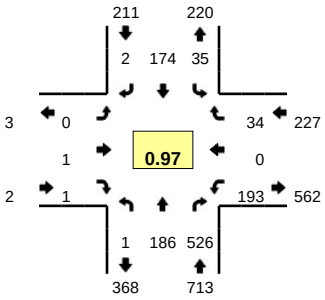
Type of peak hour being reported: Intersection Peak

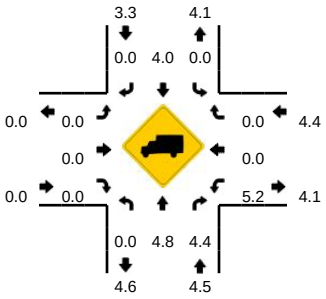
Method for determining peak hour: Total Entering Volume

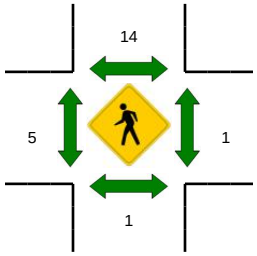
LOCATION: NW Pacific Hwy -- W 4th St
CITY/STATE: La Center, WA

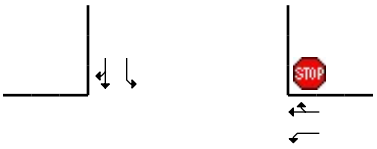
QC JOB #: 13416210
DATE: Thu, Jun 04 2015

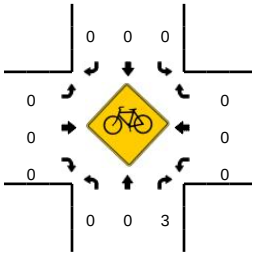
Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 5:10 PM -- 5:25 PM

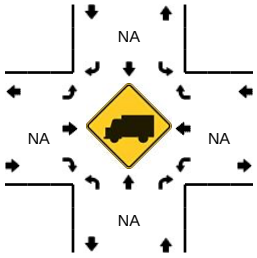


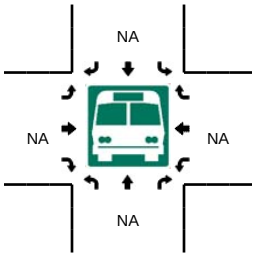












5-Min Count Period Beginning At	NW Pacific Hwy (Northbound)				NW Pacific Hwy (Southbound)				W 4th St (Eastbound)				W 4th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	12	41	0	2	18	1	0	0	0	0	0	17	1	3	0	95	
4:05 PM	0	7	39	0	0	19	0	0	0	0	0	0	20	0	2	0	87	
4:10 PM	0	18	43	0	3	11	0	0	0	0	2	0	17	0	3	0	97	
4:15 PM	0	15	34	0	4	12	0	0	0	0	0	0	16	0	3	0	84	
4:20 PM	0	23	34	0	0	11	0	0	0	0	2	0	24	0	1	0	95	
4:25 PM	0	9	39	0	3	11	0	0	0	0	0	0	14	0	4	0	80	
4:30 PM	0	9	29	0	2	8	0	0	0	1	1	0	23	0	3	0	76	
4:35 PM	0	8	39	0	6	3	0	0	0	0	0	0	19	0	1	0	76	
4:40 PM	0	13	20	0	6	5	0	0	0	1	1	0	21	0	2	0	69	
4:45 PM	0	12	45	0	3	11	0	0	0	0	0	0	11	0	3	0	85	
4:50 PM	0	15	40	0	6	9	0	0	0	0	0	0	14	0	3	0	87	
4:55 PM	0	18	44	0	4	8	0	0	0	0	0	0	19	0	1	0	94	1025
5:00 PM	1	17	53	0	3	25	0	0	0	0	0	0	17	0	2	0	118	1048
5:05 PM	0	18	31	0	3	9	1	0	0	0	0	0	18	0	2	0	82	1043
5:10 PM	0	13	37	0	2	19	1	0	0	0	0	0	18	0	4	0	94	1040
5:15 PM	0	15	48	0	5	14	0	0	0	0	0	0	13	0	5	0	100	1056
5:20 PM	0	16	49	0	3	22	0	0	0	1	0	0	9	0	2	0	102	1063
5:25 PM	0	13	30	0	3	14	0	0	0	0	0	0	22	0	1	0	83	1066
5:30 PM	0	18	41	0	3	16	0	0	0	0	1	0	14	0	6	0	99	1089
5:35 PM	0	13	60	0	2	13	0	0	0	0	0	0	16	0	1	0	105	1118
5:40 PM	0	13	47	0	4	12	0	0	0	0	0	0	12	0	2	0	90	1139
5:45 PM	0	16	40	0	0	11	0	0	0	0	0	0	18	0	5	0	90	1144
5:50 PM	0	16	46	0	3	11	0	0	0	0	0	0	17	0	3	0	96	1153
5:55 PM	1	15	42	0	5	8	1	0	0	1	0	0	12	0	5	0	90	1149

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	176	536	0	40	220	4	0	0	4	0	0	160	0	44	0	1184
Heavy Trucks	0	8	44		0	4	0		0	0	0		4	0	0		60
Pedestrians		0				8				4				0			12
Bicycles	0	0	2		0	0	0		0	0	0		0	0	0		2
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

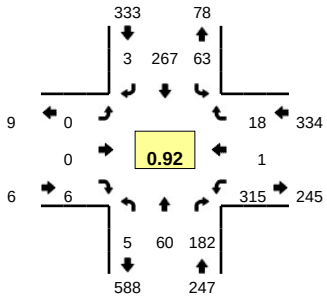
Type of peak hour being reported: Intersection Peak

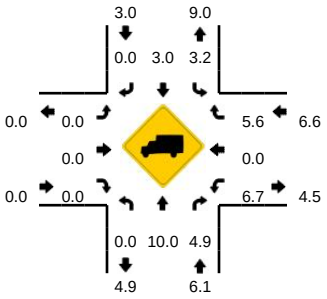
Method for determining peak hour: Total Entering Volume

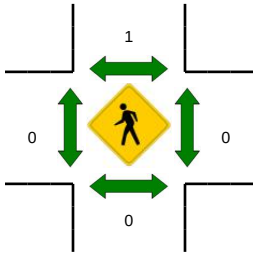
LOCATION: NW Pacific Hwy -- W 4th St
CITY/STATE: La Center, WA

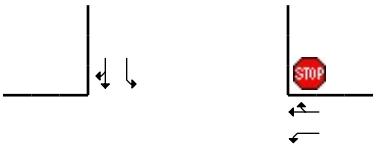
QC JOB #: 13416209
DATE: Thu, Jun 04 2015

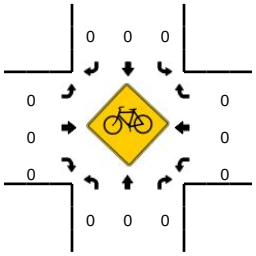
Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 8:00 AM -- 8:15 AM

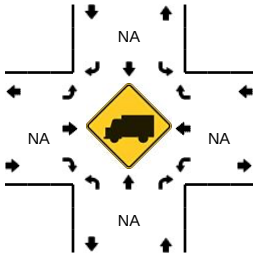


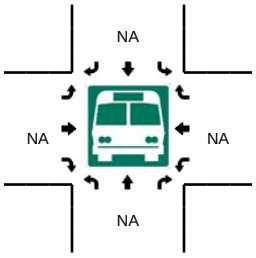












5-Min Count Period Beginning At	NW Pacific Hwy (Northbound)				NW Pacific Hwy (Southbound)				W 4th St (Eastbound)				W 4th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	6	5	0	2	22	0	0	0	0	1	0	25	0	0	0	61	
7:05 AM	1	6	16	0	1	25	0	0	0	0	0	0	30	0	1	0	80	
7:10 AM	0	7	12	0	4	25	2	0	0	0	0	0	37	0	1	0	88	
7:15 AM	0	5	6	0	1	30	2	0	0	0	1	0	18	0	0	0	63	
7:20 AM	1	6	10	0	4	27	0	0	0	0	2	0	32	0	2	0	84	
7:25 AM	0	5	9	0	1	21	0	0	0	0	0	0	28	0	0	0	64	
7:30 AM	0	5	7	0	0	24	0	0	0	0	1	0	28	0	0	0	65	
7:35 AM	0	6	13	0	2	23	0	0	0	0	0	0	27	1	0	0	72	
7:40 AM	2	3	19	0	1	15	0	0	0	0	0	0	27	0	1	0	68	
7:45 AM	2	12	17	0	4	23	0	0	0	0	0	0	21	0	1	0	80	
7:50 AM	0	5	26	0	6	19	0	0	0	0	0	0	23	0	2	0	81	
7:55 AM	0	4	21	0	9	23	1	0	0	0	0	0	14	0	2	0	74	880
8:00 AM	0	3	16	0	7	18	1	0	0	0	0	0	36	0	5	0	86	905
8:05 AM	0	2	14	0	10	22	1	0	0	0	3	0	20	0	0	0	72	897
8:10 AM	0	7	15	0	13	30	0	0	0	0	0	0	26	0	0	0	91	900
8:15 AM	0	2	15	0	6	22	0	0	0	0	0	0	33	0	5	0	83	920
8:20 AM	0	4	9	0	1	18	0	0	0	0	0	0	27	0	2	0	61	897
8:25 AM	1	7	7	0	1	25	0	0	0	0	1	0	31	0	1	0	74	907
8:30 AM	0	3	9	0	4	16	0	0	0	0	0	0	23	0	0	0	55	897
8:35 AM	1	8	8	0	3	15	0	0	0	0	0	0	21	0	5	0	61	886
8:40 AM	0	6	12	0	1	16	0	0	0	0	0	0	17	0	3	0	55	873
8:45 AM	0	2	8	0	1	8	0	0	0	0	0	0	13	0	0	0	32	825
8:50 AM	0	8	12	0	3	8	0	0	0	0	0	0	18	1	2	0	52	796
8:55 AM	0	4	10	0	3	11	0	0	0	0	0	0	23	0	2	0	53	775

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	48	180	0	120	280	8	0	0	0	12	0	328	0	20	0	996
Heavy Trucks	0	8	4		0	24	0		0	0	0		32	0	0		68
Pedestrians		0				4				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Aspen Ave -- E 4th St

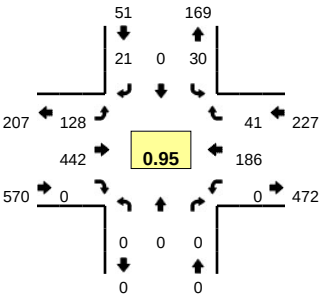
CITY/STATE: La Center , WA

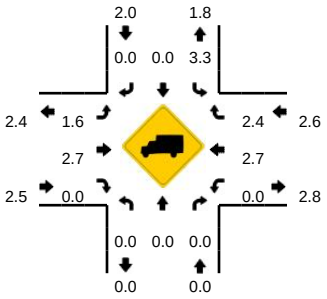
QC JOB #: 13416208

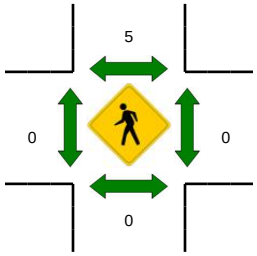
DATE: Thu, Jun 04 2015

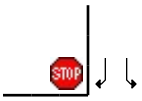
Peak-Hour: 4:55 PM -- 5:55 PM

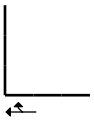
Peak 15-Min: 5:30 PM -- 5:45 PM

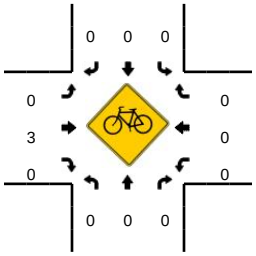


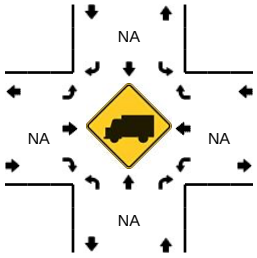


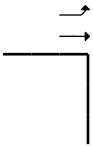


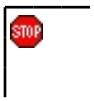


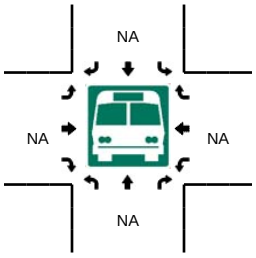












5-Min Count Period Beginning At	Aspen Ave (Northbound)				Aspen Ave (Southbound)				E 4th St (Eastbound)				E 4th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	2	0	2	0	10	27	0	0	0	20	2	0	63	
4:05 PM	0	0	0	0	3	0	5	0	13	30	0	0	0	13	4	0	68	
4:10 PM	0	0	0	0	2	0	1	0	12	34	0	0	0	19	6	0	74	
4:15 PM	0	0	0	0	1	0	2	0	11	26	0	0	0	12	4	0	56	
4:20 PM	0	0	0	0	1	0	5	0	13	20	0	0	0	18	5	0	62	
4:25 PM	0	0	0	0	2	0	4	0	15	27	0	0	0	14	2	0	64	
4:30 PM	0	0	0	0	2	0	5	0	7	26	0	0	0	19	4	0	63	
4:35 PM	0	0	0	0	3	0	4	0	11	33	0	0	0	13	6	0	70	
4:40 PM	0	0	0	0	0	0	0	0	3	24	0	0	0	21	3	0	51	
4:45 PM	0	0	0	0	5	0	1	0	17	30	0	0	0	12	0	0	65	
4:50 PM	0	0	0	0	2	0	0	0	11	37	0	0	0	18	4	0	72	
4:55 PM	0	0	0	0	3	0	0	0	10	37	0	0	0	15	6	0	71	779
5:00 PM	0	0	0	0	5	0	4	0	7	45	0	0	0	18	6	0	85	801
5:05 PM	0	0	0	0	0	0	0	0	8	29	0	0	0	15	1	0	53	786
5:10 PM	0	0	0	0	2	0	4	0	13	29	0	0	0	14	4	0	66	778
5:15 PM	0	0	0	0	4	0	2	0	11	41	0	0	0	15	3	0	76	798
5:20 PM	0	0	0	0	3	0	0	0	16	40	0	0	0	12	0	0	71	807
5:25 PM	0	0	0	0	0	0	3	0	6	28	0	0	0	17	1	0	55	798
5:30 PM	0	0	0	0	4	0	2	0	13	31	0	0	0	20	6	0	76	811
5:35 PM	0	0	0	0	3	0	0	0	9	50	0	0	0	15	3	0	80	821
5:40 PM	0	0	0	0	0	0	1	0	10	41	0	0	0	14	2	0	68	838
5:45 PM	0	0	0	0	2	0	3	0	11	33	0	0	0	16	4	0	69	842
5:50 PM	0	0	0	0	4	0	2	0	14	38	0	0	0	15	5	0	78	848
5:55 PM	0	0	0	0	1	0	2	0	7	39	0	0	0	16	5	0	70	847

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	28	0	12	0	128	488	0	0	0	196	44	0	896
Heavy Trucks	0	0	0		4	0	0		0	16	0		0	8	4		32
Pedestrians		0				8				0				0			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

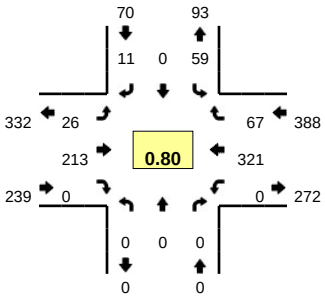
Type of peak hour being reported: Intersection Peak

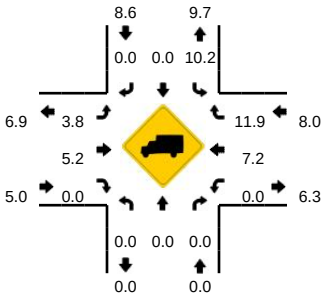
Method for determining peak hour: Total Entering Volume

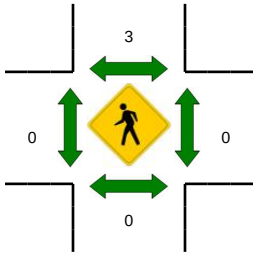
LOCATION: Aspen Ave -- E 4th St
CITY/STATE: La Center , WA

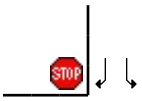
QC JOB #: 13416207
DATE: Thu, Jun 04 2015

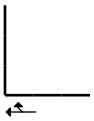
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 8:00 AM -- 8:15 AM

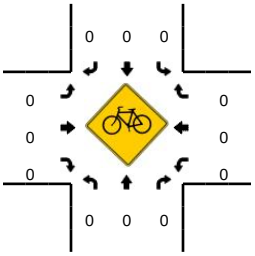


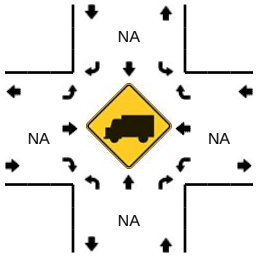


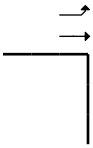


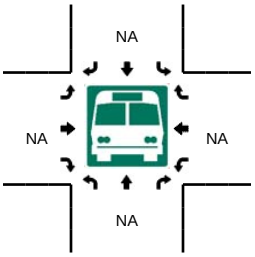












5-Min Count Period Beginning At	Aspen Ave (Northbound)				Aspen Ave (Southbound)				E 4th St (Eastbound)				E 4th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	1	0	1	0	0	7	0	0	0	23	2	0	34	
7:05 AM	0	0	0	0	4	0	1	0	2	15	0	0	0	37	0	0	59	
7:10 AM	0	0	0	0	3	0	1	0	1	15	0	0	0	30	2	0	52	
7:15 AM	0	0	0	0	1	0	0	0	1	4	0	0	0	23	1	0	30	
7:20 AM	0	0	0	0	3	0	0	0	5	9	0	0	0	30	3	0	50	
7:25 AM	0	0	0	0	0	0	0	0	0	12	0	0	0	25	2	0	39	
7:30 AM	0	0	0	0	2	0	1	0	2	4	0	0	0	35	5	0	49	
7:35 AM	0	0	0	0	1	0	2	0	1	15	0	0	0	17	1	0	37	
7:40 AM	0	0	0	0	3	0	2	0	3	15	0	0	0	25	1	0	49	
7:45 AM	0	0	0	0	5	0	0	0	0	21	0	0	0	20	3	0	49	
7:50 AM	0	0	0	0	7	0	2	0	5	27	0	0	0	22	8	0	71	
7:55 AM	0	0	0	0	7	0	1	0	2	29	0	0	0	19	3	0	61	580
8:00 AM	0	0	0	0	9	0	0	0	3	19	0	0	0	36	6	0	73	619
8:05 AM	0	0	0	0	9	0	0	0	3	23	0	0	0	28	6	0	69	629
8:10 AM	0	0	0	0	4	0	1	0	4	23	0	0	0	27	17	0	76	653
8:15 AM	0	0	0	0	6	0	0	0	0	21	0	0	0	35	10	0	72	695
8:20 AM	0	0	0	0	3	0	0	0	0	10	0	0	0	32	6	0	51	696
8:25 AM	0	0	0	0	3	0	2	0	3	6	0	0	0	25	1	0	40	697
8:30 AM	0	0	0	0	1	0	4	0	1	11	0	0	0	24	1	0	42	690
8:35 AM	0	0	0	0	0	0	2	0	1	11	0	0	0	16	1	0	31	684
8:40 AM	0	0	0	0	3	0	1	0	3	11	0	0	0	17	1	0	36	671
8:45 AM	0	0	0	0	0	0	0	0	2	6	0	0	0	12	2	0	22	644
8:50 AM	0	0	0	0	0	0	0	0	3	12	0	0	0	19	1	0	35	608
8:55 AM	0	0	0	0	2	0	1	0	2	11	0	0	0	25	1	0	42	589

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	88	0	4	0	40	260	0	0	0	364	116	0	872
Heavy Trucks	0	0	0		8	0	0		0	4	0		0	28	8		48
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

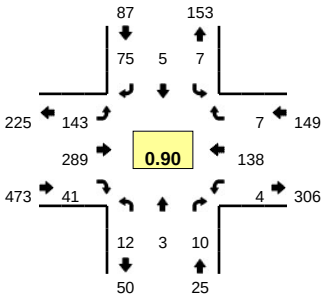
LOCATION: NE Highland Ave -- E 4th St

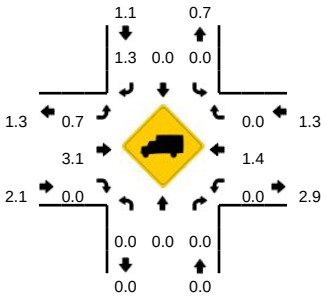
QC JOB #: 13416206

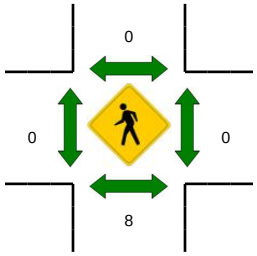
CITY/STATE: La Center, WA

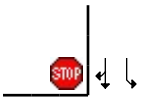
DATE: Thu, Jun 04 2015

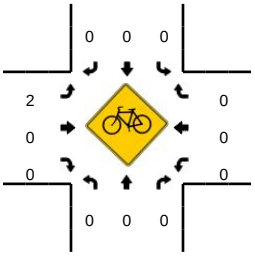
Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:30 PM -- 5:45 PM

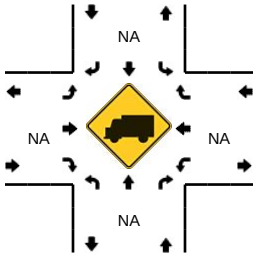


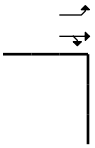


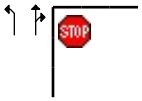


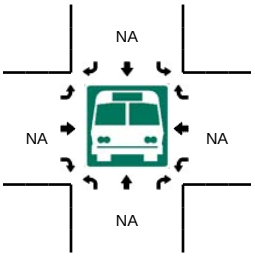












5-Min Count Period Beginning At	NE Highland Ave (Northbound)				NE Highland Ave (Southbound)				E 4th St (Eastbound)				E 4th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	1	1	7	0	8	16	1	0	0	10	1	0	45	
4:05 PM	0	0	0	0	1	0	1	0	7	24	0	0	0	15	0	0	48	
4:10 PM	0	1	0	0	2	0	5	0	10	19	1	0	2	12	1	0	53	
4:15 PM	0	0	1	0	1	0	8	0	7	10	2	0	0	8	1	0	38	
4:20 PM	1	0	0	0	1	1	3	0	7	10	1	0	0	6	1	0	31	
4:25 PM	2	0	0	0	0	1	11	0	5	27	1	0	0	10	1	0	58	
4:30 PM	2	1	1	0	0	0	6	0	9	12	0	0	0	13	1	0	45	
4:35 PM	0	0	0	0	0	0	10	0	8	24	0	0	0	10	1	0	53	
4:40 PM	1	1	0	0	0	0	5	0	5	20	1	0	0	9	1	0	43	
4:45 PM	0	0	0	0	0	0	6	0	8	19	0	0	1	8	0	1	43	
4:50 PM	1	1	1	0	1	1	4	0	12	23	5	0	1	23	1	0	74	
4:55 PM	1	1	0	0	1	0	5	0	12	27	1	0	1	9	0	0	58	589
5:00 PM	1	0	0	0	0	0	6	0	15	36	1	0	0	16	0	0	75	619
5:05 PM	1	0	0	0	0	0	7	0	7	24	0	0	1	14	1	0	55	626
5:10 PM	2	0	0	0	0	1	1	0	8	25	3	0	0	10	1	0	51	624
5:15 PM	1	0	0	0	1	1	3	0	11	12	6	0	0	16	0	0	51	637
5:20 PM	0	1	0	0	0	0	4	0	15	23	4	0	0	11	1	0	59	665
5:25 PM	1	0	2	0	0	0	12	0	8	13	3	0	0	12	1	0	52	659
5:30 PM	2	0	0	0	0	1	1	0	15	21	3	0	0	16	1	0	60	674
5:35 PM	0	0	0	0	0	2	5	0	12	32	5	0	0	11	2	0	69	690
5:40 PM	0	0	0	0	3	0	10	0	19	29	6	0	1	6	0	0	74	721
5:45 PM	0	0	1	0	2	0	9	0	14	19	4	0	1	5	0	0	55	733
5:50 PM	2	2	4	0	1	0	9	0	7	24	4	0	0	8	0	0	61	720
5:55 PM	2	0	3	0	0	0	8	0	12	31	2	0	1	13	0	0	72	734

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	0	0	0	12	12	64	0	184	328	56	0	4	132	12	0	812
Heavy Trucks	0	0	0		0	0	0		0	12	0		0	4	0		16
Pedestrians		8				0				0				0			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

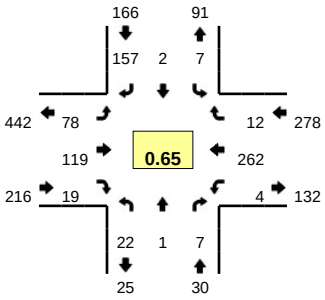
LOCATION: NE Highland Ave -- E 4th St

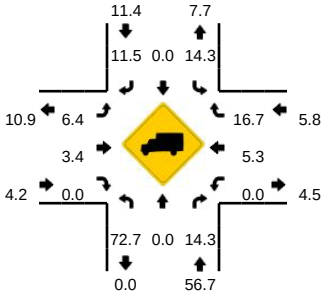
CITY/STATE: La Center, WA

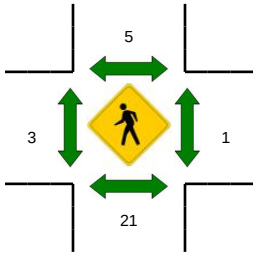
QC JOB #: 13416205

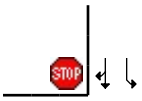
DATE: Thu, Jun 04 2015

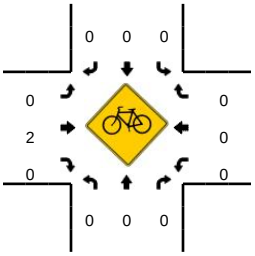
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 8:00 AM -- 8:15 AM

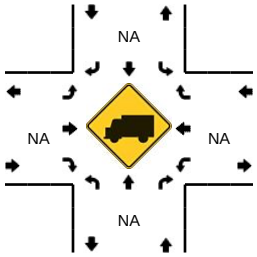


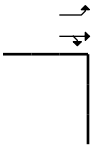


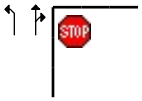


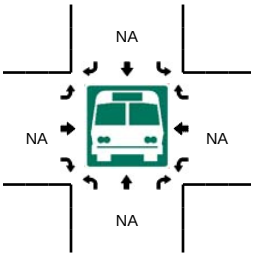












5-Min Count Period Beginning At	NE Highland Ave (Northbound)				NE Highland Ave (Southbound)				E 4th St (Eastbound)				E 4th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	0	0	6	0	3	3	0	0	0	10	0	0	22	
7:05 AM	0	0	0	0	0	0	10	0	4	11	0	0	0	18	2	0	45	
7:10 AM	1	0	0	0	0	0	14	0	5	12	0	0	1	18	0	0	51	
7:15 AM	0	0	0	0	0	1	7	0	4	4	0	0	0	26	1	0	43	
7:20 AM	0	0	0	0	0	0	16	0	8	2	0	0	0	17	0	0	43	
7:25 AM	1	0	0	0	0	0	10	0	4	3	0	0	0	8	1	0	27	
7:30 AM	0	0	0	0	0	0	11	0	3	5	0	0	0	24	0	0	43	
7:35 AM	0	0	0	0	0	0	5	0	1	6	0	0	0	19	1	0	32	
7:40 AM	0	0	0	0	0	0	7	0	5	6	0	0	0	17	0	0	35	
7:45 AM	0	0	0	0	0	0	11	0	8	4	0	0	0	13	1	0	37	
7:50 AM	0	0	0	0	1	0	6	0	11	8	0	1	0	20	3	0	50	
7:55 AM	1	0	0	0	1	1	23	0	11	14	1	0	0	23	1	0	76	504
8:00 AM	3	0	0	0	1	0	26	0	11	11	0	0	0	27	2	0	81	563
8:05 AM	8	0	0	0	3	1	19	0	12	17	3	0	2	36	2	0	103	621
8:10 AM	5	0	1	0	0	0	22	0	6	9	4	0	2	31	0	0	80	650
8:15 AM	0	0	2	0	0	0	11	1	5	13	6	0	0	19	1	0	58	665
8:20 AM	5	1	3	0	0	0	12	0	0	14	5	0	0	23	1	0	64	686
8:25 AM	0	0	1	0	0	0	4	0	4	12	0	0	0	10	0	0	31	690
8:30 AM	2	0	0	0	2	0	9	0	5	7	0	0	0	14	0	0	39	686
8:35 AM	0	0	0	0	0	0	6	0	2	6	0	0	0	5	0	0	19	673
8:40 AM	0	0	1	0	0	0	4	0	2	10	0	0	0	12	0	0	29	667
8:45 AM	0	0	0	0	1	0	8	0	3	5	0	0	0	11	1	0	29	659
8:50 AM	4	0	0	0	0	0	6	0	0	9	0	0	0	8	1	0	28	637
8:55 AM	2	0	0	0	1	0	3	0	2	7	0	0	0	9	1	0	25	586

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	64	0	4	0	16	4	268	0	116	148	28	0	16	376	16	0	1056
Heavy Trucks	52	0	0		0	0	40		4	4	0		0	12	0		112
Pedestrians		12				4				4				4			24
Bicycles	0	0	0		0	0	0		0	2	0		0	0	0		2
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: NE 24th Ave -- NE 339th St

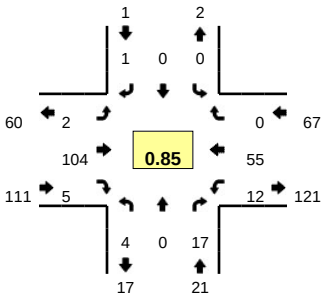
CITY/STATE: La Center, WA

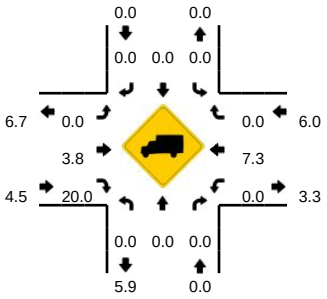
QC JOB #: 13416204

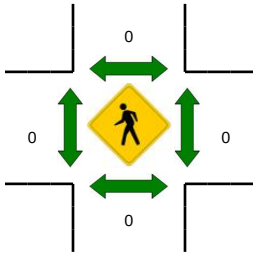
DATE: Thu, Jun 04 2015

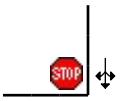
Peak-Hour: 4:50 PM -- 5:50 PM

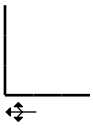
Peak 15-Min: 5:15 PM -- 5:30 PM

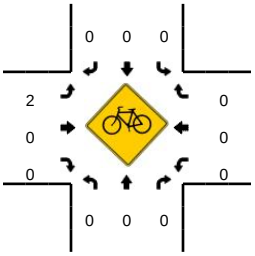


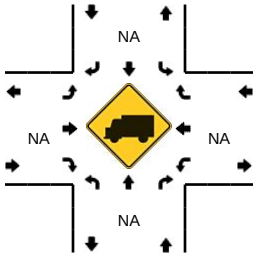


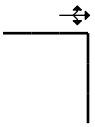


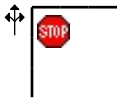


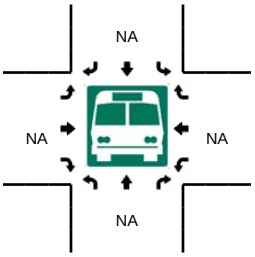












5-Min Count Period Beginning At	NE 24th Ave (Northbound)				NE 24th Ave (Southbound)				NE 339th St (Eastbound)				NE 339th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	0	1	0	0	0	0	0	0	7	1	0	2	4	0	0	16	
4:05 PM	0	0	2	0	0	0	0	0	0	11	0	0	0	2	0	0	15	
4:10 PM	0	0	5	0	0	0	0	0	0	7	0	0	1	3	0	0	16	
4:15 PM	1	0	3	0	0	0	1	0	0	5	0	0	1	3	0	0	14	
4:20 PM	0	0	1	0	0	0	0	0	0	9	1	0	1	6	0	0	18	
4:25 PM	0	0	1	0	0	0	0	0	0	1	0	0	1	7	0	0	10	
4:30 PM	0	0	3	0	0	0	0	0	0	6	0	0	0	3	0	0	12	
4:35 PM	0	0	0	0	0	0	0	0	0	6	0	0	0	7	0	0	13	
4:40 PM	1	0	2	0	0	0	0	0	0	6	0	0	0	7	0	0	16	
4:45 PM	0	0	1	0	0	0	0	0	0	3	0	0	0	3	0	0	7	
4:50 PM	1	0	4	0	0	0	0	0	1	8	0	0	2	3	0	0	19	
4:55 PM	0	0	0	0	0	0	1	0	1	9	1	0	0	3	0	0	15	171
5:00 PM	0	0	2	0	0	0	0	0	0	11	0	0	1	3	0	0	17	172
5:05 PM	1	0	1	0	0	0	0	0	0	7	0	0	0	3	0	0	12	169
5:10 PM	0	0	1	0	0	0	0	0	0	5	1	0	1	5	0	0	13	166
5:15 PM	0	0	2	0	0	0	0	0	0	8	1	0	0	1	0	0	12	164
5:20 PM	1	0	0	0	0	0	0	0	0	8	0	0	2	7	0	0	18	164
5:25 PM	1	0	3	0	0	0	0	0	0	10	0	0	3	12	0	0	29	183
5:30 PM	0	0	1	0	0	0	0	0	0	6	0	0	1	3	0	0	11	182
5:35 PM	0	0	2	0	0	0	0	0	0	9	0	0	2	4	0	0	17	186
5:40 PM	0	0	1	0	0	0	0	0	0	13	0	0	0	7	0	0	21	191
5:45 PM	0	0	0	0	0	0	0	0	0	10	2	0	0	4	0	0	16	200
5:50 PM	2	0	2	0	0	0	0	0	0	7	0	0	1	0	0	0	12	193
5:55 PM	0	0	1	0	0	0	0	0	0	10	2	0	0	2	0	0	15	193

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	0	20	0	0	0	0	0	0	104	4	0	20	80	0	0	236
Heavy Trucks	0	0	0		0	0	0		0	12	4		0	16	0		32
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: NE 24th Ave -- NE 339th St

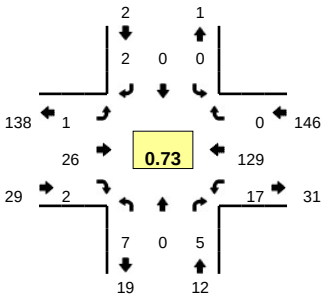
CITY/STATE: La Center, WA

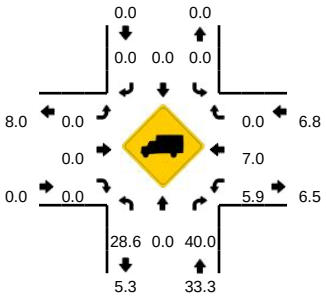
QC JOB #: 13416203

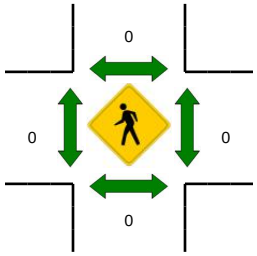
DATE: Thu, Jun 04 2015

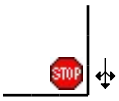
Peak-Hour: 7:20 AM -- 8:20 AM

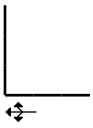
Peak 15-Min: 7:50 AM -- 8:05 AM

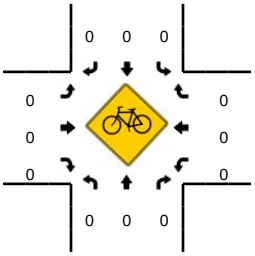


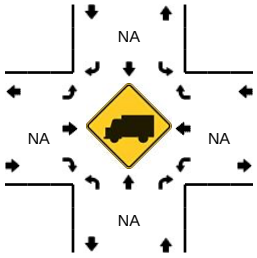


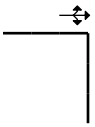


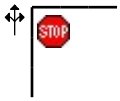


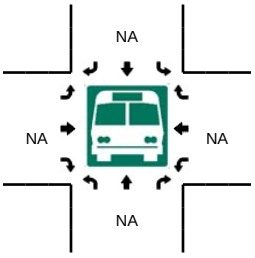












5-Min Count Period Beginning At	NE 24th Ave (Northbound)				NE 24th Ave (Southbound)				NE 339th St (Eastbound)				NE 339th St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	5	0	0	7	
7:05 AM	1	0	0	0	0	0	0	0	0	2	0	0	0	11	0	0	14	
7:10 AM	0	0	1	0	0	0	0	0	0	1	0	0	1	8	0	0	11	
7:15 AM	1	0	0	0	0	0	0	0	0	2	0	0	1	9	0	0	13	
7:20 AM	0	0	0	0	0	0	0	0	0	2	0	0	1	12	0	0	15	
7:25 AM	1	0	1	0	0	0	0	0	0	2	0	0	0	10	0	0	14	
7:30 AM	0	0	0	0	0	0	0	0	0	2	0	0	0	8	0	0	10	
7:35 AM	0	0	1	0	0	0	0	0	0	0	0	0	3	2	0	0	6	
7:40 AM	1	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	11	
7:45 AM	0	0	0	0	0	0	0	0	0	0	1	0	5	9	0	0	15	
7:50 AM	1	0	0	0	0	0	0	0	0	4	0	0	2	13	0	0	20	
7:55 AM	2	0	1	0	0	0	0	0	0	2	1	0	2	19	0	0	27	163
8:00 AM	2	0	1	0	0	0	0	0	0	2	0	0	2	11	0	0	18	174
8:05 AM	0	0	0	0	0	0	1	0	0	4	0	0	0	13	0	0	18	178
8:10 AM	0	0	1	0	0	0	0	0	0	3	0	0	0	10	0	0	14	181
8:15 AM	0	0	0	0	0	0	1	0	1	5	0	0	1	13	0	0	21	189
8:20 AM	0	0	2	0	0	0	1	0	0	2	1	0	1	7	0	0	14	188
8:25 AM	0	0	0	0	0	0	0	0	0	2	1	0	0	3	0	0	6	180
8:30 AM	1	0	0	0	0	0	1	0	0	4	0	0	2	6	0	0	14	184
8:35 AM	0	0	0	0	0	0	0	0	0	2	0	0	1	3	0	0	6	184
8:40 AM	0	0	1	0	0	0	0	0	1	2	1	0	0	6	0	0	11	184
8:45 AM	0	0	1	0	0	0	0	0	0	1	1	0	0	5	0	0	8	177
8:50 AM	0	0	1	0	0	0	1	0	0	1	0	0	2	3	0	0	8	165
8:55 AM	0	0	1	0	0	0	0	0	0	1	0	0	0	2	0	0	4	142

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	20	0	8	0	0	0	0	0	0	32	4	0	24	172	0	0	260
Heavy Trucks	8	0	0		0	0	0		0	0	0		0	20	0		28
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

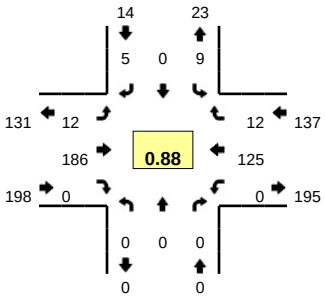
Method for determining peak hour: Total Entering Volume

LOCATION: NE 24th Ave -- NE Lockwood Creek Rd

QC JOB #: 13416202

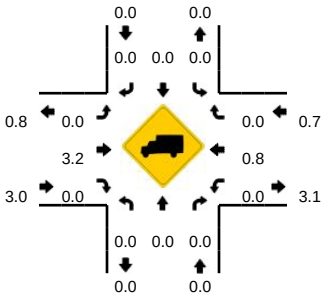
CITY/STATE: La Center, WA

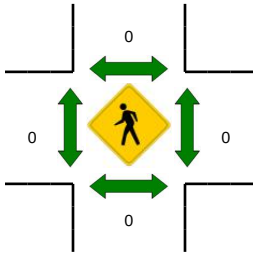
DATE: Thu, Jun 04 2015

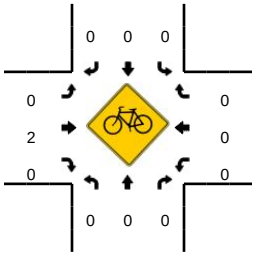


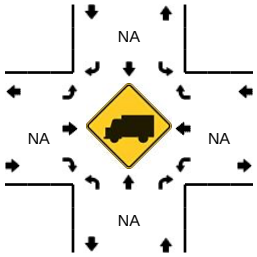
Peak-Hour: 4:40 PM -- 5:40 PM

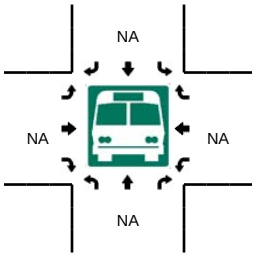
Peak 15-Min: 4:40 PM -- 4:55 PM











5-Min Count Period Beginning At	NE 24th Ave (Northbound)				NE 24th Ave (Southbound)				NE Lockwood Creek Rd (Eastbound)				NE Lockwood Creek Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	2	0	2	0	2	16	0	0	0	5	1	0	28	
4:05 PM	0	0	0	0	0	0	1	0	1	11	0	0	0	11	3	0	27	
4:10 PM	0	0	0	0	0	0	1	0	1	15	0	0	0	8	2	0	27	
4:15 PM	0	0	0	0	0	0	1	0	3	12	0	0	0	5	1	0	22	
4:20 PM	0	0	0	0	1	0	1	0	0	7	0	0	0	3	0	0	12	
4:25 PM	0	0	0	0	0	0	1	0	1	19	0	0	0	11	1	0	33	
4:30 PM	0	0	0	0	0	0	0	0	3	9	0	0	0	7	0	0	19	
4:35 PM	0	0	0	0	0	0	0	0	1	12	0	0	0	11	0	0	24	
4:40 PM	0	0	0	0	0	0	0	0	1	18	0	0	0	9	1	0	29	
4:45 PM	0	0	0	0	0	0	0	0	1	12	0	0	0	18	1	0	32	
4:50 PM	0	0	0	0	0	0	2	0	3	14	0	0	0	18	1	0	38	
4:55 PM	0	0	0	0	1	0	0	0	1	13	0	0	0	8	0	0	23	314
5:00 PM	0	0	0	0	1	0	0	0	0	25	0	0	0	6	1	0	33	319
5:05 PM	0	0	0	0	0	0	0	0	1	17	0	0	0	7	1	0	26	318
5:10 PM	0	0	0	0	1	0	1	0	2	13	0	0	0	9	1	0	27	318
5:15 PM	0	0	0	0	0	0	0	0	0	13	0	1	0	11	0	0	25	321
5:20 PM	0	0	0	0	2	0	0	0	0	16	0	0	0	10	2	0	30	339
5:25 PM	0	0	0	0	2	0	0	0	1	10	0	0	0	9	0	0	22	328
5:30 PM	0	0	0	0	1	0	1	0	1	13	0	0	0	12	1	0	29	338
5:35 PM	0	0	0	0	1	0	1	0	0	22	0	0	0	8	3	0	35	349
5:40 PM	0	0	0	0	0	0	0	0	0	16	0	0	0	8	0	0	24	344
5:45 PM	0	0	0	0	1	0	0	0	0	18	0	0	0	5	0	0	24	336
5:50 PM	0	0	0	0	3	0	0	0	4	11	0	0	0	10	2	0	30	328
5:55 PM	0	0	0	0	1	0	0	0	0	15	0	0	0	7	1	0	24	329

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	0	0	8	0	20	176	0	0	0	180	12	0	396
Heavy Trucks	0	0	0		0	0	0		0	12	0		0	0	0		12
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 6/11/2015 12:09 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

TRIP GENERATION CALCULATIONS

Land Use: Single-Family Detached Housing
Land Use Code: 210
Variable: Dwelling Units
Variable Value: 119

AM PEAK HOUR

Trip Rate: 0.75

	Enter	Exit	Total
Directional Distribution	25%	75%	
Trip Ends	**22**	**67**	**89**

PM PEAK HOUR

Trip Rate: 1.00

	Enter	Exit	Total
Directional Distribution	63%	37%	
Trip Ends	**75**	**44**	**119**

WEEKDAY

Trip Rate: 9.52

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**566**	**566**	**1,132**

SATURDAY

Trip Rate: 9.91

	Enter	Exit	Total
Directional Distribution	50%	50%	
Trip Ends	**590**	**590**	**1,180**

Source: TRIP GENERATION, Ninth Edition

LEVEL OF SERVICE

Level of service is used to describe the quality of traffic flow. Levels of service A to C are considered good, and rural roads are usually designed for level of service C. Urban streets and signalized intersections are typically designed for level of service D. Level of service E is considered to be the limit of acceptable delay. For unsignalized intersections, level of service E is generally considered acceptable. Here is a more complete description of levels of service:

Level of service A: Very low delay at intersections, with all traffic signal cycles clearing and no vehicles waiting through more than one signal cycle. On highways, low volume and high speeds, with speeds not restricted by other vehicles.

Level of service B: Operating speeds beginning to be affected by other traffic; short traffic delays at intersections. Higher average intersection delay than for level of service A resulting from more vehicles stopping.

Level of service C: Operating speeds and maneuverability closely controlled by other traffic; higher delays at intersections than for level of service B due to a significant number of vehicles stopping. Not all signal cycles clear the waiting vehicles. This is the recommended design standard for rural highways.

Level of service D: Tolerable operating speeds; long traffic delays occur at intersections. The influence of congestion is noticeable. At traffic signals many vehicles stop, and the proportion of vehicles not stopping declines. The number of signal cycle failures, for which vehicles must wait through more than one signal cycle, are noticeable. This is typically the design level for urban signalized intersections.

Level of service E: Restricted speeds, very long traffic delays at traffic signals, and traffic volumes near capacity. Flow is unstable so that any interruption, no matter how minor, will cause queues to form and service to deteriorate to level of service F. Traffic signal cycle failures are frequent occurrences. For unsignalized intersections, level of service E or better is generally considered acceptable.

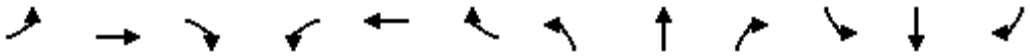
Level of service F: Extreme delays, resulting in long queues which may interfere with other traffic movements. There may be stoppages of long duration, and speeds may drop to zero. There may be frequent signal cycle failures. Level of service F will typically result when vehicle arrival rates are greater than capacity. It is considered unacceptable by most drivers.

LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (Seconds)
A	<10
B	10-20
C	20-35
D	35-55
E	55-80
F	>80

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

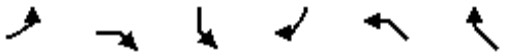
LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (Seconds)
A	<10
B	10-15
C	15-25
D	25-35
E	35-50
F	>50



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	1	27	5	18	134	0	15	0	5	0	0	2
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	1	39	7	26	191	0	21	0	7	0	0	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	191			46			291	288	42	295	291	191
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	191			46			291	288	42	295	291	191
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			97	100	99	100	100	100
cM capacity (veh/h)	1382			1562			650	611	1029	644	608	850

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	47	217	29	3
Volume Left	1	26	21	0
Volume Right	7	0	7	3
cSH	1382	1562	716	850
Volume to Capacity	0.00	0.02	0.04	0.00
Queue Length 95th (ft)	0	1	3	0
Control Delay (s)	0.2	1.0	10.2	9.2
Lane LOS	A	A	B	A
Approach Delay (s)	0.2	1.0	10.2	9.2
Approach LOS			B	A

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	29.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Sign Control	Free		Stop		Free	
Grade	0%		0%		0%	
Volume (veh/h)	9	73	13	30	216	10
Peak Hour Factor	0.68	0.68	0.68	0.68	0.68	0.68
Hourly flow rate (vph)	13	107	19	44	318	15
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	332		459	325		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	332		459	325		
tC, single (s)	4.1		6.4	6.2		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	99		97	94		
cM capacity (veh/h)	1227		554	716		

Direction, Lane #	EB 1	SB 1	NW 1
Volume Total	121	63	332
Volume Left	13	19	0
Volume Right	0	44	15
cSH	1227	658	1700
Volume to Capacity	0.01	0.10	0.20
Queue Length 95th (ft)	1	8	0
Control Delay (s)	1.0	11.1	0.0
Lane LOS	A	B	
Approach Delay (s)	1.0	11.1	0.0
Approach LOS		B	

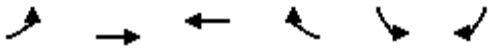
Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	89	134	20	6	303	12	23	2	7	6	4	189
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	137	206	31	9	466	18	35	3	11	9	6	291
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	485			237			1274	998	222	986	1005	475
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	485			237			1274	998	222	986	1005	475
tC, single (s)	4.1			4.1			*6.0	*6.0	*6.0	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			*2.5	*2.5	*2.5	3.5	4.0	3.3
p0 queue free %	87			99			69	99	99	95	97	50
cM capacity (veh/h)	1078			1330			114	328	1074	198	207	583

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	137	237	9	485	35	14	9	297
Volume Left	137	0	9	0	35	0	9	0
Volume Right	0	31	0	18	0	11	0	291
cSH	1078	1700	1330	1700	114	713	198	562
Volume to Capacity	0.13	0.14	0.01	0.29	0.31	0.02	0.05	0.53
Queue Length 95th (ft)	11	0	1	0	30	1	4	77
Control Delay (s)	8.8	0.0	7.7	0.0	50.0	10.1	24.1	18.3
Lane LOS	A		A		F	B	C	C
Approach Delay (s)	3.2		0.1		38.8		18.5	
Approach LOS					E		C	

Intersection Summary				
Average Delay	7.2			
Intersection Capacity Utilization	50.2%	ICU Level of Service		A
Analysis Period (min)	15			

* User Entered Value



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	27	241	390	70	61	11
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	34	301	488	88	76	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	575				900	531
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	575				900	531
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				74	97
cM capacity (veh/h)	998				299	548

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	34	301	575	76	14
Volume Left	34	0	0	76	0
Volume Right	0	0	88	0	14
cSH	998	1700	1700	299	548
Volume to Capacity	0.03	0.18	0.34	0.26	0.03
Queue Length 95th (ft)	3	0	0	25	2
Control Delay (s)	8.7	0.0	0.0	21.1	11.7
Lane LOS	A			C	B
Approach Delay (s)	0.9		0.0	19.7	
Approach LOS				C	

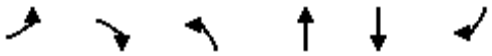
Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	34.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	6	377	1	26	5	62	206	68	278	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	7	410	1	28	5	67	224	74	302	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	559	754	304	535	532	67	305			291		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	559	754	304	535	532	67	305			291		
tC, single (s)	7.1	6.5	6.2	*6.0	*6.0	*6.0	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	*2.5	*2.5	*2.5	2.2			2.2		
p0 queue free %	100	100	99	39	100	98	100			94		
cM capacity (veh/h)	409	317	736	667	666	1317	1238			1270		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	7	410	29	73	224	74	305
Volume Left	0	410	0	5	0	74	0
Volume Right	7	0	28	0	224	0	3
cSH	736	667	1271	1238	1700	1270	1700
Volume to Capacity	0.01	0.61	0.02	0.00	0.13	0.06	0.18
Queue Length 95th (ft)	1	105	2	0	0	5	0
Control Delay (s)	9.9	18.6	7.9	0.6	0.0	8.0	0.0
Lane LOS	A	C	A	A		A	
Approach Delay (s)	9.9	17.9		0.2		1.6	
Approach LOS	A	C					

Intersection Summary				
Average Delay	7.6			
Intersection Capacity Utilization	49.0%	ICU Level of Service	A	
Analysis Period (min)	15			

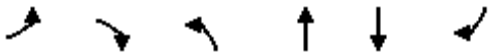
* User Entered Value



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	8	0	0	16	22	3
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	11	0	0	23	31	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	56	34	36			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	56	34	36			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	951	1040	1575			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	23	36
Volume Left	11	0	0
Volume Right	0	0	4
cSH	951	1575	1700
Volume to Capacity	0.01	0.00	0.02
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.8	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.8	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	18	7	16	22	0
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	0	26	10	23	31	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	74	31	31			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	74	31	31			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	98	99			
cM capacity (veh/h)	923	1043	1581			

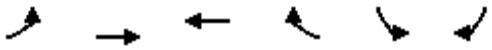
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	26	33	31
Volume Left	0	10	0
Volume Right	26	0	0
cSH	1043	1581	1700
Volume to Capacity	0.02	0.01	0.02
Queue Length 95th (ft)	2	0	0
Control Delay (s)	8.5	2.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	2.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	17.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	33	7	0	151	20	0
Peak Hour Factor	0.25	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	132	8	0	164	22	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			140		300	136
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			140		300	136
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		97	100
cM capacity (veh/h)			1444		692	913

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	140	164	22
Volume Left	0	0	22
Volume Right	8	0	0
cSH	1700	1444	692
Volume to Capacity	0.08	0.00	0.03
Queue Length 95th (ft)	0	0	2
Control Delay (s)	0.0	0.0	10.4
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.4
Approach LOS			B

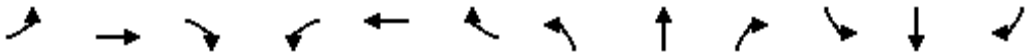
Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		17.9%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	7	82	246	0	0	20
Peak Hour Factor	0.67	0.67	0.67	0.67	0.67	0.67
Hourly flow rate (vph)	10	122	367	0	0	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	367				510	367
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	367				510	367
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	96
cM capacity (veh/h)	1191				518	678

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	133	367	30
Volume Left	10	0	0
Volume Right	0	0	30
cSH	1191	1700	678
Volume to Capacity	0.01	0.22	0.04
Queue Length 95th (ft)	1	0	3
Control Delay (s)	0.7	0.0	10.6
Lane LOS	A		B
Approach Delay (s)	0.7	0.0	10.6
Approach LOS			B

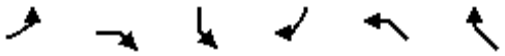
Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	3	135	17	14	57	0	9	0	18	0	0	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	4	159	20	16	67	0	11	0	21	0	0	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	67			179			277	276	169	297	286	67
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	67			179			277	276	169	297	286	67
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			98	100	98	100	100	100
cM capacity (veh/h)	1534			1397			667	623	875	632	615	996

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	182	84	32	1
Volume Left	4	16	11	0
Volume Right	20	0	21	1
cSH	1534	1397	793	996
Volume to Capacity	0.00	0.01	0.04	0.00
Queue Length 95th (ft)	0	1	3	0
Control Delay (s)	0.2	1.6	9.7	8.6
Lane LOS	A	A	A	A
Approach Delay (s)	0.2	1.6	9.7	8.6
Approach LOS			A	A

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	SBL	SBR	NWL	NWR
Lane Configurations						
Sign Control	Free		Stop		Free	
Grade	0%		0%		0%	
Volume (veh/h)	21	194	14	13	130	23
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	24	220	16	15	148	26
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	174		429	161		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	174		429	161		
tC, single (s)	4.1		6.4	6.2		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	98		97	98		
cM capacity (veh/h)	1403		573	884		

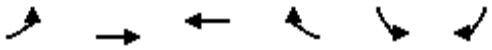
Direction, Lane #	EB 1	SB 1	NW 1
Volume Total	244	31	174
Volume Left	24	16	0
Volume Right	0	15	26
cSH	1403	690	1700
Volume to Capacity	0.02	0.04	0.10
Queue Length 95th (ft)	1	3	0
Control Delay (s)	0.9	10.5	0.0
Lane LOS	A	B	
Approach Delay (s)	0.9	10.5	0.0
Approach LOS		B	

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	181	333	43	5	164	7	14	5	10	7	6	95
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	201	370	48	6	182	8	16	6	11	8	7	106
Pedestrians								8				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	190			426			1106	1005	402	983	1025	186
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	190			426			1106	1005	402	983	1025	186
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	85			99			89	97	98	96	97	88
cM capacity (veh/h)	1366			1110			140	203	644	193	198	856

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	201	418	6	190	16	17	8	112
Volume Left	201	0	6	0	16	0	8	0
Volume Right	0	48	0	8	0	11	0	106
cSH	1366	1700	1110	1700	140	374	193	715
Volume to Capacity	0.15	0.25	0.01	0.11	0.11	0.04	0.04	0.16
Queue Length 95th (ft)	13	0	0	0	9	3	3	14
Control Delay (s)	8.1	0.0	8.3	0.0	33.9	15.1	24.5	11.0
Lane LOS	A		A		D	C	C	B
Approach Delay (s)	2.6		0.2		24.1		11.8	
Approach LOS					C		B	

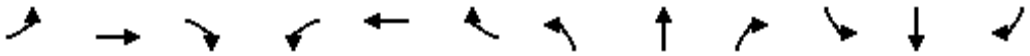
Intersection Summary				
Average Delay	4.0			
Intersection Capacity Utilization	41.0%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	133	524	229	43	31	22
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	140	552	241	45	33	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	286				1095	264
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	286				1095	264
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				84	97
cM capacity (veh/h)	1276				210	775

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	140	552	286	33	23
Volume Left	140	0	0	33	0
Volume Right	0	0	45	0	23
cSH	1276	1700	1700	210	775
Volume to Capacity	0.11	0.32	0.17	0.16	0.03
Queue Length 95th (ft)	9	0	0	13	2
Control Delay (s)	8.2	0.0	0.0	25.2	9.8
Lane LOS	A			D	A
Approach Delay (s)	1.7		0.0	18.8	
Approach LOS				C	

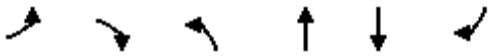
Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	1	234	0	39	1	194	603	44	181	2
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	1	241	0	40	1	200	622	45	187	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	521	1102	188	480	481	200	189			822		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	521	1102	188	480	481	200	189			822		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	49	100	95	100			94		
cM capacity (veh/h)	425	200	854	471	454	836	1368			808		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	1	241	40	201	622	45	189
Volume Left	0	241	0	1	0	45	0
Volume Right	1	0	40	0	622	0	2
cSH	854	471	836	1368	1700	808	1700
Volume to Capacity	0.00	0.51	0.05	0.00	0.37	0.06	0.11
Queue Length 95th (ft)	0	72	4	0	0	4	0
Control Delay (s)	9.2	20.4	9.5	0.0	0.0	9.7	0.0
Lane LOS	A	C	A	A		A	
Approach Delay (s)	9.2	18.9		0.0		1.9	
Approach LOS	A	C					

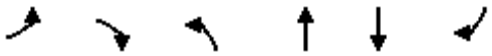
Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	53.7%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	5	0	0	23	16	10
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	7	0	0	33	23	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	63	30	37			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	63	30	37			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	943	1044	1573			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	7	33	37
Volume Left	7	0	0
Volume Right	0	0	14
cSH	943	1573	1700
Volume to Capacity	0.01	0.00	0.02
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.8	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.8	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	13	21	23	16	0
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	0	19	30	33	23	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	116	23	23			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	116	23	23			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	98	98			
cM capacity (veh/h)	864	1054	1592			

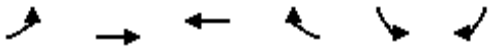
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	19	63	23
Volume Left	0	30	0
Volume Right	19	0	0
cSH	1054	1592	1700
Volume to Capacity	0.02	0.02	0.01
Queue Length 95th (ft)	1	1	0
Control Delay (s)	8.5	3.6	0.0
Lane LOS	A	A	
Approach Delay (s)	8.5	3.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	156	24	0	67	13	0
Peak Hour Factor	0.25	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	624	26	0	73	14	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			650		710	637
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			650		710	637
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		96	100
cM capacity (veh/h)			936		400	477

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	650	73	14
Volume Left	0	0	14
Volume Right	26	0	0
cSH	1700	936	400
Volume to Capacity	0.38	0.00	0.04
Queue Length 95th (ft)	0	0	3
Control Delay (s)	0.0	0.0	14.3
Lane LOS			B
Approach Delay (s)	0.0	0.0	14.3
Approach LOS			B

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization		19.7%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	24	225	149	0	0	13
Peak Hour Factor	0.67	0.67	0.67	0.67	0.67	0.67
Hourly flow rate (vph)	36	336	222	0	0	19
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	222				630	222
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	222				630	222
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	98
cM capacity (veh/h)	1347				434	817

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	372	222	19
Volume Left	36	0	0
Volume Right	0	0	19
cSH	1347	1700	817
Volume to Capacity	0.03	0.13	0.02
Queue Length 95th (ft)	2	0	2
Control Delay (s)	1.0	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	1.0	0.0	9.5
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: Site Access at NE 339th Street
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - AM Peak Hour

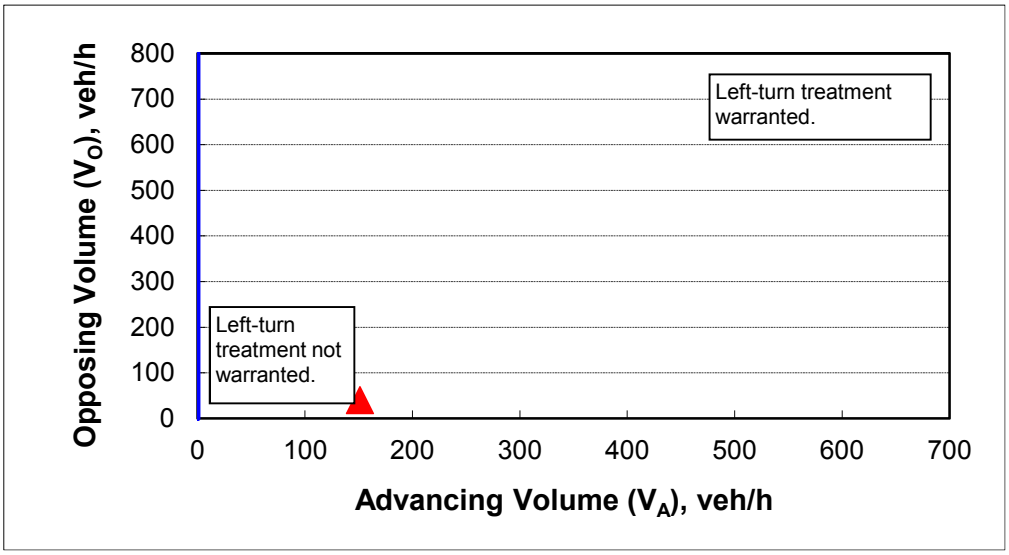
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	0%
Advancing volume (V_A), veh/h:	151
Opposing volume (V_O), veh/h:	40

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	#DIV/0!
Guidance for determining the need for a major-road left-turn bay:	
#DIV/0!	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: Site Access at NE 339th Street
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - PM Peak Hour

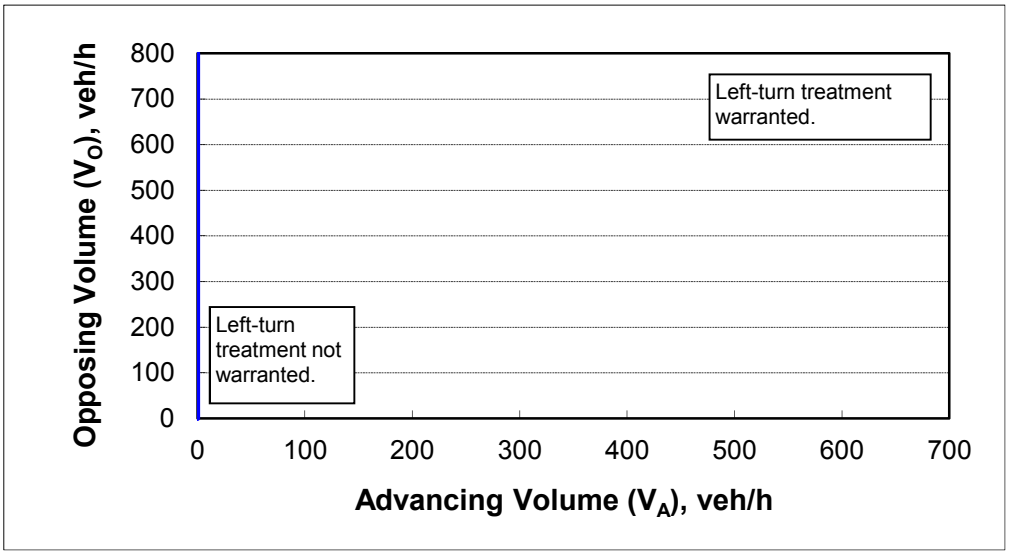
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	0%
Advancing volume (V_A), veh/h:	67
Opposing volume (V_O), veh/h:	147

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	#DIV/0!
Guidance for determining the need for a major-road left-turn bay:	
#DIV/0!	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: North Site Access at NE 24th Avenue
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - AM Peak Hour

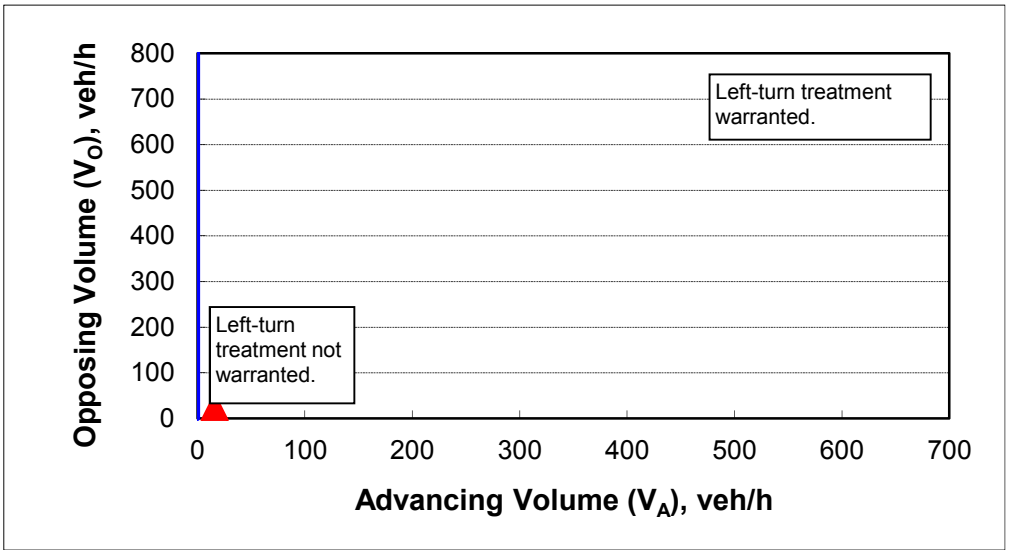
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	0%
Advancing volume (V_A), veh/h:	16
Opposing volume (V_O), veh/h:	25

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	#DIV/0!
Guidance for determining the need for a major-road left-turn bay:	
#DIV/0!	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: North Site Access at NE 24th Avenue
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - PM Peak Hour

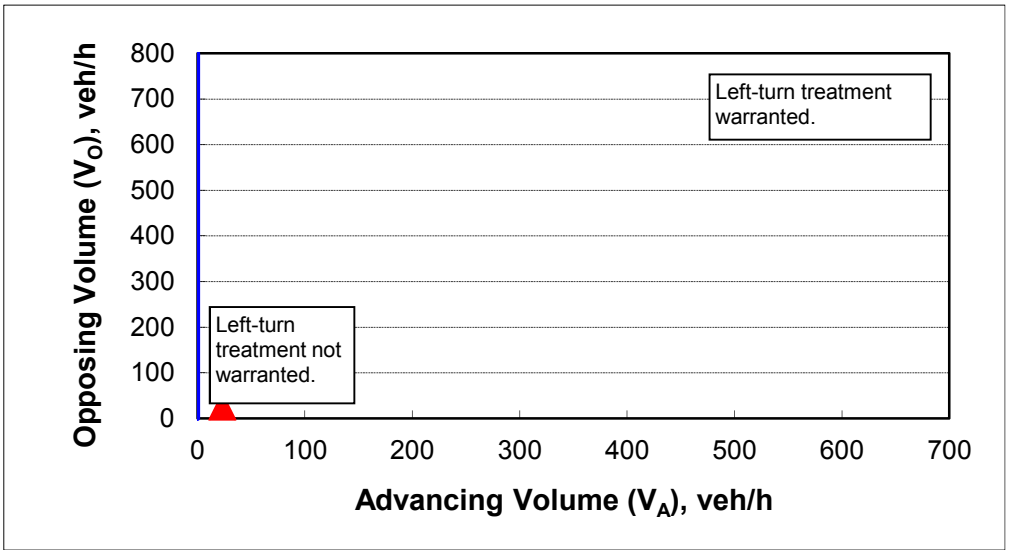
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	0%
Advancing volume (V_A), veh/h:	23
Opposing volume (V_O), veh/h:	26

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	#DIV/0!
Guidance for determining the need for a major-road left-turn bay:	
#DIV/0!	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: South Site Access at NE 24th Avenue
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - AM Peak Hour

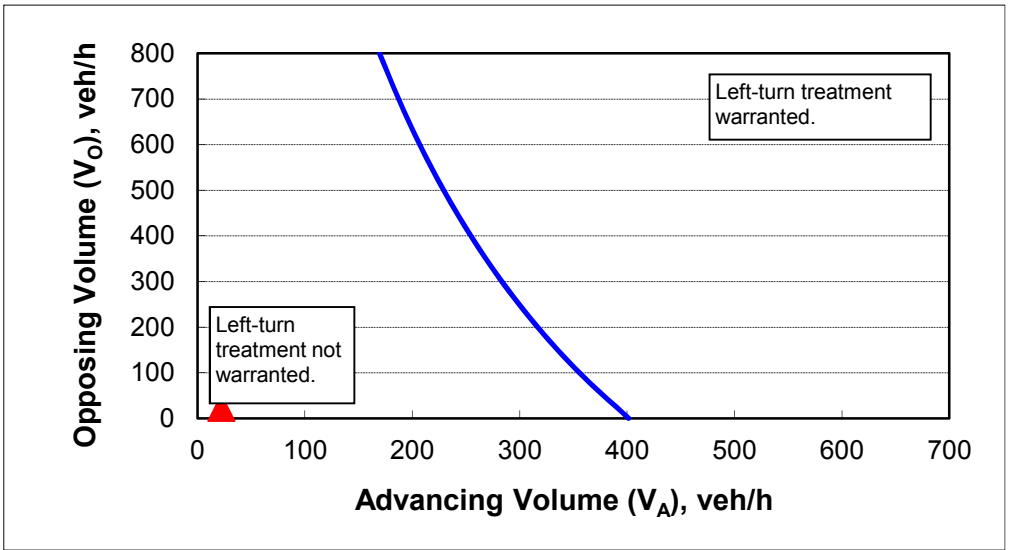
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	30%
Advancing volume (V_A), veh/h:	22
Opposing volume (V_O), veh/h:	23

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	390
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: South Site Access at NE 24th Avenue
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - PM Peak Hour

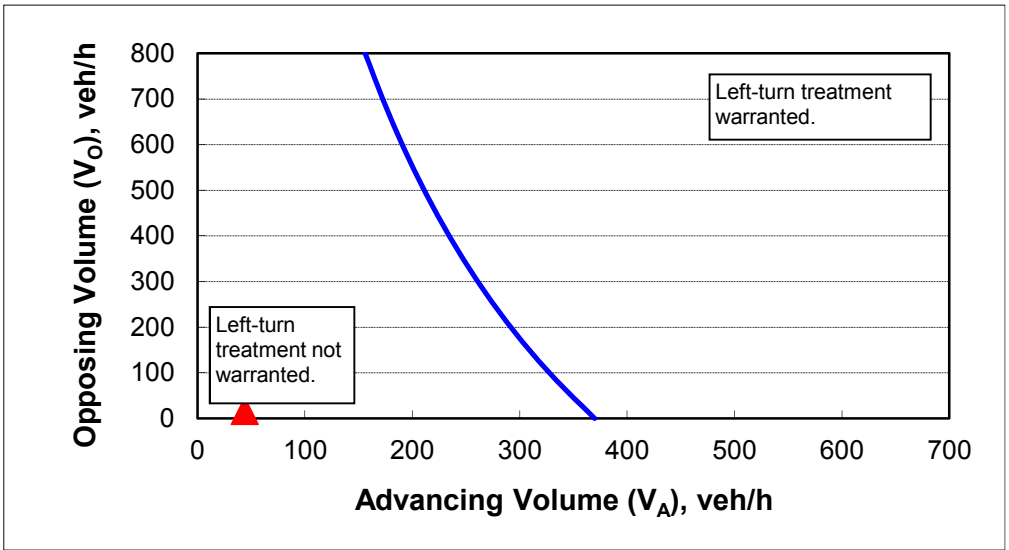
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	48%
Advancing volume (V_A), veh/h:	44
Opposing volume (V_O), veh/h:	16

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	362
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: Site Access at NE Lockwood Creek Road
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - AM Peak Hour

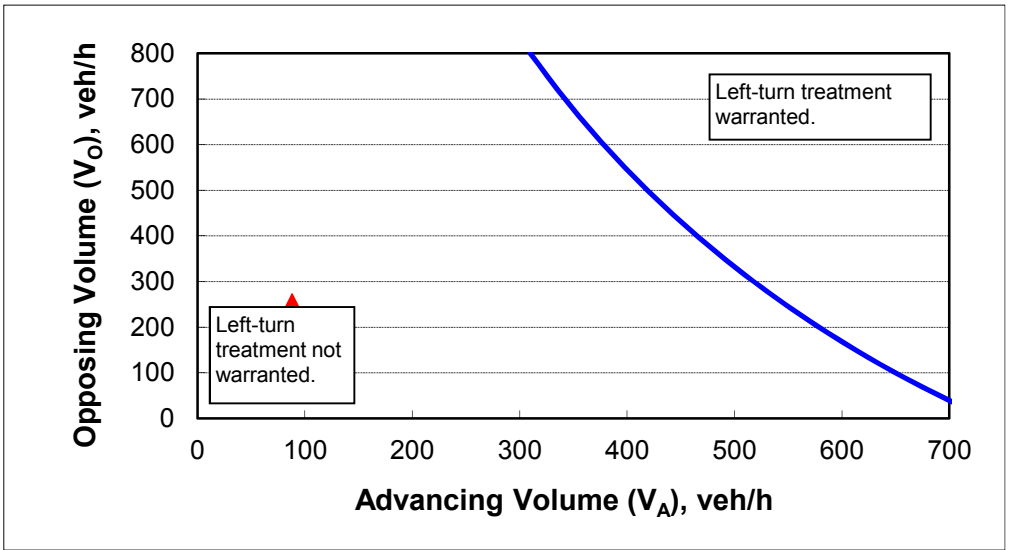
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	7%
Advancing volume (V_A), veh/h:	88
Opposing volume (V_O), veh/h:	243

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	551
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 15089 - Sunrise Terrace
Intersection: Site Access at NE Lockwood Creek Road
Date: 7/7/2015
Scenario: 2017 Background + Site Conditions - PM Peak Hour

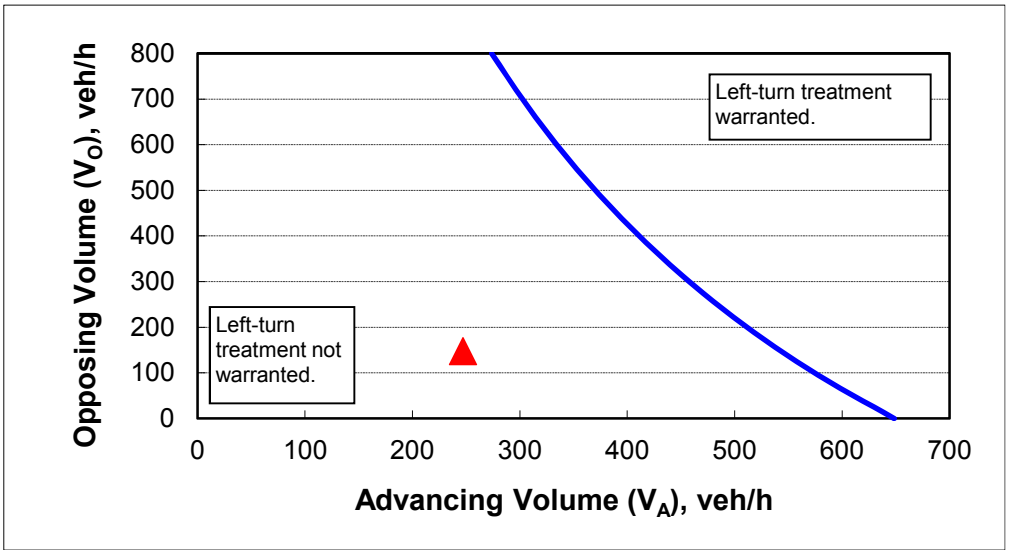
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	35
Percent of left-turns in advancing volume (V_A), %:	9%
Advancing volume (V_A), veh/h:	247
Opposing volume (V_O), veh/h:	147

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	543
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NW Pacific Highway	Minor Street:	W 4th Street
Number of Lanes:	2	Number of Lanes:	2
PM Peak Hour Volumes:	1021	PM Peak Hour Volumes:	271

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	10,210	10,600	
Minor Street*	2,710	3,550	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	10,210	15,900	
Minor Street*	2,710	1,750	**No**
Combination Warrant			
Major Street	10,210	12,720	
Minor Street*	2,710	2,840	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	E 4th Street	Minor Street:	Aspen Avenue
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	925	PM Peak Hour Volumes:	53

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	9,250	8,850	
Minor Street*	530	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	9,250	13,300	
Minor Street*	530	1,350	**No**
Combination Warrant			
Major Street	9,250	10,640	
Minor Street*	530	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	E 4th Street	Minor Street:	NE Highland Avenue
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	727	PM Peak Hour Volumes:	108

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	7,270	8,850	
Minor Street*	1,080	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	7,270	13,300	
Minor Street*	1,080	1,350	**No**
Combination Warrant			
Major Street	7,270	10,640	
Minor Street*	1,080	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NE Lockwood Creek Road	Minor Street:	NE 24th Avenue
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	368	PM Peak Hour Volumes:	27

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	3,680	8,850	
Minor Street*	270	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	3,680	13,300	
Minor Street*	270	1,350	**No**
Combination Warrant			
Major Street	3,680	10,640	
Minor Street*	270	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NE 339th Street	Minor Street:	NE 24th Avenue
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	226	PM Peak Hour Volumes:	27

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	2,260	8,850	
Minor Street*	270	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	2,260	13,300	
Minor Street*	270	1,350	**No**
Combination Warrant			
Major Street	2,260	10,640	
Minor Street*	270	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NE 24th Avenue	Minor Street:	North Access
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	49	PM Peak Hour Volumes:	5

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	490	8,850	
Minor Street*	50	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	490	13,300	
Minor Street*	50	1,350	**No**
Combination Warrant			
Major Street	490	10,640	
Minor Street*	50	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NE 24th Avenue	Minor Street:	North Access
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	60	PM Peak Hour Volumes:	13

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	600	8,850	
Minor Street*	130	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	600	13,300	
Minor Street*	130	1,350	**No**
Combination Warrant			
Major Street	600	10,640	
Minor Street*	130	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NE Lockwood Creek Road	Minor Street:	Access
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	394	PM Peak Hour Volumes:	13

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	3,940	8,850	
Minor Street*	130	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	3,940	13,300	
Minor Street*	130	1,350	**No**
Combination Warrant			
Major Street	3,940	10,640	
Minor Street*	130	2,120	**No**

* Right-turning traffic volumes reduced by 50%

Traffic Signal Warrant Analysis

Project: 15089 - Sunrise Terrace
Date: 6/26/2015
Scenario: Background plus Site Conditions

Major Street:	NE 339th Street	Minor Street:	Access
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	245	PM Peak Hour Volumes:	13

Warrant Used:

X 100 percent of standard warrants used

_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	2,450	8,850	
Minor Street*	130	2,650	**No**
Condition B: Interruption of Continuous Traffic			
Major Street	2,450	13,300	
Minor Street*	130	1,350	**No**
Combination Warrant			
Major Street	2,450	10,640	
Minor Street*	130	2,120	**No**

* Right-turning traffic volumes reduced by 50%

OFFICER REPORTED CRASHES THAT OCCURRED ON ALL ROADS IN THE CITY OF LA CENTER

1/1/2010 - 12/31/2014

UNDER 23 UNITED STATES CODE – SECTION 409, THIS DATA CANNOT BE USED IN DISCOVERY OR AS EVIDENCE AT TRIAL IN ANY ACTION FOR DAMAGES AGAINST THE WSDOT, OR ANY JURISDICTIONS INVOLVED IN THE DATA

JURISDICTION	PRIMARY TRAFFICWAY	BLOCK NUMBER	INTERSECTING TRAFFICWAY	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	MILE POST	A / B	REPORT NUMBER
City Street	ASPEN AVE	900	W 10TH ST							2427340
City Street	ASPEN AVE	300	W 4TH ST							E379622
City Street	E 4TH ST	100		109	F	E	ASPEN AVE			2427349
City Street	E 4TH ST	1000		30	F	W	NE LOCKWOOD CREEK RD			2737465
City Street	E 4TH ST	900	NE HIGHLAND AVE							E354317
City Street	NE HIGHLAND AVE	400	E 4TH ST							2427331
City Street	NE HIGHLAND AVE	400	E 4TH ST							E237901
City Street	NE LOCKWOOD CREEK RD	2300		81	F	NW	NE 24TH AVE			2427339
City Street	NE LOCKWOOD CREEK RD	2300		300	F	NW	NE 24TH AVE			E331937
City Street	NW PACIFIC HWY	400	W 4TH ST							E367326
City Street	NW PACIFIC HWY	400	W 4TH ST							E358151
City Street	NW PACIFIC HWY	400	W 4TH ST							2427345
City Street	W 4TH ST	200	ASPEN AVE							E390572
City Street	W 4TH ST	200	NW PACIFIC HWY							2427295
City Street	W 4TH ST	200	NW PACIFIC HWY							E230384

DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	# FAT	# VEH	# PEDS	# PEDAL	VEHICLE 1 TYPE	VEHICLE 2 TYPE
9/11/2010	12:40	No Injury	0	0	2	0	0	Passenger Car	Passenger Car
11/29/2014	22:50	Serious Injury	1	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	
8/18/2011	18:19	No Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
2/3/2012	10:48	No Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
9/2/2014	8:05	No Injury	0	0	2	0	0	Passenger Car	Passenger Car
3/24/2010	14:50	No Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
4/14/2013	11:30	No Injury	0	0	1	0	0	Passenger Car	
9/4/2010	21:26	No Injury	0	0	1	0	0	Passenger Car	
6/1/2014	8:48	Possible Injury	1	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
10/18/2014	20:00	Possible Injury	1	0	2	0	0	Passenger Car	Passenger Car
9/12/2014	7:45	No Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb
12/14/2010	17:09	Serious Injury	1	0	1	1	0	Pickup,Panel Truck or Vanette under 10,000 lb	
12/20/2014	11:30	No Injury	0	0	2	0	0	Pickup,Panel Truck or Vanette under 10,000 lb	Passenger Car
7/18/2012	7:25	No Injury	0	0	2	0	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb
3/1/2013	8:02	Possible Injury	2	0	2	0	0	Passenger Car	Passenger Car

JUNCTION RELATIONSHIP	ROADWAY SURFACE CONDITIONS	LIGHTING CONDITIONS
At Intersection and Related	Dry	Daylight
At Intersection and Not Related	Dry	Dark-Street Lights On
Not at Intersection and Not Related	Dry	Daylight
At Driveway	Dry	Daylight
At Intersection and Related	Dry	Daylight
At Intersection and Related	Dry	Daylight
At Intersection and Related	Dry	Daylight
Not at Intersection and Not Related	Dry	Dark-No Street Lights
Not at Intersection and Not Related	Dry	Daylight
At Intersection and Related	Dry	Dark-Street Lights On
At Intersection and Related	Dry	Daylight
At Intersection and Related	Wet	Dark-Street Lights On
At Intersection and Not Related	Wet	Daylight
At Intersection and Related	Dry	Daylight
At Intersection and Related	Wet	Daylight

FIRST COLLISION TYPE / OBJECT STRUCK	VEH 1 ACTION	VEH 2 ACTION
Entering at angle	Making Left Turn	Going Straight Ahead
Building	Going Straight Ahead	
From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped for Traffic
Entering at angle	Going Straight Ahead	Making Left Turn
Entering at angle	Making Left Turn	Making Left Turn
From same direction - both going straight - one stopped - rear-end	Stopped at Signal or Stop Sign	Going Straight Ahead
Street Light Pole or Base	Going Straight Ahead	
Over Embankment - No Guardrail Present	Going Straight Ahead	
From same direction - both going straight - both moving - rear-end	Going Straight Ahead	Going Straight Ahead
Entering at angle	Stopped at Signal or Stop Sign	Making Right Turn
Entering at angle	Making Left Turn	Going Straight Ahead
Vehicle going straight hits pedestrian	Going Straight Ahead	
From same direction - both going straight - one stopped - rear-end	Stopped for Traffic	Going Straight Ahead
From same direction - both going straight - one stopped - rear-end	Stopped at Signal or Stop Sign	Going Straight Ahead
Entering at angle	Making Left Turn	Going Straight Ahead

MV DRIVER CONT CIRC 1 (UNIT 1)	MV DRIVER CONT CIRC 1 (UNIT 2)	VEH 1 COMP DIR FROM	VEH 1 COMP DIR TO
None	Disregard Stop Sign - Flashing Red	East	South
Under Influence of Alcohol		North	South
Follow Too Closely	None	East	West
None	Did Not Grant RW to Vehicle	West	East
Driver Not Distracted	Did Not Grant RW to Vehicle	West	Northeast
None	Follow Too Closely	North	Vehicle Stopped
Exceeding Stated Speed Limit		North	South
Over Center Line		East	West
None	Apparently Asleep	West	East
None	Under Influence of Alcohol	Vehicle Stopped	Vehicle Stopped
Did Not Grant RW to Vehicle	Driver Not Distracted	East	South
Fail to Yield Row to Pedestrian		South	North
None	Inattention	Vehicle Stopped	Vehicle Stopped
None	Inattention	East	Vehicle Stopped
Did Not Grant RW to Vehicle	None	East	South

VEH 2 COMP DIR FROM	VEH 2 COMP DIR TO	IMPACT LOCATION (Effective for City, County & Misc 1/1/2010; SR's indefinite)
North	South	Lane of Primary Trafficway
		Past the Outside Shoulder of Primary Trafficway
East	Vehicle Stopped	Lane of Primary Trafficway
South	West	Lane of Primary Trafficway
North	Southeast	Lane of Primary Trafficway
North	South	Lane of Primary Trafficway
		Past the Outside Shoulder of Primary Trafficway
		Past the Outside Shoulder of Primary Trafficway
West	East	Lane of Primary Trafficway
South	East	Intersecting Trafficway (WITH Intent to Access)
South	North	Lane of Primary Trafficway
		Lane of Primary Trafficway
East	West	Lane of Primary Trafficway
East	West	Lane of Primary Trafficway
South	North	Lane of Primary Trafficway

AASHTO Intersection Sight Distance

Design Speed	ISD for Cars
15	170
20	225
25	280
30	335
35	390
40	445
45	500
50	555
55	610
60	665
65	720
70	775
75	830
80	885

ISD = 1.47*Vmajor*tg

Vmajor = Design Speed on major road
tg = time gap for minor road

Speed? 25
Time Gap? 7.5
ISD 280

Washington County Intersection Sight Distance

Design Speed	ISD for Cars
15	150
20	200
25	250
30	300
35	350
40	400
45	450
50	500
55	550
60	600
65	650
70	700
75	750
80	800

ISD = 10*Vmajor

Vmajor = Design Speed on major road

AASHTO Stopping Sight Distance

Design Speed	SSD for Cars
15	80
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820
80	910

$SSD = 1.47*V*t + V^2/(30(a/32.2)\pm G)$

V = Design Speed
t = 2.5 s (brake reaction time)
a = deceleration rate (11.2 ft/s^2)

G = Grade of approach (+ up, - down)

Vmajor = Design Speed on major road
tg = time gap for minor road

Vmajor = Design Speed on major road

Speed?	25	G =	-6.3
Time Gap?	2.5		
A?	11.2		
SSD	165		

THE WOLFE GROUP, L.L.C.
Land Planning, Consulting, & Civil Engineering

2401 W. Main Street, Suite 210
Battle Ground, WA 98604
(360) 687-2699

"SUNRISE TERRACE"

Preliminary Technical Information Report

July 2015

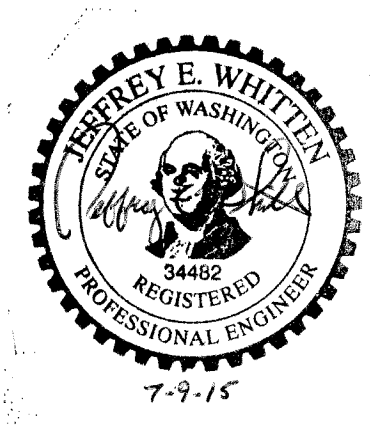


TABLE OF CONTENTS

Report:

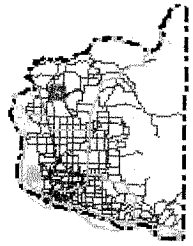
List of Tables:

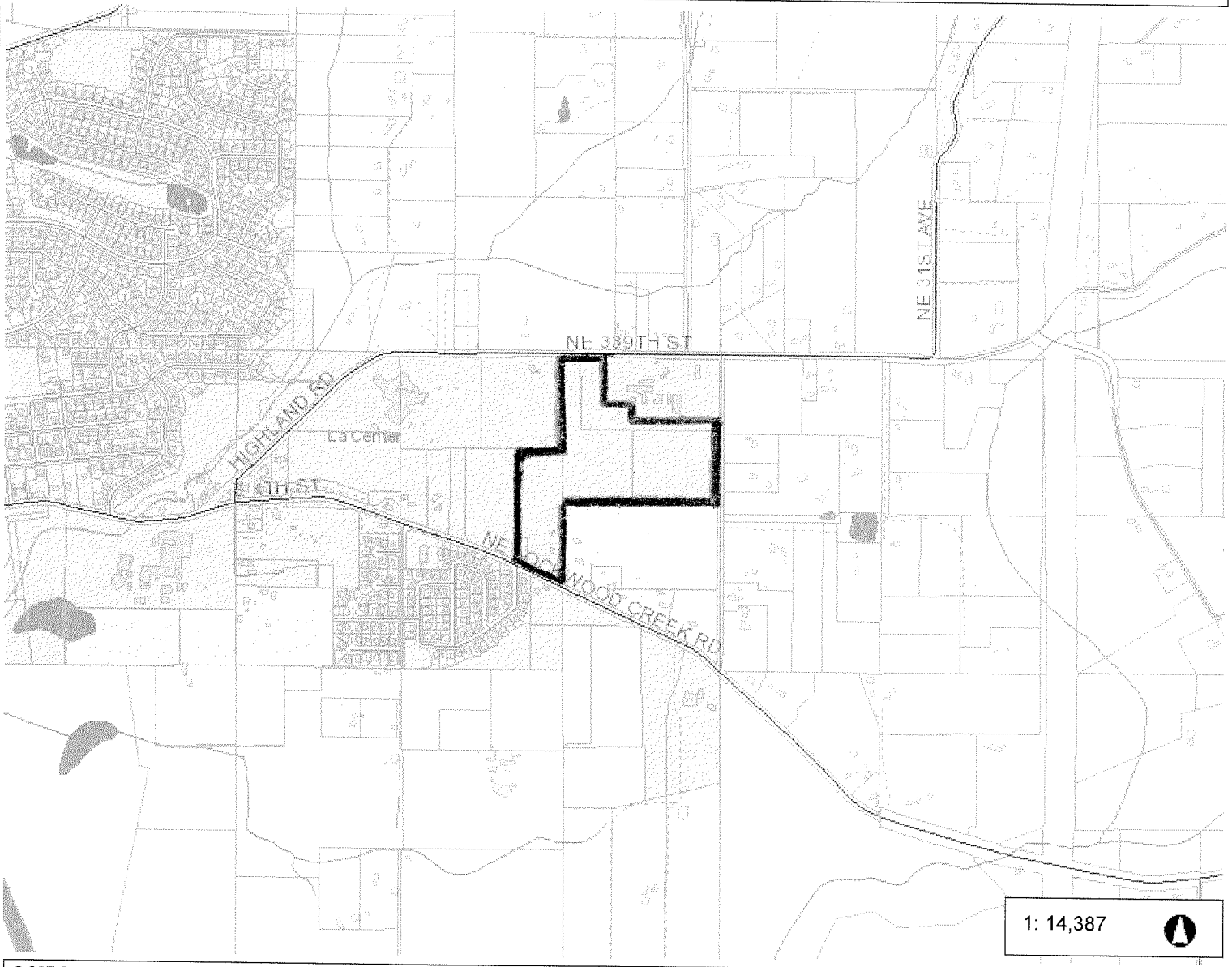
VICINITY MAPS

Vicinity Map

Soils Map

Vicinity Map





Legend

- Building Footprints
- Taxlots
- Cities Boundaries
- Urban Growth Boundaries

Notes:

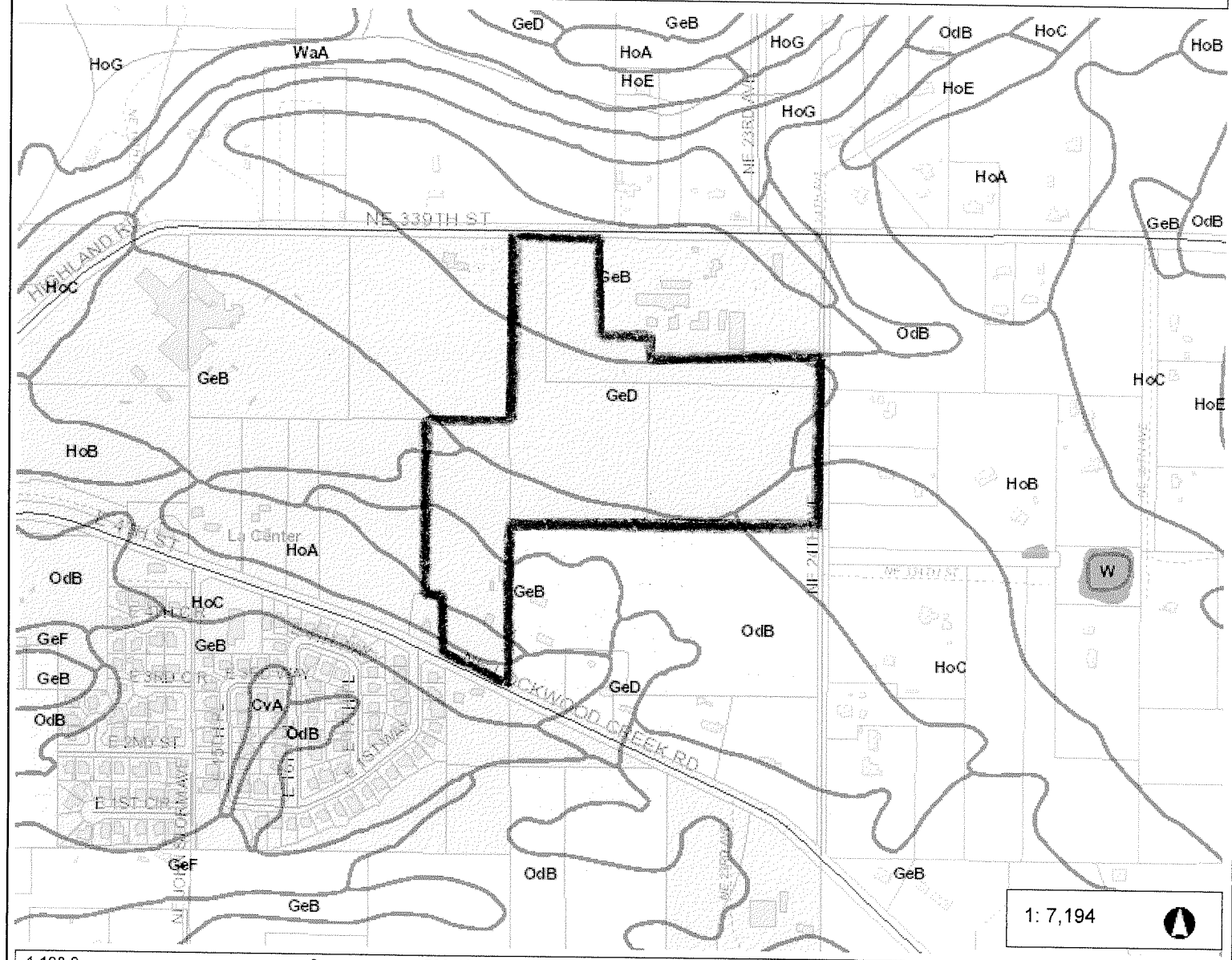
1: 14,387

2,397.8 0 1,198.92 2,397.8 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

This map was generated by Clark County's "MapsOnline" website. Clark County does not warrant the accuracy, reliability or timeliness of any information on this map, and shall not be held liable for losses caused by using this infromation.

Soils Map

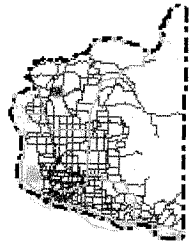


1: 7,194

1,198.9 0 599.46 1,198.9 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

This map was generated by Clark County's "MapsOnline" website. Clark County does not warrant the accuracy, reliability or timeliness of any information on this map, and shall not be held liable for losses caused by using this infromation.



Legend

- Soil Type
- Building Footprints
- Taxlots
- Cities Boundaries
- Urban Growth Boundaries

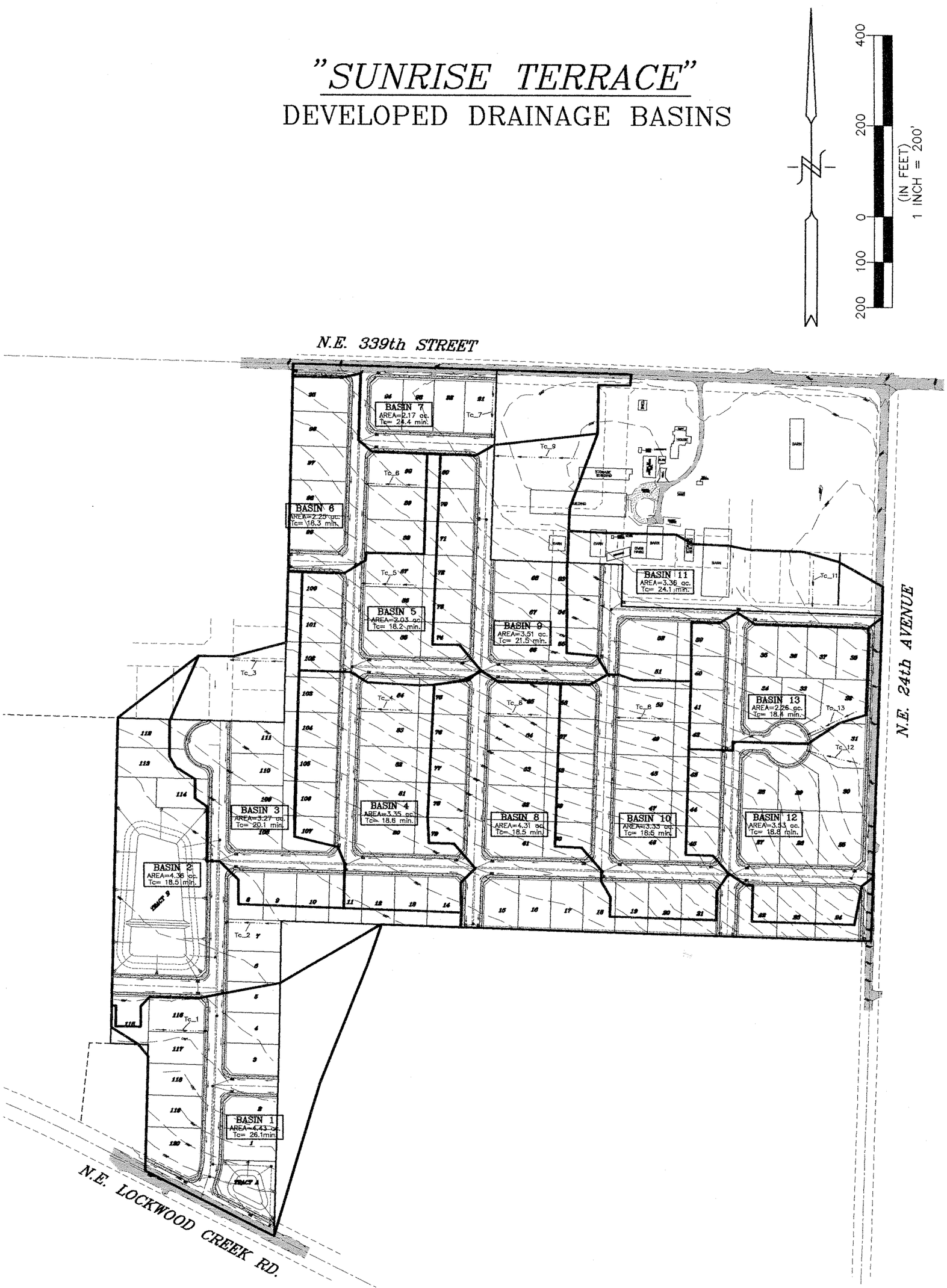
Notes:

DEVELOPMENT PLAN

Drainage Basins
Flow Routes

"SUNRISE TERRACE"

DEVELOPED DRAINAGE BASINS



SECTION A - PROJECT OVERVIEW

The project site consists of approximately 35.7 acres and lies west of N.E. 24th Avenue between N.E. 339th Street and N.E. Lockwood Creek Road. It is bordered on the west by three large undeveloped parcels. Much of the southern and eastern boundary of the project borders a large undeveloped parcel as well. The entire site is primarily in a field/pasture condition. The entire project site drains in a southwesterly manner toward N.E. Lockwood Creek Road. The stormwater from the property enters a roadside ditch along the north side of Lockwood Creek Road which drains eastward for a few hundred feet where it then crosses to the south side of the road and enters a vegetated ravine.

An onsite storm water detention facility along with two wetponds are proposed to treat and detain the stormwater runoff generated from the majority of the project site as well as portions of the future development of the Perrott and Manning properties. The proposed primary stormwater facility is preliminarily located along the western side of the proposed development. This facility will contain both a wetpond and a live detention pond. This primary stormwater facility will treat and detain the majority of stormwater generated from the developed site. A smaller wetpond is proposed at the southern end of the project adjacent to N.E. Lockwood Creek Road to treat the stormwater runoff generated south of the primary stormwater facility. No live detention is proposed at this smaller facility. The primary stormwater facility has been preliminarily designed to account for the direct release of stormwater runoff from that area south of the primary facility (Basin 1).

In summary, the proposed onsite storm water facilities are to provide treatment and detention for the runoff generated from the development site and portions of future development that may occur nearby.

SECTION B – APPROVAL CONDITIONS SUMMARY

Not applicable for this preliminary report as no conditions are issued at this time.

SECTION C – DOWNSTREAM ANALYSIS

A downstream analysis is to be prepared during the final design phase at which time detailed survey data will be obtained.

SECTION D – QUANTITY CONTROL ANALYSIS & DESIGN

In computing the runoff volume and discharges from the site, the Santa Barbara Urban Hydrograph computer program used by the King County Public Works Dept. was utilized. In using this program, some assumptions had to be made regarding the particular runoff curve numbers to use. Because the hydrological soil groups present at the site are a mix of group "B", "C" and "D" soils, pervious curve numbers ranging from 78 to 89 were determined to exist on the site. Pervious curve numbers from 83 to 88 have been used to represent the lawns, landscaped areas, and other open areas. A curve number of 98 is used for the

impervious surfaces which consist of the streets, sidewalks, driveways, and roofs. The pervious runoff curve numbers used to represent the existing condition of the site ranged from 84 to 85 (meadow or pasture). These curve numbers were obtained from Table III-1.3 of the Stormwater Management Manual for the Puget Sound Basin. The amounts of pervious and impervious acreage existing and predicted for the site are shown in **Tables 1 & 2.**

TABLE 1:

EXISTING AREA QUANTITIES (acres)

Drainage Basin:	Total Area:	Streets & Sidewalks:	Driveways:	Roofs:	Contrib. Impervious Area: (Roofs incl.):	Contrib. Impervious Area: (no Roofs):	Contrib. Pervious Area:
Basin A	23.73	0.09	0.11	0.08	0.28	0.20	23.45
Basin B	19.43	0.15	0.00	0.59	0.74	0.15	18.69
Basin C	1.53	0.17	0.00	0.00	0.17	0.17	1.36
TOTALS:	43.16			**TOTALS:**	1.02	0.52	43.50

TABLE 2:

DEVELOPED AREA QUANTITIES (acres)

Drainage Basin:	Total Area:	Streets & Sidewalks:	Driveways:	Roofs:	Contrib. Impervious Area: (Roofs incl.):	Contrib. Impervious Area: (no Roofs):	Contrib. Pervious Area:
Basin 1	4.43	0.74	0.12	0.57	1.43	0.86	3.00
Basin 2	4.36	0.50	0.04	1.09	1.63	0.54	2.73
Basin 3	3.27	0.78	0.14	0.69	1.61	0.92	1.66
Basin 4	3.35	0.68	0.16	0.80	1.64	0.84	1.71
Basin 5	2.03	0.47	0.07	0.34	0.88	0.54	1.15
Basin 6	2.25	0.48	0.09	0.46	1.03	0.57	1.22
Basin 7	2.17	0.77	0.05	0.23	1.05	0.82	1.12
Basin 8	4.31	1.00	0.16	0.80	1.96	1.16	2.35
Basin 9	3.51	0.88	0.11	0.57	1.56	0.99	1.95
Basin 10	3.33	0.67	0.15	0.75	1.57	0.82	1.76
Basin 11	3.36	0.90	0.16	0.80	1.86	1.06	1.50
Basin 12	3.53	1.00	0.15	0.75	1.90	1.15	1.63
Basin 13	2.26	0.40	0.13	0.63	1.16	0.53	1.10
TOTALS:	42.16			**TOTALS:**	19.28	10.80	22.88

Basin 2 roof area includes 0.80 ac. for pond surface (roofs=0.29 ac.)

The actual computer modeled runoff calculations are presented in appendix I. In **Tables 3 & 4**, the predicted and existing peak discharges from the project are tabulated by basin. The values presented in these tables have been obtained with the Santa Barbara Urban Hydrograph computer program by inputting those values listed in **Tables 1 & 2.**

TABLE 3: Developed Runoff Volumes/Discharge

DEVELOPED RUNOFF VOLUMES/DISCHARGE										
	66% 2-Yr, 24-hr. (6 month storm)		**2 yr., 24 hr. Storm**		**10 yr., 24 hr. Storm**		**25 yr., 24 hr. Storm**		**100 yr., 24 hr. Storm**	
Drainage Basin	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):
Basin 1	0.47	10,600	0.97	19,900	1.72	33,500	2.12	40,500	2.95	55,200
Basin 2	0.74	13,200	1.38	23,500	2.29	38,000	2.76	45,400	3.70	60,500
Basin 3	0.61	10,800	1.09	18,800	1.76	29,800	2.10	35,500	2.79	46,900
Basin 4	0.62	10,800	1.11	18,800	1.81	30,000	2.16	35,800	2.88	47,400
Basin 5	0.34	6,100	0.63	10,800	1.05	17,400	1.26	20,900	1.70	27,800
Basin 6	0.39	6,900	0.71	12,100	1.17	19,500	1.41	23,400	1.89	31,100
Basin 7	0.35	6,800	0.64	11,900	1.04	19,000	1.25	22,700	1.68	30,200
Basin 8	0.74	13,100	1.36	23,200	2.24	37,400	2.69	44,700	3.61	59,500
Basin 9	0.56	10,600	1.04	18,700	1.73	30,300	2.08	36,200	2.80	48,300
Basin 10	0.58	10,300	1.06	18,100	1.74	29,100	2.09	34,800	2.81	46,300
Basin 11	0.59	11,200	1.04	19,200	1.68	30,400	2.01	36,200	2.67	47,900
Basin 12	0.61	10,900	1.10	19,000	1.80	30,500	2.16	36,400	2.89	48,400
Basin 13	0.41	7,300	0.75	12,600	1.21	20,100	1.45	24,000	1.93	31,800
TOTALS:	7.01	128,600	12.88	226,600	21.24	365,000	25.54	436,500	34.30	581,300

TABLE 4: Existing Runoff Volumes/Discharge

EXISTING RUNOFF VOLUMES/DISCHARGE								
	2-Yr, 24-hr. Storm		**10 yr., 24 hr. Storm**		**25 yr., 24 hr. Storm**		**100 yr., 24 hr. Storm**	
Drainage Basin	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):
Basin A	3.89	85,300	7.96	155,600	10.15	193,000	14.69	269,900
Basin B	3.28	68,000	6.75	124,500	8.63	154,700	12.54	217,500
Basin C	0.33	6,080	0.62	10,700	0.78	13,200	1.11	18,200
TOTALS:	7.50	159,380	15.33	290,800	19.56	360,900	28.34	505,600

The detention facility proposed for the development consists of a proposed surface pond that will "stack" live storage volume above the permanent wet pool volume. The hydrographs for the various design storms for the site have been added together and routed through the proposed facility (see Appendix II). The results are shown in **Table 5**. The values shown in **Table 5** represent our final design values after the volume correction factor has been applied. The volume correction factor is based on the sites developed impervious cover and is calculated in Appendix II for the detention facility.

TABLE 5: PROPOSED DETENTION FACILITY PERFORMANCE

Storm Event:	Release Rate:	Allowable Release Rate:	Peak Storage:	Peak Stage:	% of allowable release rate:
2 yr., 24 hr.	2.69 cfs	6.20 cfs	62,140 ft^3	179.45'	43%
10 yr., 24 hr.	5.49 cfs	12.99 cfs	98,070 ft^3	180.23'	42%
25 yr., 24 hr.	8.65 cfs	16.66 cfs	106,980 ft^3	180.41'	52%
100 yr., 24 hr.	17.33 cfs	24.28 cfs	125,400 ft^3	180.79'	71%

Beginning stage elevation=178.0'

The stormwater facility locations and elevations are readily seen on the preliminary stormwater plan. All detailed information regarding the outlet structure and construction of the facility will be presented on the final engineering drawings.

SECTION E – CONVEYANCE SYSTEMS ANALYSIS & DESIGN

The stormwater conveyance system proposed for the project consists primarily of a series of inlets and storm piping that delivers the site stormwater runoff to the stormwater management facilities.

The capacity of each pipe will be analyzed during final design using Manning's Equation for pipe flow with a Manning's roughness coefficient of 0.012. Because of the project topography, there will be much slope within the storm conveyance system. Pipe sizes are expected to range from 12" to 24" in diameter.

SECTION F – WATER QUALITY DESIGN

Two wetponds are proposed to treat the runoff from the site. The primary wetpond will serve drainage basins 2-13 and is located along the western boundary of the project site. The 6-month, 24-hr. storm runoff volume that will be stored in this wetpond is approximately 118,000 cubic feet. This is the volume of developed runoff from drainage basins 2-13 during the 6-month, 24-hr storm event. The secondary wetpond is proposed to treat the developed runoff volume from drainage basin 1 and is located along the southern boundary of the site. It will treat a runoff volume of approximately 10,600 cubic feet

As can be seen, the treatment requirements of the City of La Center Stormwater Ordinance have been met for all runoff entering the proposed wetponds.

SECTION G- SOILS EVALUATION

The Soil Conservation Service maps the majority of soil on the site as Gee silt loam (GeB, GeD) of hydrological soil group "C". There are also areas of Hillsboro silt loam (HoA, HoC) of hydrologic soil group "B" and Odne silt loam (OdB) of hydrologic group "D". Due to the silty characteristics of all of the onsite soils, infiltration is not being proposed for this site. A geotechnical site investigation has been performed by Columbia West Engineering, Inc. Their study confirms the presence of the soils described above.

SECTION H - SPECIAL REPORTS AND STUDIES

A Geotechnical Site Investigation has been performed by Columbia West Engineering, Inc.

A Critical Areas Report has been prepared by Cascadia Ecological Services, Inc.

SECTION I - OTHER PERMITS

An NPDES Permit from the Washington State Department of Ecology is required for this project and shall be obtained prior to construction. In conjunction with the NPDES permit, a Stormwater Pollution Prevention Plan (SWPPP) will also be prepared.

SECTION J – GROUNDWATER MONITORING

Not applicable

SECTION K – MAINTENANCE & OPERATIONS MANUAL

The city of La Center shall maintain the proposed stormwater facilities. At a minimum, the following maintenance items need to be performed periodically to insure proper operation of the stormwater facilities.

Cleaning of debris/litter that may accumulate in or around stormwater facilities.
Inspection of outfall structure (orifice/riser) to prevent plugging or clogging.
Inspection of fences encompassing stormwater facilities to insure effectiveness.

SECTION L - TECHNICAL APPENDIX

Appendix I
Runoff Calculations
Existing Conditions Basin Map
Developed Conditions Basin Map

Appendix II
Detention Calculations

Appendix III
Water Quality Calculations

Appendix I

Runoff Calculations

Existing Conditions Basin Map

Developed Conditions Basin Map

Developed Condition

DEVELOPED RUNOFF VOLUMES/DISCHARGE										
	66% 2-Yr, 24-hr. storm (6 month storm)		**2 yr., 24 hr. storm**		**10 yr., 24 hr. storm**		**25 yr., 24 hr. storm**		**100 yr., 24 hr. storm**	
Drainage Basin	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):
Basin 1	0.47	10,600	0.97	19,900	1.72	33,500	2.12	40,500	2.95	55,200
Basin 2	0.74	13,200	1.38	23,500	2.29	38,000	2.76	45,400	3.70	60,500
Basin 3	0.61	10,800	1.09	18,800	1.76	29,800	2.10	35,500	2.79	46,900
Basin 4	0.62	10,800	1.11	18,800	1.81	30,000	2.16	35,800	2.88	47,400
Basin 5	0.34	6,100	0.63	10,800	1.05	17,400	1.26	20,900	1.70	27,800
Basin 6	0.39	6,900	0.71	12,100	1.17	19,500	1.41	23,400	1.89	31,100
Basin 7	0.35	6,800	0.64	11,900	1.04	19,000	1.25	22,700	1.68	30,200
Basin 8	0.74	13,100	1.36	23,200	2.24	37,400	2.69	44,700	3.61	59,500
Basin 9	0.56	10,600	1.04	18,700	1.73	30,300	2.08	36,200	2.80	48,300
Basin 10	0.58	10,300	1.06	18,100	1.74	29,100	2.09	34,800	2.81	46,300
Basin 11	0.59	11,200	1.04	19,200	1.68	30,400	2.01	36,200	2.67	47,900
Basin 12	0.61	10,900	1.10	19,000	1.80	30,500	2.16	36,400	2.89	48,400
Basin 13	0.41	7,300	0.75	12,600	1.21	20,100	1.45	24,000	1.93	31,800
TOTALS:	7.01	128,600	12.88	226,600	21.24	365,000	25.54	436,500	34.30	581,300

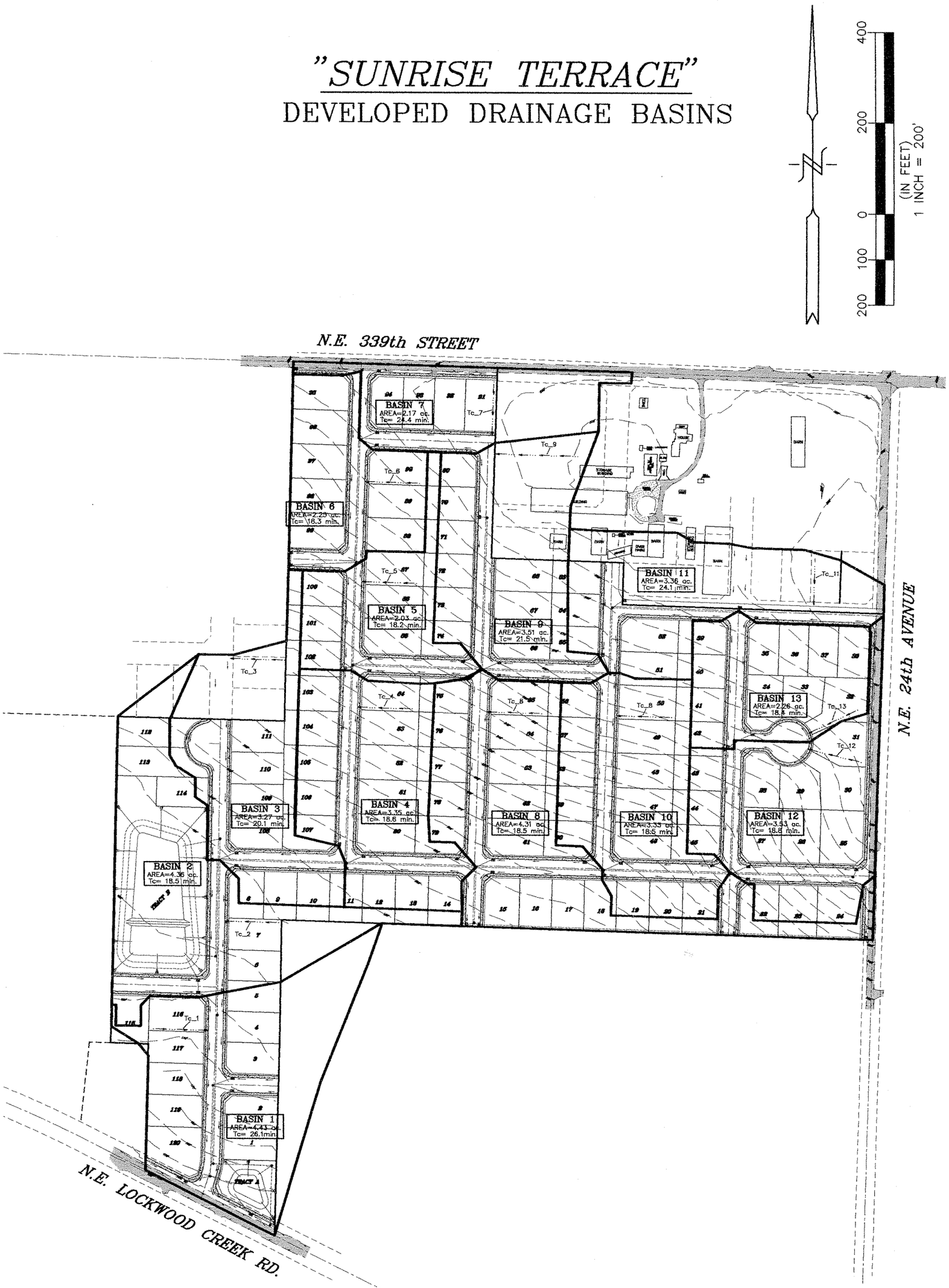
DEVELOPED AREA QUANTITIES (acres)								
Drainage Basin:	Total Area:	Streets & Sidewalks:	Driveways:	Roofs:	Contrib. Impervious Area: (Roofs incl.):	Contrib. Impervious Area: (no Roofs):	Contrib. Pervious Area:	
Basin 1	4.43	0.74	0.12	0.57	1.43	0.86	3.00	Comp. Perv. CN=83 (83.2)
Basin 2	4.36	0.50	0.04	1.09	1.63	0.54	2.73	Comp. Perv. CN=88 (88.2)
Basin 3	3.27	0.78	0.14	0.69	1.61	0.92	1.66	Comp. Perv. CN=88 (87.6)
Basin 4	3.35	0.68	0.16	0.80	1.64	0.84	1.71	Comp. Perv. CN=87 (86.7)
Basin 5	2.03	0.47	0.07	0.34	0.88	0.54	1.15	Perv. CN=86
Basin 6	2.25	0.48	0.09	0.46	1.03	0.57	1.22	Perv. CN=86
Basin 7	2.17	0.77	0.05	0.23	1.05	0.82	1.12	Perv. CN=86
Basin 8	4.31	1.00	0.16	0.80	1.96	1.16	2.35	Comp. Perv. CN=86 (85.7)
Basin 9	3.51	0.88	0.11	0.57	1.56	0.99	1.95	Perv. CN=86
Basin 10	3.33	0.67	0.15	0.75	1.57	0.82	1.76	Perv. CN=86
Basin 11	3.36	0.90	0.16	0.80	1.86	1.06	1.50	Perv. CN=86
Basin 12	3.53	1.00	0.15	0.75	1.90	1.15	1.63	Comp. Perv. CN=83
Basin 13	2.26	0.40	0.13	0.63	1.16	0.53	1.10	Perv. CN=86
TOTALS:	42.16			**TOTALS:**	19.28	10.80	22.88	

Basin 2 Roof Area includes 0.80 ac. for pond surface (roofs=0.29 ac.)

DEVELOPED TIME OF CONCENTRATION CALCULATIONS									
	Sheet Flow				Gutter Flow				
	2 yr., 24 hr. rainfall total (inches) = 2.25								
Drainage Basin:	Flow Length (ft.):	Average Slope (ft./ft.):	Rough. Coeff. (n):	Overland Flow Time (min.):	Flow Length (ft.):	Average Slope (ft./ft.):	Shallow Conc. Flow Time (min.):	Total Time of Conc. (min.)	Drainage Basin:
Basin 1	120	0.010	0.240	25.4	290	0.070	0.7	26.1	**Basin 1**
Basin 2	110	0.020	0.240	18.0	150	0.035	0.5	18.5	**Basin 2**
Basin 3	120	0.020	0.240	19.3	400	0.080	0.9	20.1	**Basin 3**
Basin 4	110	0.020	0.240	18.0	320	0.090	0.7	18.6	**Basin 4**
Basin 5	110	0.020	0.240	18.0	150	0.130	0.3	18.2	**Basin 5**
Basin 6	110	0.020	0.240	18.0	170	0.080	0.4	18.3	**Basin 6**
Basin 7	110	0.010	0.240	23.7	260	0.050	0.7	24.4	**Basin 7**
Basin 8	110	0.020	0.240	18.0	300	0.120	0.5	18.5	**Basin 8**
Basin 9	190	0.040	0.240	21.1	120	0.040	0.4	21.5	**Basin 9**
Basin 10	110	0.020	0.240	18.0	310	0.140	0.5	18.5	**Basin 10**
Basin 11	110	0.010	0.240	23.7	130	0.040	0.4	24.1	**Basin 11**
Basin 12	110	0.020	0.240	18.0	400	0.080	0.9	18.8	**Basin 12**
Basin 13	110	0.020	0.240	18.0	150	0.040	0.5	18.4	**Basin 13**

"SUNRISE TERRACE"

DEVELOPED DRAINAGE BASINS



Basin 1 (Developed)

```
--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
3 83 1.43 98 26.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        3.0  83.0    1.4  98.0        26.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
       .47          7.83          10601

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST1_BIO


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
3 83 1.43 98 26.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        3.0  83.0    1.4  98.0        26.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
       .97          7.83          19887

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST1_2


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
3 83 1.43 98 26.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        3.0  83.0    1.4  98.0        26.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.72          7.83          33484

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST1_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
3 83 1.43 98 26.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        3.0  83.0    1.4  98.0        26.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.12          7.83          40538

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST1_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
3 83 1.43 98 26.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        3.0  83.0    1.4  98.0        26.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.95          7.83          55201

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST1_100
```

Basin 2 (Developed)

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.73 88 1.63 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        2.7  88.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .74           7.83           13158

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST2_BIO


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.73 88 1.63 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        2.7  88.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.38           7.83           23485

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST2_2


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.73 88 1.63 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        2.7  88.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      2.29           7.83           37971

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST2_10
```

```
------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.73 88 1.63 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        2.7  88.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      2.76           7.83           45417

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST2_25


------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.73 88 1.63 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.4        2.7  88.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      3.70           7.83           60540

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST2_100
```

Basin 3 (Developed)

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.66 88 1.61 98 20.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  88.0    1.6  98.0        20.1
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .61           7.83           10839

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST3_BIO


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.66 88 1.61 98 20.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  88.0    1.6  98.0        20.1
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.09           7.83           18800

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST3_2


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.66 88 1.61 98 20.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  88.0    1.6  98.0        20.1
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.76           7.83           29832

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST3_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.66 88 1.61 98 20.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  88.0    1.6  98.0        20.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.10          7.83          35474

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST3_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.66 88 1.61 98 20.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  88.0    1.6  98.0        20.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.79          7.83          46899

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST3_100
```

Basin 4 (Developed)

```
--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.71 87 1.64 98 18.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  87.0    1.6  98.0        18.6
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .62           7.83           10804

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST4_BIO


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.71 87 1.64 98 18.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  87.0    1.6  98.0        18.6
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.11           7.83           18837

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST4_2


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.71 87 1.64 98 18.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  87.0    1.6  98.0        18.6
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.81           7.83           30031

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST4_10
```

```
------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.71 87 1.64 98 18.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  87.0    1.6  98.0        18.6
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.16          7.83          35772

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST4_25


------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.71 87 1.64 98 18.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.7  87.0    1.6  98.0        18.6
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.88          7.83          47417

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST4_100
```

Basin 5 (Developed)

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.15 86 .88 98 18.2

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.0        1.1  86.0     .9  98.0        18.2
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .34           7.83           6064

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST5_BIO


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.15 86 .88 98 18.2

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.0        1.1  86.0     .9  98.0        18.2
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .63           7.83          10777

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST5_2


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.15 86 .88 98 18.2

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.0        1.1  86.0     .9  98.0        18.2
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.05           7.83          17428

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST5_10
```

```
------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.15 86 .88 98 18.2

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.0        1.1   86.0     .9   98.0       18.2
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.26           7.83           20858

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST5_25


------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.15 86 .88 98 18.2

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.0        1.1   86.0     .9   98.0       18.2
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.70           7.83           27841

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST5_100
```

Basin 6 (Developed)

```
--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.22 86 1.03 98 18.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.2  86.0    1.0  98.0        18.3
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .39           7.83           6876

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST6_BIO


--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.22 86 1.03 98 18.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.2  86.0    1.0  98.0        18.3
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .71           7.83          12139

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST6_2


--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.22 86 1.03 98 18.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.2  86.0    1.0  98.0        18.3
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.17           7.83          19542

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST6_10
```

```
------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.22 86 1.03 98 18.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.2  86.0    1.0  98.0        18.3
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.41          7.83          23355

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST6_25


------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.22 86 1.03 98 18.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.2  86.0    1.0  98.0        18.3
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.89          7.83          31110

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST6_100
```

Basin 7 (Developed)

```
--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.12 86 1.05 98 24.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.2        1.1  86.0    1.0  98.0        24.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
       .35          7.83           6789

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST7_BIO


--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.12 86 1.05 98 24.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.2        1.1  86.0    1.0  98.0        24.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
       .64          7.83          11879

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST7_2


--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.12 86 1.05 98 24.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.2        1.1  86.0    1.0  98.0        24.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.04          7.83          19036

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST7_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------ENTER:
A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.12 86 1.05 98 24.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.2        1.1  86.0    1.0  98.0        24.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.25          7.83          22718

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST7_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.12 86 1.05 98 24.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.2        1.1  86.0    1.0  98.0        24.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.68          7.83          30200

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST7_100
```

Basin 8 (Developed)

```
--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.35 86 1.96 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.3        2.3  86.0    2.0  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .74           7.83           13134

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST8_BIO


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.35 86 1.96 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.3        2.3  86.0    2.0  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.36           7.83           23206

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST8_2


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.35 86 1.96 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.3        2.3  86.0    2.0  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      2.24           7.83           37378

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST8_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.35 86 1.96 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.3        2.3  86.0    2.0  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      2.69           7.83           44678

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST8_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
2.35 86 1.96 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       4.3        2.3  86.0    2.0  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      3.61           7.83           59529

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST8_100
```

Basin 9 (Developed)

```
--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.95 86 1.56 98 21.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        2.0  86.0    1.6  98.0        21.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .56           7.83           10579

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST9_BIO


--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.95 86 1.56 98 21.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        2.0  86.0    1.6  98.0        21.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.04           7.83           18747

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST9_2


--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.95 86 1.56 98 21.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        2.0  86.0    1.6  98.0        21.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.73           7.83           30256

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST9_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.95 86 1.56 98 21.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        2.0  86.0    1.6  98.0        21.5
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.08          7.83          36188

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST9_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.95 86 1.56 98 21.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        2.0  86.0    1.6  98.0        21.5
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.80          7.83          48260

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST9_100
```

Basin 10 (Developed)

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.76 86 1.57 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.8  86.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .58           7.83           10306

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST10_BIO


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.76 86 1.57 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.8  86.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.06           7.83           18127

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST10_2


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.76 86 1.57 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.8  86.0    1.6  98.0        18.5
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.74           7.83           29109

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST10_10
```

```
------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.76 86 1.57 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.8   86.0   1.6   98.0        18.5
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.09          7.83          34760

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST10_25


------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.76 86 1.57 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.3        1.8   86.0   1.6   98.0        18.5
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.81          7.83          46252

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST10_100
```

Basin 11 (Developed)

```
--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.50 86 1.86 98 24.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.4        1.5  86.0    1.9  98.0        24.1
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .59           7.83           11157

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST11_BIO


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.50 86 1.86 98 24.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.4        1.5  86.0    1.9  98.0        24.1
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.04           7.83           19228

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST11_2


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.50 86 1.86 98 24.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.4        1.5  86.0    1.9  98.0        24.1
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.68           7.83           30446

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST11_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.50 86 1.86 98 24.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN      A     CN
       3.4        1.5  86.0     1.9  98.0        24.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.01          7.83          36194

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST11_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.50 86 1.86 98 24.1

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN      A     CN
       3.4        1.5  86.0     1.9  98.0        24.1
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.67          7.83          47853

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST11_100
```

Basin 12 (Developed)

```
--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.63 83 1.90 98 18.8

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        1.6  83.0    1.9  98.0        18.8
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
       .61           7.83           10930

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST12_BIO


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.63 83 1.90 98 18.8

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        1.6  83.0    1.9  98.0        18.8
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.10           7.83           19038

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST12_2


--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.63 83 1.90 98 18.8

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        1.6  83.0    1.9  98.0        18.8
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.80           7.83           30478

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST12_10
```

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.63 83 1.90 98 18.8

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        1.6  83.0    1.9  98.0        18.8
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.16          7.83          36387

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST12_25


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.63 83 1.90 98 18.8

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       3.5        1.6  83.0    1.9  98.0        18.8
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      2.89          7.83          48431

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST12_100
```

Basin 13 (Developed)

```
------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
******* 6-MONTH  24-HOUR STORM  ****  1.49" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.10 86 1.16 98 18.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.1  86.0    1.2  98.0        18.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
       .41          7.83           7263

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST13_BIO


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.10 86 1.16 98 18.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.1  86.0    1.2  98.0        18.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
       .75          7.83          12638

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST13_2


------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.10 86 1.16 98 18.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.1  86.0    1.2  98.0        18.4
  PEAK-Q(CFS)   T-PEAK(HRS)     VOL(CU-FT)
      1.21          7.83          20146

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST13_10
```

```
------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.10 86 1.16 98 18.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.1  86.0    1.2  98.0        18.4
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.45           7.83           24001

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST13_25


------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.10 86 1.16 98 18.4

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       2.3        1.1  86.0    1.2  98.0        18.4
  PEAK-Q(CFS)    T-PEAK(HRS)     VOL(CU-FT)
      1.93           7.83           31830

ENTER [d:][path]filename[.ext] FOR STORAGE OF COMPUTED HYDROGRAPH:ST13_100
```

Existing Condition

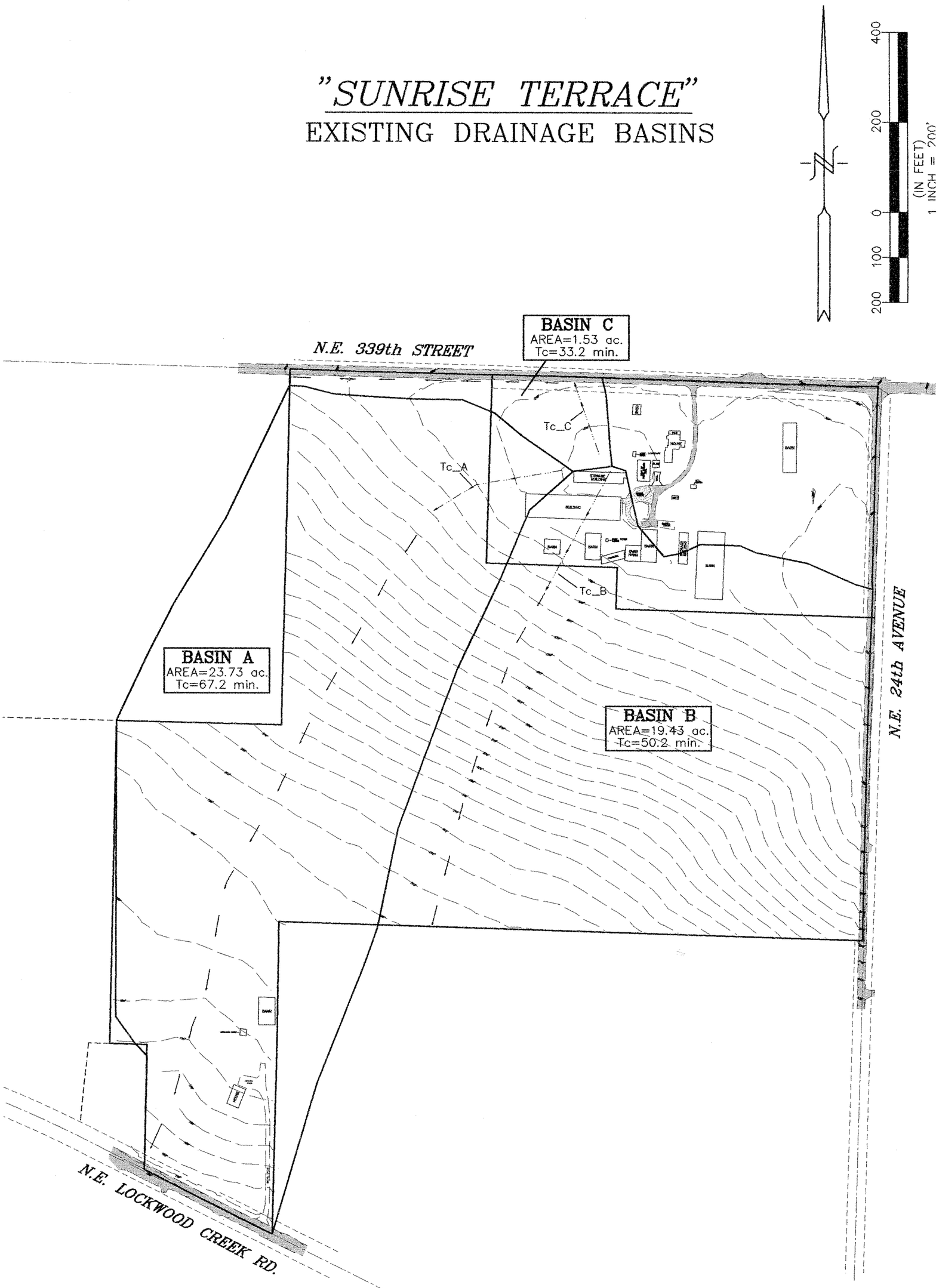
EXISTING RUNOFF VOLUMES/DISCHARGE								
	2-Yr, 24-hr. storm		10 yr., 24 hr. storm		25 yr., 24 hr. storm		100 yr., 24 hr. storm	
Drainage Basin	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):
Basin A	3.89	85,300	7.96	155,600	10.15	193,000	14.69	269,900
Basin B	3.28	68,000	6.75	124,500	8.63	154,700	12.54	217,500
Basin C	0.33	6,080	0.62	10,700	0.78	13,200	1.11	18,200
TOTALS:	7.50	159,380	15.33	290,800	19.56	360,900	28.34	505,600

EXISTING AREA QUANTITIES (acres)								
Drainage Basin:	Total Area:	Streets & Sidewalks:	Driveways:	Roofs:	Contrib. Impervious Area: (Roofs incl.):	Contrib. Impervious Area: (no Roofs):	Contrib. Pervious Area:	
Basin A	23.73	0.09	0.11	0.08	0.28	0.20	23.45	Perv. CN=85
Basin B	19.43	0.15	0.00	0.59	0.74	0.15	18.69	Perv. CN=84
Basin C	1.53	0.17	0.00	0.00	0.17	0.17	1.36	Perv. CN=85
TOTALS:	43.16			**TOTALS:**	1.02	0.52	43.50	

EXISTING TIME OF CONCENTRATION CALCULATIONS									
	Sheet Flow				Shallow Conc. Flow				
	2 yr., 24 hr. rainfall total (inches) = 2.25								
Drainage Basin:	Flow Length (ft.):	Average Slope (ft./ft.):	Rough. Coeff. (n):	Overland Flow Time (min.):	Flow Length (ft.):	Average Slope (ft./ft.):	Shallow Conc. Flow Time (min.):	Total Time of Conc. (min.)	Drainage Basin:
Basin A	300	0.066	0.150	17.1	1600	0.080	8.6	25.6	**Basin A**
Basin B	300	0.060	0.150	17.7	780	0.110	3.6	21.3	**Basin B**
Basin C	160	0.044	0.150	12.1	620	0.022	6.3	18.5	**Basin C**

"SUNRISE TERRACE"

EXISTING DRAINAGE BASINS



EXISTING BASIN A (Actual)

```
--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
23.45 85 .28 98 25.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      23.7       23.5  85.0     .3  98.0       25.6
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
      3.89          7.83          85251

--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
23.45 85 .28 98 25.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      23.7       23.5  85.0     .3  98.0       25.6
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
      7.96          7.83          155572

--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
23.45 85 .28 98 25.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      23.7       23.5  85.0     .3  98.0       25.6
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
     10.15          7.83          192990

--------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
--------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
23.45 85 .28 98 25.6

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      23.7       23.5  85.0     .3  98.0       25.6
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
     14.69          7.83          269942
```

EXISTING BASIN B (Actual)

```
--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
18.69 84 .74 98 21.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      19.4       18.7  84.0     .7  98.0       21.3
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
      3.28          7.83          67992

--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
18.69 84 .74 98 21.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      19.4       18.7  84.0     .7  98.0       21.3
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
      6.75          7.83         124455

--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
18.69 84 .74 98 21.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      19.4       18.7  84.0     .7  98.0       21.3
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
      8.63          7.83         154706

--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
18.69 84 .74 98 21.3

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS   TC(MINUTES)
                  A     CN     A     CN
      19.4       18.7  84.0     .7  98.0       21.3
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
     12.54          7.83         217549
```

EXISTING BASIN C (Actual)

```
--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 2-YEAR  24-HOUR STORM  ****  2.25" TOTAL PRECIP. *******
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.36 85 .17 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       1.5        1.4  85.0     .2  98.0        18.5
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
       .33          7.83          6075

--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  10-YEAR  24-HOUR STORM  ****  3.25" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.36 85 .17 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       1.5        1.4  85.0     .2  98.0        18.5
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
       .62          7.83         10711

--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
*********  25-YEAR  24-HOUR STORM  ****  3.75" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.36 85 .17 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       1.5        1.4  85.0     .2  98.0        18.5
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
       .78          7.83         13161

--------------------------------------------------------------------------------
******************** S.C.S. TYPE-1A DISTRIBUTION ********************
********* 100-YEAR  24-HOUR STORM  ****  4.75" TOTAL PRECIP. *********
--------------------------------------------------------------------------------
ENTER: A(PERV), CN(PERV), A(IMPERV), CN(IMPERV), TC FOR BASIN NO.  1
1.36 85 .17 98 18.5

DATA PRINT-OUT:
  AREA(ACRES)     PERVIOUS     IMPERVIOUS    TC(MINUTES)
                  A     CN     A     CN
       1.5        1.4  85.0     .2  98.0        18.5
  PEAK-Q(CFS)   T-PEAK(HRS)    VOL(CU-FT)
      1.11          7.83         18216
```

Appendix II
Detention Calculations

INITIAL DETENTION CALCULATION

ENTER: NUMBER OF ORIFICES, RISER-HEAD(ft), RISER-DIAMETER(in)
1 2 24

RISER OVERFLOW DEPTH FOR PRIMARY PEAK INFLOW = .72 FT

SPECIFY ITERATION DISPLAY: Y - YES, N - NO
N

SPECIFY: R - REVIEW/REVISE INPUT, C - CONTINUE
C

INITIAL STORAGE VALUE FOR ITERATION PURPOSES: 94281 CU-FT

SINGLE ORIFICE RESTRICTOR: DIA= 8.84"

PERFORMANCE:	INFLOW	TARGET-OUTFLOW	ACTUAL-OUTFLOW	PK-STAGE	STORAGE
DESIGN HYD:	11.91 (2-YR)	3.00	3.00	2.00	53005
TEST HYD 1:	19.52 (10-YR)	13.00	10.83	2.53	68410
TEST HYD 2:	23.42 (25-YR)	17.44	15.78	2.74	74830
TEST HYD 3:	31.35 (100-YR)	25.00	20.61	3.23	89960

AS CAN BE SEEN ABOVE, THE DESIGN AND STORAGE VOLUMES SHOWN PROVIDE MORE THAN ADEQUATE PEAK RELEASE RATES.

THE DEVELOPED SITE IS TO BECOME APPROX. 46% IMPERVIOUS ⇒ A VOLUME CORRECTION FACTOR OF 28% MUST BE APPLIED TO THE STORAGE VOLUMES (FROM FIGURE III-1.1 OF THE PUGETSOUND MANUAL)

⇒ REQUIRED STORAGE VOLUMES =

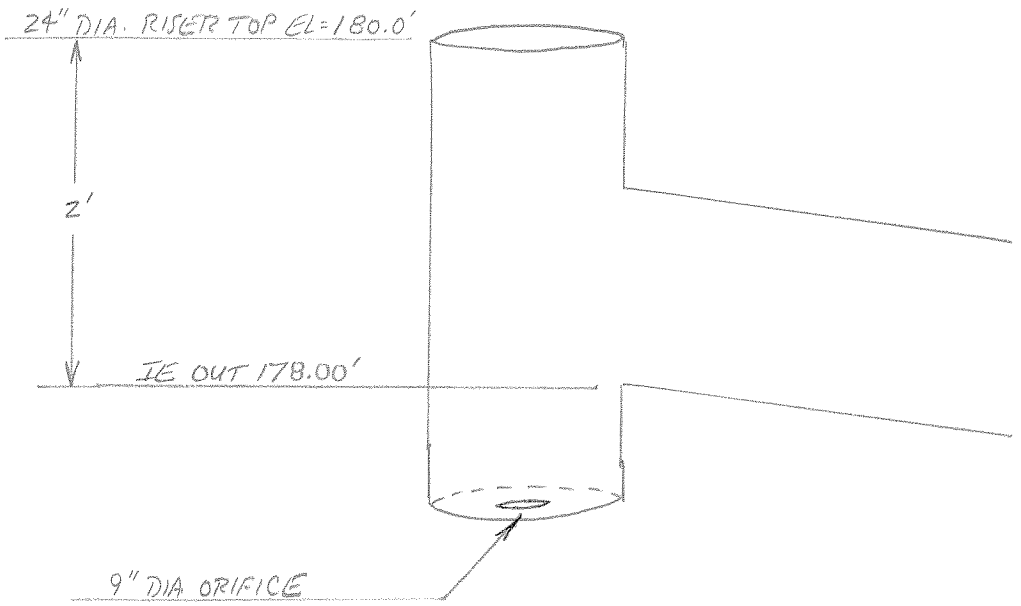
$(53{,}005\ FT^3)(1.28) = 67{,}850\ FT^3$ @ A STAGE OF 2.00' (2-YR)
$(68{,}410\ FT^3)(1.28) = 87{,}600\ FT^3$ @ A STAGE OF 2.53' (10-YR.)
$(74{,}830\ FT^3)(1.28) = 95{,}800\ FT^3$ @ A STAGE OF 2.74' (25-YR.)
$(89{,}960\ FT^3)(1.28) = 115{,}200\ FT^3$ @ A STAGE OF 3.23' (100-YR.)

*AS CAN BE SEEN IN THE STORM DETENTION ROUTING DATA ON THE FOLLOWING SHEET, THESE REQUIRED STORAGE VOLUMES ARE NOT ONLY MET BUT ARE GREATLY EXCEEDED.

STORM DETENTION ROUTING DATA

N	ELEV	STAGE (FT.):	9" DIA. ORIF. ADISC (CFS):	24" DIA. RISER BDISC (CFS):	STORAGE (CU.FT.):	PERC-AREA
1	178.00	.00	.00	.00	.0	.0
2	178.20	.20	1.00	.00	8100.0	.0
3	178.40	.40	1.41	.00	16300.0	.0
4	178.60	.60	1.73	.00	24700.0	.0
5	178.80	.80	2.00	.00	33300.0	.0
6	179.00	1.00	2.23	.00	42000.0	.0
7	179.20	1.20	2.45	.00	50700.0	.0
8	179.40	1.40	2.64	.00	59700.0	.0
9	179.60	1.60	2.83	.00	68700.0	.0
10	179.80	1.80	3.00	.00	78000.0	.0
11	180.00	2.00	3.16	.00	87300.0	.0
12	180.20	2.20	3.31	1.74	96800.0	.0
13	180.40	2.40	3.46	4.93	106400.0	.0
14	180.60	2.60	3.60	9.05	116200.0	.0
15	180.80	2.80	3.74	13.94	126100.0	.0
16	181.00	3.00	3.87	15.13	136200.0	.0
17	181.20	3.20	4.00	16.57	146400.0	.0
18	181.40	3.40	4.12	17.90	156700.0	.0
19	181.60	3.60	4.24	19.14	167200.0	.0
20	181.80	3.80	4.35	20.30	177800.0	.0
21	182.00	4.00	4.47	21.39	188600.0	.0

INITIAL STAGE ELEV = 178.00
AVERAGE PERC-RATE = .0
FILENAME: ST_DATA



2-YR., 24-HR. STORM ROUTE THROUGH DETENTION FACILITY

```
 RESERVOIR ROUTING ROUTINE W/SPLIT-OUTFLOW

 SPECIFY [d:][path]filename[.ext] OF ROUTING DATA
 ST_DATA
  DISPLAY ROUTING DATA (Y or N)?
 N

 ENTER [d:][path]filename[.ext] OF COMPUTED HYDROGRAPH:
 ST_2

 INFLOW/OUTFLOW ANALYSIS:

   PEAK-INFLOW(CFS)    PEAK-OUTFLOW(CFS)    OUTFLOW-VOL(CU-FT)
                            A       B            A           B
        11.91              2.69     .00        206933          0

   INITIAL-STAGE(FT)   TIME-OF-PEAK(HRS)    PEAK-STAGE-ELEV(FT)
       178.00              12.83                179.45

   REQUIRED STORAGE:     62140 CU-FT
```

$Q_p = 2.69$ CFS
ALLOWABLE = 6.20 CFS
⇒ O.K.

10-YR., 24-HR. STORM ROUTE THROUGH DETENTION FACILITY

```
RESERVOIR ROUTING ROUTINE W/SPLIT-OUTFLOW

SPECIFY [d:][path]filename[.ext] OF ROUTING DATA
ST_DATA
 DISPLAY ROUTING DATA (Y or N)?
N

ENTER [d:][path]filename[.ext] OF COMPUTED HYDROGRAPH:
ST_10

INFLOW/OUTFLOW ANALYSIS:

  PEAK-INFLOW(CFS)    PEAK-OUTFLOW(CFS)    OUTFLOW-VOL(CU-FT)
                           A       B            A           B
       19.52              3.33    2.16        292651      38857

  INITIAL-STAGE(FT)   TIME-OF-PEAK(HRS)    PEAK-STAGE-ELEV(FT)
      178.00              10.67                180.23

  REQUIRED STORAGE:     98070 CU-FT
```

$Q_p = 5.49$ CFS
ALLOWABLE = 12.99 CFS
⇒ O.K.

25-YR., 24-HR. STORM ROUTE THROUGH DETENTION FACILITY

```
RESERVOIR ROUTING ROUTINE W/SPLIT-OUTFLOW

SPECIFY [d:][path]filename[.ext] OF ROUTING DATA
ST_DATA
 DISPLAY ROUTING DATA (Y or N)?
N

ENTER [d:][path]filename[.ext] OF COMPUTED HYDROGRAPH:
ST_25

INFLOW/OUTFLOW ANALYSIS:

  PEAK-INFLOW(CFS)    PEAK-OUTFLOW(CFS)    OUTFLOW-VOL(CU-FT)
                          A       B            A          B
       23.42            3.47    5.18        310063     85491

  INITIAL-STAGE(FT)   TIME-OF-PEAK(HRS)    PEAK-STAGE-ELEV(FT)
      178.00               8.83                180.41

  REQUIRED STORAGE:    106980 CU-FT
```

Q_p = 8.65 CFS
ALLOWABLE ≈ 16.66 CFS
⇒ O.K.

100-YR., 24-HR. STORM ROUTE THROUGH DETENTION FACILITY

```
RESERVOIR ROUTING ROUTINE W/SPLIT-OUTFLOW

SPECIFY [d:][path]filename[.ext] OF ROUTING DATA
ST_DATA
 DISPLAY ROUTING DATA (Y or N)?
N

ENTER [d:][path]filename[.ext] OF COMPUTED HYDROGRAPH:
ST_100

INFLOW/OUTFLOW ANALYSIS:

  PEAK-INFLOW(CFS)    PEAK-OUTFLOW(CFS)    OUTFLOW-VOL(CU-FT)
                          A       B            A          B
       31.35            3.73   13.60        327839     198118

  INITIAL-STAGE(FT)   TIME-OF-PEAK(HRS)    PEAK-STAGE-ELEV(FT)
      178.00               8.50                180.79

  REQUIRED STORAGE:    125400 CU-FT
```

Q_p = 17.33 CFS
ALLOWABLE ≈ 24.28 CFS
⇒ O.K.

Appendix III
Water Quality Calculations

DEVELOPED RUNOFF VOLUMES/DISCHARGE										
	66% 2-Yr, 24-hr. storm (6 month storm)		**2 yr., 24 hr. storm**		**10 yr., 24 hr. storm**		**25 yr., 24 hr. storm**		**100 yr., 24 hr. storm**	
Drainage Basin	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):	Peak Discharge (cfs):	Total Volume (ft3):
Basin 1	0.47	10,600	0.97	19,900	1.72	33,500	2.12	40,500	2.95	55,200
Basin 2	0.74	13,200	1.38	23,500	2.29	38,000	2.76	45,400	3.70	60,500
Basin 3	0.61	10,800	1.09	18,800	1.76	29,800	2.10	35,500	2.79	46,900
Basin 4	0.62	10,800	1.11	18,800	1.81	30,000	2.16	35,800	2.88	47,400
Basin 5	0.34	6,100	0.63	10,800	1.05	17,400	1.26	20,900	1.70	27,800
Basin 6	0.39	6,900	0.71	12,100	1.17	19,500	1.41	23,400	1.89	31,100
Basin 7	0.35	6,800	0.64	11,900	1.04	19,000	1.25	22,700	1.68	30,200
Basin 8	0.74	13,100	1.36	23,200	2.24	37,400	2.69	44,700	3.61	59,500
Basin 9	0.56	10,600	1.04	18,700	1.73	30,300	2.08	36,200	2.80	48,300
Basin 10	0.58	10,300	1.06	18,100	1.74	29,100	2.09	34,800	2.81	46,300
Basin 11	0.59	11,200	1.04	19,200	1.68	30,400	2.01	36,200	2.67	47,900
Basin 12	0.61	10,900	1.10	19,000	1.80	30,500	2.16	36,400	2.89	48,400
Basin 13	0.41	7,300	0.75	12,600	1.21	20,100	1.45	24,000	1.93	31,800
TOTALS:	7.01	128,600	12.88	226,600	21.24	365,000	25.54	436,500	34.30	581,300

- THE PRIMARY WETPOND ACCEPTS THE RUNOFF FROM DEVELOPED DRAINAGE BASINS 2-13. THE 6-MONTH, 24-HR STORM VOLUME FROM BASINS 2-13 IS 118,000 FT^3 => THIS VOLUME MUST BE PROVIDED AS "DEAD" STORAGE WITHIN THE WETPOND.

- THE SECONDARY WETPOND RECEIVES RUNOFF FROM BASIN 1. THE 6-MONTH, 24-HR. STORM VOLUME FROM BASIN 1 IS 10,600 FT^3 => THIS VOLUME MUST BE PROVIDED AS "DEAD" STORAGE WITHIN THE WETPOND.