PW00101401

DESIGN REPORT ADDENDUM

14TH AVE W EXTENSION TO LOCUST WAY

(220th St SW to Locust Way)

RC-1497
UPI# 06-0025

ENGINEERING SERVICES
Snohomish County Public Works

DESIGN REPORT ADDENDUM

14TH AVE W EXTENSION TO LOCUST WAY

(220th St SW to Locust Way)

RC1497 UPI# 06-0025

APPROVED BY: Douglas W. McCormick, P.E. — 1/31/19 Date
County Engineer

CONCURRED BY: Janice L. Fahning, P.E. — 1-30-19 Date
Director of Engineering Services

CONCURRED BY: Mohammad Uddin, P.E. — 1/29/2019 Date
County Traffic Engineer

PREPARED BY: Sheela E. George, P.E. — 1/22/2019 Date
Project Manager

Snohomish County Department of Public Works
3000 Rockefeller Avenue
Everett, Washington 98201
425-388-3488

14th Ave W Extension to Locust Way

January 2019

Project Proposal

Snohomish County proposes to build a northerly extension of 14th Ave W with a new urban 2-lane roadway that includes two 11-foot travel lanes, and two 5-foot bike lanes. Curb, gutter, and sidewalk will be constructed to provide a continuous, accessible pedestrian route along 14th Ave W. A new roundabout intersection is proposed to connect 14th Ave W with Locust Way. Stormwater facilities will be constructed for detention and water quality treatment. This project will complete the northerly extension of this corridor, which was identified as the preferred alternative in the 1985 Design Report for 14th Ave W.

Project Benefits

- Creating an extension to connect Locust Way to 220th Street SW
- Adding sidewalks and bike lanes
- New stormwater detention and treatment facilities
- Improve traffic circulation, connectivity, flow and mobility for vehicles, pedestrians and bikes

Project Cost

	New Corridor with	
	Alternative 1: Two Way Stop Intersection	***Alternative 2: Single Lane Roundabout****
Preliminary Engineering	$ 1,969,000	$ 1,979,000
Right-of-Way Acquisition	$ 610,000	$ 630,000
Land Acq. For Mitigation**	$ 925,000	$ 925,000
Construction (includes mitigation)	$ 9,844,000	$ 9,897,000
Construction Engineering	$ 1,477,000	$ 1,485,000
Total	**$14,825,000**	**$14,916,000**

** Roundabout is the preferred alternative*

Project Schedule

Project Phase	*2017*	*2018*	*2019*	*2020*	*2021*	*2022-2024*
Environmental						
Design (PS&E)						
Right of Way						
Construction*						

**Based on construction funds being secured.*

Required Permits

National Environmental Policy Act (NEPA), National Historic Preservation Act, US Army Corps of Engineers section 404 Permit, Endangered Species Act – section 7, Essential Fish Habitat, NPDES Permit, 401 Water Quality Certification, State Environmental Policy Act (SEPA), National Historic Preservation Act - section 106 review, Critical Area Regulations, Land Disturbing Activity

Project Contacts

Sheela George, P.E., Project Manager
Matthew Feeley, P.E., Project Manager

Table of Contents

Table of Contents 4
Executive Summary 5
Vicinity Map 6
Local Improvements Map 7
Project Area Photographs 8
Introduction 16
Existing Conditions 17
Traffic Analysis 18
Design Criteria 23
Accessibility 25
Environmental/Wetlands/Streams 25
Permits 26
Hydraulics/Drainage 26
Geotechnical 28
Utilities 28
Right-of-Way 28
Deviations 29
Public Involvement 29
Preliminary Project Cost Estimate 29
Appendix A - Intersection Alternatives 30
Appendix B – Preliminary Plan and Profile 31
Appendix C - Preliminary Project Cost Estimate 32
Appendix D – Traffic Report and Warrants 33
Appendix E – Environmental Review Memo 34
Appendix F – TDA Map 35
Appendix G – Soil Map 36
Appendix H – Developer Construction Plan and Road Section 37

Executive Summary

Snohomish County Public Works proposes to extend the 14th Ave W roadway to the north to intersect with Locust Way. The purpose of this project is to improve north-south traffic circulation as identified in the original 14th Ave West - Final Design Report & Final Environmental Impact Statement dated 9-12-1985. The preferred alternative identified in the 1985 report is the recommended alignment for this 14th Ave W Extension project. The preferred alternative consists of extending 14th Ave W north from 220th St SW to Locust Way.

14th Ave W is classified as an urban minor arterial that intersects with Locust Way, which is classified as an urban minor collector. Pedestrian facilities are present along 14th Ave W to the south of the project as areas of widened shoulder and short segments of sidewalk that were built by the neighborhood developments. The County proposes to build 14th Ave W with two 11-foot lanes, two 5-foot bike lanes, curb, gutter, and two 5-foot sidewalks. A new intersection will be built where 14th Ave W joins into Locust Way. Traffic warrants based on Traffic Report done in July 2016 (updated in August 2017) indicate that a roundabout or two-way stop control are adequate intersection options through 2035, with the roundabout selected as the preferred alternative. Please see Appendix D for traffic Warrants and Forecasts.

The proposed new roadway construction and stormwater facilities will require right-of-way acquisition from some of the properties along the 14th Ave W alignment and adjacent to Locust Way. Approximately 10 parcels will be impacted for roadway improvements with potentially 3 more for wetland mitigation requirements. The table below summarizes the breakdown of the estimated project costs for the preferred roundabout option.

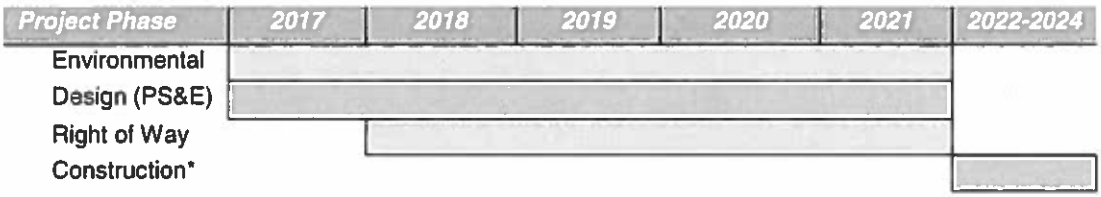
This project has tentatively been programmed for construction in the draft 2019-2024 Transportation Improvement Program (TIP) as E.58. Project costs for the preferred alternative are summarized in the table below.

Project Cost

Project Element	*Estimated Project Cost*
Preliminary Engineering	$ 1,979,000
Right-of-Way Acquisition	$ 630,000
Land Acq. For Mitigation*	$ 925,000
Construction (includes mitigation)	$ 9,897,000
Construction Engineering	$ 1,485,000
Total	**$14,916,000**

** Need for land acquisition depends on mitigation option chosen*

Project Schedule



**Based on construction funds being secured.*

Vicinity Map

Incorporated City
UGA Boundary
County Boundary
Interstate Highway
Minor Arterial
Arterial Roadway
Local Road
Railroad
Water
N
(NTS)

Figure 1

Local Improvements Map

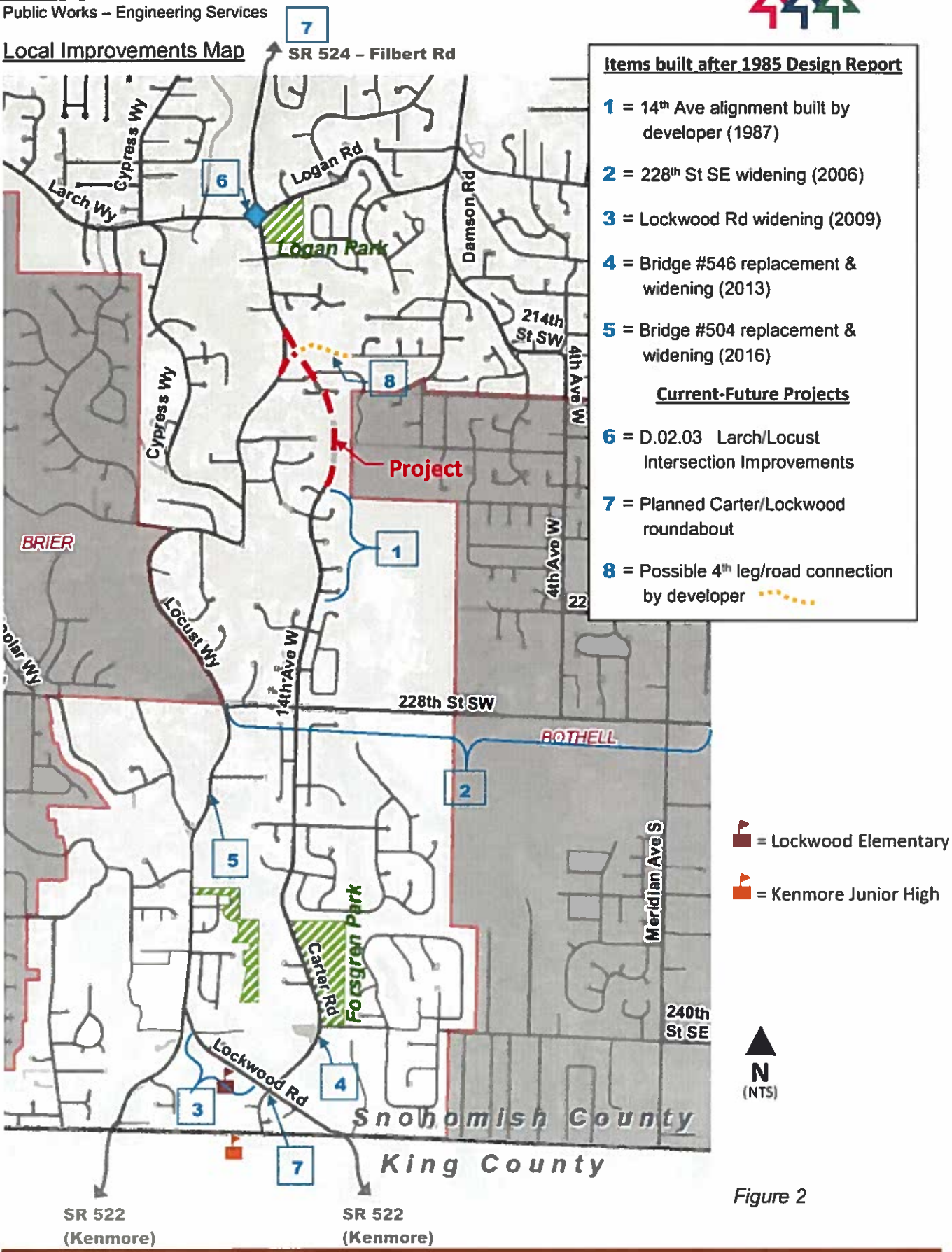


Figure 2

Project Area Photographs

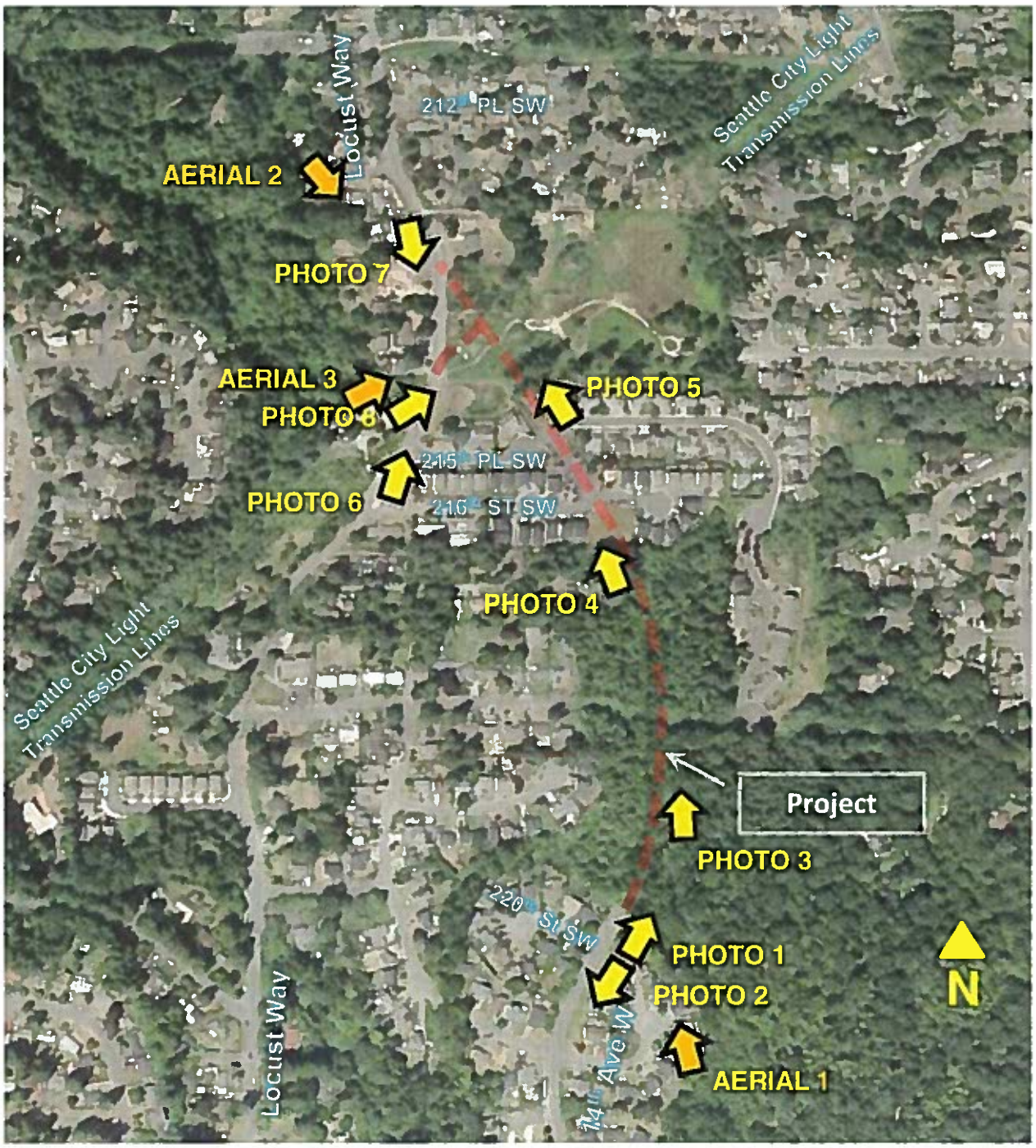
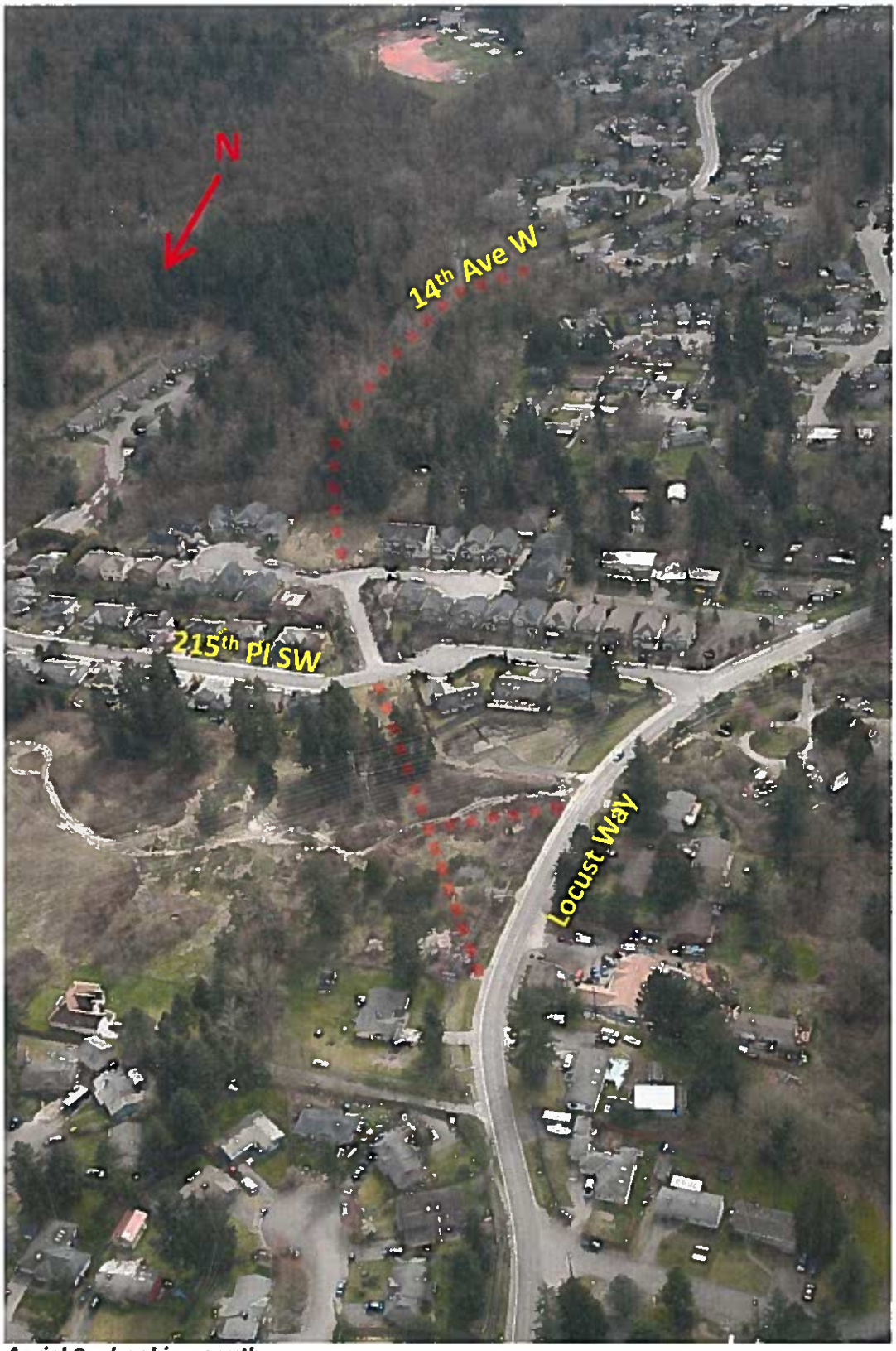
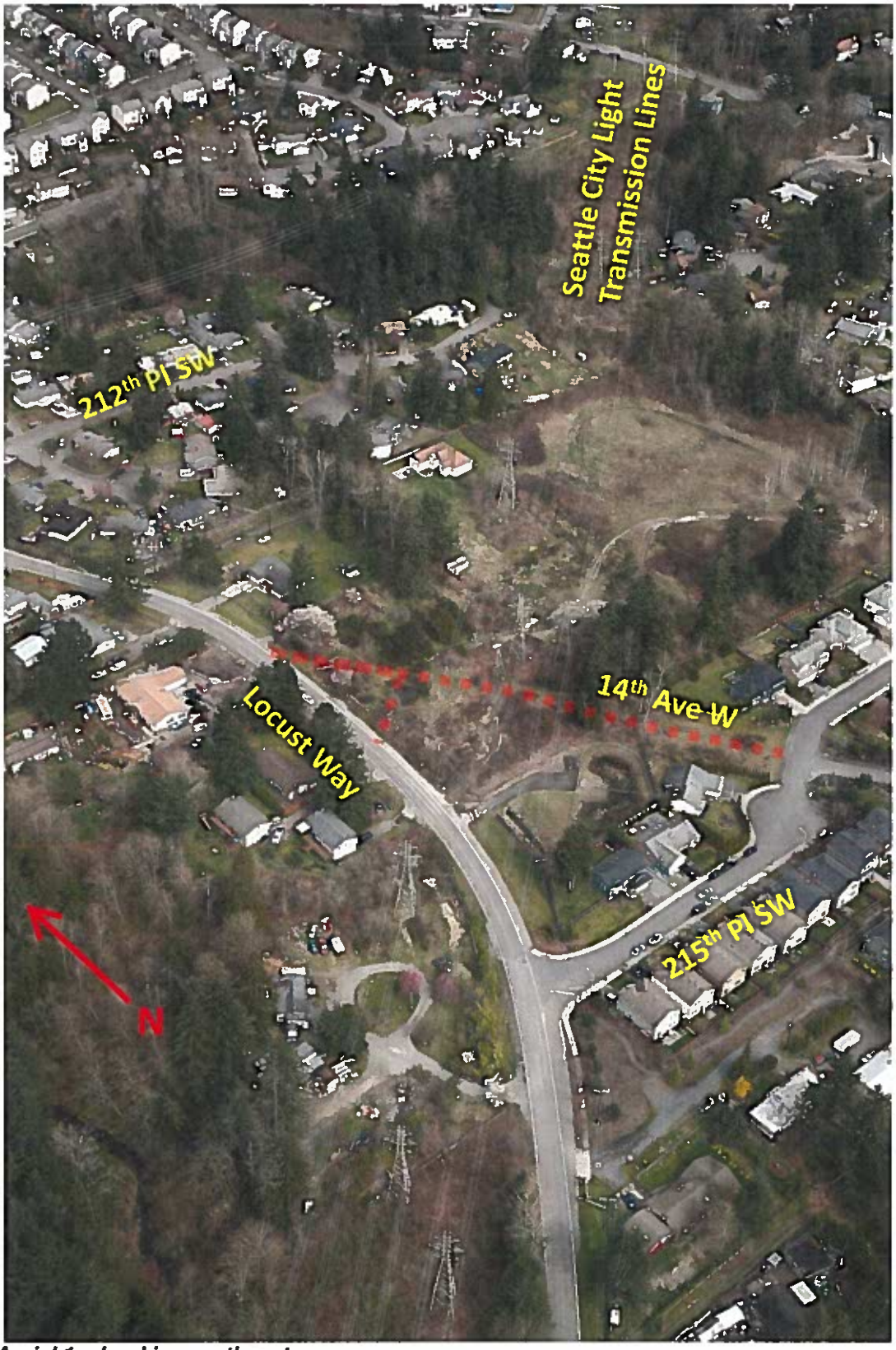


Figure 3. *Aerial overview of project site.* *(2016 photo – Google Earth)*

Aerial 1. Looking north.



Aerial 2. Looking south.



Aerial 1. Looking northeast.

Photo 1. Dead end stub for 14th Ave W at 220th St SW (looking north).

Photo 2. 14th Ave W (looking south) from 220th St SW intersection.

Photo 3. Dedicated ROW for road extension beyond 14th Ave W dead end (looking north).

Photo 4. Looking north along proposed alignment, through the 216th St SW and 215th Pl SW intersections.

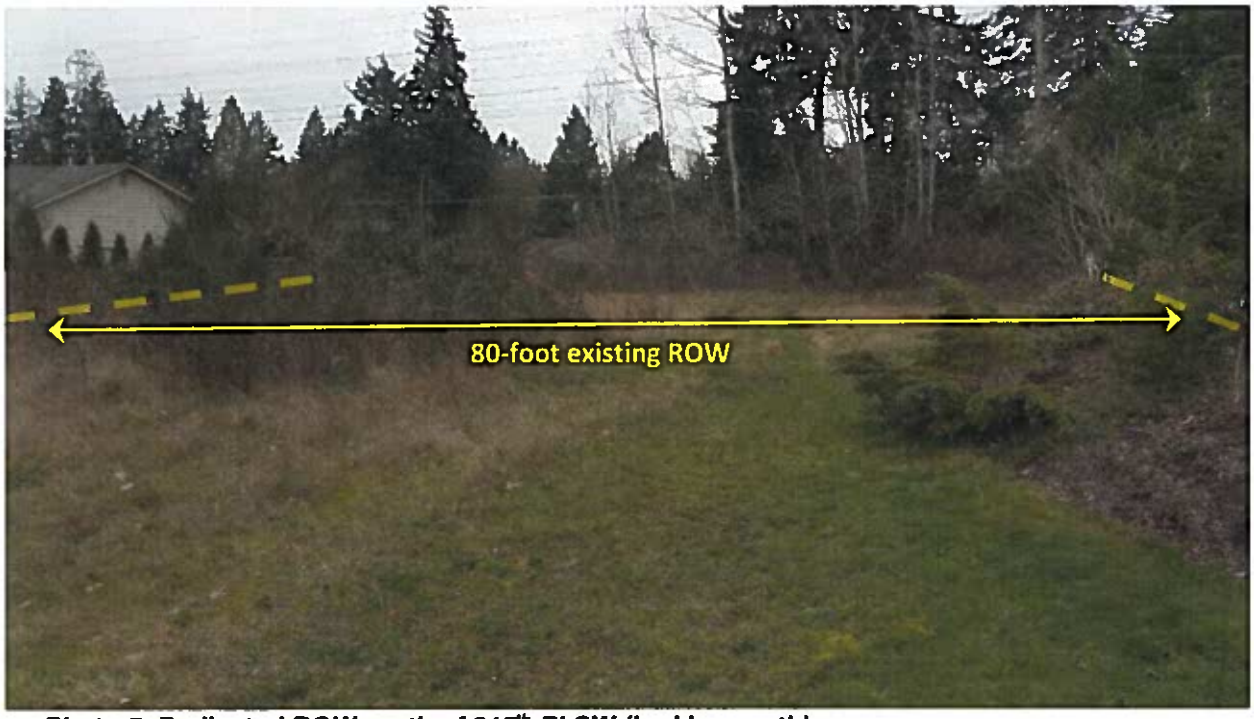


Photo 5. Dedicated ROW north of 215th Pl SW (looking north).

Photo 6. Locust Way looking north toward the future intersection with 14th Ave W.

Photo 7. Locust Way (looking south) near the future intersection of 14th Ave W.

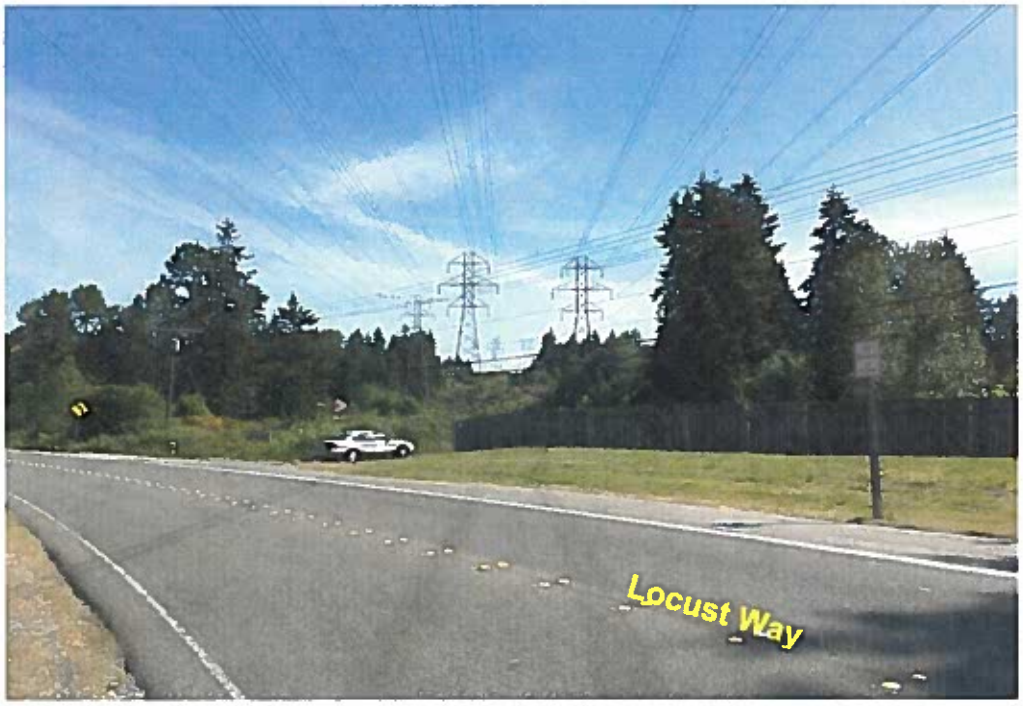


Photo 8. View of Seattle City Light transmission lines crossing Locust Way (looking east)

Introduction

The 14th Ave W extension was first identified in the Transportation Element of the 1995 Comprehensive Plan and reaffirmed by the 2015 update. It is listed as a new proposed arterial with an urban section necessary to improve neighborhood traffic circulation. This new arterial is within the City of Bothell's Urban Growth Area (UGA), and abuts the border of the City of Brier's UGA at the western edge of the new Locust Way intersection. Improvements consist of constructing a new urban 2-lane roadway with bike lanes, and sidewalk to improve mobility of pedestrians, bicyclists, and motorists through this 0.4 mile corridor, along with adding an intersection at Locust Way.

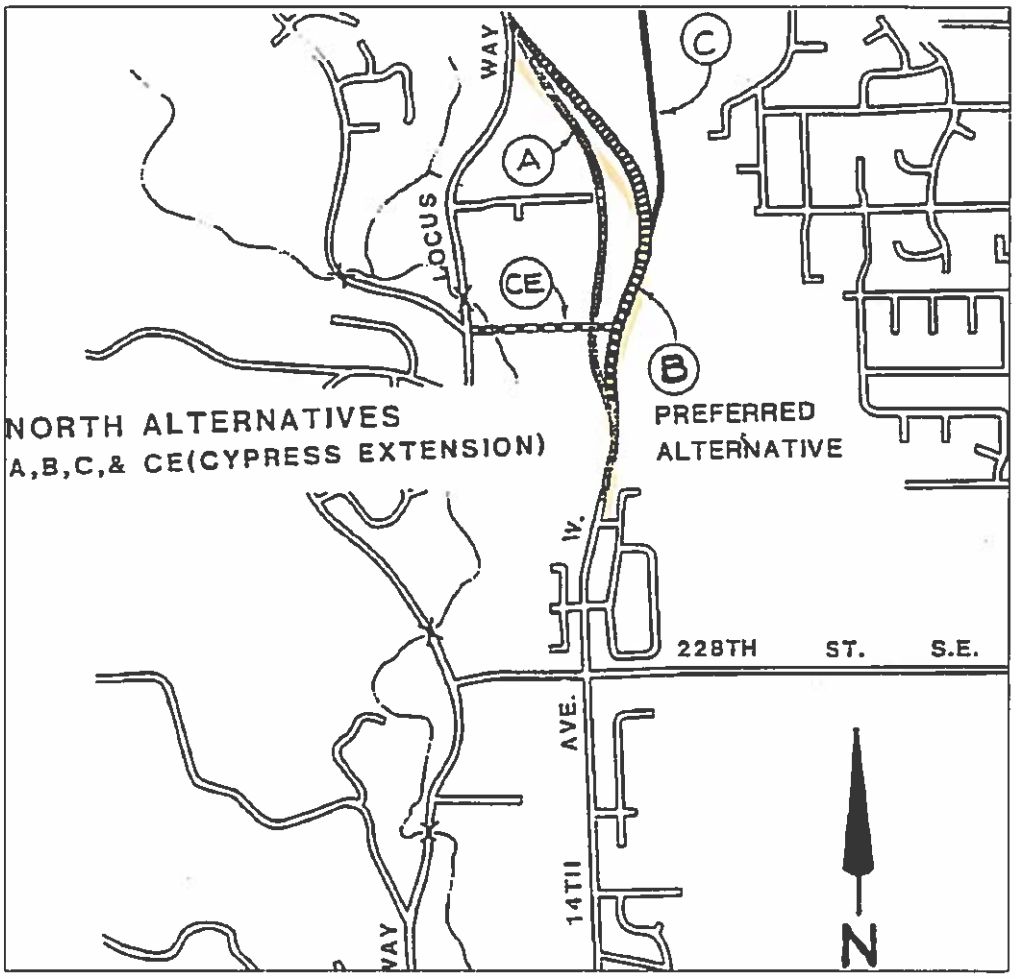


Figure 4. Vicinity Map from the 14th Ave W Final Design Report (dated 9/12/1985) – showing alternatives for north extension

This report is an addendum to the design report entitled "14th Avenue West – Final Design Report and Environmental Impact Statement" dated September 12, 1985. The 1985 Design Report concluded the extension of 14th Ave W was necessary "in order to provide a safer, more efficient, and higher capacity area road network." This report outlines the proposed design and basic criteria that will be used to design the 14th Ave W Extension Project. The proposed

project alignment corresponds with 'preferred alternative B' in the 1985 Report (see Figure 4 above). 14th Ave W is proposed to be extended using a two lane roadway section, starting at the existing road stub near 220th St SW and heading north through the existing sections of right-of-way (ROW), finally intersecting with Locust Way near the 21400 block vicinity. This northerly connection of 14th Ave W will create a new north-south arterial corridor.

Existing Conditions

14th Ave W currently ends at a road stub near 220th St SW. The existing 14th Ave W roadway between 228th St SW and the stub consists of 2 lanes, with alternating sections of asphalt walkway or concrete sidewalk. The pavement width through this section varies from 40 feet to 32 feet delineated into two 12 foot travel lanes and shoulders of varying width up to 10 feet. The stub near 220th St SW has a pavement width of 38 feet (see Photos 1 & 2).

North of the stub, a swath of unopened 70 foot wide ROW extends approximately 830 feet northward and is currently overgrown with trees (see Photo 3).

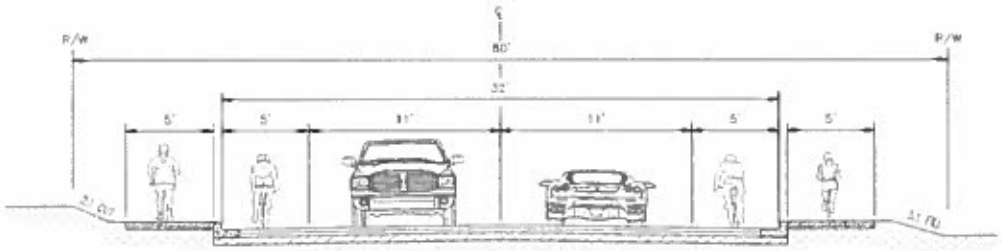
The segment of 13th Pl W between 216th St SW and 215th Pl SW was built by 2 separate developers. Pavement is built to a width of 21 feet (with no lane striping), including an attached asphalt thickened edge and raised asphalt sidewalk (see Photo 4). This segment aligns with the proposed road for 14th Ave W Extension (see Figure 2, Local Improvements Map).

Locust Way, north of 215th Pl SW, consists of 2 lanes with an asphalt walkway on the east side of the road. The pavement width is 31 feet delineated into two 11 foot lanes, 1 foot shoulder on the west side, and 8 foot walkway on the east side (see Photos 6-8).

A portion of 14th Ave W extension was also permitted and constructed by a developer in the late 1980's through the wetland north of 220th St SW. See Appendix H for developer construction plan and road section.

Proposed Design

The proposed design will construct 14th Ave W with the following cross-section:

Typical Section	Description
14th Ave W ▪ 2 – 11' Travel Lanes ▪ 2 – 5' Bike Lanes	

As noted above, the horizontal alignment for this project follows the preferred alternative in the 1985 Design Report. The roadway will be centered in the existing ROW and the alignment for the entry/exit legs of the roundabout intersection will be finalized during project design. Bike lanes and sidewalks will link into existing walkable shoulders on either end. Bike lanes will be striped on both sides of 14th Ave W and transition to a 10 foot (8-ft min.) shared use path upon entering/exiting the roundabout.

The road vertical alignment is currently designed to minimize the wall heights as the road traverses through a large fill ravine area and steep cut required south of 216th St SW (see plan-profile in Appendix B). Retaining walls have to be constructed in these cut/fill areas due to critical area buffers and adjacent homes. Fill walls will have a maximum height of approximately 17 feet over the ravine area. Cut walls will have a maximum height of approximately 10 feet, with the possibility of minimizing the wall height with some regrading and use of side slopes. The vertical alignment may need further optimization based on pending geotechnical recommendations.

A noise study will be performed as required after the horizontal and vertical alignments have been finalized to determine if sound walls may be necessary (sound wall cost not included in the project estimate).

Culvert crossings will need to be installed at 3 to 4 locations (see stream locations in Appendix F). None of these crossings are identified as needing design for fish or wildlife passage.

The posted speed is currently 25 MPH along 14th Ave W. At the completion of this project, 14th Ave W will be posted with a speed of 35 MPH to suit the functionality of this road as an urban minor arterial.

Two intersection alternatives for 14th Ave W/Locust Way were evaluated for this project and are discussed in more detail below in the Traffic Analysis section.

- Alternative 1 – Construct a two-way stop controlled intersection, with a southbound right turn pocket. This alternative would include provisions to easily allow for a traffic signal and accommodate a 4th leg for future improvements

- Alternative 2 – Construct a single lane roundabout, with accommodation for a 4th leg for future improvements

Traffic Analysis

The 14th Ave W corridor is designated as an urban minor arterial and Locust Way as a minor collector. The existing average daily traffic (ADT) for Locust Way near 215th Pl SW is 4,100 vehicles and the 85th percentile speed is 39.6 mph.

This project will provide a connection of 14th Ave W to Locust Way, with 14th Ave W being the primary traffic corridor and Locust Way being the minor leg of the intersection. A traffic report was completed in August 2017 that details the existing traffic patterns within the project area and details the future traffic patterns and volumes anticipated to use the proposed 14th Ave W extension. See Appendix D for the Traffic report and figures showing distribution of traffic.

Taking into consideration 2035 traffic forecasts from the Traffic Report for 14th Ave West Extension, July 2016 (updated August 2017) included in Appendix D, warrant analyses were also performed for this intersection. The alternative for a traffic signal was ruled out for consideration because it only met 3 weak warrants. The alternatives for a two way stop controlled intersection and roundabout were both accepted as good options from the warrant analyses and are discussed below:

- *Traffic Analysis for Alternative 1:* Two-Way Stop Controlled – The two way stop controlled intersection would be an interim improvement until stronger signal warrants are met sometime beyond year 2035. Accommodations for a future signal (conduit and junction boxes) would be installed to allow for this upgrade when warranted. This option would require further realignment of Locust Way to the north beyond 213th Pl SW. Traffic analysis showed this alternative would operate at an overall intersection LOS A (combined 2.2 sec delay), and the eastbound leg would operate at LOS D with a 25.6 second delay. See Appendix D for warrant analysis.

- *Traffic Analysis for Alternative 2: Single Lane Roundabout* – Single lane roundabouts (inscribed circle diameter = 140') are designed to slow traffic upon entry to increase safety, yet allow for optimum traffic flow. A roundabout at this location will require more right-of-way acquisition than Alternative 1. The roundabout accommodates the existing residential driveways on the south leg of Locust Way better as it would place their access further away from the intersection and allow for easier entry onto Locust Way. Traffic analysis showed this alternative would operate at an overall intersection LOS B (combined 12.6 sec delay), and the northbound leg would operate at LOS C with a 16.4 second delay. See Appendix D for warrant analysis.

  The advantage of a roundabout is that it provides better traffic management and traffic control into the future without additional improvements.

Alternatives

Either of these intersections would potentially need to accommodate a 4th leg because of the large vacant parcel that lies to the east of the intersection and transmission line easement (see Appendix A, Figure 2). This project does not propose to construct any improvements for a 4th leg and it will be left up to future development to construct these improvements if needed. See exhibits below for each of these alternatives and the figures in Appendix A.

ALTERNATIVE 1:

- Construct an interim two-way stop controlled intersection, with a right turn pocket for southbound traffic
- Provide provisions for a traffic signal to be added at a later date when stronger warrants are met (after 2035)
- Accommodate a 4th leg to potentially be built by adjacent development

Advantages:

- Overall intersection operations would have lower delays (with the exception of the eastbound leg) versus a roundabout.
- Realignment prioritizes the highest volume movements and encourages travel

onto the new arterial segment.

- Requires less right-of-way.

Figure 5. Two Way Stop Controlled Intersection

Disadvantages:

- Location of the intersection would be mostly fixed with most of the intersection under the transmission line easement
- Bicycle lanes and pedestrian crossings are more exposed to conflict within the intersection versus a roundabout
- Location of future signal poles under transmission lines may present an issue for Seattle City Light easement concurrence approval
- Addition of a 4th leg by a developer may be more difficult with proximity to transmission tower and less flexibility in adjusting the intersection point.
- Requires significant realignment of Locust Way further to the north
- Eastbound leg of intersection would have a LOS D.

ALTERNATIVE 2:

- Construct a single lane roundabout with a shared use path for bike lanes to transition onto sidewalks through the roundabout
- Accommodate a 4th leg to potentially be built by adjacent development

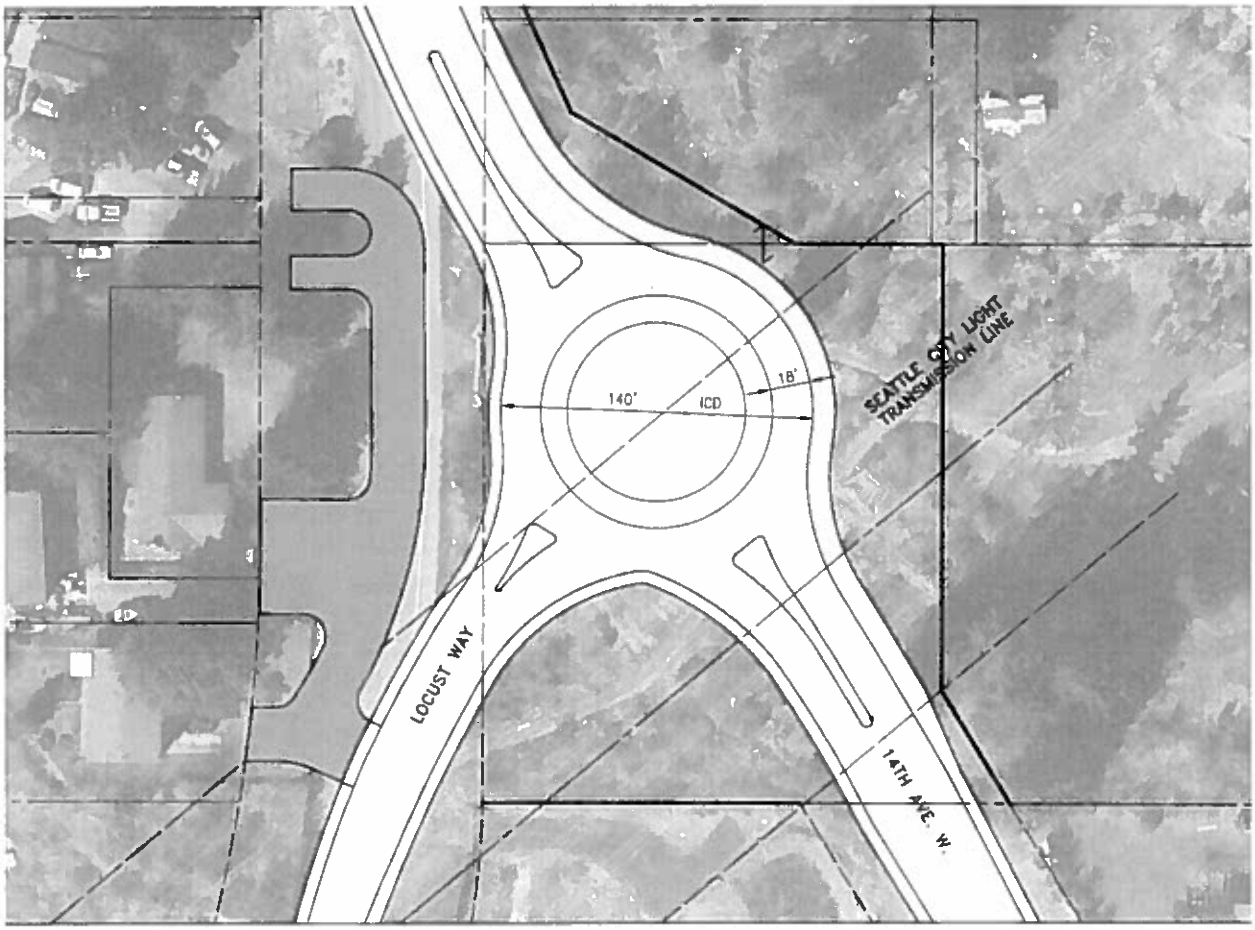


Figure 6. Roundabout Intersection

Advantages:

- Provides better traffic management and traffic control
- More flexible to better accommodate transmission line easement, drainage facility location, ROW concerns, accommodation of a 4th leg, stream crossings, etc.
- Does not require significant realignment of Locust Way beyond what's needed to match into the north leg.
- Allows bikes to easily transition onto a 10 foot wide shared use path through the intersection for safety.
- Traffic calming.
- Fewer traffic conflict points.
- Reduced fuel consumption/emissions (less stopping/acceleration).

Disadvantages:

- Has slightly lower Level of Service (LOS) over two-way stop.
- No roundabouts currently exist in this local area; may need additional public outreach to gain acceptance. However, other roundabouts are planned in the vicinity of this arterial corridor.
- More ROW acquisition.

Intersection Alternative Summary:

#	Alternative	Advantages	Disadvantages
1	Two-Way Stop	• Lower delay • Less ROW impact	• More realignment of Locust Way to north • Needs future improvement to maintain LOS
2	Single Lane Roundabout (Inscribed Circle Diameter = 110'-150')	• Maintain acceptable LOS and better flexibility for adding a future access to the east of the intersection • Safer for vehicles/peds/bikes • Better for driveway access • Provides better traffic management and traffic control	• Requires greater amount right-of-way

Recommended Alternative:

The roundabout intersection alternative 2 with the preferred alternate alignment from the 1985 report as shown on the Preliminary Plan & Profile in Appendix B is recommended for this new extension. The roundabout provides better traffic management and traffic control at the intersection for all users. The proposed alignment with the roundabout options provide a better geometry to tie into existing Locust Way roadway alignment. Refer to the proposed plan and profile in Appendix B for proposed horizontal and vertical alignments.

Alternative 2 was identified as the preferred alternative mainly because it would be a safer intersection for all users and not require additional improvements in the future (ie. stop control→signal) to keep it performing at an acceptable level. See Appendix B for plan and profile exhibit for this alternative.

Other roundabouts are also planned in the vicinity of this arterial corridor to the north by WSDOT (SR524/Locust Way & SR524/Larch Way) and to the south by Snohomish County (Carter Rd & Lockwood Rd – see Figure 2, Local Improvements Map).

Future Projects

The existing built portions of 14th Ave W, between this project and 228th St SW, will need to be restriped to match the proposed cross-section of the new road extension. These improvements would be part of a separate project.

A Roundabout Feasibility Technical Report was prepared for the Lockwood/Carter Rd intersection in August 2006 by the Transpo Group. The report concluded a single lane roundabout was an appropriate intersection improvement that had some advantages over a traffic signal with turn lanes. The roundabout project has been postponed until after the northerly connection of 14th Ave W has been made.

The proposed three-leg intersection of 14th Ave W/Locust Way can accommodate a potential fourth leg for the vacant property located to the east of the intersection (see Local Improvement Map - Figure 2). The fourth leg would need to be designed and built by a private developer, if required as a condition of development. Access is available for this property from the stub off of 214th Pl SW, although County EDDS section 3-01 B. 5 states that a second road connection may be required because that stub already has 48 lots on a dead end and would exceed the 250 ADT threshold.

Design Criteria

The applicable roadway design standards for this project will include the following:

- **Design Manuals:**
  - Snohomish County Engineering Design and Development Standards (2018)
  - WSDOT Design Manual, July 2018 Edition
  - AASHTO Greenbook, 2011 Edition
  - Manual of Uniform Traffic Control Devices, 2009 Edition
  - Public Right of Way Accessible Guidelines (PROWAG)
  - Roundabouts: An Informational Guide, 2nd Edition (2010), NCHRP Report 672

- **Roadway Classification:**
  - 14th Ave W -
    - Urban Minor Arterial
  - Locust Way –
    - Urban Collector Arterial

- **Posted Speed:**

	14th Ave W	Locust Way
Existing (MPH)	25	35
Proposed (MPH)	35	35

- **85th Percentile for Locust Way:** 40 mph (2016 traffic study)

- **Design Speed:** 40 mph
  - Arterial design speed is established during the design process. (EDDS 3-06.A.1). The proposed design speed is 40 miles per hour.
- **Design Vehicle:**
  - AASHTO "WB-50" (intermediate semitrailer, 50' wheel base) or "S-BUS-40" (school bus) for roadway turning movements.
  - AASHTO "P" (vehicle) for turning movements for adjacent property access.

Design Element	***Criteria***	***Design Reference***
Number of Access Points	1 per residential parcel	Section 2-02A (EDDS 2018)
Access Point Types	Residential width = 10'- 30'	Sections 2-03A,B (EDDS 2018) Drawings 2-010 and 2-020
Access Point Location, separation and Spacing	10' Separation between adjoining residential parcels	Section 2-04B (EDDS 2018)
Horizontal Alignment of Access points	90 degrees to adjacent road	Section 2-06 (EDDS 2108)
Vertical Alignment of Access Points	15' landing width, +/- 15% max grade	Section 2-07 (EDDS 2018) Drawing 2-070 for urban residential to non-arterial
Right-of-Way Standard Width	80' for Minor Arterial	Section 3-03A (EDDS 2018) Table 3-1/Drawing 3-030B
Vertical Alignment – Maximum Grade	Arterial (minor or collector) @10%; Residential/Sub-collector @12%; Local Access 15%	Section 3-07A (EDDS 2018) Table 3-5
Stopping Sight Distance (SSD)	SSD = 305'- 40 mph design speed	Section 3-08B,C (EDDS 2018) Table 3-6, Table 3-7 used for effect of grades
Intersection Sight Distance (ISD)	ISD = 390' - 35 mph posted speed	Section 3-08D (EDDS 2018) Table 3-8 ISD (<80 ADT) Table 3-9 ISD (>80 ADT) Drawing 3-140
Angle of Intersection	90 degrees +/- degrees for exiting intersections	Section 3-09A (EDDS 2018)
Rockeries – Fences and handrails	Required when wall height is 30" or greater	Section 4-171 (EDDS 2018)
Intersections – Radius Returns	35' minimum radius return for any road intersecting with arterial	Section 3-09, Table 3-10 (EDDS 2018)
Concrete Sidewalks – Width and Cross	2% Maximum cross slope 5' width for meandering sidewalks	Sections 4-05A,B (EDDS 2018) WSDOT Standard Plan F Series
Concrete Sidewalks – Curb Ramps	4' minimum landing 4' minimum width	Section 4-05D (EDDS 2018) WSDOT Standard Plans F Series
Mailboxes	Turnouts required serving cluster mailbox units on arterial roads	Section 4-13B & D (EDDS 2018) Drawing 4-190
Side Slopes	3H:1V or flatter for fill slopes 2H:1V or flatter for all cut slopes	Sections 4-14 A (EDDS 2018)
Pedestrian (Safety) Railing	Required when the vertical drop-off behind the sidewalk is 2.5' or greater.	Section 4-16 (EDDS 2018) WSDOT Design Manual (2018), Chapter 1515
Clear Zone	10' from the edge of traveled way	Section 4-15 (EDDS 2018)

Accessibility

This project will improve pedestrian accessibility through the added sidewalk facilities and shared use paths. These facilities will connect to existing walkable shoulders at either end of the project. All pedestrian elements will be designed to comply with current Americans with Disabilities Act (ADA) standards. The pedestrian elements of this project that will involve ADA compliance include the curb ramps and sidewalks/shared use paths. In addition to constructing new pedestrian elements, existing pedestrian features will be evaluated for ADA compliance and will be upgraded as necessary.

Environmental/Wetlands/Streams

Preliminary critical area reconnaissance identified that there are two non-fish bearing tributary streams that cross under 14th Ave W alignment and drain to Swamp Creek. The two culverts that convey these streams will be analyzed to determine if they meet current engineering design standards. One large Category III wetland with a 110 foot buffer has also been identified within the project limits and will be impacted by the roadway extension. The majority of the proposed road alignment through the wetland area was permitted and filled in by the Willow Grove Development in the late 1980's. See Appendix H for approved developer construction plan and road section. The design will comply with the mitigation sequencing standards and will be appropriately documented. The extent of impacts and required mitigation has not been determined yet, although for estimate purposes three options were identified and summarized in a table below: 1) property acquisition for wetland and buffer enhancement and 2) King County's in-lieu fee program. 3) There is also the potential to use a mitigation bank that is currently pending approval, preliminary costs are only available at this time. The Preliminary Environmental Review Memo outlines these options in more detail in Appendix E. To minimize the environmental impacts the road section was reduced by eliminating planters and constructing walls.

The Environmental Services group will develop a SEPA checklist for this project and issue a SEPA determination in coordination with the design of this project. A noise analysis will need to be completed prior to the SEPA checklist completion due to the construction of new roadway.

	Mitigation Alternative	Acquisition Cost	Construction Cost	Total Estimated Cost
1	Enhancement	$925,000***	$1,200,000	$2,125,000*
2	In-Lieu Fee	-	$5,837,000	$5,837,000
3	Keller Farm Bank	-	$1,200,000**	$1,200,000**

** Does not include cost for monitoring*
***Bank is still pending approval status (~early 2018) and cost is estimated by bank manager*
****Estimated by ROW group based on preliminary information from Environmental Services*

Climate Change

Snohomish County is exploring how to predict and plan for future impacts of climate change. Snohomish County Public Works Department has developed a preliminary tool to evaluate the effects of climate change on County infrastructure projects. The tool has been applied for this project and the County will be evaluating how to proceed with the data. The County's goal is to strengthen the resiliency of infrastructure, to extend the life of transportation systems and provide safe travel routes for Snohomish County citizens.

Permits

The permits required for this project are listed in the Preliminary Environmental Review Memo. Potential permits include the following:

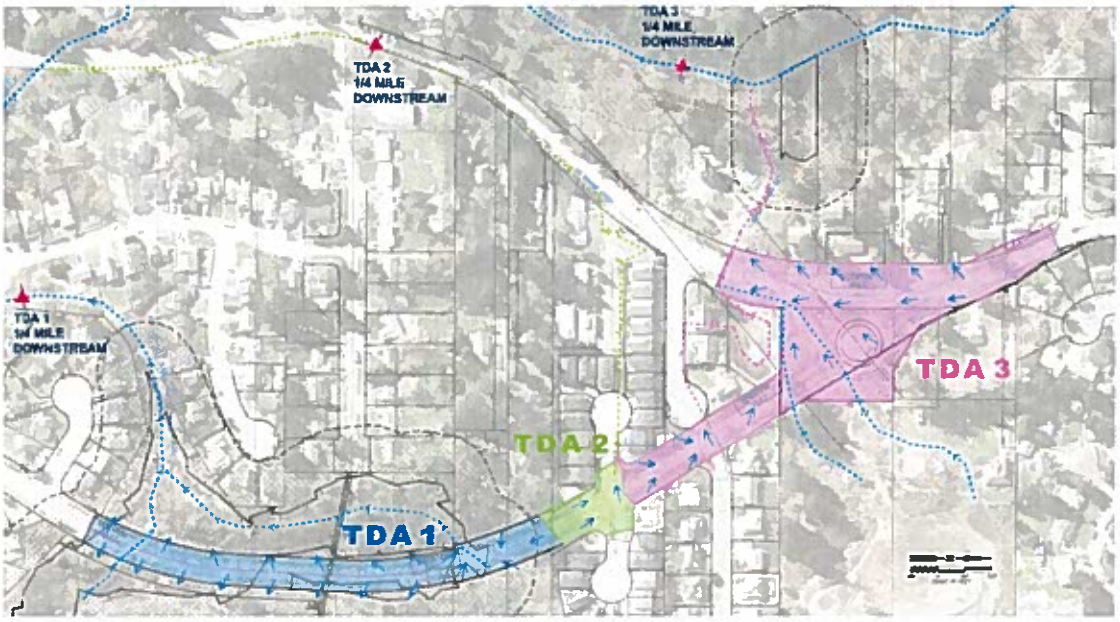
- NEPA
- National Historic Preservation Act
- US Army Corps of Engineers section 404 Permit
- Endangered Species Act – section 7
- Essential Fish Habitat
- NPDES Permit
- 401 Water Quality Certification
- State Environmental Policy Act
- Washington State Archaeological Laws
- Critical Area Regulations
- Land Disturbing Activity

Hydraulics/Drainage

A hydraulic/drainage report will be developed following the Snohomish County Engineering Design and Development Standards (EDDS), the 2016 Edition of the Snohomish County Drainage Manual, and Snohomish County Code (SCC). Stormwater detention and water quality treatment will be designed according to the 2016 Snohomish County Drainage Manual.

This project corridor is located in WRIA 8 and is part of the Swamp Creek drainage basin, which is tributary to the Sammamish River, Lake Washington, and then finally Puget Sound. Roadway drainage along the corridor currently consists of a combination of ditches and enclosed storm drain systems. Based on preliminary field investigations and a review of existing maps, three (3) Threshold Discharge Areas (TDAs) have been identified. It has been determined that two (2) TDAs will be required to satisfy both water quality treatment and flow control requirements and one (1) TDA will be required to satisfy just water quality treatment requirements. See Appendix F for full size TDA map.

- TDA 1 - STA 11+32 – STA 21+86 (south)
- TDA 2 - STA 21+86 – STA 23+53 (middle)
- TDA 3 - STA 23+53 – STA 35+00 (north)



	TDA 1	TDA 2	TDA 3
New Effective Impervious Surface (SF)*	47,610	8,514	70,919
Water Quality	✓	✓	✓
Flow Control	✓		✓

**Includes Replaced Impervious Surface.*

The following water quality treatment and flow control BMPs were selected as the preferred potential stormwater BMPs for this project:

- Bioretention Cells (grass lined)
- Bioplanters (Filterra® or Modular Wetland MWS Linear units)
- Detention Vault

The flow control and water quality treatment BMPs listed above will be designed and sized using the continuous hydrologic simulation program, MGS Flood.

On this project for flow control, a stormwater detention vault is proposed for TDA 1 and TDA 3. For water quality treatment, bioplanter type units will be proposed for water quality treatment for all TDA's, with the possibility of using bioretention cells in TDA 3.

During the project design, feasibility for full dispersion, permeable pavement, bioretention, and dispersion will be assessed. A full drainage report will be completed during the design of this project.

Geotechnical

The Soil Survey of Snohomish County Area classifies the soils in the project area as:

- Alderwood gravelly sandy loam, 15 to 30 percent slopes
- Alderwood-Urban land complex, 2 to 8 percent slopes
- Alderwood-Urban land complex, 8 to 15 percent slopes
- Everett very gravelly sandy loam, 0 to 8 percent slopes
- Pits

A comprehensive geotechnical investigation and report will be completed by the Snohomish County Public Works Geotechnical Group to provide site specific recommendations. See Appendix G for USDA soil map.

Utilities

The following utilities have been identified within the project corridor:

- Snohomish County PUD (Electrical – Distribution/Service)
- Puget Sound Energy (Natural Gas)
- Alderwood Water and Wastewater District (Water Main/Service & Sewer Main/Service)
- King County Metro Sewer (Sewer Main)
- Seattle City Light (Electrical - Aerial Transmission Lines and Towers)
- Comcast Communications
- Frontier/Verizon Communications

County staff will coordinate with Seattle City Light for the intersection improvements underneath the transmission line easement. Utility as-built records will be obtained from each utility company and coordination will be ongoing during the design phase of this project.

Right-of-Way

Road Name	*Classification*	*Bike lanes*	*Planter Strip*	*Sidewalk*	*ROW width*
14th Ave W	Minor Arterial	✓	✓	✓	80-ft
Locust Way	Collector Arterial		✓	✓	70-ft

EDDS standard drawing 3-030B defines the right-of-way widths listed in the table above. This project will impact approximately 10 parcels for the roadway improvements utilizing the preferred roundabout alternative. Additional right-of-way may be required for storm water facilities and mitigation for critical area (wetland/stream) impacts.

This project will develop a right of way plan after additional engineering is complete. The right of way plan will require approval by the County Engineer and County Council. The right of way group prepared a preliminary estimate of $630,000 based on a draft ROW plan.

Deviations

Deviations from the Snohomish County Public Works Engineering and Design Standards (EDDS) will be documented and approved through the EDDS deviation process as they arise during the project design. Anticipated deviations include using 11 foot lane widths instead of the standard 12 foot lane width in the critical areas and buffers.

Public Involvement

Newsletters were sent out and public meetings were held during the preliminary design phase of the project. A project website has been established and will be maintained with updated information/documents throughout the life of the project.

Project website address:

https://snohomishcountywa.gov/3756/14th-Ave-West---Road-Extension

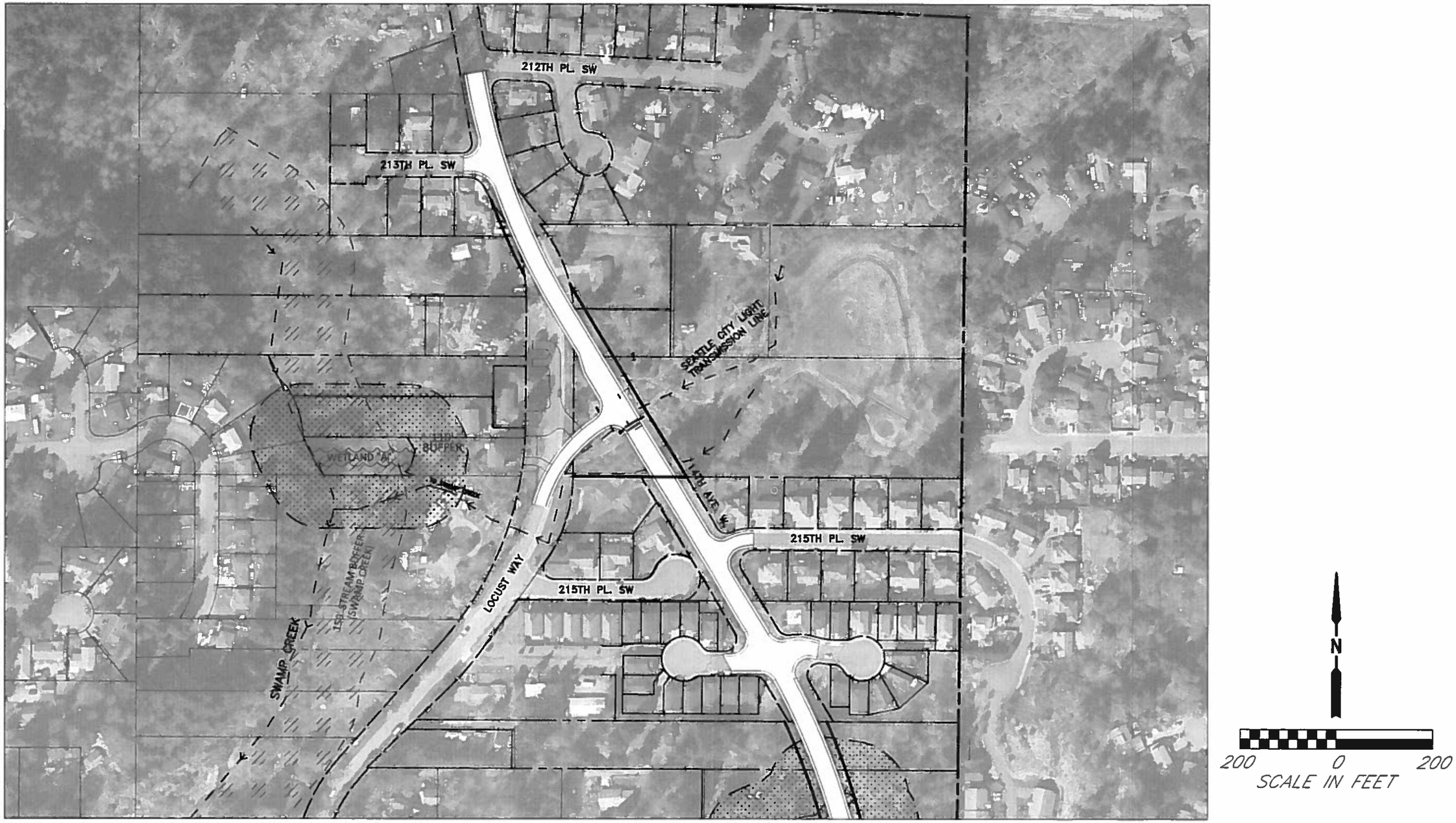
Preliminary Project Cost Estimate

Snohomish County Road and Developer Mitigation funds are currently programmed for PE and ROW stages of the project. Construction funding is tentatively programmed in the draft 2019-2024 TIP as E.58.

Project Element	***Estimated Project Cost***
Preliminary Engineering	$ 1,979,000
Right-of-Way Acquisition	$ 630,000
Land Acq. For Mitigation*	$ 925,000
Construction (includes mitigation)	$ 9,897,000
Construction Engineering	$ 1,485,000
Total	**$14,916,000**

** Need for land acquisition depends on mitigation option chosen*

Appendix A - Intersection Alternatives

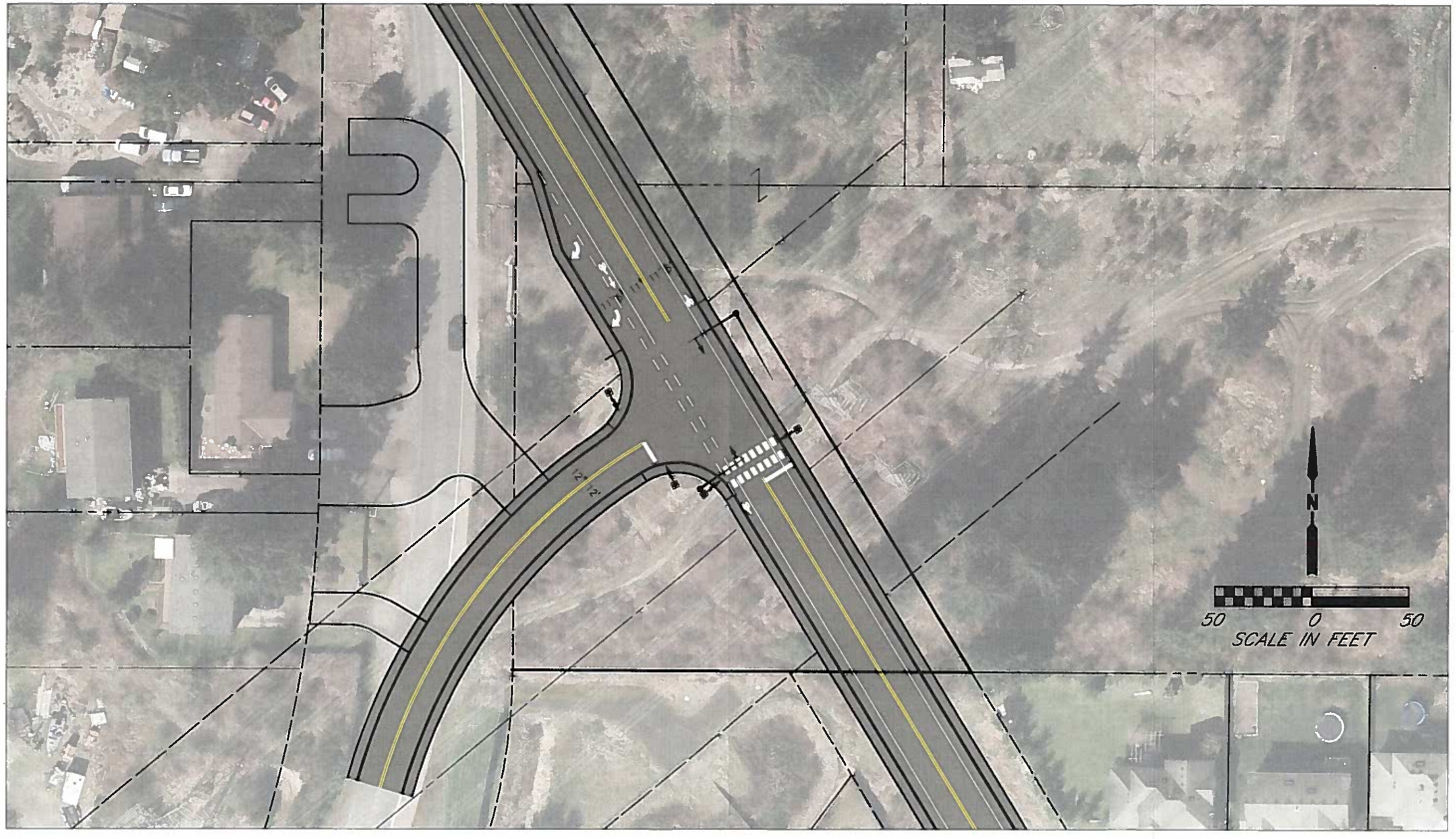


14th Ave W – Locust Way
RC1497 / 06–0025

North Corridor - Stop controlled (Future Signal)

Figure 1

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UPI YEAR_2006\06-0025\2 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: NORTH CORRIDOR - SIGNAL



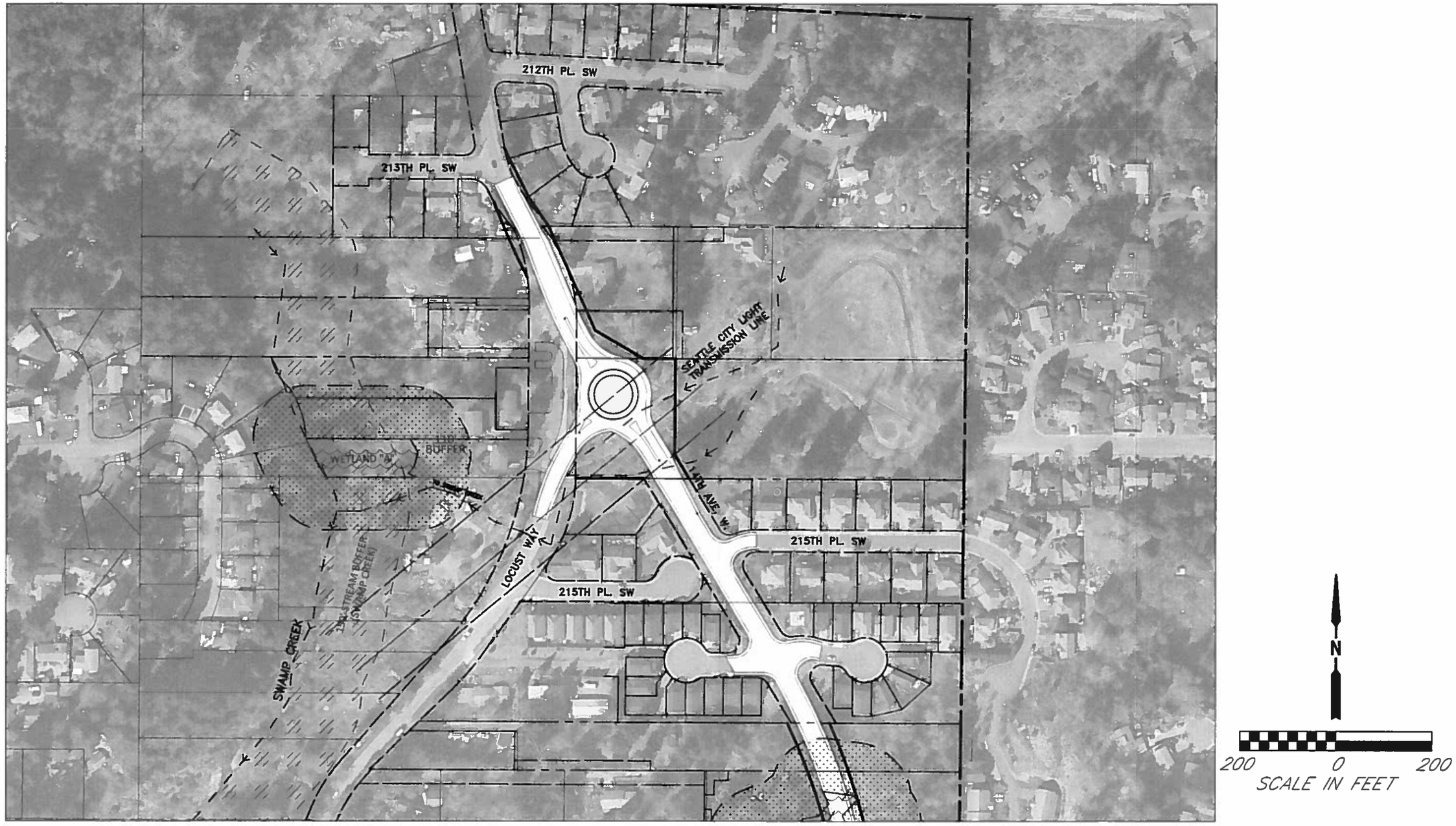
14th Ave W – Locust Way
RC1497 / 06–0025

Intersection Alternative 1
(Stop Controlled - Future Signal)

Figure 1A

Preliminary, Subject to change

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UP\YEAR_2006\06-002\2 CAD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: INTERSECTION ALT 1

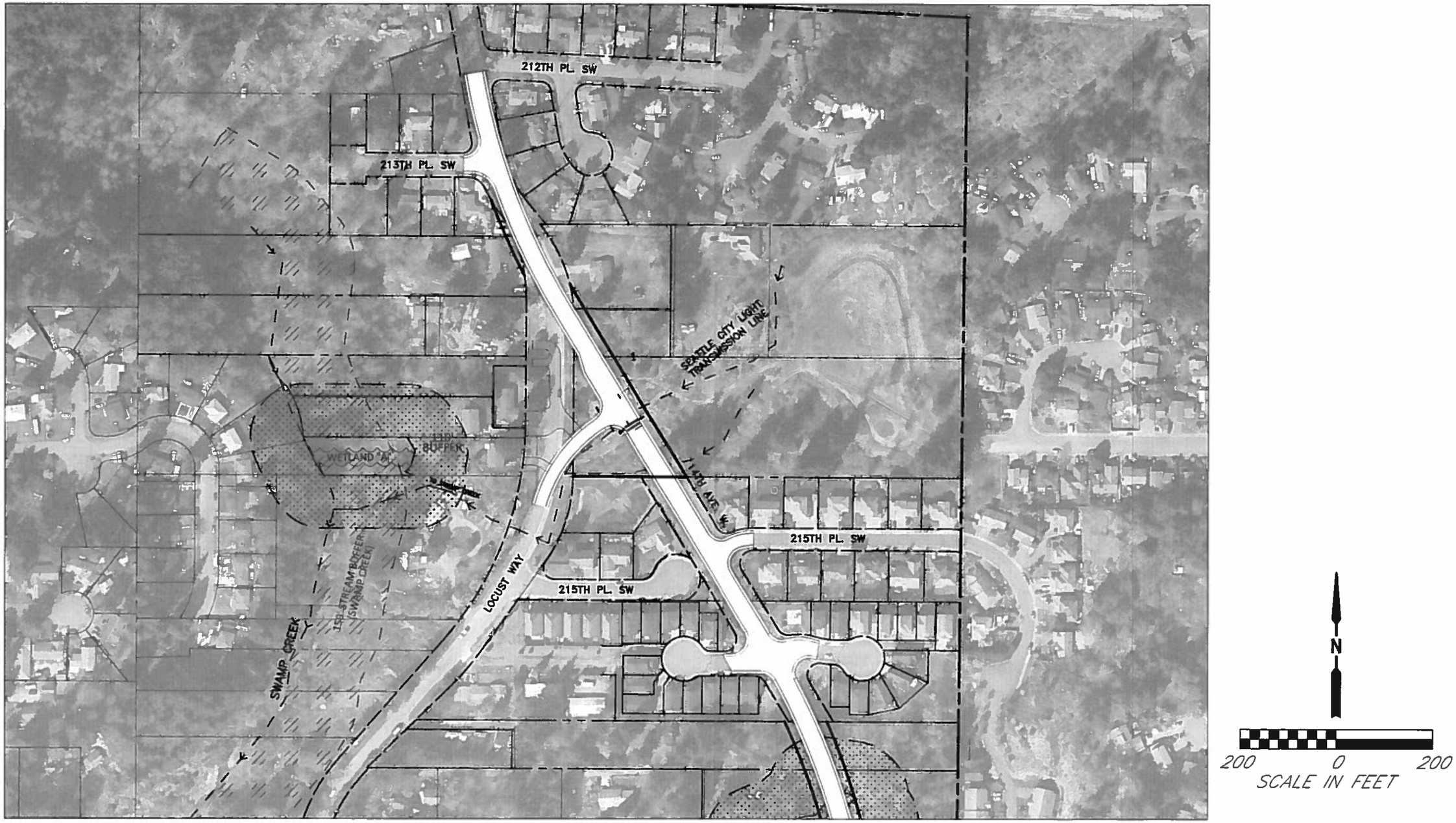


14th Ave W – Locust Way
RC1497 / 06-0025

North Corridor Plan - Roundabout

Figure 2

S:\PW_PROJECT_DATA_MANAGEMENT\G-PROJECTS_UPI YEAR_2006\06-0025\2 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: NORTH CORRIDOR - ROUNDABOUT

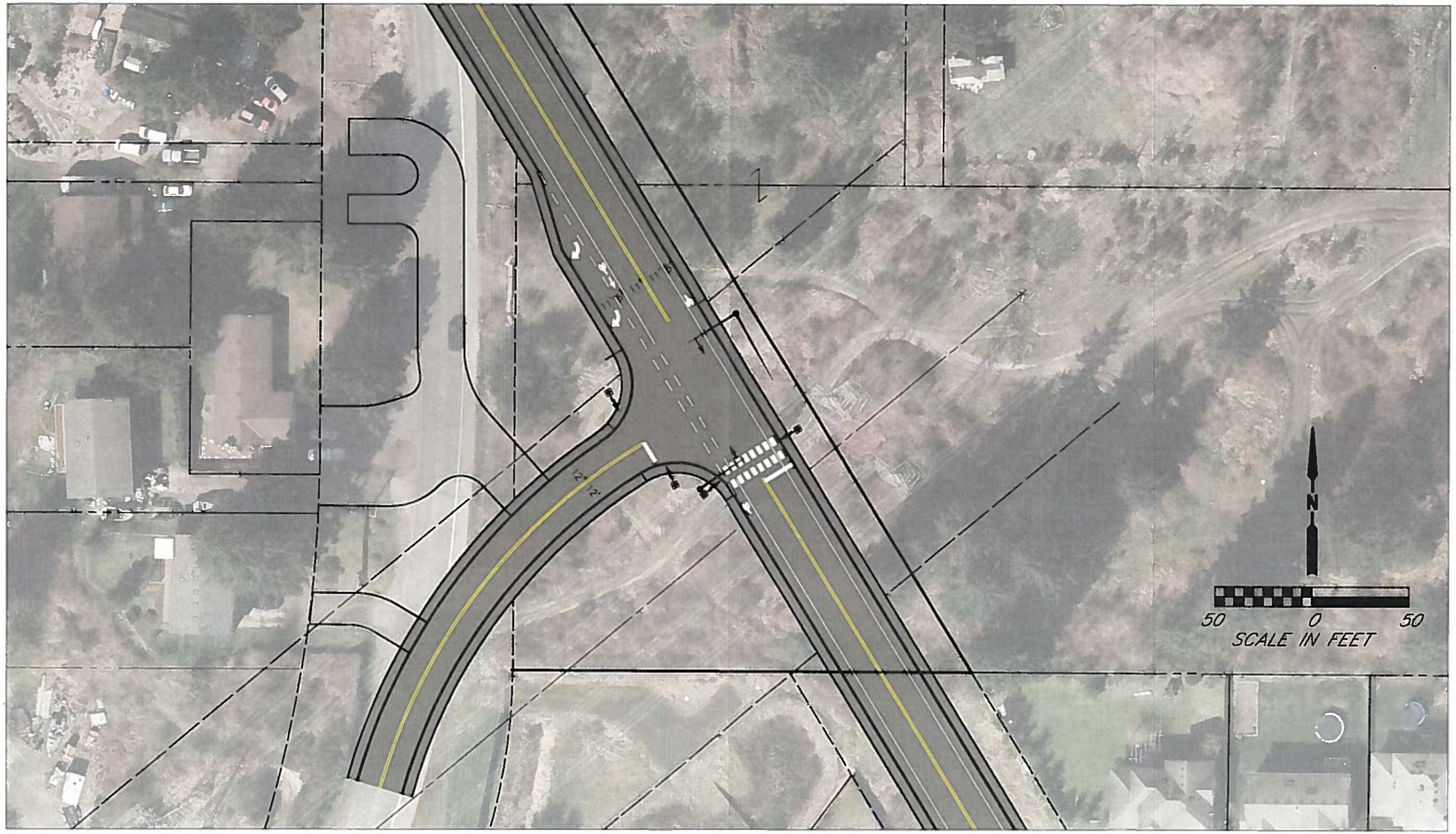


14th Ave W – Locust Way
RC1497 / 06–0025

North Corridor - Stop controlled (Future Signal)

Figure 1

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UPI YEAR_2006\06-0025\2 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: NORTH CORRIDOR - SIGNAL



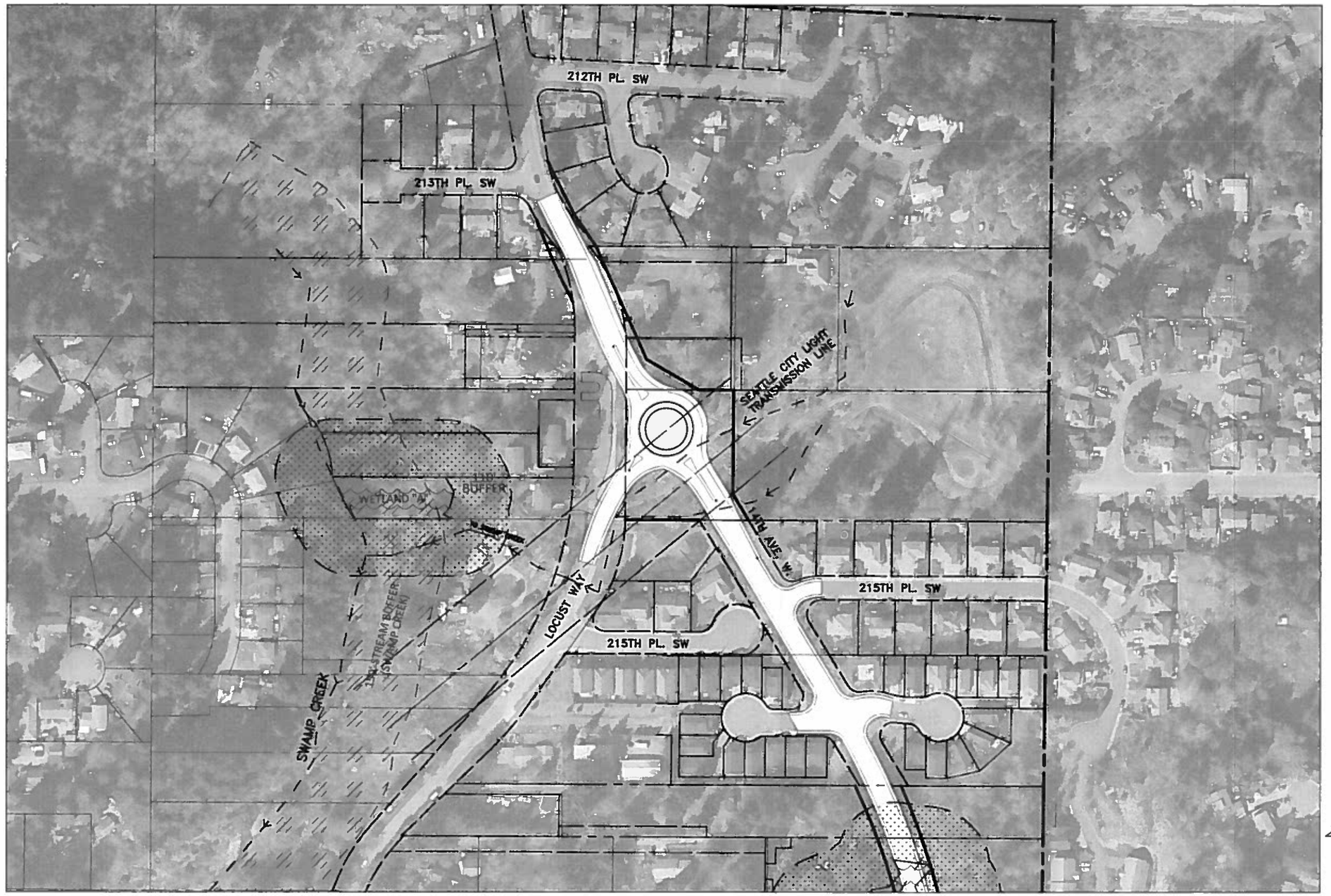
14th Ave W – Locust Way
RC1497 / 06–0025

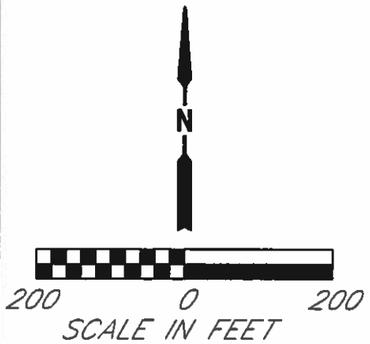
Intersection Alternative 1
(Stop Controlled - Future Signal)

Figure 1A

Preliminary, Subject to change

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UPI YEAR_2006\06-0025\2 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: INTERSECTION ALT 1



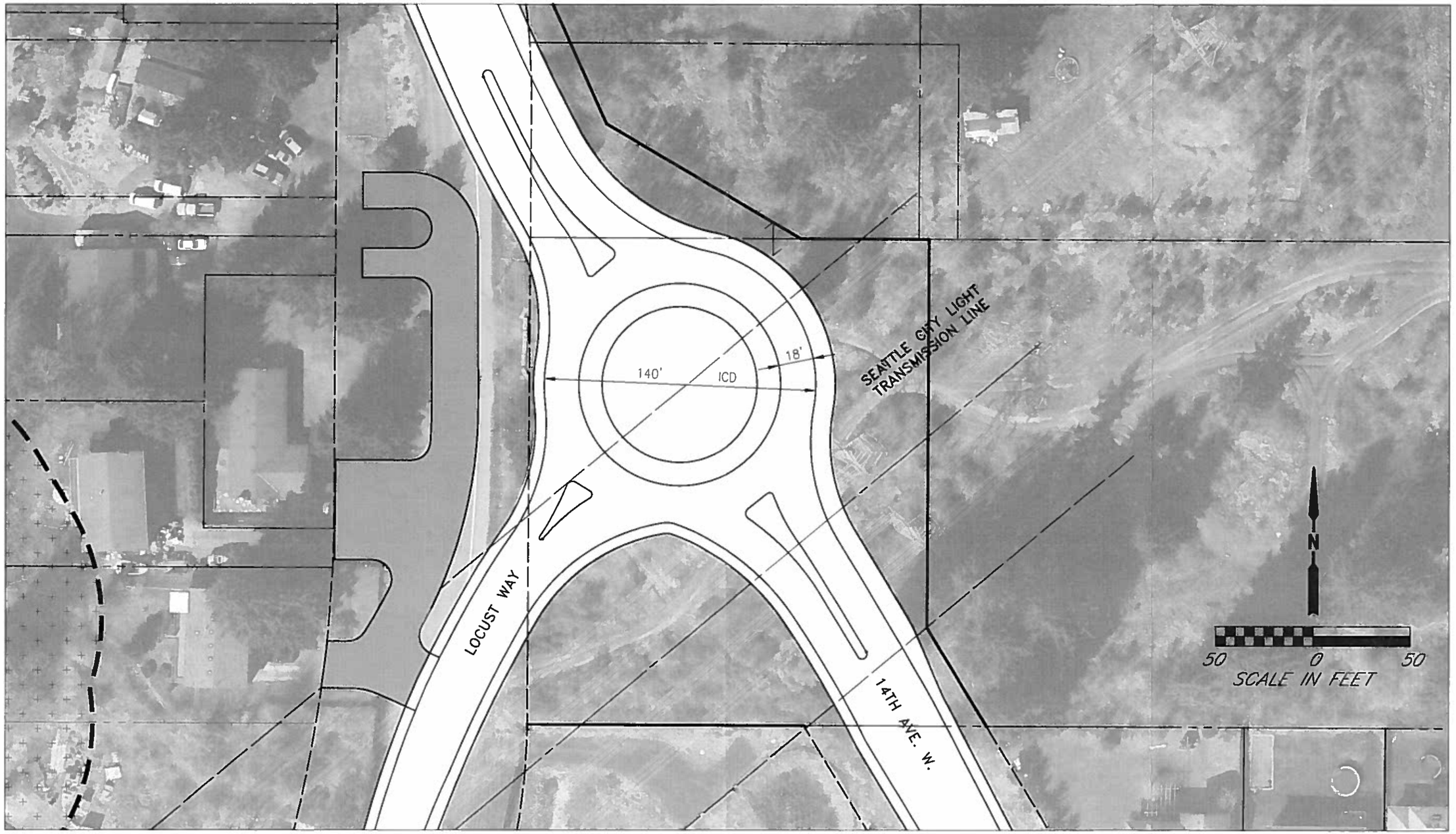


14th Ave W – Locust Way
RC1497 / 06-0025

North Corridor Plan - Roundabout

Figure 2

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UP\YEAR_2006\06-002\52 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: NORTH CORRIDOR - ROUNDABOUT

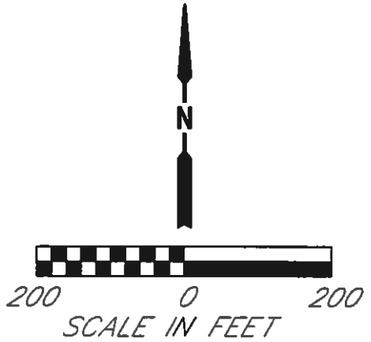


14th Ave W – Locust Way
RC1497 / 06–0025

Intersection Alternative 2 (Roundabout)

Figure 2A

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UPI YEAR_2006\06-00252 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: INTERSECTION ALT 2



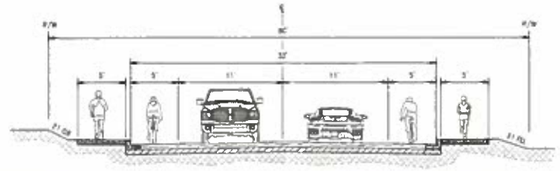
14th Ave W – Locust Way
RC1497 / 06–0025

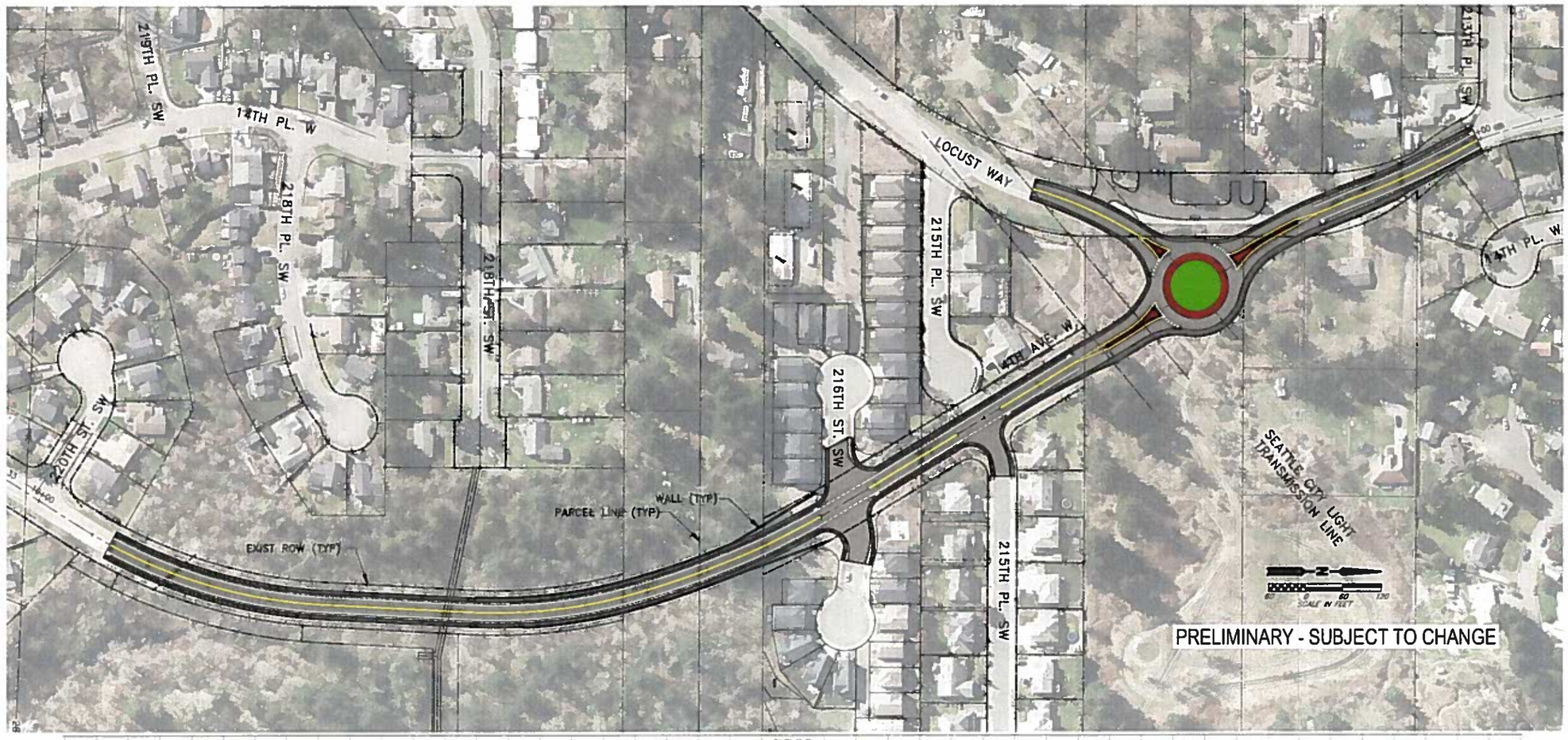
South Corridor

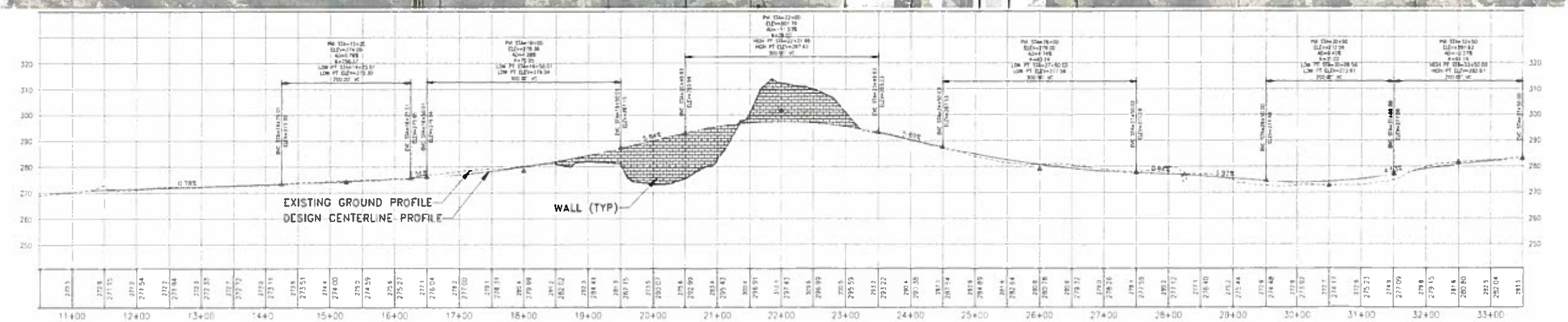
Figure 3

S:\PW_PROJECT_DATA_MANAGEMENT\6-PROJECTS_UPI YEAR_2006\06-0025\2 CADD\2.1 PRODUCTION DATA\DRAWINGS\DESIGN\EXHIBITS\06-0025 CORRIDOR - FIGURES.DWG - Layout Name: SOUTH CORRIDOR

Appendix B – Preliminary Plan and Profile




219TH PL. SW
14TH PL. W
218TH PL. SW
218TH ST. SW
220TH ST. SW
LOCUST WAY
215TH PL. SW
216TH ST. SW
14TH AVE. W
213TH PL. SW
14TH PL. W
SEATTLE CITY LIGHT TRANSMISSION LINE
WALL (TYP)
PARCEL LINE (TYP)
EXIST ROW (TYP)
215TH PL. SW
SCALE IN FEET
PRELIMINARY - SUBJECT TO CHANGE


EXISTING GROUND PROFILE
DESIGN CENTERLINE PROFILE
WALL (TYP)
11+00
12+00
13+00
14+0
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
29+00
30+00
31+00
32+00
33+00

Appendix C - Preliminary Project Cost Estimate

14th Ave W Extension to Locust Way (220th St SW-Locust Wy)

Urban two-lane with bicycle lane, planter, sidewalk, and **SINGLE LANE ROUNDABOUT**

PROJECT ESTIMATING DATA

ITEM	QUANTITY	UNIT	PLANNING LEVEL ESTIMATE UNIT COST	TOTAL COST
PREPARATION				
MOBILIZATION	1	L.S.	$5,708,900	570,900
CLEARING AND GRUBBING	4.20	ACRE	$10,000	42,000
REMOVAL OF STRUCTURE AND OBSTRUCTION	1	L.S.	$20,000	20,000
GRADING				
ROADWAY EXCAVATION INCL. HAUL	11,500	C.Y.	$25	287,500
GRAVEL BORROW INCL. HAUL	19,400	TON	$25	485,000
UNSUITABLE FOUNDATION EXCAVATION INCL HAUL	8,000	C.Y.	$35	280,000
DRAINAGE				
QUARRY SPALLS	14,300	TON	$30	429,000
UNDERDRAIN PIPE 6 IN. DIAM.	400	L.F.	$15	6,000
DROP INLET TYPE 1	2	EA	$3,000	6,000
SCHEDULE A CULVERT PIPE 30 IN DIAM	180	L.F.	$80	14,400
PRECAST REINFORCED CONC. BOX CULVERT	120	L.F.	$1,200	144,000
STORM SEWER				
CATCH BASIN TYPE 1	39	EA	$1,500	58,500
CATCH BASIN TYPE 2	10	EA	$4,000	40,000
CORRUGATED POLYETHYLENE STORM SEWER PIPE 12 IN. DIAM.	2,620	L.F.	$45	117,900
CORRUGATED POLYETHYLENE STORM SEWER PIPE 18 IN. DIAM.	660	L.F.	$60	39,600
DETENTION VAULTS - TDA 1	1	L.S.	$620,000	620,000
DETENTION VAULT - TDA 3	1	L.S.	$850,000	850,000
FILTERRA BIOPLANTER (4X6 UNIT)	10	EA	$13,500	135,000
SURFACING				
CRUSHED SURFACING BASE COURSE	3,300	TON	$30	99,000
CRUSHED SURFACING TOP COURSE	730	TON	$35	25,550
HOT MIX ASPHALT				
HMA CL. 1/2 IN. PG 64-22	1,760	TON	$100	176,000
HMA CL. 1 IN. PG 64-22	1,760	TON	$100	176,000
EROSION CONTROL AND ROADSIDE RESTORATION				
SILT FENCE	5,000	L.F.	$10	50,000
ESC LEAD	100	DAY	$100	10,000
TOPSOIL TYPE A	2,800	S.Y	$10	28,000
SEEDING, FERTILIZING, AND MULCHING	0.60	ACRE	$3,000	1,800
INLET PROTECTION	35	EA	$100	3,500
EROSION/WATER POLLUTION CONTROL	50,000	EST	$1	50,000
TRAFFIC				
CEMENT CONC. TRAFFIC CURB AND GUTTER	5,140	LF	$25	128,500
ROUNDABOUT CENTRAL ISLAND CEMENT CONC. CURB	300	LF	$90	27,000
BEAM GUARDRAIL FLARED TERMINAL	4	EA	$3,000	12,000
BEAM GUARDRAIL TYPE 1	600	LF	$45	27,000
BEAM GUARDRAIL TRANSITION SECTION TYPE 1	4	EA	$3,000	12,000
JUNCTION BOX - FUTURE UTILITY CONDUIT	25	EA	$500	12,500
PLASTIC WIDE LINE (TRAFFIC MARKINGS INCL SYM)	2,590	LF	$15	38,850
PERMANENT SIGNING	5,700	LF	$5	28,500
ROUNDABOUT TRUCK APRON CEMENT CONC. CURB & GUTTER	325	LF	$90	29,250
PROJECT TEMPORARY TRAFFIC CONTROL	1	L.S.	$150,000	150,000
CONSTRUCTION SIGNS CLASS "A"	100	SF	$15	1,500
OTHER				
STRUCTURE EXCAVATION CL B INCL HAUL	1,000	C.Y.	$25	25,000
CEMENT CONCRETE SIDEWALK	2,855	S.Y.	$60	171,300
CEMENT CONCRETE CURB RAMP	24	EA	$2,500	60,000
CEMENT CONCRETE DRIVEWAY APPROACH	100	S.Y.	$45	4,500
GRAVEL BACKFILL FOR WALL	990	C.Y.	$25	24,750
GEOGRID REINFORCED EARTH WALL	6,400	S.F.	$60	384,000
ROCK FOR ROCK WALL	200	TON	$20	4,000
WELDED WIRE FACED STRUCTURAL EARTH WALL	3,800	S.F.	$60	228,000
COATED CHAIN LINK FENCE TYPE 3	1,000	L.F.	$20	20,000
COATED CHAIN LINK FENCE TYPE 4	1,000	L.F.	$15	15,000
ROADSIDE CLEANUP	10,000	EST	$1	10,000
DEWATERING	100,000	EST	$1	100,000
SPCC PLAN	1	L.S.	$500	500
FUTURE UTILITY CONDUIT AND JUNCTION BOXES	10,840	L.F.	$10	108,400
ROUNDABOUT LANDSCAPING	1	L.S.	$25,000	25,000
MITIGATION - PLANTING/ENHANCEMENT	1	L.S.	$1,200,000	1,200,000
SUBTOTAL				7,613,000
CONTINGENCY			30%	2,284,000
CONSTRUCTION SUBTOTAL				**9,897,000**
PE ENGINEERING @ 20%			20%	1,979,000
CE ENGINEERING @ 15%			15%	1,485,000
LAND ACQUISITION FOR MITIGATION				925,000
RIGHT OF WAY (TRUE COST ESTIMATE: LAND + ACQ. FEES)				630,000
PROJECT TOTAL COST				$14,916,000

14th Ave W Extension to Locust Way (220th St SW-Locust Wy)

Urban two-lane with bicycle lane, planter, sidewalk, **STOP CONTROLLED INTERSECTION**

PROJECT ESTIMATING DATA

ITEM	QUANTITY	UNIT	PLANNING LEVEL ESTIMATE UNIT COST	TOTAL COST
PREPARATION				
MOBILIZATION	1	L.S.	$5,792,600	579,300
CLEARING AND GRUBBING	4.20	ACRE	$10,000	42,000
REMOVAL OF STRUCTURE AND OBSTRUCTION	1	L.S.	$20,000	20,000
GRADING				
ROADWAY EXCAVATION INCL. HAUL	11,500	C.Y.	$25	287,500
GRAVEL BORROW INCL. HAUL	19,400	TON	$25	485,000
UNSUITABLE FOUNDATION EXCAVATION INCL HAUL	8,000	C.Y.	$35	280,000
DRAINAGE				
QUARRY SPALLS	14,300	TON	$30	429,000
UNDERDRAIN PIPE 6 IN. DIAM.	400	L.F.	$15	6,000
DROP INLET TYPE 1	2	EA	$3,000	6,000
SCHEDULE A CULVERT PIPE 30 IN DIAM	180	L.F.	$80	14,400
PRECAST REINFORCED CONC. BOX CULVERT	120	L.F.	$1,200	144,000
STORM SEWER				
CATCH BASIN TYPE 1	39	EA	$1,500	58,500
CATCH BASIN TYPE 2	10	EA	$4,000	40,000
CORRUGATED POLYETHYLENE STORM SEWER PIPE 12 IN. DIAM.	2,620	L.F.	$45	117,900
CORRUGATED POLYETHYLENE STORM SEWER PIPE 18 IN. DIAM.	660	L.F.	$60	39,600
DETENTION VAULT - TDA 1	1	L.S.	$620,000	620,000
DETENTION VAULT - TDA 3	1	L.S.	$850,000	850,000
FILTERRA BIOPLANTER (4X6 UNIT)	11	EA	$13,500	148,500
SURFACING				
CRUSHED SURFACING BASE COURSE	3,300	TON	$30	99,000
CRUSHED SURFACING TOP COURSE	730	TON	$35	25,550
HOT MIX ASPHALT				
HMA CL. 1/2 IN. PG 64-22	1,760	TON	$100	176,000
HMA CL. 1 IN. PG 64-22	1,760	TON	$100	176,000
EROSION CONTROL AND ROADSIDE RESTORATION				
SILT FENCE	5,000	L.F.	$10	50,000
ESC LEAD	100	DAY	$100	10,000
TOPSOIL TYPE A	2,800	S.Y	$10	28,000
SEEDING, FERTILIZING, AND MULCHING	0.60	ACRE	$3,000	1,800
INLET PROTECTION	35	EA	$100	3,500
EROSION/WATER POLLUTION CONTROL	1	L.S.	$50,000	50,000
TRAFFIC				
CEMENT CONC. TRAFFIC CURB AND GUTTER	5,140	LF	$25	128,500
BEAM GUARDRAIL FLARED TERMINAL	4	EA	$3,000	12,000
BEAM GUARDRAIL TYPE 1	600	LF	$45	27,000
BEAM GUARDRAIL TRANSITION SECTION TYPE 1	4	EA	$3,000	12,000
JUNCTION BOX - FUTURE SIGNAL	3	EA	$400	1,200
JUNCTION BOX - FUTURE UTILITY CONDUIT	22	EA	$500	11,000
PLASTIC WIDE LINE (TRAFFIC MARKINGS INCL SYM)	2,590	LF	$15	38,850
PERMANENT SIGNING	5,200	LF	$5	26,000
CONDUIT PIPE 2 IN. DIAM.	245	LF	$25	6,125
CONDUIT PIPE 4 IN. DIAM.	490	LF	$30	14,700
PROJECT TEMPORARY TRAFFIC CONTROL	1	L.S.	$150,000	150,000
CONSTRUCTION SIGNS CLASS "A"	100	SF	$15	1,500
OTHER				
STRUCTURE EXCAVATION CL B INCL HAUL	1,000	C.Y.	$25	25,000
CEMENT CONCRETE SIDEWALK	2,855	S.Y.	$60	171,300
CEMENT CONCRETE CURB RAMP	24	EA	$2,500	60,000
CEMENT CONCRETE DRIVEWAY APPROACH	100	S.Y.	$45	4,500
GRAVEL BACKFILL FOR WALL	990	C.Y.	$25	24,750
GEOGRID REINFORCED EARTH WALL	6,400	S.F.	$60	384,000
ROCK FOR ROCK WALL	200	TON	$20	4,000
WELDED WIRE FACED STRUCTURAL EARTH WALL	3,800	S.F.	$60	228,000
COATED CHAIN LINK FENCE TYPE 3	1,000	L.F.	$20	20,000
COATED CHAIN LINK FENCE TYPE 4	1,000	L.F.	$15	15,000
ROADSIDE CLEANUP	10,000	EST	$1	10,000
DEWATERING	1	EST	$100,000	100,000
SPCC PLAN	1	L.S.	$500	500
FUTURE UTILITY CONDUIT AND JUNCTION BOXES	10,840	L.F.	$10	108,400
MITIGATION - PLANTING/ENHANCEMENT	1	L.S.	$1,200,000	1,200,000
SUBTOTAL				7,572,000
CONTINGENCY			30%	2,272,000
CONSTRUCTION SUBTOTAL				**9,844,000**
PE ENGINEERING @ 20%			20%	1,969,000
CE ENGINEERING @ 15%			15%	1,477,000
LAND ACQUISITION FOR MITIGATION				925,000
RIGHT OF WAY (LAND + ACQ. FEES)				610,000
PROJECT TOTAL COST				$14,825,000

Appendix D – Traffic Report and Warrants

Snohomish County
Public Works

MEMORANDUM

DATE: August 16, 2016

TO: Bin Lee, P.E., P.T.O.E; Engineer III
TES- Traffic Operations

FROM: Stephanie Prescott, P.E., Engineer II
TES – Traffic Operations

SUBJECT: Roundabout Warrant for Locust Way and 14th Ave W

Based on Washington State Guidelines published in the WSDOT Design manual, a roundabout should be considered an alternative for this intersection. The proposed intersection at Locust Way and 14th Ave W will be a three legged intersection of an Urban Minor Arterial with an Urban Collector. Forecast volumes for 2035 were used for this analysis, these were supplied from Program Planning. For this project it is assumed that the north south alignment will by 14th Ave W to Locust way and that the Southwest leg (existing Locust Way) will be the stem leg on the T-intersection (Minor leg). The forecast 2035 generated PM peak volumes were analyzed using Synchro/SimTraffic. Per the Synchro HCM results, the 2035 forecast operations for a two-way stop controlled intersection will be LOS A (2.2 sec). Operating this intersection as a roundabout will result in LOS B (12.6 sec). If the intersection is signalized, the LOS would be LOS A (6.6 sec). Although there are two signal warrants met for the future intersection with 2035 volumes, the delay is more than operating the intersection with a two-way stop control or roundabout. This signal was planned with two phases and no protection for northbound left-turn and an added southbound right-turn pocket. It should also be noted that the analysis also took into consideration the operations of the intersection at Logan/Locust and Larch Way due to its being 1276ft away. It was assumed that they signal will be installed at this location and that all approaches will have a left turn pocket and that the right turn pockets will be added to Eastbound and Northbound approaches.

The tables below and the attached Synchro HCM 2010 reports summarize the Levels of Service for each of the approaches with the various intersection controls.

Table 1 – Level of Service and Delays (sec)

	Intersection	Eastbound	Northbound	Southbound
Two Way Stop Control	A (2.2)	D (25.6)	A (7.9)	A (0.0)
Roundabout	B (12.6)	A (5.4)	C (16.4)	A (6.0)
Signal w/ warranted turn lanes/pockets	A (6.6)	B (15.3)	A (6.7)	A (3.5)

Table 2 below summarizes the queues that were generated using SimTraffic for each of the scenarios. The table only reports the longest queue for each approach.

Table 2 - 95% Queue lengths for each approach (ft)

	Eastbound	Northbound	Southbound
Two Way Stop Control	112	256	0
Roundabout	42	193	0
Signal w/ warranted turn lanes/pockets	112	175	75

Attachments

cc: Theam Ong, TADM Supervisor, TES-Traffic Operations
Sheela George, P.E. Project Manager (Engineer III), PW Engineering Services

Round-a-bout Warrant

Analyst:	SVP
Date:	8/15/2016

Instructions:
These are the guidelines set up by WSDOT and published in the WSDOT Design manual.
There were several other guidelines publish and many mention the following.
Answer the following questions, putting the answer in the highlighted boxes.
If the majority of the questions are answered as yes, then a round-about should be considered.

Intersection:	Locust Way and 14th Ave W
Primary Rd:	Locust Way
Secondary Rd:	14th Ave W
Peak Hour:	PM Peak 2035 forecast

	Eastbound	Westbound	Northbound	Southbound
What is the existing sidestreet LOS operation. (LOS A, B, C, D, E, F)?	D		A	A
What is the left-Turn percentage by approach? (LT/TOTAL)	0.98		0.00	0.00
Pedestrians during peak hours	0.00		0.00	0.00
Existing queues (Symtraffic report)	112.00		256.00	0.00
Roundabout Queues	42.00		193.00	0.00
How many legs are there?	3			
Corridor Speeds	Marked (mph)	35	Actual 85% (mph)	40

	Through Movement	Turning Movement
Accidents (WITHIN 3 YR PERIOD)	0	0

Is there adequate Right of Way: No

Is a traffic Signal warranted (yes/no)	yes
Is a four way stop warranted (yes/no)	yes

Should the roundabout be considered? Yes

Due to lack of intersection at this location, there are no collisions at this location

Intersection	
Int Delay, s/veh	2.2

Movement	NBL	NBT	SBT	SBR	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	2	688	226	66	90	2
Future Vol, veh/h	2	688	226	66	90	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	3	3	3	4	4
Mvmt Flow	2	724	238	69	95	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	307	0	-	0	1001	273
Stage 1	-	-	-	-	273	-
Stage 2	-	-	-	-	728	-
Critical Hdwy	4.13	-	-	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.227	-	-	-	3.536	3.336
Pot Cap-1 Maneuver	1248	-	-	-	267	761
Stage 1	-	-	-	-	768	-
Stage 2	-	-	-	-	474	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1248	-	-	-	266	761
Mov Cap-2 Maneuver	-	-	-	-	266	-
Stage 1	-	-	-	-	768	-
Stage 2	-	-	-	-	473	-

Approach	NB	SB	NE
HCM Control Delay, s	0	0	25.6
HCM LOS			D

Minor Lane/Major Mvmt	NELn1	NBL	NBT	SBT	SBR
Capacity (veh/h)	270	1248	-	-	-
HCM Lane V/C Ratio	0.359	0.002	-	-	-
HCM Control Delay (s)	25.6	7.9	0	-	-
HCM Lane LOS	D	A	A	-	-
HCM 95th %tile Q(veh)	1.6	0	-	-	-

Intersection: 3: Locust Way & Larch Way/Logan Way

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	310	188	1364	143
Average Queue (ft)	310	150	1104	96
95th Queue (ft)	310	199	1572	149
Link Distance (ft)	295	284	1362	314
Upstream Blk Time (%)	100		8	
Queuing Penalty (veh)	0		65	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Locust Way & 14th AVe W

Movement	NB	NE
Directions Served	LT	LR
Maximum Queue (ft)	273	108
Average Queue (ft)	84	68
95th Queue (ft)	256	112
Link Distance (ft)	297	288
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 65

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	97	726	307
Demand Flow Rate, veh/h	101	748	316
Vehicles Circulating, veh/h	245	99	2
Vehicles Exiting, veh/h	73	247	845
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	5.4	16.4	6.0
Approach LOS	A	C	A

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	101	748	316
Cap Entry Lane, veh/h	884	1023	1128
Entry HV Adj Factor	0.960	0.971	0.971
Flow Entry, veh/h	97	726	307
Cap Entry, veh/h	849	994	1095
V/C Ratio	0.114	0.731	0.280
Control Delay, s/veh	5.4	16.4	6.0
LOS	A	C	A
95th %tile Queue, veh	0	7	1

Queuing and Blocking Report
2035 PM Peak Roundabout

8/16/2016

Intersection: 3: Locust Way & Larch Way/Logan Way

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	T	R	L	TR
Maximum Queue (ft)	174	341	175	174	280	174	475	225	174	323
Average Queue (ft)	81	287	43	38	162	131	120	94	61	170
95th Queue (ft)	199	356	143	106	257	190	276	172	149	277
Link Distance (ft)		288			265		1236			308
Upstream Blk Time (%)		28			1					0
Queuing Penalty (veh)		0			0					0
Storage Bay Dist (ft)	150		150	150		150		200	150	
Storage Blk Time (%)	0	38	0		8	7	0	0		10
Queuing Penalty (veh)	0	47	0		3	33	3	0		5

Intersection: 6: 14th AVe W & Locust Way

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	55	284
Average Queue (ft)	14	76
95th Queue (ft)	42	193
Link Distance (ft)	313	267
Upstream Blk Time (%)		2
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 91

Lanes, Volumes, Timings
6: 14th AVe W & Locust Way

8/16/2016

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	90	2	2	688	226	66
Future Volume (vph)	90	2	2	688	226	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150	0	150			150
Storage Lanes	0	0	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997					0.850
Flt Protected	0.953					
Satd. Flow (prot)	1753	0	0	1845	1827	1553
Flt Permitted	0.953			0.999		
Satd. Flow (perm)	1753	0	0	1843	1827	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	2					69
Link Speed (mph)	35			30	35	
Link Distance (ft)	451			404	1420	
Travel Time (s)	8.8			9.2	27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	3%	3%	3%	3%	4%	4%
Adj. Flow (vph)	95	2	2	724	238	69
Shared Lane Traffic (%)						
Lane Group Flow (vph)	97	0	0	726	238	69
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1		1	2	2	1
Detector Template	Left		Left	Thru	Thru	Right
Leading Detector (ft)	20		20	100	100	20
Trailing Detector (ft)	0		0	0	0	0
Detector 1 Position(ft)	0		0	0	0	0
Detector 1 Size(ft)	20		20	6	6	20
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot		Perm	NA	NA	Perm
Protected Phases	4			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases			2			6
Detector Phase	4		2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		37.5	37.5	37.5	37.5
Total Split (%)	37.5%		62.5%	62.5%	62.5%	62.5%
Maximum Green (s)	18.0		33.0	33.0	33.0	33.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0
Total Lost Time (s)	4.5			4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		None	None	None	None
Walk Time (s)	7.0				7.0	7.0
Flash Dont Walk (s)	11.0				11.0	11.0
Pedestrian Calls (#/hr)	0				0	0
Act Effct Green (s)	9.5			24.2	24.2	24.2
Actuated g/C Ratio	0.30			0.75	0.75	0.75
v/c Ratio	0.19			0.52	0.17	0.06
Control Delay	15.3			6.7	4.0	1.5
Queue Delay	0.0			0.0	0.0	0.0
Total Delay	15.3			6.7	4.0	1.5
LOS	B			A	A	A
Approach Delay	15.3			6.7	3.5	
Approach LOS	B			A	A	

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 32.2	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.52	
Intersection Signal Delay: 6.6	Intersection LOS: A
Intersection Capacity Utilization 50.4%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 6: 14th AVe W & Locust Way

Queuing and Blocking Report
2035 PM Peak

8/16/2016

Intersection: 3: Locust Way & Larch Way/Logan Way

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	R	L	TR	L	T	R	L	TR
Maximum Queue (ft)	175	304	175	174	300	174	337	208	174	308
Average Queue (ft)	65	271	57	39	165	128	104	100	49	165
95th Queue (ft)	169	364	165	106	272	178	202	163	114	260
Link Distance (ft)		288			265		1354			308
Upstream Blk Time (%)		25			3					0
Queuing Penalty (veh)		0			0					0
Storage Bay Dist (ft)	150		150	150		150		500	150	
Storage Blk Time (%)		35	0		9	6	2			13
Queuing Penalty (veh)		43	0		3	28	9			6

Intersection: 6: 14th AVe W & Locust Way

Movement	EB	NB	SB	SB
Directions Served	LR	LT	T	R
Maximum Queue (ft)	176	243	139	31
Average Queue (ft)	55	83	25	11
95th Queue (ft)	112	175	75	34
Link Distance (ft)	406	367	1354	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				150
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Network Summary

Network wide Queuing Penalty: 90

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	97	726	307
Demand Flow Rate, veh/h	101	748	316
Vehicles Circulating, veh/h	245	99	2
Vehicles Exiting, veh/h	2	247	845
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	5.4	16.4	4.1
Approach LOS	A	C	A

Lane	Left	Left	Left	Bypass
Designated Moves	LR	LT	T	R
Assumed Moves	LR	LT	T	R
RT Channelized				Free
Lane Util	1.000	1.000	1.000	
Critical Headway, s	5.193	5.193	5.193	
Entry Flow, veh/h	101	748	245	71
Cap Entry Lane, veh/h	884	1023	1128	1957
Entry HV Adj Factor	0.960	0.971	0.971	0.971
Flow Entry, veh/h	97	726	238	69
Cap Entry, veh/h	849	994	1095	1900
V/C Ratio	0.114	0.731	0.217	0.036
Control Delay, s/veh	5.4	16.4	5.3	0.0
LOS	A	C	A	A
95th %tile Queue, veh	0	7	1	0

SNOHOMISH COUNTY
Public Works

MEMORANDUM

DATE: Thursday, August 4, 2016

TO: Bin Lee, P.E., P.T.O.E., Traffic Signal Operations Engineer

FROM: Don Wisehart, Engineer I, TES-Traffic Operations

SUBJECT: **Forecast 2035 Signal Warrant for 14 Avenue West (Extension) @ Locust Way**

Attached you will find a Traffic Signal Warrant Analysis for the above location. The warrant was requested by Eric Nordstrom as part of the *14th Avenue West Extension Project* (RC1497). A turn-warrant analysis is included. A roundabout warrant and capacity analysis for a signal and roundabout will also be performed. A decision is still pending on whether a 6-year forecast will be needed. That will come at a later date if needed.

The warrant examines the proposed new intersection of the 14th Avenue West extension with Locust Way approximately 425 feet north of 215th Place SW. Joseph Bervell in Program Planning developed the 2035 approach volumes, PM turning movement volumes and ADT's that were used in the warrant process.

The following warrants were met with the forecast 2035 volumes.

Warrant 2: Four Hour Vehicular Volume
Warrant 3B: Peak Hour Volume
All-Way Stop: Warrant A

Please complete the following statement, sign where indicated, and return it to me as soon as possible. The attached analysis shows that a signal **is / is not** warranted based on forecast 2035 volumes.

Comments:

Signed: _____ Date: 8/18/16
Title: Traffic Signal Operations Engineer

If you have any questions or need additional information, please e-mail or call me on extension 4593.

Bin Lee, P.E., P.T.O.E.; Traffic Signal Operations Engineer
Thursday, August 4, 2016

DW

Attachments

cc: Sheela George, P.E. Project Manager (Engineer III), PW-Engineering Services
Eric Nordstrom, P.E. Project Engineer (Engineer II), PW-Engineering Services
Theam Ong, TADM Supervisor, TES-Traffic Operations
Stephanie Prescott, P.E., Engineer II, TES-Traffic Operations

SIGNAL WARRANTS CHECKLIST

Date of Counts: 4/27/16	**Location:14 AVE W EXTENSION @ LOCUST WAY**
Analyzed By: D. WISEHART	**Forecast Warrant (2035)**
Date of Analysis: 8/4/16	
Checked By: SNP	
Date Checked: 8-15-16	
Reviewed By: 8-18-16	
Date Reviewed:	

		Met/Not Met
Warrant 1A	Minimum Volume	Not Met
Warrant 1B	Interruption	Not Met
Warrant 1C	Combination of Warrants	Not Met
Warrant 2	Four Hour Volumes	**Met**
Warrant 3A	Peak Hour Delay	Not Met
Warrant 3B	Peak Hour Volume	**Met**
Warrant 4	Pedestrian Volume	N/A
Warrant 5	School Crossing	N/A
Warrant 6	Coordinated Signal System	N/A
Warrant 7	Crash Experience	Not Met
Warrant 8	Roadway Network	N/A
Warrant 9	Intersection Near Grade Crossing	N/A

All-Way Stop Warrant	**Met**

14 AVE W (EXTENSION) @ LOCUST WAY 08/03/16
2035 SIGWAR ANALYSIS BY D. WISEHART ORIG. COUNT: 4/27/16 18:32:50
CHECKED BY: SVP DATE: 8-15-16

TEAPAC[Ver 8.62.01] - MUTCD Warrant Analysis

Conditions Used for Warrant Analysis	2009 MUTCD

Intersection # 1 (14 AVE W EXT. @ LOCUST WAY)

Major Street Direction	NorthSouth
Number of Lanes in North-South direction	1
Number of Lanes in East-West direction	1
Approach speed on major street is greater than 40 mph	Yes
Isolated community has population less than 10,000	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to improve conditions	No
Number of accidents correctable by a signal	0
Peak hour stop sign delay for worst minor approach (veh-hours)	1
Number of accidents correctable by a multi-way stop	0
Peak hour average delay for all minor approaches (sec/veh)	26

TEAPAC[Ver 8.62.01] - Warrant Analysis for Traffic Signal

Warrant 1A Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	105
Major Volume	975	936	841	790	610	561	453	712	350
Warrant Met?	Yes	Yes	No	No	No	No	No	No	8

Number of 1-hour periods meeting the warrant	2
Signal will not seriously disrupt progressive traffic flow	Yes

>> WARRANT 1A IS NOT MET <<

Warrant 1B Analysis - 8-Hour Interruption of Continuous Traffic

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	53
Major Volume	975	936	841	790	610	561	453	712	525
Warrant Met?	Yes	Yes	Yes	Yes	Yes	No	No	No	8

Number of 1-hour periods meeting the warrant	5
Signal will not seriously disrupt progressive traffic flow	Yes

>> WARRANT 1B IS NOT MET <<

14 AVE W (EXTENSION) @ LOCUST WAY 08/03/16
2035 SIGWAR ANALYSIS BY D. WISEHART ORIG. COUNT: 4/27/16 18:32:50
CHECKED BY: SMP DATE: 8-15-16

TEAPAC[Ver 8.62.01] - Warrant Analysis for Traffic Signal

Warrant 1A Analysis (80%) - 8-Hour Minimum Vehicular Volume

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	84
Major Volume	975	936	841	790	610	561	453	712	280
Warrant Met?	Yes	Yes	Yes	No	No	No	No	No	8

Number of 1-hour periods meeting the warrant (56% allowed) 3

Warrant 1B Analysis (80%) - 8-Hour Interruption of Continuous Traf

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	42
Major Volume	975	936	841	790	610	561	453	712	420
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	8

Number of 1-hour periods meeting the warrant (56% allowed) 7

Warrant 1C Analysis - 8-Hour Combination of Warrants

80% of Warrants 1A and 1B are met (56% allowed)	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce delays	No

>> WARRANT 1C IS NOT MET <<

Warrant 2 Analysis - 4-Hour Vehicular Volume

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	——
Minor Reqrmt	60	60	60	61	93	107	144	69	<--
Warrant Met?	Yes	Yes	Yes	Yes	No	No	No	No	4

Number of 1-hour periods meeting the warrant	4
Signal will not seriously disrupt progressive traffic flow	Yes

>> WARRANT 2 IS MET <<

14 AVE W (EXTENSION) @ LOCUST WAY 08/03/16
2035 SIGWAR ANALYSIS BY D. WISEHART ORIG. COUNT: 4/27/16 18:32:50
CHECKED BY: SW DATE: 8-15-16

TEAPAC[Ver 8.62.01] - Warrant Analysis for Traffic Signal

Warrant 3A Analysis - Peak Hour Delay

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	100
Total Volume	1091	1045	935	871	666	610	499	750	650
Warrant Met?	Yes	Yes	No	No	No	No	No	No	1

Number of 1-hour periods meeting the warrant	2
Signal will not seriously disrupt progressive traffic flow	Yes
Delay for worst minor approach (must be at least 4 veh-hours)	1

>> WARRANT 3A IS NOT MET <<

Warrant 3B Analysis - Peak Hour Volume

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	——
Minor Reqrmt	83	86	105	118	177	196	244	141	<--
Warrant Met?	Yes	Yes	No	No	No	No	No	No	1

Number of 1-hour periods meeting the warrant	2
Signal will not seriously disrupt progressive traffic flow	Yes

>> WARRANT 3B IS MET <<

Warrant 7 Analysis - Crash Experience

80% of Warrant 1A or 1B is met	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce accidents	No
Number of correctable accidents (must be 5 or more per year)	0

>> WARRANT 7 IS NOT MET <<

Summary of MUTCD Traffic Signal Warrant Analysis

Warrant 1A 8-Hour Minimum Vehicular Volume	NOT MET
Warrant 1B 8-Hour Interruption of Continuous Traffic	NOT MET
Warrant 1C 8-Hour Combination of Warrants	NOT MET
Warrant 2 4-Hour Vehicular Volume	MET
Warrant 3A Peak Hour Delay	NOT MET
Warrant 3B Peak Hour Volume	MET
Warrant 7 Crash Experience	NOT MET

>> Traffic Signal Warrant is MET <<

14 AVE W (EXTENSION) @ LOCUST WAY 08/03/16
2035 SIGWAR ANALYSIS BY D. WISEHART ORIG. COUNT: 4/27/16 18:32:50
CHECKED BY: SVP DATE: 8-15-16

TEAPAC[Ver 8.62.01] - Warrant Analysis for Multi-way Stop

Warrant A Analysis - Interim Measure for Signal

If signal warrants are met, a temporary multi-way stop is allowed

>> WARRANT A IS MET <<

Warrant B Analysis - Crash Experience

Number of correctable accidents (must be 5 or more per year) 0

>> WARRANT B IS NOT MET <<

Warrant C Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	140
Major Volume	975	936	841	790	610	561	453	712	210
Warrant Met?	No	No	No	No	No	No	No	No	8

Average minor volume for 8 highest minor hours	74
Average major volume for 8 highest minor hours	735
Delay for all minor approaches (must be at least 30 sec/veh)	26

>> WARRANT C IS NOT MET <<

Warrant D Analysis - 8-Hour Combination of Warrants

Start Time	1700	1600	1800	1500	1400	1900	1300	800	Req.
Minor Volume	116	109	94	81	56	49	46	38	160
Major Volume	975	936	841	790	610	561	453	712	240
Warrant Met?	No	No	No	No	No	No	No	No	8

Average minor volume for 8 highest minor hours	74
Average major volume for 8 highest minor hours	735
Number of correctable accidents (must be 4 or more per year)	0
Delay for all minor approaches (must be at least 24 sec/veh)	26

>> WARRANT D IS NOT MET <<

Summary of MUTCD Multi-way Stop Warrant Analysis

Warrant A Interim Measure for Signal	MET
Warrant B Crash Experience	NOT MET
Warrant C 8-Hour Minimum Vehicular Volume	NOT MET
Warrant D 8-Hour Combination of Warrants	NOT MET

>> Multi-way Stop Warrant is MET <<

14 AVE W EXT. @ LOCUST WAY

RIGHT-TURN ANALYSIS

AT UNSIGNALIZED INTERSECTIONS

SOUTHBOUND (LOCUST WAY)

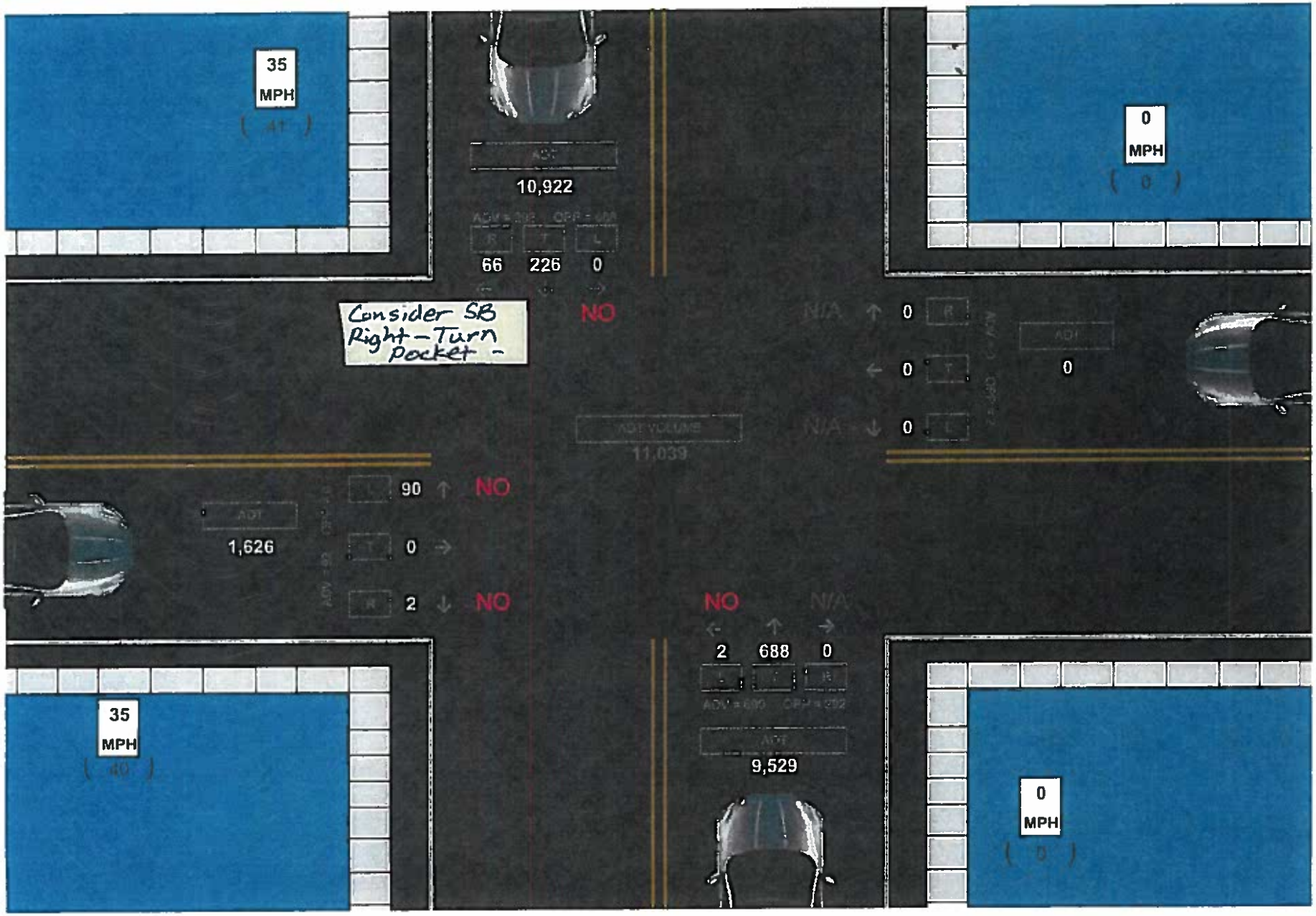
Peak Hour Approach Volume =	292
Peak Hour Right-Turn Volume =	66
Adjusted Right-Turn Volume =	46

Right-Turn Lane is NOT Warranted, however a Right-Turn Pocket should be considered -see graph- 8/4/16

Note: See attached Page 1310-40, WSDOT Design Manual

Prepared by: D. WISEHART
Date: 8/4/2016
Based on Volumes from a Turning Movement Count dated 1/1/35
Checked by: SP
Date Checked: 8-9-16

* BASED on 2035 FORECAST VOLUMES


35
MPH
(41)
ADT
10,922
66
226
0
Consider SB
Right-Turn
Pocket -
NO
0
MPH
(0)
N/A
0
0
0
N/A
ADT
0
ADT VOLUME
11,039
90
NO
ADT
1,626
0
2
NO
NO
N/A
2
688
0
ADT
9,529
35
MPH
(40)
0
MPH
(0)

Year 2035 Demand Forecasts

14th Avenue West Extension

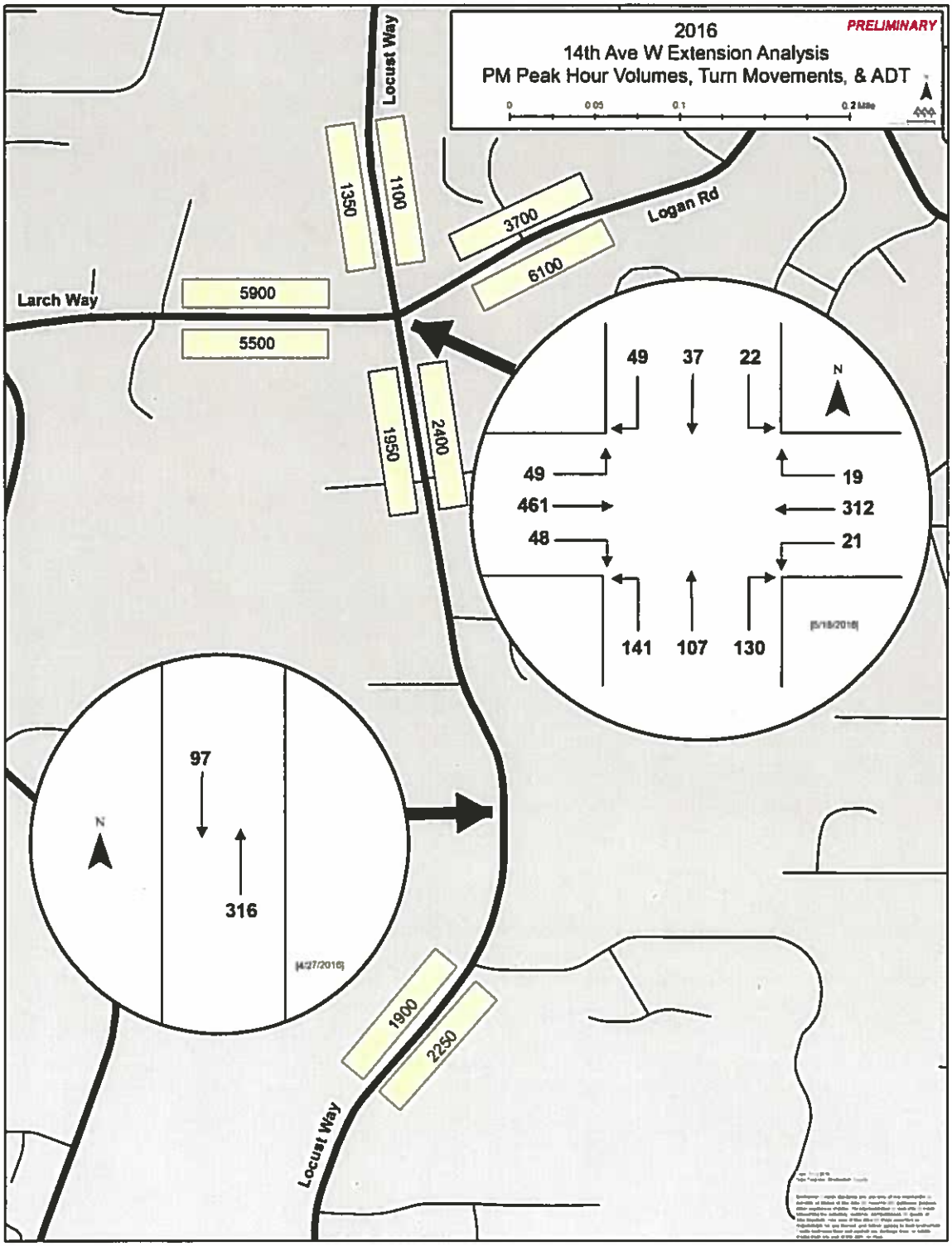
&

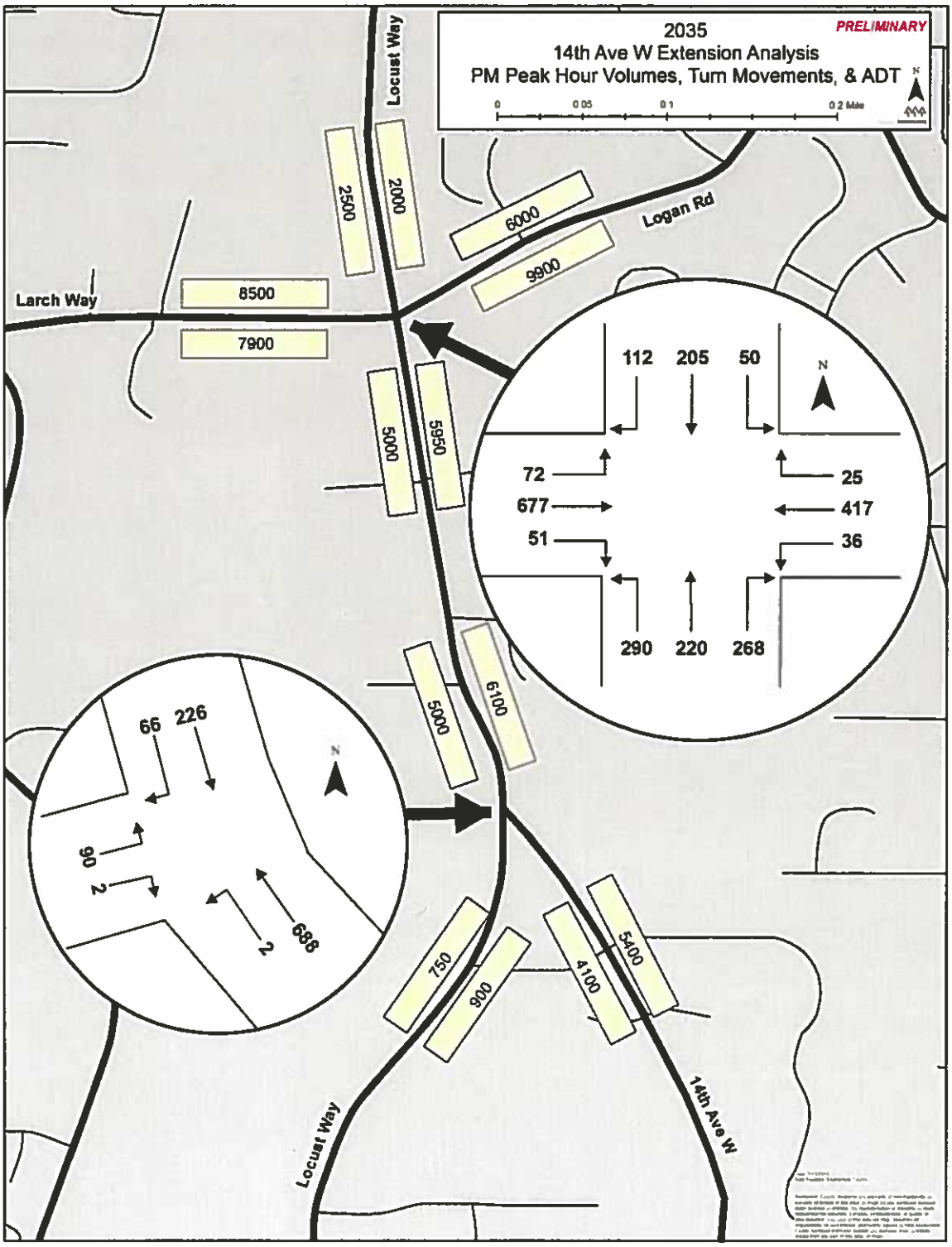
Locust Way @ Larch Way Intersection

Snohomish County Public Works

Program Planning

July, 2016


2016
14th Ave W Extension Analysis
PM Peak Hour Volumes, Turn Movements, & ADT
PRELIMINARY
0
0.05
0.1
0.2 Mile
Locust Way
Logan Rd
Larch Way
1350
1100
3700
6100
5900
5500
1950
2400
1900
2250
49
37
22
N
49
461
48
19
312
21
141
107
130
[5/18/2016]
97
316
N
[4/27/2016]


2035
14th Ave W Extension Analysis
PM Peak Hour Volumes, Turn Movements, & ADT
PRELIMINARY
0
0.05
0.1
0.2 Mile
N
Locust Way
Logan Rd
Larch Way
14th Ave W
2500
2000
6000
9900
8500
7900
5000
5950
5000
6100
750
900
4100
5400
112
205
50
72
25
677
417
51
36
290
220
268
66
226
90
2
2
688

2035 Hourly Volumes - Locust Way North of New Intersection

	NB	SB	Model	Adjusted
12:00 AM	17	13		
1:00 AM	25	7		
2:00 AM	13	5		
3:00 AM	17	7		
4:00 AM	28	12		
5:00 AM	87	115		
6:00 AM	181	550		
7:00 AM	213	660		
8:00 AM	255	462		
9:00 AM	249	253		
10:00 AM	201	205		
11:00 AM	199	183		
12:00 PM	249	197		
1:00 PM	312	180		
2:00 PM	376	276		
3:00 PM	545	288		
4:00 PM	734	292		
5:00 PM	778	269	1164	1048
6:00 PM	633	269		
7:00 PM	329	240		
8:00 PM	236	213		
9:00 PM	145	163		
10:00 PM	72	87		
11:00 PM	48	32		

	PM	
	NB	SB
ADT Estimate	5944	4978
Check	5944	4978

2035 Hourly Volumes - Locust Way South of New Intersection

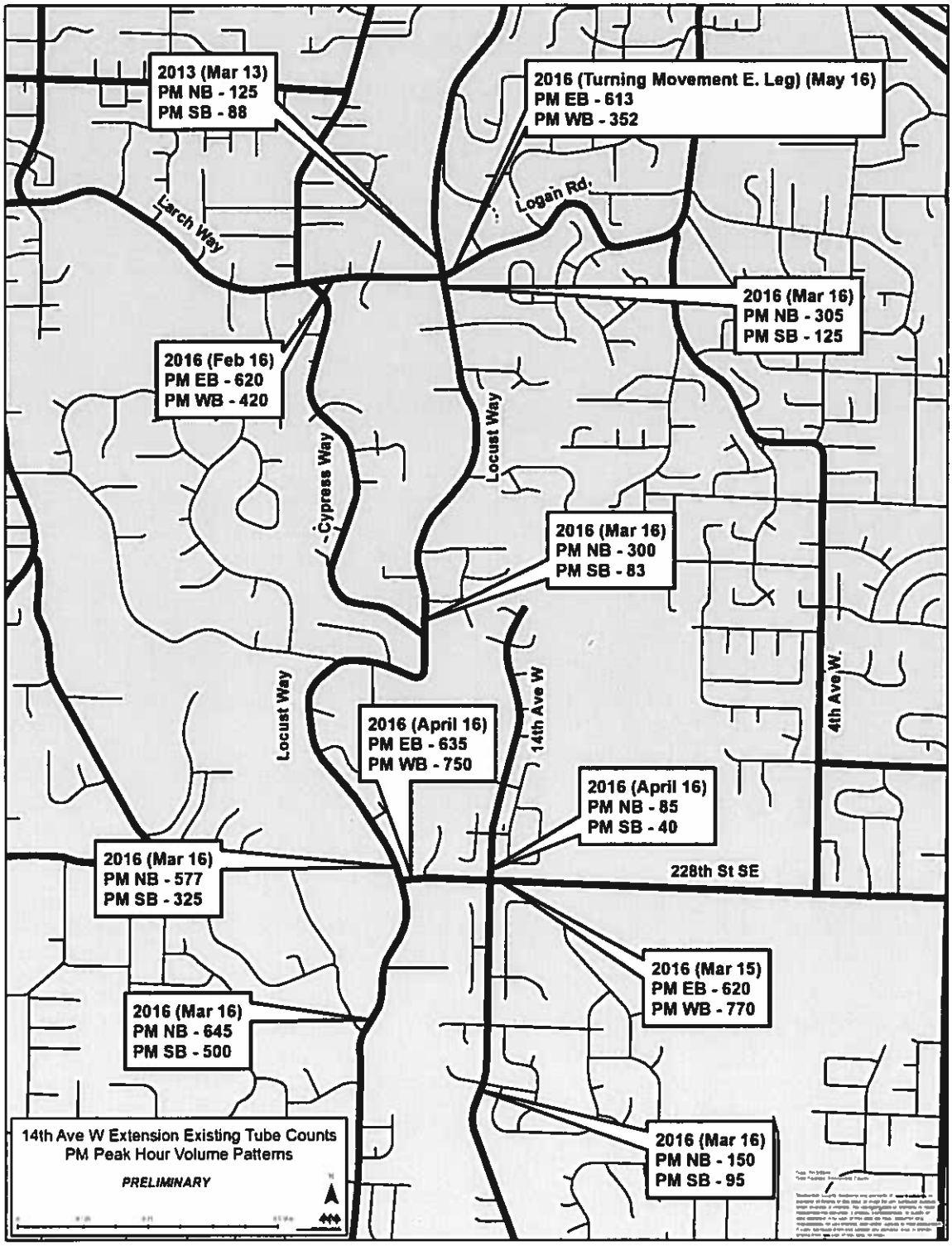
	NB	SB	Model	Adjusted
12:00 AM	3	2		
1:00 AM	4	1		
2:00 AM	2	1		
3:00 AM	3	1		
4:00 AM	4	2		
5:00 AM	13	17		
6:00 AM	27	82		
7:00 AM	32	98		
8:00 AM	38	69		
9:00 AM	37	38		
10:00 AM	30	31		
11:00 AM	30	27		
12:00 PM	37	29		
1:00 PM	46	27		
2:00 PM	56	41		
3:00 PM	81	43		
4:00 PM	109	43		
5:00 PM	116	40	156	156
6:00 PM	94	40		
7:00 PM	49	36		
8:00 PM	35	32		
9:00 PM	22	24		
10:00 PM	11	13		
11:00 PM	7	5		

	PM	
	NB	SB
ADT Estimate	885	741
Check	885	741

2035 Hourly Volumes - 14th Ave W Extension

	NB	SB	Model	Adjusted
12:00 AM	23	13		
1:00 AM	20	8		
2:00 AM	10	4		
3:00 AM	14	11		
4:00 AM	22	34		
5:00 AM	72	133		
6:00 AM	137	421		
7:00 AM	187	485		
8:00 AM	250	404		
9:00 AM	207	225		
10:00 AM	177	169		
11:00 AM	198	181		
12:00 PM	232	168		
1:00 PM	273	160		
2:00 PM	334	217		
3:00 PM	502	247		
4:00 PM	644	264		
5:00 PM	706	244	1056	950
6:00 PM	572	208		
7:00 PM	321	170		
8:00 PM	233	143		
9:00 PM	153	111		
10:00 PM	90	64		
11:00 PM	43	26		

	PM	
	NB	SB
ADT Estimate	5418	4111
Check	5418	4111


2013 (Mar 13)
PM NB - 125
PM SB - 88
2016 (Turning Movement E. Leg) (May 16)
PM EB - 613
PM WB - 352
Logan Rd.
Larch Way
2016 (Mar 16)
PM NB - 305
PM SB - 125
2016 (Feb 16)
PM EB - 620
PM WB - 420
Cypress Way
Locust Way
2016 (Mar 16)
PM NB - 300
PM SB - 83
Locust Way
14th Ave W
4th Ave W.
2016 (April 16)
PM EB - 635
PM WB - 750
2016 (April 16)
PM NB - 85
PM SB - 40
2016 (Mar 16)
PM NB - 577
PM SB - 325
228th St SE
2016 (Mar 15)
PM EB - 620
PM WB - 770
2016 (Mar 16)
PM NB - 645
PM SB - 500
2016 (Mar 16)
PM NB - 150
PM SB - 95
14th Ave W Extension Existing Tube Counts
PM Peak Hour Volume Patterns
PRELIMINARY

Appendix E – Environmental Review Memo

Snohomish County
Public Works
Transportation & Environmental Services

DATE: January 27, 2017

TO: Sheela George, Engineer III
Public Works – Engineering Services, M/S 607

CC: Stephanie Cotton, Senior Planner
Public Works – Environmental Services

FROM: Troy Fields, Senior Environmental Planner
Public Works – Environmental Services

SUBJECT: Revised Environmental Review Memo – 14th Ave W. Extension to Locust Way (RC1497; UPI#06-0025-1)

This memo provides updates to the preliminary Environmental Review Memorandum (ERM) from November 2007 and documents Environmental Services (ENVS) Section's current assessment of your proposed project referenced above. The determination of permit and approval requirements is based on information received from Engineering Services and a site visit by ENVS staff on November 9, 2016.

A. Summary of Permits and Approvals Required

Our assessment may be subject to revision in the event of future design alterations or changes in scope of work, scheduling or funding.

FEDERAL

- ☒ ESA Section 7 Compliance
- ☒ NEPA Compliance
  - ☒ NEPA CE Form
  - ☒ Section 106 Compliance
  - ☐ Air Study
  - ☒ Noise Study
  - ☒ Environmental Justice
  - ☐ Section 4(f)
  - ☐ Section 6(f)
- ☒ Corps Permit, Section 404-Nationwide
- ☐ Corps Permit, Section 404-Individual
- ☐ Corps Permit, Section 10
- ☐ US Coast Guard

STATE

- ☐ Forest Practice Permit
- ☒ HPA ☐ HPA (Fish Enhancement)
- ☒ NPDES - Construction Stormwater General
- ☐ Aquatic Land Use Authorization
- ☒ Section 401, Water Quality Certification
- ☐ CZM Certification

LOCAL

- ☒ CAR Compliance
- ☒ SEPA Compliance
- ☐ Flood Hazard Permit
- ☐ Shoreline Exemption Permit
- ☒ Noise Ordinance Compliance
- ☒ Land Disturbing Activity Permit
- ☒ Drainage Compliance
- ☒ LID Compliance

B. Project Narrative

Project Description

Snohomish County Public Works proposes to establish 14th Avenue West as a Minor Arterial, improving mobility by extending a 2-lane roadway including bike lanes, planter strips and sidewalks. This project will connect the existing road with Locust Way to the north either with a signalized intersection or roundabout, and as proposed, will require right-of-way acquisition. Stormwater runoff will be collected and treated according to state and local standards. These improvements are identified in the 2015 Transportation Element of the Growth Management Act Comprehensive Plan. Right-of-way property will need to be acquired for the project and mitigation of impacts.

Project Location

This project is located within the City of Bothell's Urban Growth Area between the Cities of Brier and Bothell, in Snohomish County. The site starts at 14th Avenue West, just north of 220th Street SW, and proceeds north to Locust Way near 215th Street SW in Section 26, Township 27N, Range 4E, W.M. (see Figure 1).

Site Description

The study area for this project is between 220th Street SW and Locust Way, and extends 200 feet outward from both sides of the proposed roadway alignment (see Figure 2). Preliminary critical area information was collected during the site visits and delineation conducted on July 11 and August 16, 2007. This information was reviewed during a site visit on November 7, 2016.Wetland ratings originally determined in 2007 require updating using the *Washington State Wetland Rating System for Western Washington, 2014 Update.*

Swamp Creek (WRIA 08.0059) is a Type S stream flowing to the west of the project area (see Figure 2). Per SCC 30.62A, Swamp Creek has a 150-foot buffer on both sides of the creek. Swamp Creek in the vicinity of the project is designated "Urban" shoreline environment pursuant to Snohomish County's 2012 Shoreline Management Program (SMP). Both Swamp Creek and its buffer are outside the study area.

Stream 1 is a Type Ns stream flowing through the project area from the eastern side of the existing fill material, and has a 50-foot buffer. This small channel wraps around the northern terminus of the fill and proceeds south along the west side where it joins the outflow of Wetland B via a small culvert.

Stream 2 is a Type Ns drainage with a 50-foot buffer flowing from east to west at the northern end of the project. This drainage appears to originate from a stormwater detention pond approximately 550 feet to the northeast of the proposed intersection. The drainage passes under Locust Way in the vicinity of 215th Place SW, eventually joining Swamp Creek near Wetland A.

Wetland A is a small slope wetland adjacent to Swamp Creek. Wetland A is a Category III wetland with a 110-foot buffer, both of which are likely out of the limits of project impacts.

Wetland B is a large, approximately 6.7-acre Category III wetland with a 110-foot buffer. This wetland dominates the area between 220th Street SW and the ravine south of 216th Place SW, extending offsite to the south and west. Wetland B flows southwest into Stream 1 via a culvert, and joins Swamp Creek through a small channel at the southern end of 14th Place West.

C. Potential Environmental Impacts and Issues

Critical Area Impacts

The project, as currently designed, would impact Wetland B and Stream 1, and likely impact Stream 2. An Army Corps of Engineers (USACE) 404 permit and Section 401 Water Quality Certification from WA Dept. of Ecology will be required for any work within the wetland, including the required geotechnical investigation. This federal permit nexus will require Section 7 Endangered Species Act (ESA) consultation resulting in the need for a Biological Assessment to be prepared and submitted with the USACE application. In addition to USACE and ESA review, a Hydraulic Project Approval will be required from the Washington State Department of Fish and Wildlife for any activity at or below the Ordinary High Water Mark. The full extent of site disturbance is not known at this time. If the project disturbs one acre or greater, the project will be required to seek coverage under the NPDES Construction Stormwater General Permit. Additionally, this project will need to meet the requirements of Snohomish County Critical Area Regulations (CAR) Chapter 30.62. The Washington State Environmental Policy Act (SEPA) requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. A SEPA Checklist and SEPA determination are the minimum requirements to satisfy SEPA. For projects with no impacts or impacts that can be mitigated, the SEPA determination will be a Determination of Non-Significance (DNS). In order to complete the SEPA Checklist and support the determination, a noise analysis will be required due to the construction of a new section of roadway.

While Swamp Creek has documented use by anadromous salmonids, the 2 small drainages within the study area do not (WDFW Salmonscape). According to the National Marine Fisheries Service, Swamp Creek is designated essential fish habitat as well as critical habitat for chinook. According to the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species database, the upland area adjacent to Wetland B is designated as priority terrestrial habitat. Wetland B and Swamp Creek are designated as priority aquatic habitats.

Wildlife Impacts

The project area is characterized by dense urban land use and the proposed road extension will bisect important wildlife habitat, disconnecting a portion of that habitat from the Swamp Creek Corridor. Swamp Creek has spawning populations of coho, sockeye, and chinook salmon, coastal cutthroat trout and steelhead. Additionally, wetlands can host several types of migratory and resident waterfowl as well as various amphibian species.

Birds and mammals found in the project vicinity are typical of lowland suburban habitats. Birds observed include robin, song sparrow, common crow, violet-green swallow, goldfinch and red-shafted flicker. Mammals likely to be found in the area include opossum, spotted skunk, raccoon, and eastern gray squirrel. A number of alder snags were noted in the wetland area, and

some appear to have been used by pileated woodpeckers. Dense vegetation in the wetland and along Swamp Creek may be used by warblers and other neotropical birds during migration.

Designers must consider wildlife impacts and habitat connectivity, and plan for wildlife passage when developing designs for this project.

Historic & Cultural Resources

Preliminary archaeological screening performed in 2007 and updated on November 29, 2016 confirms that there are no recorded sites located where potential future ground disturbing activities could be anticipated. Any future construction work could require some level of Section 106 National Historic Preservation Act review because the project as designed, has a federal permit nexus. Section 106 compliance requirements could range from construction monitoring or contracting with an archaeological consultant to complete a field survey of the project site to determine if cultural resources are present.

Title VI/Environmental Justice

As a recipient of Federal Aid, Snohomish County Public Works must comply with Title VI of the Civil Rights Act and related laws, regulations, and other requirements. This involves documenting that a specific program, project, or activity will not discriminate against or have a disproportionately adverse impact on minority, low-income, and limited English proficiency populations. The 14th Avenue West area has significantly diverse populations. For this project, a report will be prepared documenting these populations and determining the level of support required to assist them to understand the projects and voice any concerns. This may take the form of public meetings where interpreters are present, and project informational materials translated into other languages.

Considerations to Reduce Impacts

Every effort should be made to avoid impacts to critical areas, especially wetlands and buffers. Alternative project designs should be considered that would minimize environmental impacts associated with this proposal.

Construction impacts can be reduced by adhering to the following sequencing in accordance with SCC 30.62A.300 and Corps permit processes. The prescribed sequence includes:

- Avoiding the impacts altogether by not taking a certain action or parts of an action
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing, enhancing, or providing substitute resources or environments, or
- Monitoring the impact and taking appropriate corrective measures.

Mitigation Requirements and Options

The proposed project requires a critical area study and mitigation plan for impacts to critical areas and their buffers. A CAR compliance certificate will be issued upon completion of the Critical Area Study and 90% design.

It is expected that onsite restoration of temporary impacts would include revegetation, but it is recommended that the project explore all available options for mitigation of permanent impacts. These options could include conventional property acquisition and compensatory mitigation activities, participation in the King County In-Lieu fee program or purchase of mitigation credits from an approved habitat mitigation bank. The proposed Keller Farm Mitigation Bank in WRIA 8 is currently pending approval, and may be a future option. However, this project is not currently within the service area of an approved habitat mitigation bank, and the cost of this option has not been estimated. Cost estimates of conventional mitigation and King County's In-Lieu fee program are included here for comparison. Project impacts were estimated based on conceptual designs and could change depending on final plans.

MITIGATION SITE OPTION

Table 1: Wetland Mitigation Requirements

Wetland	Wetland Category	Wetland Impact (sq. ft.)	Wetland Mitigation		
			Ratio		Area
			Enhancement 4:1	Cost[A]	Enhancement
B	III	29,168	116,672 (sq. ft.)	$466,688	2.7 acres

Table 2: Buffer Mitigation Requirements

Wetland	Wetland Category	Buffer Width	Buffer Impact (sq. ft.)	Mitigation		
				Ratio (non-mature forest)		Area
				Enhancement 6:1	Cost[A]	Enhancement
B	III	110'	29,199	175,194 (sq. ft.)	$700,776	4.0 acres

[A] Average cost for the mitigation site option is calculated at $4/sq. ft. ROW acquisition costs and monitoring are not included in this cost estimate.

NOTE: Impacts were estimated based on conceptual designs.

A preliminary list of potential mitigation sites has been compiled (see Table 3). This list only includes parcels that are located adjacent to a critical area within the Swamp Creek watershed and that have the possibility of enhancement. A site visit to confirm whether these sites would be appropriate for mitigation has not been conducted. Figure 3 shows the locations of each of the parcels from the table below.

Table 3: List of potential mitigation sites

Site #	Parcel Number	Acreage	Ownership
1	00374100100505	7	Snohomish County
2	00373101100101	0.86	Private
3	00373100800401	3	Private
4	00373100800301	1.8	Private

KING COUNTY IN-LIEU FEE OPTION

Table 4: Estimated Fee for Wetland Impacts

	King County In-Lieu Fee		Sammamish Watershed	
	Total Debit[B] (1.7 acres)	Cost/Debit (x$36,500)	Land Fee (sq. ft. x 88 cents)	Total
Wetland B	116.7	$4,259,550	$25,668	$4,285,218

Table 5: Estimated Fee for Buffer Impacts

	King County In-Lieu Fee		Sammamish Watershed	
	Mitigation Ratio	Cost/Sq. Ft. (x$9.00)	Land Fee (x 88 cents	Total
Buffer (6:1)	175,194 (sq. ft.)	$1,576,746	$25,695	$1,602,441

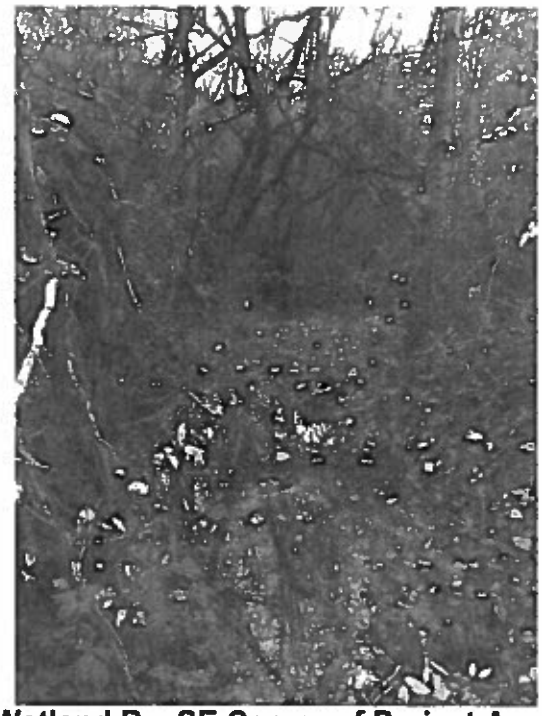
[B] Numbers based on debit worksheets
NOTE: Impacts were estimated based on conceptual designs.

D. What ENVS Needs

As the project moves forward with permit document preparation additional information will be required. This information includes the following:

- Rights of Entry (ROE) to the section between 215th Place SW and Locust Way. Once ROE has been secured, ENVS can delineate any changes and/or additions to critical areas and evaluate potential impacts.
- Design Report identifying location and size of permanent and temporary impacts, staging areas, construction techniques, construction machinery and schedule.

E. Photographs

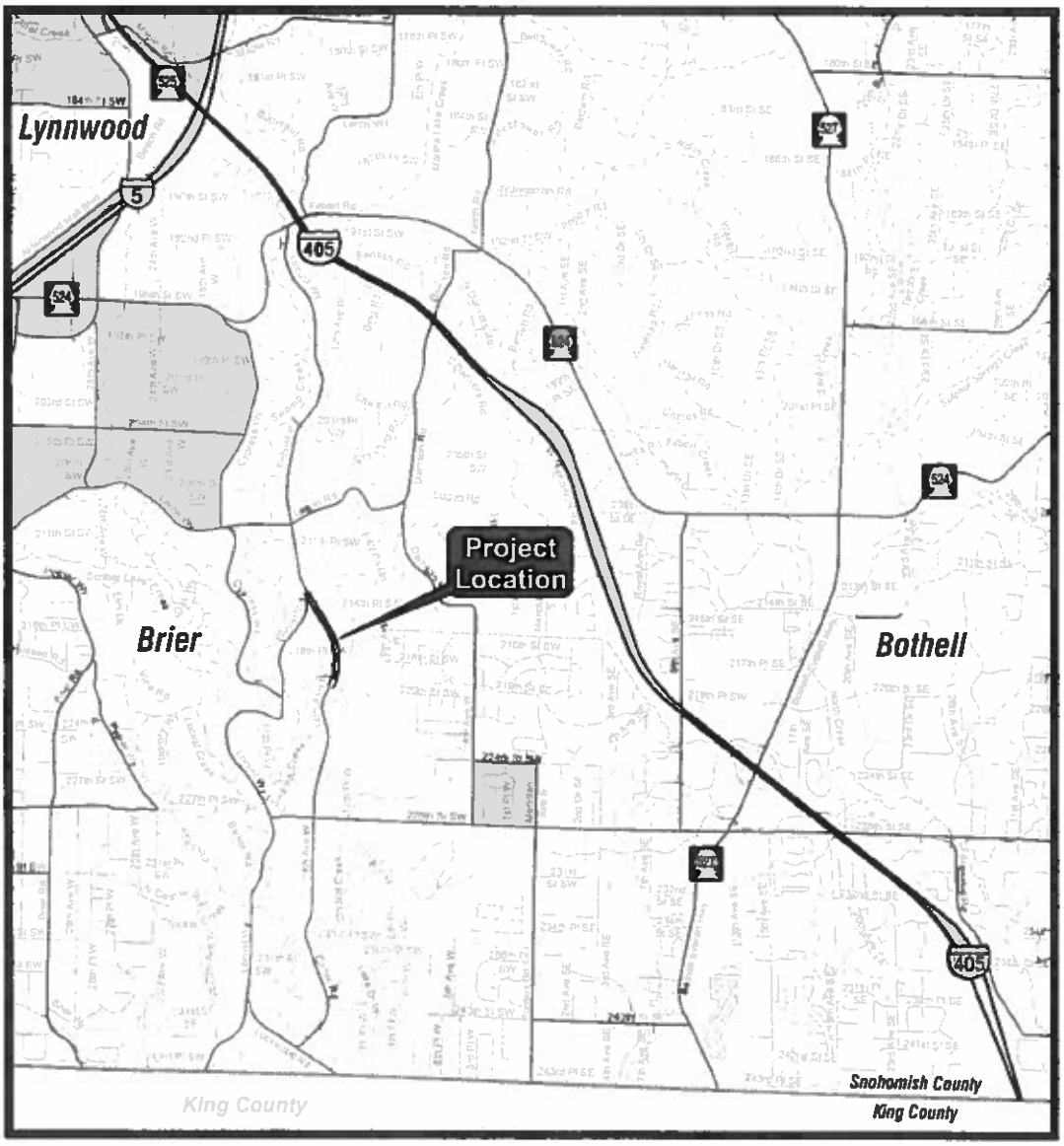


Wetland B – SE Corner of Project Area.
Wetland extends to the south

Wetland B – Standing on Fill Material
Proposed Road Alignment Route

Proposed Road Alignment Route

F. Figures



Key to Features:

- Project Location
- Arterial Roads
- County Boundary
- Incorporated Cities
- Local Roads
- Streams
- Waterbodies

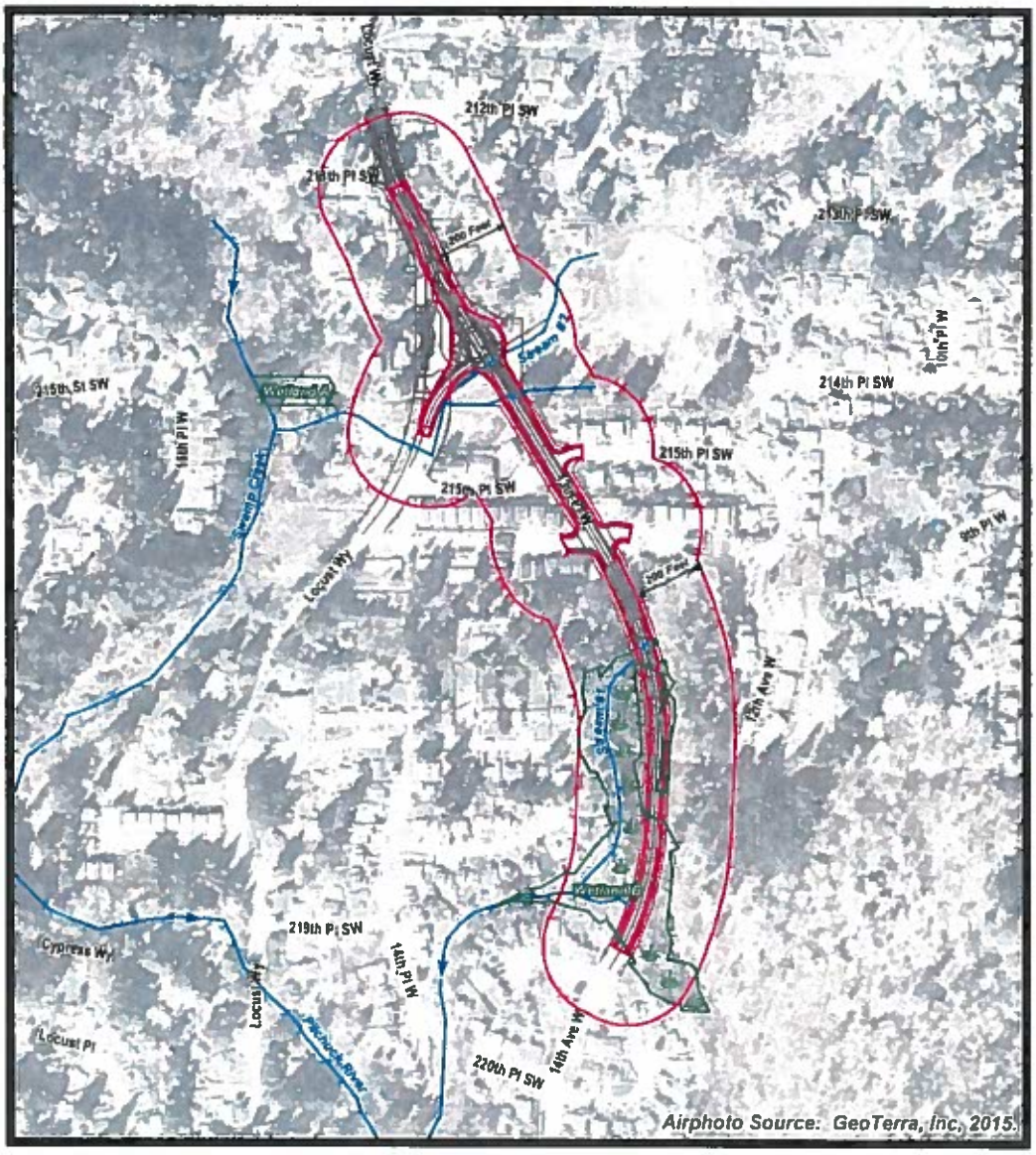
0 0.25 0.5 Miles

Snohomish County

Area Detailed

Figure 1. Project Vicinity

Snohomish County



Key to Features:

- Study Area
- Proposed Improvements
- Streams
- Wetland Edge

0 200 400 Ft

Area Detailed

Snohomish County disclaims any warranty of merchantability or warranty of fitness of this map for any particular purpose, either express or implied. Any user of this map assumes all responsibility for use thereof, and further agrees to hold Snohomish County harmless from and against any damage, loss, or liability arising from any use of this map

Figure 2: Study Area

Snohomish County Public Works

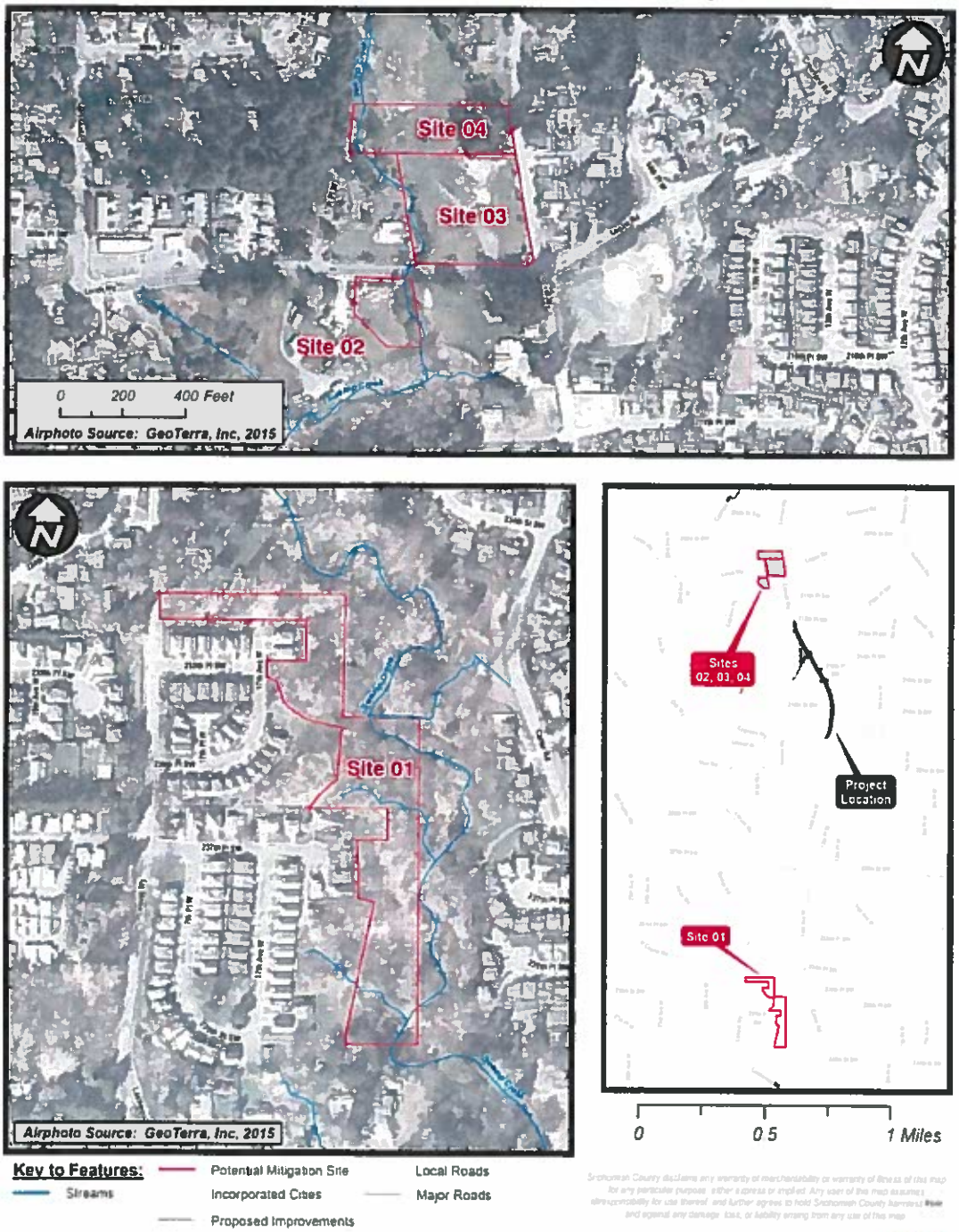
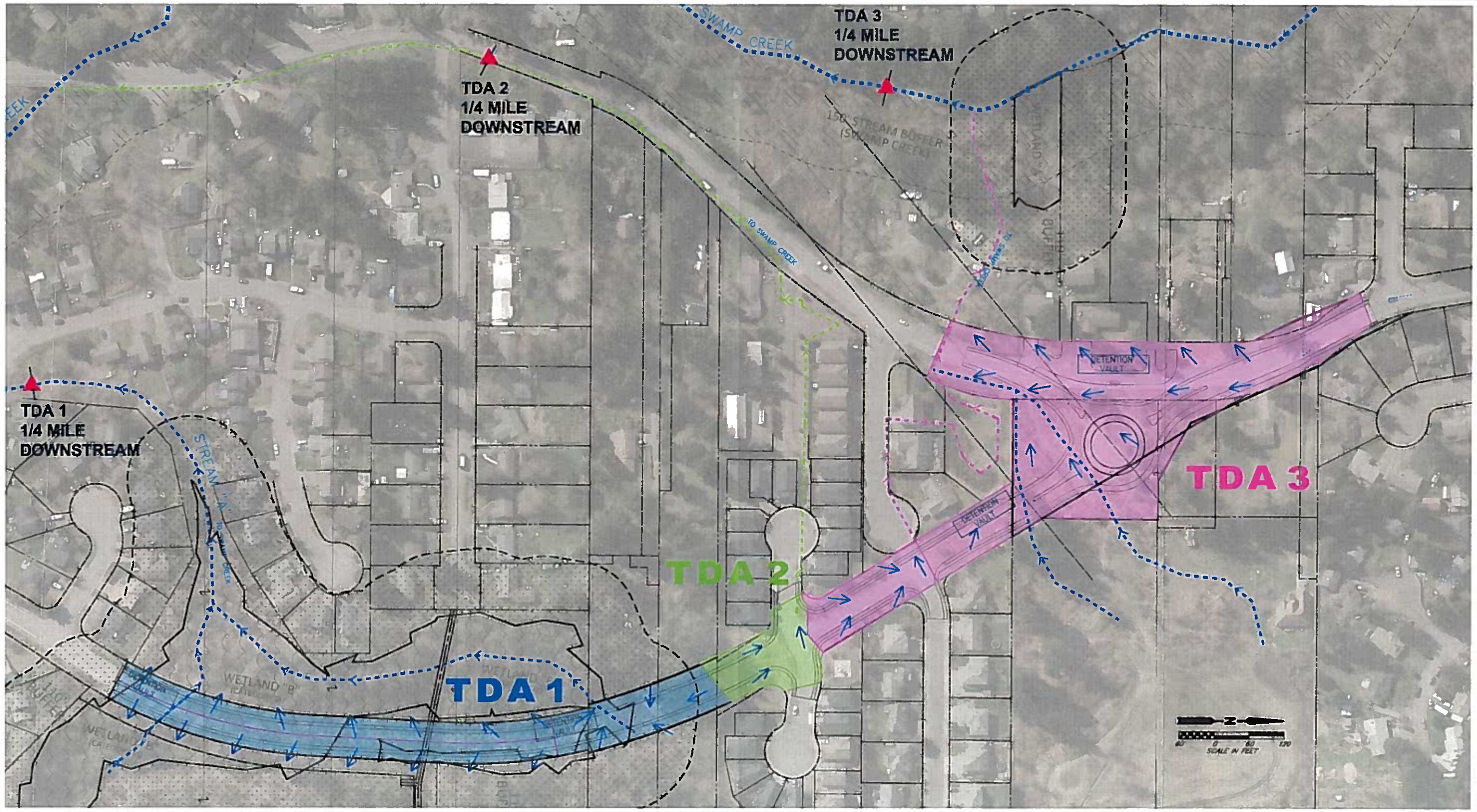
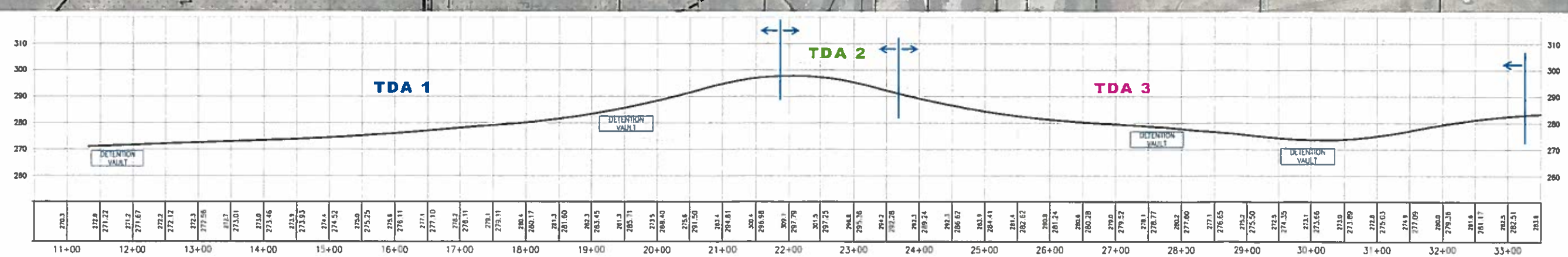


Figure 3. Potential Mitigation Sites

Snohomish County

Appendix F – TDA Map


TDA 1
1/4 MILE
DOWNSTREAM
TDA 2
1/4 MILE
DOWNSTREAM
TDA 3
1/4 MILE
DOWNSTREAM
SWAMP CREEK
TO SWAMP CREEK
STREAM "A"
WETLAND "B"
DETENTION VAULT
TDA 1
TDA 2
TDA 3
SCALE IN FEET


TDA 1
TDA 2
TDA 3
DETENTION VAULT
310
300
290
280
270
260
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
29+00
30+00
31+00
32+00
33+00

Appendix G – Soil Map

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Snohomish County Area, Washington

14th Ave W Extension to Locust Way

December 22, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

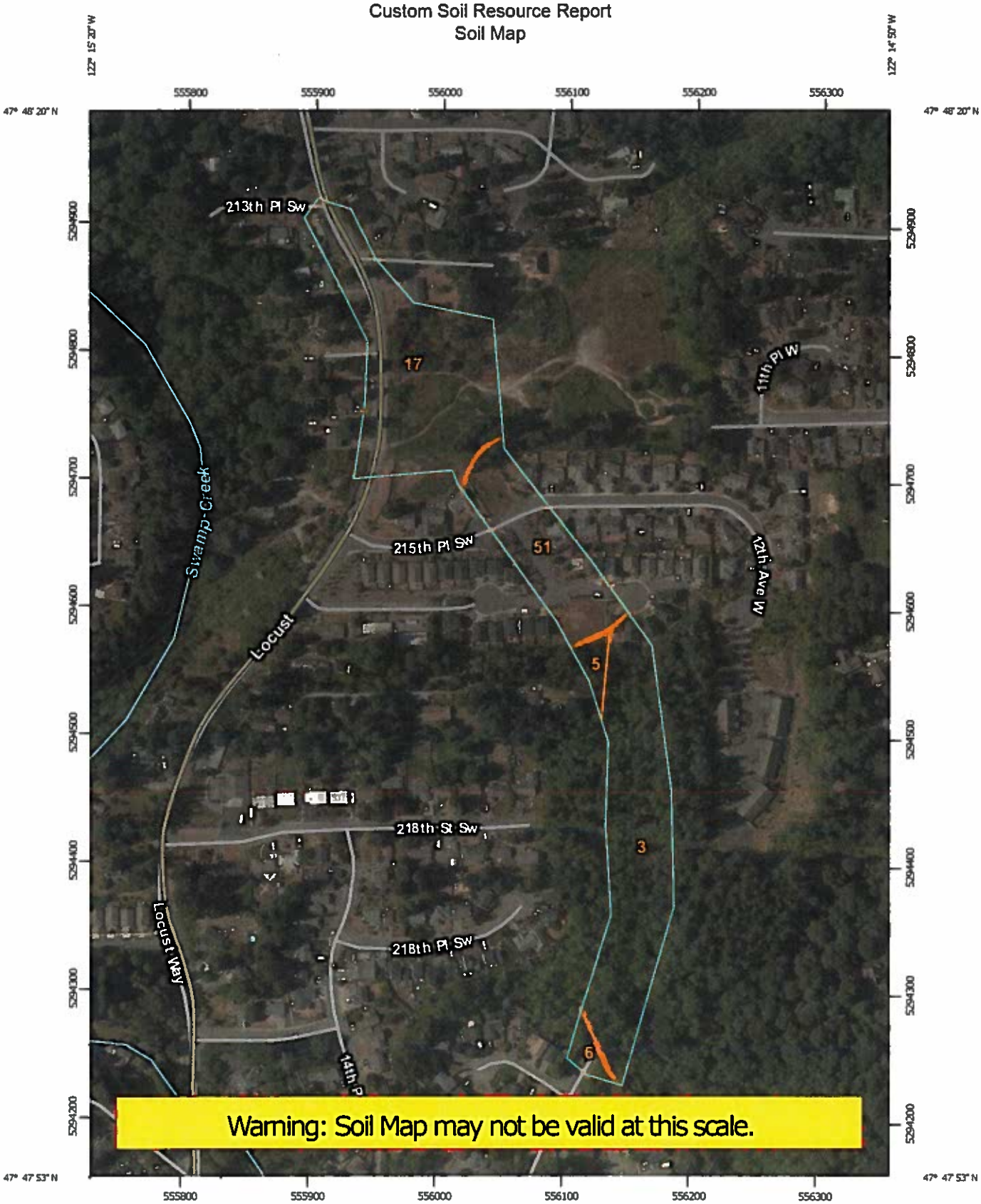
for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
Soil Map.....5
Soil Map.....6
Legend.....7
Map Unit Legend.....8
Map Unit Descriptions.....8
Snohomish County Area, Washington.....10
3—Alderwood gravelly sandy loam, 15 to 30 percent slopes.....10
5—Alderwood-Urban land complex, 2 to 8 percent slopes.....11
6—Alderwood-Urban land complex, 8 to 15 percent slopes.....12
17—Everett very gravelly sandy loam, 0 to 8 percent slopes.....13
51—Pits.....15

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:4,060 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 14, Sep 8, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 7, 2014—Jul 8, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Snohomish County Area, Washington (WA661)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
3	Alderwood gravelly sandy loam, 15 to 30 percent slopes	3.9	36.9%
5	Alderwood-Urban land complex, 2 to 8 percent slopes	0.2	2.2%
6	Alderwood-Urban land complex, 8 to 15 percent slopes	0.2	2.2%
17	Everett very gravelly sandy loam, 0 to 8 percent slopes	4.2	39.6%
51	Pits	2.0	19.1%
Totals for Area of Interest		**10.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Snohomish County Area, Washington

3—Alderwood gravelly sandy loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2t627
Elevation: 0 to 1,000 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, nose slope, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Hydric soil rating: No

Minor Components

Indianola

Percent of map unit: 5 percent
Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Everett

Percent of map unit: 5 percent
Landform: Eskers, kames, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Shalcar

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

5—Alderwood-Urban land complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2hz9
Elevation: 50 to 800 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Alderwood and similar soils: 60 percent
Urban land: 25 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Till plains
Parent material: Basal till

Typical profile

H1 - 0 to 7 inches: gravelly ashy sandy loam
H2 - 7 to 35 inches: very gravelly ashy sandy loam
H3 - 35 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Other vegetative classification: Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Mckenna

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Terric medisaprists

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

6—Alderwood-Urban land complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2hzn
Elevation: 50 to 800 feet

Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Alderwood and similar soils: 60 percent
Urban land: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Till plains
Parent material: Basal till

Typical profile

H1 - 0 to 7 inches: gravelly ashy sandy loam
H2 - 7 to 35 inches: very gravelly ashy sandy loam
H3 - 35 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Other vegetative classification: Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Norma

Percent of map unit: 5 percent
Landform: Drainageways
Hydric soil rating: Yes

17—Everett very gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t629

Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Eskers, kames, moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Other vegetative classification: Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 10 percent
Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

51—Pits

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Appendix H – Developer Construction Plan and Road Section

SEC 26 TWP 27 N RGE 4 E WM

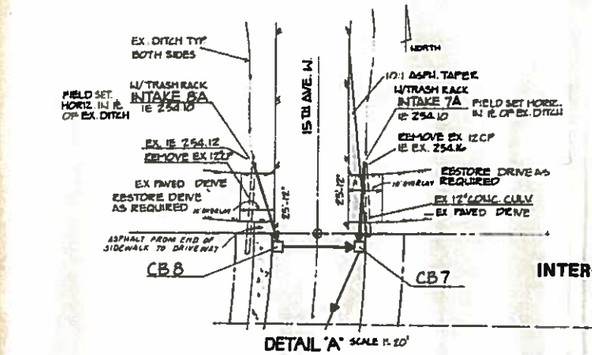
NORTH

SCALE: 1" = 50'

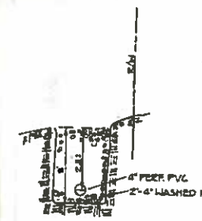
MERIDIAN: WASHINGTON LAMBERT NORTH
DATUM ALDERWOOD WATER DISTRICT
BENCHMARK TBM 22 - TOP, EXISTING CONC. MON. CNW PLAT COR. EL. 269.27
TBM 23 - EXISTING PK NAIL & INT. OF 219TH ST. SW & LOCUST WAY EL. 206.76

⊕ DENOTES CONC MONUMENT IN CASE TO BE SET

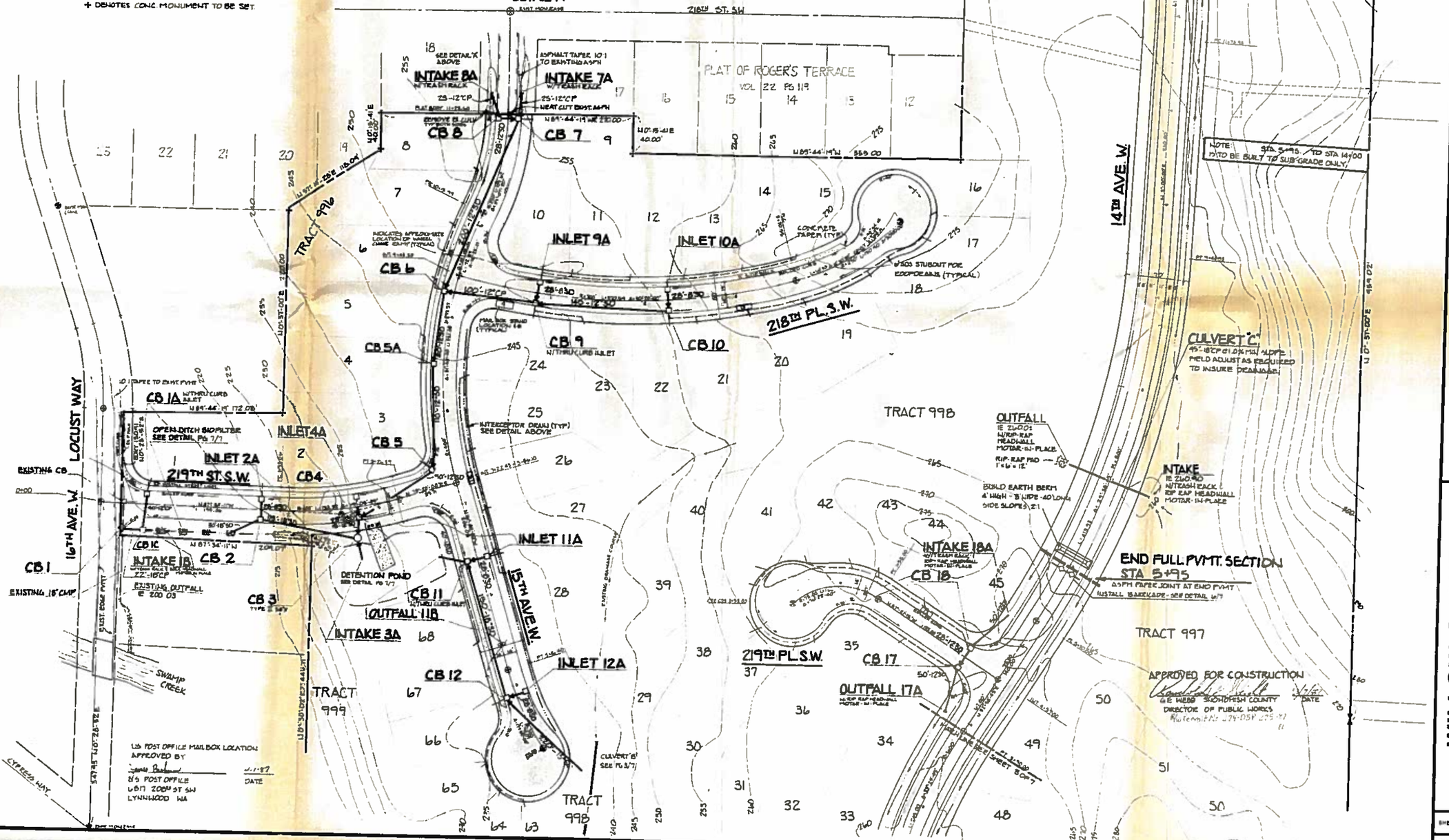
+ DENOTES CONC MONUMENT TO BE SET.



DETAIL "A" SCALE 1" = 20'



INTERCEPTOR DRAIN DETAIL
NTS.



REV	REVISION	DATE	BY
1	ADD CB5A PER REQUEST A.I.12	5-4-87	HJ

GROUP FOUR, Inc.
19502 36th Avenue West
Lynnwood, Washington 98036 • 206 775-4581

DESIGN BY
DRAWN BY
CHECKED BY
APPROVED BY

WILLOW GROVE

ROAD AND STORM PLAN

SNOHOMISH COUNTY WASHINGTON

SHEET NO 2 OF 7

JOB NO. 86-8024

SCALE: HORIZONTAL 1"=50'
VERTICAL 1"=5'

CB 14 TYPE II 48"
TOP 254.92
IE 248.79 - 12"
IE 248.54 - 15"
INTAKE 14A
IE 252.45
50' 12" 50 @ 7.32 %
W/TRASH RACK

W/THRU CURB INLET
CB 15 TYPE 1A
TOP 245.60
IE 242.44 - 15"

CULVERT 'B'
100' - 18" CP @ 10.0%
FIELD ADJUSTED AS REQUIRED SEE PLAN

INLET 12A
TOP 235.53
IE 232.12

CB 12 TYPE 1A
TOP 235.53
IE 230.98 - 15"
IE 230.73 - 18"
IE 231.56 - 8"

CB 5
TOP 235.80
IE 232.00

INLET 11A
TOP 233.75
IE 230.62

CB 11 TYPE 1A W/THRU CURB INLET
TOP 233.75
22.23 - 18"
IE 230.06 - 8"

OUTFALL 11B
IE 227.40

CB 6
TOP 245.96
IE 241.11

CB 5A
TOP 242.11
IE 237.28

CB 8 INTAKE 8A
TOP 254.99
IE 252.09
IE 254.10 25' 12" CPE @ 0.04%

CB 7 INTAKE 7A
TOP 254.99
IE 251.53
IE 254.10 25' 12" CPE @ 10.28%

MATCH EXISTING FV/FT

EXISTING GROUND

PROPOSED GRADE

AREA BETWEEN CUL-DE-SACS TO BE GRADED TO SUB-GRADE ONLY - SEE PLAN

EDGE OF EXISTING BALL OF 2.0%

EDGE OF RAILS MAX. OF 5.0%

PLAT BOUNDARY

15TH AVE. W.

14TH AVE. W.

SEE SNOHOMISH CO. 14TH AVE. W. DESIGN FOR ADDITIONAL DETAIL.

END SUB GRADE
CONST. AT STA. 14+00
& SLOPE TO NATURAL GROUND

PLAT BOUNDARY 14+18.24

NOTE: 14TH AVE FROM STA 5+95. TO STA 14+18.24 IS TO BE BROUGHT TO SUB-GRADE ONLY AT THIS TIME. ALL ELEV. GIVEN ARE TO FINISHED GRADE.

CULVERT 'C'
80' - 18" CP @ 1.03% FALL
FIELD ADJUST AS REQUIRED

PLAT OF WILLOW GLEN

EXISTING GROUND

PROPOSED GRADE

CULVERT 'A'

INTAKE
STA 0+10 - 25' LT
IE 254.2

OUTFALL
STA 0+08 - 25' RT
IE 250.7

INLET 15A
TOP 255.40
IE 250.96

INTAKE 15B
IE 252.44
W/TRASH RACK

CB 15
TOP 255.40
IE 250.42 - 8"
IE 250.07 - 12"

OUTFALL 17A
IE 251.80

CB 17
TOP 260.08
IE 257.30

INTAKE 18A
IE 260.56
W/TRASH RACK

CB 18
TOP 260.08
IE 257.58

APPROVED FOR CONSTRUCTION
DE WEED SNOHOMISH COUNTY
DIRECTOR OF PUBLIC WORKS
5/1/87
DATE

GROUP FOUR, Inc.
19502 56th Avenue West
Lynnwood, Washington 98036 • 206 775-4581

DRAWN BY 1-29-87 | CHECKED BY | APPROVED BY

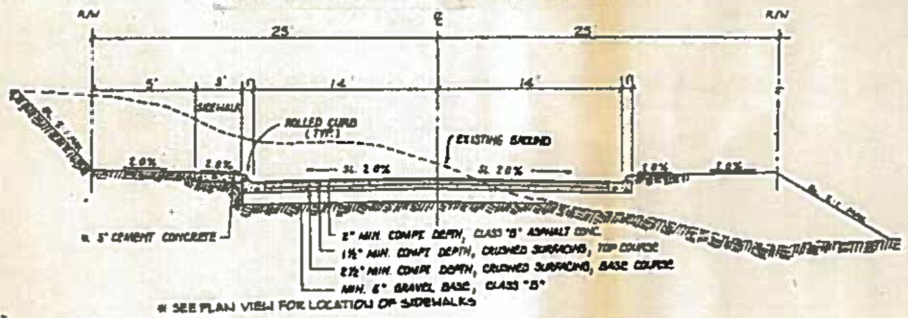
WILLOW GROVE

ROAD AND STORM PROFILES

SNOHOMISH COUNTY WASHINGTON

SEC 26 TWP 27 N RGE 4 E WM

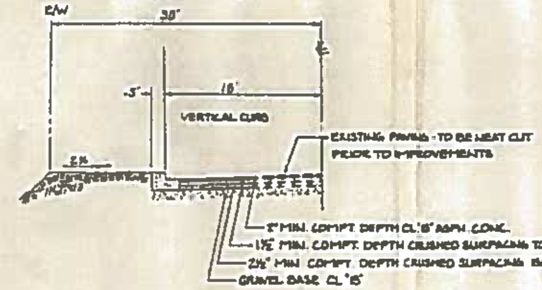
TWO LANE LOCAL SERVICE STREET



TYPICAL ROADWAY SECTION

NTS

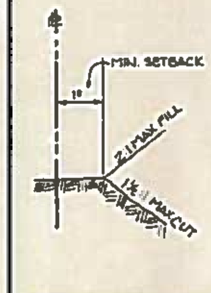
220th PL.S.W. 218th PL.S.W. 219th ST.S.W. 15th AVE. W.



TYPICAL ROADWAY SECTION

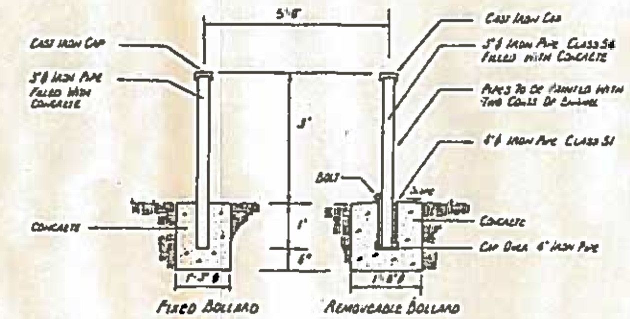
NTS

16th AVE. W.



PROPERTY LINE SETBACK

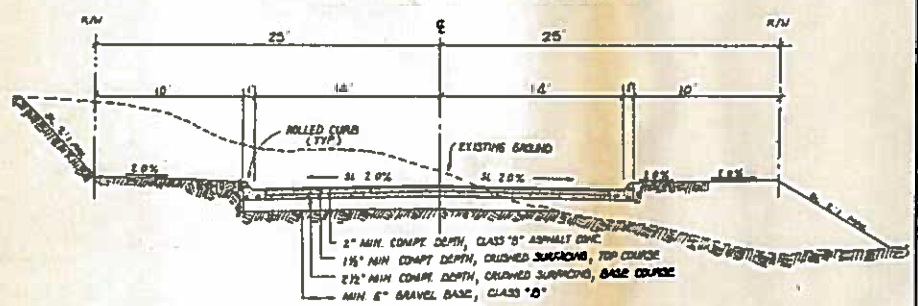
NO SCALE



BOLLARD DETAIL

NTS

TWO LANE LOCAL SERVICE STREET

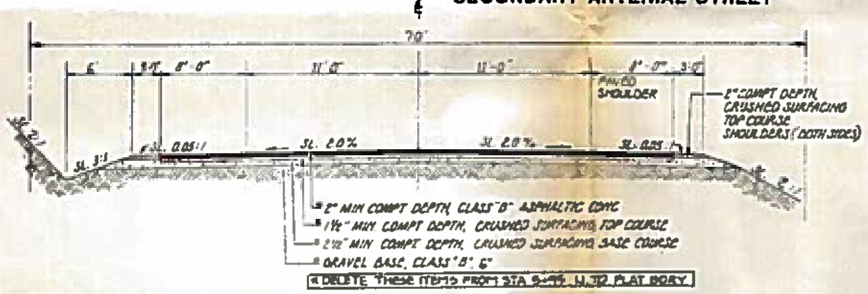


TYPICAL ROADWAY SECTION

NTS

219th PL.S.W.

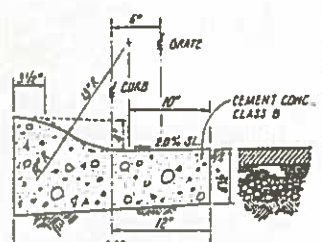
SECONDARY ARTERIAL STREET



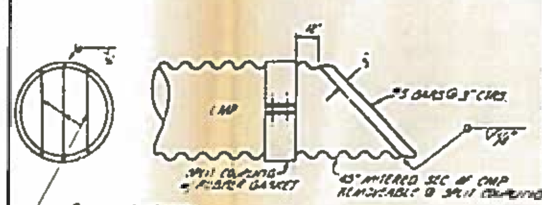
TYPICAL ROADWAY SECTION

NTS

14th AVE.W.

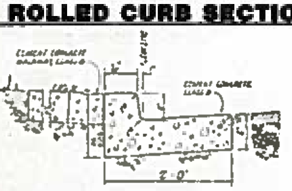


ROLLED CURB SECTION NTS



TRASH RACK

NTS



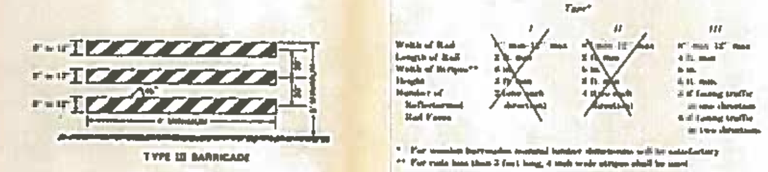
VERTICAL CURB SECTION

GENERAL NOTES

1. Locations shown of existing utilities are approximate only, and it shall be the responsibility of the contractor to verify the exact locations of all utilities so as to avoid damage or disturbance.
2. All work and materials shall be in accordance with the latest edition of the standards and specifications of Snohomish County.
3. Wheelchair ramps, shown by the symbol, shall be constructed in accordance with specifications.
4. Storm water retention/detention facilities must be constructed and maintained in accordance with Snohomish County requirements.
5. Provide and maintain temporary sedimentation collection facilities to insure sediment laden water does not enter the natural drainage system. These facilities must be in operation prior to clearing and building construction, and satisfactorily maintained until construction and landscaping are completed and the potential of on-site erosion has passed.
6. Rip-Rap to be of sound quarry rock placed to a depth of one foot. Rock aggregate to be 4" plus. Rock bed to be 8' long x 8' wide minimum size. Minimum volume of rock bed to be 1.0 cu. yd.
7. All disturbed areas such as retention facilities, roadway backslopes and etc. shall be seeded with a perennial ground cover (grass) to minimize erosion.
8. All work within the plat and County right-of-way shall be subject to the inspection of the engineer or his designated representative.

[illegible]

STREET BARRICADE DETAIL



NTS

PER SECTION 6C-8 M.U.T.C.D.

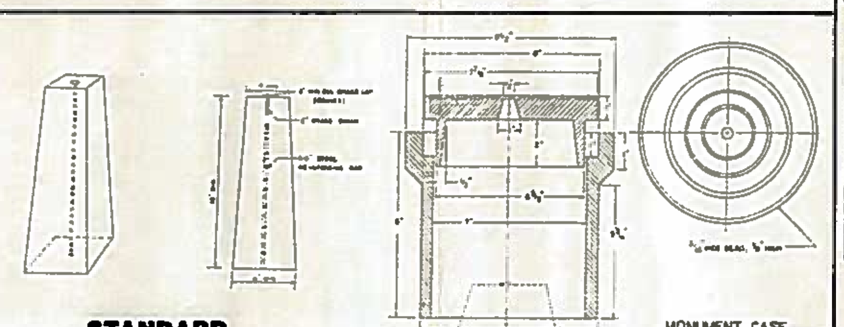
PIPE SPECIFICATIONS

[illegible]

STRUCTURE SCHEDULE

ITEM	TYPE	GRATE	LID	STATION	OFFSET GRATE	OFFSET STRUCTURE
CB 1	IA	5435 A	N/A	SEE PLAN	—	—
* CB 1A	I	5435 A	*	Δ	13.50 LT	13.50 LT
* CB 2	IA	5435 A	*	1+20	13.50 RT	13.50 RT
INLET 2A	INLET	5435 A	*	1+70	13.50 LT	13.50 LT
CB 3	II 54"	5449 S-L	UNIT R	SEE PLAN	—	—
CB 4	I	5435 A	N/A	7+60	13.50 RT	13.50 RT
INLET 4A	INLET	5435 A	*	7+60	13.50 LT	13.50 LT
CB 5	I	5435 A	*	Δ/2	36.50 RAD	36.50 RAD
CB 6	I	5435 A	*	9+25	13.50 LT	13.50 LT
CB 7	I	5435 A	*	11+20	13.50 RT	13.50 RT
CB 8	I	5435 A	*	11+20	13.50 LT	13.50 LT
* CB 9	I	5435 A	*	0+65	13.50 RT	13.50 RT
INLET 9A	INLET	5435 A	*	0+65	13.50 LT	13.50 LT
CB 10	I	5435 A	*	2+25	13.50 RT	13.50 RT
INLET 10A	INLET	5435 A	*	2+25	13.50 LT	13.50 LT
* CB 11	IA	5435 A	*	2+40	13.37 LT	13.37 LT
* INLET 11A	INLET	5435 A	*	2+40	13.37 RT	13.37 RT
CB 12	IA	5435 A	*	4+90	13.50 LT	13.50 LT
INLET 12A	INLET	5435 A	*	4+90	13.50 RT	13.50 RT
* CB 13	IA	5435 A	*		39.37 RAD	39.54 RAD
CB 14	II 48"	5435 A	UNIT P	0+55	13.50 RT	12.72 RT
CB 15	I	5435 A	N/A	Δ: [illegible]	36.50	36.50
INLET 15A	INLET	5435 A	*	Δ: [illegible]	36.50	36.50
CB 16	I	5435 A	*	1+05	13.50 LT	13.50 LT
INLET 16A	INLET	5435 A	*	1+05	13.50 RT	13.50 RT
			*			
CB 17	I	5435 A	*	Δ: 17°42'22"	36.50	36.50
CB 18	I	5435 A	*	Δ: 17°42'25"	36.50	36.50
CB 1C	IA	5435 S-L	*	SEE PLAN	—	—
CB 5A	I	5435 A	*	8+50	13.50 LT	13.50 LT

* DENOTES THRU CURB INLET TO BE USED
** DENOTES SOLID, LOCKING LID TO BE USED



STANDARD CONCRETE MONUMENT NTS

APPROVED FOR CONSTRUCTION

G.E. WEED, SNOHOMISH COUNTY DIRECTOR OF PUBLIC WORKS

DATE

NO.	REVISION	DATE	BY
1	ADD CB 5A PER REQUEST A.H.D.	5-4-87	

GROUP FOUR, Inc.
19502 56th Avenue West
Lynnwood, Washington 98036 • 206 775-4581

WILLOW GROVE

GENERAL NOTES AND DETAILS

SNOHOMISH COUNTY WASHINGTON

SHEET NO. 6 OF 7

JOB NO. 86-8024